



Essential Skills Manual

Machinist

NOC 7231

MACHINIST MANUAL CONTENTS

Included in this Essential Skills Manual:

	PAGE
Essential Skills Inventory Assessor's Guide	7
Essential Skills Inventory	38
Technical Reading	43
Document Use	48
Numeracy	53
Oral Communication	64
Computer Use	66
Writing	67
Essential Skills Answer Key	69
Technical Reading	76
Document Use	81
Numeracy	86
Oral Communication	100
Computer Use	103
Writing	105
Essential Skills Curriculum Instructor Guide	107
Curriculum Frameworks and Guidelines	120
Technical Reading	121
Document Use	136
Numeracy	154
Oral Communication	199
Computer Use	210
Writing	221
Technical Skills Inventory	231

ABOUT TRADE ESSENTIALS

Trade Essentials is a research project funded under the Pan-Canadian Innovations Initiative, Human Resources and Skills Development Canada, in partnership with the Apprenticeship Section of the PEI Department of Innovation and Advanced Learning.

The Trades Essentials program was designed to increase participation in trades by providing a well-defined pathway for each client to build on present skills and access services necessary for success in his or her occupation.

This new concept, focusing on essential skills and recognition of prior learning (RPL), provides assessment, interventions and coordination of services for clients. This is the first project to provide a seamless learning path to trades certification.

To create this path, a number of educational tools were created and tested for thirteen trades. These tools are available in both official languages for use in any jurisdiction.

The Tools:

- Trade Specific Essential Skills Inventories (ESI)

Through a dynamic assessment process using contextualized Essential Skills assessments, clients can identify individual proficiency levels of the following Essential Skills: reading text, document use, numeracy, oral communication, writing and using computers.

The Essential Skills Inventory and the Technical Skills Inventory assist the client to develop a learning path which includes measurable targets to reach his/her individual goals.

- Trade Specific Essential Skills Curriculum

Trade specific curriculum frameworks have been created for each of the thirteen trades along with trades specific curriculum guidelines and suggested resource materials.

- Technical Skills Inventories (TSI)

Through a self assessment process, clients are able to identify their individual trade specific skills.

The Thirteen Trades:

Automotive Service Technician - Cabinet Maker – Carpenter - Construction Electrician – Cook - Industrial Electrician – Machinist - Metal Fabricator - Oil Burner Mechanic - Plumber - Refrigeration and Air Conditioning Mechanic - Steamfitter/Pipefitter - Welder

ACKNOWLEDGEMENTS

Materials from the *Trade Essentials Manuals* may be reproduced for individual educational purposes only. No part of this material may be reproduced or used for any commercial purpose or sold by any person other than the owner.

This project is the result of the collaboration of the following dedicated adult educational consultants in Prince Edward Island:

Ruth Rogerson
Karen Chandler
Gaelyne MacAulay
Karen Dempsey.

Our sincere thanks to the *Trade Essentials Advisory Committee* for their suggestions, input and ongoing support.

We also recognize the valuable contribution made by the apprentices and challengers who volunteered to participate in this research project. It is our sincere hope that they have gained as much from their participation as we have. We also hope that their contributions will assist many more tradespeople to reach their goals.

We are grateful to the assessors, tutors and classroom instructors who patiently piloted our materials and who gave back invaluable insights and advice.

All Trade Essentials materials have been validated by teams of tradespeople who hold Certificates of Qualification, Red Seal Endorsement. We gratefully acknowledge the crucial contribution made by the following team members:

Glenn Ellsworth (Automotive Service Technician)
Cecil Banks (Automotive Service Technician)
Scott Bagnall (Automotive Service Technician)
Darcy MacKenzie (Automotive Service Technician)
Elmer MacDougall (Cabinet Maker)
Graham Hicken (Cabinet Maker)
Gerard Lund (Carpenter)
Leo MacDonald (Carpenter)
Ryan Rogerson (Carpenter)
Darren Richards (Construction Electrician)
Mark Seaman (Construction Electrician)

Ken Zakem (Cook)
Rod Lukeman (Cook)
Barry Strongman (Industrial Electrician)
Gregg Francis (Industrial Electrician)
Jake Shaw (Machinist)
Sue LeFort (Machinist)
John Hebert (Metal Fabricator / Welder)
Joe Johnson (Metal Fabricator)
Jim Arsenault (Metal Fabricator)
Kent Mitchell (Oil Burner Mechanic / Steamfitter-Pipefitter)
Rod Arsenault (Oil Burner Mechanic / Refrigeration and Air
Conditioning Mechanic)
Kent Mitchell (Plumber)
Scott Carter (Plumber)
Charlie Redmond (Refrigeration and Air Conditioning Mechanic)
Scott Lacey (Steamfitter-Pipefitter)
Vincent Jenkins (Welder)

Thanks to the Apprenticeship Section of the PEI Department of Innovation and Advanced Learning and to the Government of Canada's Pan-Canadian Innovation Initiative for financial assistance and for continuing support to trades and apprentices in Canada.

TABLE OF CONTENTS

1	SECTION 1	10
1.1	Introduction	10
2	SECTION 2	10
2.1	Interactive Assessment	10
2.2	Adult Education	11
2.2.1	Principles of Adult Education.....	11
2.2.2	Characteristics of Adult Learners	12
3	SECTION 3	14
3.1	The Essential Skills Inventory	14
3.1.1	Process	14
3.1.2	Essential Skills Profiles	14
3.1.3	Preparation	15
3.1.4	Sections of the Inventory	17
4	SECTION 4	21
4.1	Essential Skills Inventory Records	21
5	SECTION 5	21
5.1	Essential Skills Post-Inventory	21
5.1.1	Post-Inventory Directions.....	21
5.1.2	Post-Inventory Reporting Form	22

APPENDIX A - FORMS

APPENDIX B – EXTRA INFORMATION

GLOSSARY

The definitions are intended as a guide for the language used in the Essential Skills Inventories.

ABE	Adult Basic Education
Apprentice	For the purpose of this Guide, apprentice is an inclusive term that refers to anyone working in a trade except those already certified.
Authentic workplace documents	Actual documents obtained from an employer that may be used as teaching tools. An example document is a Material Safety Data Sheet (MSDS).
Block Release Training	A period of in-school training for apprentices. It may also be referred to as Period Training or a Level.
Dynamic (interactive) Assessment	A flexible, holistic, context-sensitive approach used to evaluate learning.
Essential Skills	The set of nine skills defined by Human Resources and Skills Development Canada as being common to all occupations. The skills are: reading text (technical language), document use, numeracy (math), oral communication, writing, computer use, thinking skills, continuous learning and working with others.
Essential Skills Profile	A document that describes how each Essential Skill is used by an occupational group.
GED	General Education Diploma; a Grade 12 equivalency for adults.
Grade 12	A diploma issued by a provincial or territorial government that recognizes completion of High School. It is a challenge to use this as a common credential, since there are several different Grade 12 diplomas.

ESSENTIAL SKILLS INVENTORY ASSESSOR'S GUIDE

Intervention	For the purpose of this Guide, intervention refers to a trade-specific Essential Skills program delivered to either a group or an individual.
Journeyperson	A person who holds a Certificate of Qualification in a designated trade. A certified journeyperson is allowed to train and mentor apprentices.
Red Seal	A seal of endorsement applied to a Certification of Qualification for a trade. It allows for mobility among provinces and territories. A certified journeyperson is allowed to train and mentor apprentices.
Trade Essentials	A three-year research project to develop Essential Skills and Prior Learning assessments and curricula specific to 13 trades and to pilot the materials with six of those trades. The 13 trades included in this project were: Automotive Service Technician, Carpenter, Cabinetmaker, Cook, Construction Electrician, Industrial Electrician, Machinist, Metal Fabricator, Oil Burner Mechanic, Plumber, Refrigeration and Air Conditioning Mechanic, Steamfitter/Pipefitter and Welder. Materials were piloted with Carpenters, Steamfitter/Pipefitters, Welders, Automotive Service Technicians, Plumbers and Cooks.

1 SECTION 1

1.1 Introduction

The Essential Skills Inventories include:

- reading text
- document use
- numeracy
- oral communication
- computer use
- writing

The Essential Skills Inventories were developed during a three-year Trade Essentials project whose mandate was to develop Essential Skills assessments and curricula for 13 trades. These materials provide an opportunity for tradespeople to identify and update the Essential Skills required for their respective trades as an important step towards successful trade certification. The Essential Skills Inventory is a tool used to identify both strengths and weaknesses in trade-specific Essential Skills profiles.

2 SECTION 2

2.1 Interactive Assessment

Essential Skills Inventories:

Automotive Service Technician	7321
Carpenter	7271
Cabinetmaker	7272
Cook	6242
Construction Electrician	7241
Industrial Electrician	7242
Machinist	7231
Metal Fabricator	7263
Oil Burner Mechanic	7331
Plumber	7251
Refrigeration and Air Conditioning Mechanic	7313
Steamfitter/Pipefitter	7252
Welder	7265

Adult learners have different needs than “traditional” students so strategies must be developed to engage, motivate and build their confidence.

The Essential Skills Inventories use an innovative, interactive (dynamic) approach to assessment that is both client-centred and asset-based. An asset-based approach compares the apprentices’ present Essential Skills to the skills needed for their trade, connecting what they already know with what they need to learn.

The Inventory is a process more than a product and requires skilled and experienced assessors to establish an atmosphere where apprentices are comfortable enough to think about and explore their learning in an Essential Skills context. ***Assessors need the “inner technology” to be sensitive to the needs of the apprentice and to know when to stop an Essential Skills Inventory if the apprentice is struggling.*** The interactive assessment explores not only what the apprentice knows and can do, but also, gives an awareness of how the apprentice learns.

This type of assessment can be used in a pre- and post-format but cannot be referred to normative tables for interpretation. It is designed as a starting point for instruction in Essential Skills for the trades.

By using the trade-specific Essential Skills Inventory you can help an apprentice identify those skills to be updated by building upon the skills he/she already has. This process provides immediate, individual feedback to the learner. This is an assessment used *for* learning, not *of* learning.

Motivation is fundamental to change and this process helps an apprentice become motivated, engaged and confident in learning. Confidence can never be disconnected from skills. However, the apprentice does need to have a readiness, willingness and an ability to learn in order to be successful. In addition, many adults fear returning to a structured learning environment after a lengthy absence. It is very difficult to discover the learning needs of adults without the creation of a "safe environment". This is even more evident with those who have the greatest learning needs.

We need assessment and training so the workforce has the required Essential Skills to adapt to changing demands.

Why do apprentices need to go through this process?

At present, there is neither a process nor a place for those who are already working in a trade to update their trade-related Essential Skills other than completing Block training. Awareness of the trade-specific Essential Skills and the knowledge of the scope of a trade is a starting point on the path to certification. Individual assessments (inventories) followed by appropriate interventions (supports) provide the opportunity for eventual certification in the trade. The objective of this process is to help apprentices be successful in passing certification exams whether they be Block or Interprovincial Red Seal exams.

2.2 Adult Education

It is very important to be mindful of both the principles of Adult Education and the characteristics of adult learners.

2.2.1 Principles of Adult Education ¹

- ***Adults must want to learn.***
Trade Essentials clients have stated the primary reason for participating in an Essential Skills program and

¹ Adapted from www.literacy.ca, *Movement for Canadian Literacy, Principles of Adult Education*

obtaining certification was personal satisfaction, not job mobility or an increase in pay.

- ***Adults will learn only what they believe they need to learn.***
They have a practical approach to learning as they need to know how this learning affects them now.
- ***Adults learn by doing.***
Ninety-eight percent of the apprentices in the Trade Essentials Project identified their preferred learning style as kinesthetic.
- ***Adult learning focuses on problems and the problems must be realistic.***
The Essential Skills Inventories use trade-specific materials and focus on the apprentice's ability to solve problems since that is the nature of their jobs.
- ***Experience affects adult learning.***
All apprentices bring a varied background of acquired skills and knowledge together with an attitude about learning.
- ***Adults learn best in an informal situation.***
Many of the apprentices indicated they appreciate the opportunity to learn with their peers at a time convenient to them (evenings, Saturdays) and in a setting where they are comfortable sharing their knowledge with others. For the first time, there is a place dedicated to apprentices where they can access the information and the support they need.
- ***Adults want guidance.***
While experienced in their individual trades, apprentices may need help to create a learning plan to meet their objective.

2.2.2 Characteristics of Adult Learners ²

- ***Adult students are mature people and prefer to be treated as such.*** Being "lectured at" can cause resentment and frustration. Apprentices are usually kinesthetic learners and need to be active when

² Adapted from www.assetproject.info. *Learner Centred Methodologies*, Wynne, R.

learning. They also learn from each other in a classroom setting.

- ***Adults are goal/relevancy-oriented.*** Adults need to know why they are learning because their needs are concrete and immediate. They will be more interested in theory if it links to practical application.
- ***Adults may have insufficient confidence.*** A number of apprentices *may* have had prior experiences within the education system that have led to feelings of inadequacy, fear of study and failure. Many apprentices have been out of a formal learning situation for 20 years or more. Returning to a classroom environment can be daunting and challenging.
- ***Adults are often tired when they come to class as they are juggling work, family and other responsibilities.*** Most apprentices are working full time and are attending a program in the evenings and on occasional Saturdays. Many drive considerable distances, as well as driving in winter conditions.
- ***Adults learn best when they are ready to learn and when they have identified their own learning needs as opposed to being controlled by someone else.*** They want to choose options based on their own needs. Providing the apprentices with a chance to self-assess and identify their strengths and weaknesses is an important first step.

Adults learn at different rates and in various ways according to their learning styles, educational levels, experiences and relationships. The first section of the ESI is a Learning Styles Inventory. Most apprentices have never identified their own learning styles and this is often an “aha” moment for them. Being able to use this information for learning and studying techniques is invaluable to them.

- ***Adults have accumulated life/work experiences.*** They tend to favour learning that draws on their prior skills and knowledge. The Essential Skills Inventory is an assessment *for* learning, providing an opportunity for each apprentice to realize what he/she already knows and to move forward from that base. The Essential Skills Inventory identifies skills in need of updating using in-context materials and a guided self-

assessment. The skills may have been learned in a formal setting or on the job.

3 SECTION 3

3.1 The Essential Skills Inventory

Conducted in a manner that engages the apprentice and helps build confidence, the completed Inventory provides a picture of the apprentice's learning needs while recognizing the skills that have already been acquired. The Inventory is as much a process as a product. The time required to complete an Inventory will vary depending on the apprentice but should be completed in one and a half to two hours. Six of the nine Essential Skills are assessed in these Inventories and are in this order: reading text (technical language), document use, numeracy, oral communication, computer use and writing. The Inventory is divided into sections and the section questions are ordered from simple to complex.

3.1.1 Process

Sit *beside*, not across from, the apprentice as a table or desk impedes good communication and can be interpreted as one person being in a position of authority over another. If a round table is available, use it. Apprentices are not often asked to self assess, but will do so willingly if they are comfortable with the assessor and understand the process.

3.1.2 Essential Skills Profiles

The concept of Essential Skills and Essential Skills Profiles will likely be new to the apprentice. At the beginning of the interview therefore, introduce the trade-specific Essential Skills Profile. Give the apprentice a hard copy of the profile to take away with him/her. Encourage a thorough review of the profile as well as the Essential Skills website (www.hrsdc.gc.ca/essentialskills) for additional information.

*Knowledge is knowing ...
or knowing where to
find out.*

- Alvin Toffler

When introducing the profile, include these points:

- The profiles are Canadian. They were developed by interviewing fellow tradespersons, supervisors, managers and researchers in workplaces across the country.

ESSENTIAL SKILLS INVENTORY ASSESSOR'S GUIDE

- Over 350 occupational profiles are available on the website with development ongoing for additional profiles.
- Nine skills are identified as core skills common to all occupations. (The Trade Essentials Project developed learning materials for six of the nine Essential Skills).
- The Essential Skills are used in different ways and at different degrees of complexity, depending on the occupation.
- The complexity levels have nothing to do with Grade levels; they refer to the degree of difficulty of tasks completed at work. A scale of 1-5 is used for complexity levels and, even though there is a range in complexity levels, one must be able to complete tasks at the most complex level.

Gather the supplies you need prior to beginning the Essential Skills Inventory:

- *scientific calculator*
- *pencils and an eraser*
- *intake form*
- *skills summary form*
- *ESI printed on coloured paper*
- *Answer Key*

It is important to keep this discussion brief and framed in a positive manner. Adults do not want to spend time re-learning what they already know so it is helpful to give examples of the advantages of using the profile. Suggestions are: a) a plumbing apprentice may not ever need to know how to solve quadratic equations but will need to be very good at measurement and calculations for such uses as determining grade, elevation and slope, b) an apprentice may not have to read an entire operating manual but will need to find and use specific pieces of information from the manual, c) an apprentice will have to be very accurate when completing an incident or an accident report but will not be required to write an essay. The writing, in this instance, does not have to be long or complicated but it does need to be accurate and precise. It is important to make the connections between what they have learned in a more "academic" setting and how to apply those skills in a work setting.

3.1.3 Preparation

Print the apprentice's copy of the ES Inventory on light-coloured paper, preferably beige, as it reflects less light than white paper so is easier to read; the black print actually is clearer on a pastel background. The font used is Verdana, a sans serif font, 11 point, which is slightly easier to read than a serif font; 11 point is also easier to read than a smaller font.

The rationale for this formatting is that there is a need to provide equal opportunity for all apprentices without compromising standards. No two learners (apprentices) are the same. There is a possibility that an apprentice could have a learning disability and unless the apprentice has disclosed that information or provided documentation, you do not know who is at risk. Using standard formatting does not give an advantage to anyone.

Before you begin the actual Inventory, it is very important to explain to the apprentice that you will complete the Skills Summary Form as the assessment proceeds and you will give him/her a copy at the end of the interview. This avoids any discomfort that would be caused if the apprentice does not know why you are recording information during the Inventory. It is important to provide immediate feedback from the Inventory so the apprentice has a picture of the Essential Skills he/she needs to update. This also helps to mitigate anxiety prior to beginning an intervention.

Before you begin an Inventory, be sure to have these items:

- Two copies of the trade-specific **Essential Skills Profile** (one for the apprentice and one for you).
- Appropriate forms. You will need copies of the **Intake Form** and the **Skills Summary Form** (find samples in Appendix A).
- A copy of the **Essential Skills Inventory printed on pastel-coloured paper**, preferably beige or buff. You may want to work from a single copy with the apprentice or have a separate copy for yourself. Do whatever is comfortable for you and the apprentice.
- A copy of the **Answer Key**.
- A **pencil and an eraser**.
- A **basic scientific calculator**.

Although an apprentice may use a programmable or trade-specific calculator on the worksite, these types of calculators *cannot* be used when writing a Block or an Interprovincial exam. However, the prudent use of a basic scientific calculator should be encouraged while completing the Essential Skills Inventory. (One suggestion is the Casio FX-260 Solar.) A calculator is also a time saver on the job which results in increased efficiency and cost savings. Therefore the apprentice needs to be very familiar with its use. For anyone with a learning disability, the calculator can be a particularly helpful tool. The use of a calculator does

not, however, preclude the apprentice's ability to understand mathematical concepts and to estimate reasonable answers.

3.1.4 Sections of the Inventory

3.1.4.1 Learning Styles

Briefly explain the concept of learning styles (refer to Appendix B for more information). Then ask the apprentice to read each of the statements in the Inventory relatively quickly. Tell him/her to check any statements that are true personally, all or most of the time. It is best for the apprentice to go with a first reaction to the statement rather than to spend too much time thinking about it. If a statement does not apply, it is to be left blank. If there are *three or more* checks in one category, that indicates a preferred learning style. A pattern will emerge from the answers; most apprentices will have more than one learning style.

Follow the same instructions for the section on learning in a group or learning alone. This is important information for the apprentice and for the instructor.

3.1.4.2 Technical Language (Reading text)

This section begins with lists of words that are contextualized to the trade and have been taken from either the Essential Skills Profile (ESP) or the National Occupational Analysis (NOA) glossary. The lists are arranged in order from simple to complex, each list containing ten words.

Ask the apprentice to choose a list he/she would be comfortable reading aloud. As long as the apprentice has *seven out of ten* words correct in any list, ask him/her to continue reading aloud as far as possible with the lists. Some apprentices will begin reading at a lower level and continue to the end of list four; others will read list four on the first try. It is important for the apprentice to begin reading at a point of comfort and to proceed from there. *If an apprentice struggles with the first list, stop there.* Use the list to indicate a beginning point for the technical reading excerpts. For example, if an apprentice reads six out of ten words (less than seven) in list three, refer to section two in the reading. ***A crucial aspect of the technical reading is to know when to stop if the apprentice is struggling***

The Essential Skills Inventory provides a wealth of information about the apprentices and their learning.

with a skill. This is one of the most important skills for you to have as an assessor, that is, to be sensitive and responsive to the needs of each apprentice.

Before using the reading excerpts, ask each apprentice to read the list of pseudowords (nonsense words). Explain the reason for using this list; that decoding words is an important reading skill for comprehension, speed and fluency. If the apprentice struggles with this list and cannot read most of the words, this is a warning that the apprentice may have reading difficulties.

The reading excerpts consist of trade-related materials. A readability index has been completed on each passage as a guide for the difficulty of the reading. Give the apprentice the appropriate reading. Ask him/her to read the questions first, then find the answers to the questions from the excerpt. Explain that the answers to certain questions are not direct matches of information but require “reading between the lines” to find the answer. The questions have been intentionally placed at the beginning of the reading to help the apprentice become a “directed” reader.

Record the section(s) with which the apprentice experiences difficulty (if any). While the reading is not timed, you will want to record if an apprentice takes an exceptionally long time to answer the questions. All apprentices need to be able to read and understand at a post-secondary level (level 3) if they are to be able to confidently use materials at work and to keep pace with workplace changes.

If the apprentice does not need to update reading skills, complete the Skills Summary Form with “No updating required”. If the apprentice has difficulty answering any questions in a particular section, record the Section Number on the Skills Summary Form.

3.1.4.3 Document Use

The document use sections contain information that is presented in a format other than text. There may be charts, graphs, tables, schematics and/or blueprints that are trade-related. There is always a question taken from the National Occupational Analysis (NOA), in the form of a pie chart that explains the construction of the Interprovincial (Red Seal) exam and the percentage of questions on each topic (block) for the particular trade. This question not only indicates if

the apprentice can find and use information from a pie chart but also gives you, the assessor, the opportunity to give a brief explanation of the exam format and the scope of the specific trade.

Record the Section and **the type of document** with which an apprentice experiences difficulty. If there is no apparent difficulty, record "No updating required".

3.1.4.4 Numeracy

The numeracy sections are arranged from simple to complex and are based on the Math Skills Summary identified in the Essential Skills Profile for each trade. Not all skills are included for the sake of brevity of the Inventory but enough are included to give an instructor a picture of the skills of the apprentices. There is a *Math Legend* included in each Inventory that identifies the math concept illustrated by each question. Refer to this as you proceed through the Inventory and record the skills needing updates on the Skills Summary Sheet.

Section 1 (S-1) begins with using whole numbers. It is important to have a place for the apprentice to begin where he/she is comfortable and confident and then proceed to more difficult concepts. The apprentice will likely choose to skip the work with whole numbers. An apprentice does not have to write the answers to all the questions as this is often far too time-consuming. You can decide to ask the apprentice *how* to find the answer. *The process is as important as the product.* Stop Inventory if the apprentice is struggling. The numeracy sections take the most amount of time when completing an Inventory.

Record the section number and the concepts the apprentice needs to update. This information will be required by both the apprentice and the instructor or tutor; it will also be used for a post-inventory after instruction or self-study has occurred. If your apprentice can answer all the questions, record "No updating required".

3.1.4.5 Oral Communication

There are two parts to the Oral Communication section of the Essential Skills Inventory. The Speaking Skills Rating Scale is to be completed by you, the assessor; the other is a self-assessment completed by the apprentice. After having

spent one and a half to two hours with the apprentice, you will be able to complete most sections of the scale. If not, document a particular skill as “not assessed” or “not applicable”. The remaining questions are taken directly from the Essential Skills Profile for the trade. The questions (tasks) are arranged in order from simple to complex. The self-assessment scale mirrors the stages of learning or skill building, that is, “needs help”, “can do alone” and “can help an apprentice”. This is an opportune time to mention the fact that it is a responsibility of being a journeyperson to mentor other apprentices.

If the journeyperson indicates he/she cannot help an apprentice, record that updating is required.

3.1.4.6 Computer Use

The questions in the Computer Use section may reflect the information in the trade-specific Essential Skills Profile or may go beyond that profile. In a knowledge-based economy, it is realistic to expect a certain level of computer literacy regardless of the trade in which one is employed. The Computer Use questions reflect the basic skills required. Changes in technology will continue to occur rapidly so it is critical to have at least a basic knowledge of computer use.

Record the skills to be updated. If there are no needs identified, record “No updating required”.

3.1.4.7 Writing

The first questions in the writing section are examples taken directly from the Essential Skills profile and range in difficulty from simple to complex. The scale used reflects the stages of learning: “needs help”, “can do alone”, and “can help an apprentice”. One additional question pertains to the preparation of a resumé, a skill required by all tradespersons.

The last question is a writing sample and is common to all the Inventories. The writing sample provides an opportunity for you to observe if the apprentice is able to:

- use cursive writing (as compared to printing)
- write legibly
- complete the activity with ease or struggle to write a sentence or two

- put thoughts on paper in a logical order
- use punctuation correctly
- spell correctly
- use correct grammar

Record on the Skills Summary Form areas in need of updating, or use "No updating required".

4 SECTION 4

4.1 Essential Skills Inventory Records

*Education is what remains
after one has forgotten
what has been learned at
school.*

- Albert Einstein

You will have completed the Skills Summary form by the end of the Inventory. Using this process as a means of learning the apprentice's strengths and weaknesses provides an opportunity to give each apprentice immediate, individual and confidential feedback about his/her Essential Skills needs. Inform the apprentice that a copy will go to an instructor or a tutor if an Essential Skills intervention is planned. Both the apprentice and the instructor are then cognizant of the Essential Skills needs of each apprentice.

The information from the Skills Summary can be summarized in graph form (bar graph recommended) individually, or as a group dependent on specific needs. It is also helpful for an instructor to have an accompanying narrative.

5 SECTION 5

5.1 Essential Skills Post-Inventory

5.1.1 Post-Inventory Directions

The post-inventory will be different for each apprentice dependent upon his/her learning needs as identified in the original ES Inventory. Only the skills that were to be updated are used to create the post-inventory. There is a scale used to indicate an apprentice's improvement or mastery of the skills. This post-inventory can be used at a time determined either by the instructor or after a specific number of intervention hours.

The administrative directions for the post-inventory are that it is to be given under standard test conditions, that is, each

apprentice is to complete the inventory independently and without assistance. The time required for each post-inventory will vary, but each apprentice must be allowed the time required for completion.

5.1.2 Post-Inventory Reporting Form

See Appendix A for a sample Post-Inventory form.

APPENDIX A

FORMS

**ESSENTIAL SKILLS INVENTORY
INTAKE FORM**

DATE: _____		TIME IN: _____	
TRADE: _____		TIME OUT: _____	
1.	NAME: Last _____	First _____	Middle _____
2.	Mailing Address: _____ _____ _____ _____		Email Address: _____ _____
3.	PHONE: Home _____	Work _____	Cell _____
4.	Who is your present employer? _____		
5.	Have you registered as an apprentice?	<input type="checkbox"/> YES	<input type="checkbox"/> NO
6.	Do you have experience in other trades:	<input type="checkbox"/> YES	<input type="checkbox"/> NO
7.	What school did you attend? (be sure to document if they have Grade 12)	_____ _____	When? _____
8.	How long have you been out of school? _____		
9.	What other training have you taken? _____		
If you have written the Red Seal exam before, continue with questions 10 and 11. If you have not written the exam before, please skip to question 12.			
10.	When did you write the Red Seal exam? _____		
11.	What difficulties did you have with the exam? _____ _____		
12.	Why do you want to write the Red Seal exam? _____ _____		

ESSENTIAL SKILLS INVENTORY
INTAKE FORM

13.	Which Essential Skills updating programs do you believe will be most helpful for you?
14.	What would be the best time for you to attend a program?
	Days of the week? _____
	Time of Day? _____
	Months? _____
15.	How did you hear about this program?

NOTES:

NAME: _____

TRADE: _____

DATE: _____

Having completed the Essential Skills Inventory for your trade, this summary outlines which Essential Skills you need to update as you continue on your chosen career path.

	Auditory (hearing)	Visual (seeing)	Kinesthetic (doing)	Group	Alone
Learning Style					

1. Technical Reading _____

2. Document Use _____

3. Numeracy _____

3.1 Scientific Calculator YES _____ NO _____

4. Oral Communication _____

5. Computer Use _____

6. Writing _____

 Interviewer

Essential Skills Post Inventories

The results of the Essential Skills Inventories, completed by each of your apprentices prior to the beginning of your program, indicated the Essential Skills in need of updating for each apprentice.

To track each apprentice's progress, it is now time to complete a post-inventory of those same skills.

Please administer the Post-Inventory as a "test", that is, each apprentice is to complete the Inventory *without any help*. **Ask each apprentice to complete only the questions that are marked.** The time required will vary for each apprentice as each post-inventory is different; therefore please give each apprentice the time needed to complete the inventory. Upon completion, return the Inventories to Trade Essentials (with your program coordinator). The results will be returned to you to share with your apprentices. This will be one indication of each apprentice's readiness to challenge an exam whether it be the IP Red Seal exam or block exam.

If you have any questions, please contact the Trade Essentials office at 620-3623.

Thanks in advance for your cooperation.

NAME:

TRADE:

DATE:

INSTRUCTOR:

Upon completion of the Essential Skills Inventory prior to the beginning of the program, your Essential Skills Summary indicated that you would benefit from instruction in the Essential Skills shown in the chart below as you prepare for licensing in your trade.

The results of the Post Inventory indicate which of your Essential Skills have improved, which need further development and those that appear to meet trade requirements. Please note that "meets trade Essential Skill requirement" means that you had the correct response to *each* question.

	Shows Improvement	Needs further development	Meets trade Essential Skill requirement
Technical Reading			
➤ Section 1			
➤ Section 2			
➤ Section 3			
➤ Section 4			
Document Use			
➤ Section 1			
➤ Section 2			
➤ Section 3			
➤ Section 4			
Numeracy			
➤ Section 1			
➤ Section 2			
➤ Section 3			
➤ Section 4			

APPENDIX B

EXTRA INFORMATION

The following information is provided as supplemental information for you the interviewer. Because the Essential Skills initial interview is a dynamic assessment involving your input and possible responses to the apprentice, you may need/want additional reference material on both Learning Styles and the Essential Skills required for the various trades.

Learning style refers to the way an individual processes information, that is, the way a person learns best. Most people tend to use one sense more than the other. However, a number of people may learn equally well regardless of how information is presented to them. Knowing your learning style is an important key to improving success in a classroom and on exams.

It is important to know *how* one learns, not just *what* one needs to learn. Completion of the Learning Styles section at the beginning of the Essential Skills Inventory will help the apprentice discover his/her learning style. This can often be an “Aha” moment for the apprentice as s/he may not have had access to this information. The learner can then reflect on, gather, or be provided with information about the study and learning techniques suited to his/her individual learning style. This knowledge should contribute to an improvement in the quality and speed of learning.

There are basically three learning styles preferences: auditory (hearing), visual (seeing), and kinesthetic (doing, experiencing).

Visual learners are those who learn best by seeing things. A visual learner may display these characteristics:

- good at spelling but may forget names
- needs quiet time to study
- needs time to think before understanding a lecture
- understands/likes charts
- good with sign language

Auditory learners are those who learn best by hearing things. An auditory learner may display these characteristics:

- not afraid to speak in a group/class
- likes to read aloud to him/herself
- likes oral reports
- good at explaining
- remembers names
- enjoys music
- good at grammar and foreign languages
- may read slowly
- follows spoken directions well
- good in study groups
- finds it difficult to stay quiet for long periods

Kinesthetic learners are those who learn by experiencing /doing things. A kinesthetic learner is one who:

- can't sit still for long
- may be good at sports
- may not have great handwriting
- likes role playing
- studies with music playing
- takes breaks when studying
- fidgets during lectures

(Adapted from <http://homeworktips.about.com>)

Suggested strategies for studying /learning are:

Auditory	Visual	Kinesthetic
Listen to instructions and information orally	Watch for key words to summarize points	Ask questions and participate in discussions whenever possible
Sit towards the front of the room	Complete readings before class	Do something physical before sitting down to study
Repeat information silently to yourself	Use visuals like symbols and color in notes	Break reading tasks into small chunks
Work in quiet areas	Write down what you hear	Highlight, underline or take notes
Tape important information	Ask for other visual information	Take regular brief breaks to move around
Use rhymes or jingles to summarize important points	Try to remember important terminology by looking for parts of words already known	Break reading into chunks and write brief summaries
Create verbal descriptions	Color code notes	

(Adapted from The University of Western Ontario, Student Development Centre)

Note : There are many Learning Style Inventories available, some of which can be completed on line. These sites may also provide strategies for learning for each Learning Style.

Suggestions are:

www.vark-learn.com

<http://homeworks.about.com>

www.sdc.uwo.ca

pi (π) = 3.1415926535 ...

Perimeter formula

Square	$4 * \text{side}$
Rectangle	$2 * (\text{length} + \text{width})$
Parallelogram	$2 * (\text{side1} + \text{side2})$
Triangle	$\text{side1} + \text{side2} + \text{side3}$
Regular n-polygon	$n * \text{side}$
Trapezoid	$\text{height} * (\text{base1} + \text{base2}) / 2$
Trapezoid	$\text{base1} + \text{base2} + \text{height} * [\csc(\text{theta1}) + \csc(\text{theta2})]$
Circle	$2 * \pi * \text{radius}$
Ellipse	$4 * \text{radius1} * E(k, \pi/2)$ E(k, $\pi/2$) is the Complete Elliptic Integral of the Second Kind $k = (1/\text{radius1}) * \sqrt{\text{radius1}^2 - \text{radius2}^2}$

Area formula

Square	side^2
Rectangle	$\text{length} * \text{width}$
Parallelogram	$\text{base} * \text{height}$
Triangle	$\text{base} * \text{height} / 2$
Regular n-polygon	$(1/4) * n * \text{side}^2 * \cot(\pi/n)$
Trapezoid	$\text{height} * (\text{base1} + \text{base2}) / 2$
Circle	$\pi * \text{radius}^2$
Ellipse	$\pi * \text{radius1} * \text{radius2}$
Cube (surface)	$6 * \text{side}^2$
Sphere (surface)	$4 * \pi * \text{radius}^2$
Cylinder (surface of side)	$\text{perimeter of circle} * \text{height} = 2 * \pi * \text{radius} * \text{height}$
Cylinder (whole surface)	Areas of top and bottom circles + Area of the side
	$2(\pi * \text{radius}^2) + 2 * \pi * \text{radius} * \text{height}$
Cone (surface)	$\pi * \text{radius} * \text{side}$
Torus (surface)	$\pi^2 * (\text{radius2}^2 - \text{radius1}^2)$

Volume formula

Cube	side^3
Rectangular Prism	$\text{side1} * \text{side2} * \text{side3}$
Sphere	$(4/3) * \pi * \text{radius}^3$
Ellipsoid	$(4/3) * \pi * \text{radius1} * \text{radius2} * \text{radius3}$
Cylinder	$\pi * \text{radius}^2 * \text{height}$
Cone	$(1/3) * \pi * \text{radius}^2 * \text{height}$
Pyramid	$(1/3) * (\text{base area}) * \text{height}$
Torus	$(1/4) * \pi^2 * (r1 + r2) * (r1 - r2)^2$

METRIC PREFIX IN ELECTRONICS

Multiplication Factor	Prefix	Symbol
$1,000,000,000,000,000,000 = 10^{18}$	exa	E
$1,000,000,000,000,000 = 10^{15}$	peta	P
$1,000,000,000,000 = 10^{12}$	tera	T
$1,000,000,000 = 10^9$	giga	G
$1,000,000 = 10^6$	mega	M
$1,000 = 10^3$	kilo	k
$100 = 10^2$	hecto	h
$10 = 10^1$	deka	da
$0.1 = 10^{-1}$	deci	d
$0.01 = 10^{-2}$	centi	c
$0.001 = 10^{-3}$	milli	m
$0.000\ 001 = 10^{-6}$	micro	μ
$0.000,000,001 = 10^{-9}$	nano	n
$0.000,000,000,001 = 10^{-12}$	pico	p
$0.000,000,000,000,001 = 10^{-15}$	femto	f
$0.000,000,000,000,000,001 = 10^{-18}$	atto	a

Example: $1500\text{ Hz} = 1.5\text{ kHz} = 1.5\text{ kilohertz} = 1.5 \times 10^3\text{ Hz}$

Example: $0.007\text{ A} = 7\text{ mA} = 7\text{ milliamps} = 7 \times 10^{-3}\text{ Amps}$

Each different ratio has its own formula. These are shown below.

The ratio of $\frac{\text{opposite}}{\text{hypotenuse}}$ = sine or sin

The ratio of $\frac{\text{adjacent}}{\text{hypotenuse}}$ = cosine or cos

The ratio of $\frac{\text{opposite}}{\text{adjacent}}$ = tangent or tan

NOTE

The acronyms for the three ratios are:

- Sine opposite hypotenuse – SOH
- Cosine adjacent hypotenuse – CAH
- Tangent opposite adjacent - TAS

These acronyms are extremely helpful as they can be used to write out the three different formulas and aid in solving trigonometry questions. These three formulas can be changed into three formula triangles and then it is a matter of substituting them into the formula. The three formula triangles are shown in Figure 9.

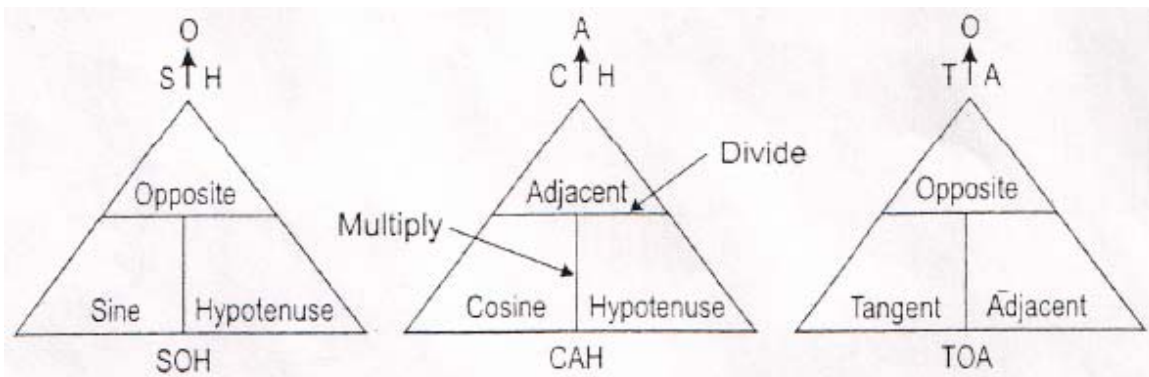


Figure 9 – Formula triangles

To use the formula triangles, cover the unknown and complete the remaining calculation. Each formula triangle can be used to construct three variations.

TABLE OF CONTENTS

MACHINIST NOC 7231

	PAGE
Learning Styles Checklist	39
Technical Reading (Reading Text)	
Technical Language	41
Pseudowords	42
Section 1	43
Section 2	44
Section 3	45
Section 4	46
Document Use	
Section 1	48
Section 2	50
Section 3	51
Section 4	52
Numeracy	
Section 1	53
Section 2	56
Section 3	60
Section 4	61
Oral Communication	64
Computer Use	66
Writing	67

NAME:

DATE:

LEARNING STYLES CHECKLIST**Learning by hearing (auditory)**

- ☐ I remember the things I hear better than the things I see.
- ☐ I learn better when someone explains to me how to do something better than when I follow a diagram.
- ☐ I find it easier to remember a telephone number I have heard than one I have read.
- ☐ I prefer to listen to the news on the radio than to read the newspaper.
- ☐ I remember the times tables by saying them to myself.
- ☐ After I am introduced to someone, I'm good at remembering his/her name.

Learning by seeing (visual)

- ☐ I remember what I've seen, better than what I have heard.
- ☐ I remember what happened by seeing the incident in my head.
- ☐ I remember what I hear by picturing it in my head.
- ☐ I am good at remembering faces.
- ☐ When someone says a number, I don't understand it until I see it written down.
- ☐ I can add simple numbers which are written down better than numbers that are in my head (e.g., $16+24+10+98$).
- ☐ To remember a car license number, I picture it in my head.

Learning by doing (kinesthetic)

- ☐ When I put something together, I remember how it works.
- ☐ I remember certain directions after I have done something once or twice.
- ☐ I like to do things like simple repairs where I can use my hands.
- ☐ I can learn best if the instructor uses models, experiments and other practical tools to show what he/she is talking about.
- ☐ Using concrete examples is a good way for me to improve my math or spelling skills.
- ☐ I remember telephone numbers if I've dialed them a few times.

Learning in a group

- ☐ I like learning in a group so I can discuss the work with others.
- ☐ I enjoy helping other people in the group with their work.
- ☐ If I need to do something, I don't mind asking the person next to me.

Learning Alone

- ☐ I can concentrate best if I work on my own.
- ☐ It's hard to work if people are talking around me.
- ☐ I'd be embarrassed to show my mistakes to anyone other than an instructor.
- ☐ I can't concentrate if people are moving around the room.

(Adapted from SGL Handbook, ALSO, Ottawa)

1	2	3	4
pitch	helix	diameter	micrometer
crest	knurling	vernier	counterbore
drill	alloy	radial	centrifugal
thread	shackle	parallel	numerical
depth	cotter	pedestal	comparator
gauge	coolant	abrasive	adjustable
lathe	grinder	turnbuckle	compensations
force	reamer	trepanning	material
grit	chisel	calipers	capacity
dies	mandrels	optical	indexable

poy

meef

fesh

moyp

toof

koyth

hafe

tibe

hoysh

thoop

marp

theg

yome

zule

NAME:

DATE:

From the article below, answer the following questions.

1. Of which two elements is steel made?

2. What would be the number used to describe steel with 40% carbon content and combined with the alloy nickel (number 23)?

Steel

Steel is a material that is made up of iron. Most steel contains over 90% iron, and many carbon steels contain more than 99%. In addition to iron, steel is made up of a second element: carbon. Other alloys are contained in steel, but iron and carbon are only two elements that exist in steel. Steels that contain the least carbon are more ductile than others but not as strong. When carbon is added, strength, hardness, and brittleness increase.

Steel is made by dissolving the carbon in iron. Sometimes, there is too much carbon for the iron to "digest". In this case, the alloy can no longer be called steel. The carbon will precipitate out and remain as carbon flakes. There are many different types of steel and each has a name containing four numbers. The first two digits tell us the alloy content and the last two (or three) digits refer to the percent of carbon in the steel.

Evaluating Academic Readiness for Apprenticeship Training, Communication Skills # 5, Ontario Ministry of Education, 2008
FOG Index 6.5

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. What is the meaning of torque?

2. Which type of gear would you choose when you need high torque?

3. Why can helical gears run more smoothly than spur gears?

Gears and Gearing

Gears transmit power positively from one shaft to another. When the matching teeth of two gears engage, they can maintain power and exact speed ratios. They can increase or decrease the speed of the driven shaft which results in an increase or decrease to the turning power (torque) of the shaft. Although shafts in a gear drive are usually parallel, they can be driven at any angle by gears designed to do this. Different types of gears are used in industry:

Spur gears generally transmit power between two parallel shafts. Teeth on these gears are straight and parallel to the shafts to which they are attached. They are used where slow to moderate speed drives are needed.

Internal gears are used where shafts are parallel but where the centres must be closer than possible with spur (or helical) gears. Because of a greater area of contact, a stronger drive than with conventional gear drive is possible. Speed reductions are also possible with minimum of space requirements. These gears are suited for heavy-duty tractors for high torque demands.

Helical gears can contact parallel or shafts at an angle. The action of the teeth is termed progressive rather than intermittent and for this reason these gears run more smoothly and quietly than spur gears. Also, because more than one gear is engaged at any time, these gears are stronger than spur gears of the same size and pitch. Special bearings may be required of shafts to overcome the end thrust produced as these gears turn.

*Evaluating Academic Readiness for Apprenticeship Training Communication Skill #10, Ontario Ministry of Education 2008
FOG Index 10.4*

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. Nickel and copper share many of the same properties. Why is copper used more often?

2. What is an *alloy* as referred to in the article?

3. What is the meaning of *dimensionally stable*?

Nickel (NI)

Nickel is valued for its good resistance to corrosion and oxidation. Pure nickel is used for metal plating, electrical contacts, food processing components and coinage. When used as an alloying element, it imparts toughness, ductility, high strength and wear-resistance. Austenitic stainless steels, for example, have nickel added to achieve many of these properties.

Although nickel has many of the same properties as copper, it is much more expensive, so it is used only where properties unique to nickel are required.

Monel is an alloy of nickel and copper, used widely in marine applications because of its high strength and resistance to salt-water corrosion.

Invar is an alloy of nickel and iron. It is unique among metals in that it is dimensionally stable over an ordinary range of temperatures. In other words, it does not shrink or expand as the temperature changes, making it useful for length standards and bimetal strips.

Inconel, *Chromel* and *Nichrome* are trade names for alloys containing nickel and chromium. These metals are used in heating elements, thermocouples and other high-temperature applications.

Superalloys, containing nickel, chromium and molybdenum, are used in applications where temperatures as high as 1800°F (1000°C) are anticipated.

Individual Learning Module 150203b, Metal Specifications and Testing, 2008
FOG Index 12.2.

NAME:

DATE:

From the article below, answer the following questions.

1. Name four changes in today's machine tools.

2. Name two examples of incremental advancements in cutting tool technology.

3. What does "more revolutionary than evolutionary" mean?

New Technology addresses insert wear resistance, toughness dilemma

A new methodology addresses the long-standing dilemma of increasing both the wear resistance and toughness of a cutting insert at the same time.

Achieving greater productivity and improving competitiveness is important across all of manufacturing. Within the metal cutting industry, research and development efforts continue to be focused on developing increasingly productive technologies. Success has come over the years with frequent incremental increases in machine tool, tool holding and cutting tool capability.

For example, advancements in machine tools have been noticeable and numerous. Today's equipment is capable of higher speeds, machining in multiple axes, quick tool change, multi-spindle capability and much more.

Tool holding, the critical connection between machine and tool, can be accomplished using a number of methods and continues to improve, providing accuracy and runnout in the tenths of thousandths. And, cutting tools continue to evolve for all materials and intended applications.

In the past, advancements in cutting tool technology have typically been incremental. A new geometry, a new grade, a new coating on a cutter body ... all designed to improve quality, productivity or reduce cost.

However, a recent introduction in the world of indexable carbide that is much more than a slight improvement has been pioneered. The tool is a coated cemented carbide grade developed for steel turning that provides results that are more revolutionary than evolutionary for this significantly large and important marketing segment. However, the real development was in the process used to develop the coating.

www.metalworkingcanada.com/index.php/Magazine10/30/08
(FOG Index 14.2)

NAME: _____

DATE: _____

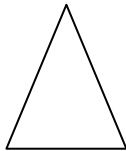
1. In Column 2, sketch the geometric shapes pictured in Column 1 as they would appear in 3 dimensions. In column 3, name the 3-dimensional figure.

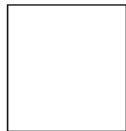
Column 1

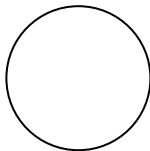


Column 2

Column 3







2. From the table on the next page, determine the correct pipe size for #4-20 thread.

3. Find the correct pipe size for a 5/8-11 thread.

TAP DRILL SIZES

Table 6. Tap Drill Sizes for Threads of American National Form

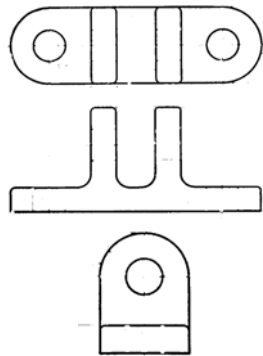
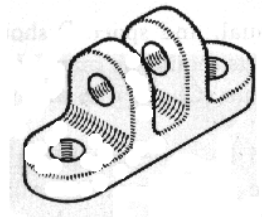
Screw Thread		Commercial Tap Drills ^a		Screw Thread		Commercial Tap Drills ^a	
Outside Diam. Pitch	Root Diam.	Size or Number	Decimal Equiv.	Outside Diam. Pitch	Root Diam.	Size or Number	Decimal Equiv.
1/16-64	0.0422	3/64	0.0469	27	0.4519	1 1/32	0.4687
72	0.0445	3/64	0.0469	9/16-12	0.4542	3 1/64	0.4844
3/64-60	0.0563	1/16	0.0625	18	0.4903	3 3/64	0.5156
72	0.0601	52	0.0635	27	0.5144	1 7/32	0.5312
3/32-48	0.0667	49	0.0730	5/8-11	0.5069	1 7/32	0.5312
50	0.0678	49	0.0730	12	0.5168	3 5/64	0.5469
7/64-48	0.0823	43	0.0890	18	0.5528	3 7/64	0.5781
1/8-32	0.0844	3 1/32	0.0937	27	0.5769	1 9/32	0.5937
40	0.0925	38	0.1015	1 1/16-11	0.5694	1 9/32	0.5937
3/32-40	0.1081	32	0.1160	16	0.6063	5/8	0.6250
3/32-32	0.1157	1/8	0.1250	3/4-10	0.6201	2 1/32	0.6562
36	0.1202	30	0.1285	12	0.6418	4 3/64	0.6719
1 1/64-32	0.1313	9/64	0.1406	16	0.6688	1 1/16	0.6875
3/16-24	0.1334	26	0.1470	27	0.7019	2 3/32	0.7187
32	0.1469	22	0.1570	1 1/16-10	0.6826	2 3/32	0.7187
1 3/64-24	0.1490	20	0.1610	7/8-9	0.7307	4 9/64	0.7656
7/32-24	0.1646	16	0.1770	12	0.7668	5 1/64	0.7969
32	0.1782	12	0.1890	14	0.7822	1 3/16	0.8125
1 5/64-24	0.1806	10	0.1935	18	0.8028	3 5/64	0.8281
1/4-20	0.1850	7	0.2010	27	0.8269	2 7/32	0.8437
24	0.1959	4	0.2090	1 5/16-9	0.7932	3 5/64	0.8281
27	0.2019	3	0.2130	1-8	0.8376	7/8	0.8750
28	0.2036	3	0.2130	12	0.8918	3 7/64	0.9219
32	0.2094	7/32	0.2187	14	0.9072	1 5/16	0.9375
5/16-18	0.2403	F	0.2570	27	0.9519	3 1/32	0.9687
20	0.2476	1 7/64	0.2656	1 1/8-7	0.9394	6 3/64	0.9844
24	0.2584	I	0.2720	12	1.0168	1 3/64	1.0469
27	0.2644	J	0.2770	1 1/4-7	1.0644	1 7/64	1.1094
32	0.2719	9/32	0.2812	12	1.1418	1 11/64	1.1719
3/8-16	0.2938	5/16	0.3125	1 3/8-6	1.1585	1 7/32	1.2187
20	0.3100	2 1/64	0.3281	12	1.2668	1 19/64	1.2969
24	0.3209	Q	0.3320	1 1/2-6	1.2835	1 11/32	1.3437
27	0.3269	R	0.3390	12	1.3918	1 27/64	1.4219
7/16-14	0.3447	U	0.3680	1 3/8-5 1/2	1.3888	1 29/64	1.4531
20	0.3726	2 5/64	0.3906	1 3/4-5	1.4902	1 9/16	1.5625
24	0.3834	X	0.3970	1 7/8-5	1.6152	1 11/16	1.6875
27	0.3894	Y	0.4040	2-4 1/2	1.7113	1 25/32	1.7812
1/2-12	0.3918	2 7/64	0.4219	2 1/8-4 1/2	1.8363	1 29/32	1.9062
13	0.4001	2 7/64	0.4219	2 1/4-4 1/2	1.9613	2 1/32	2.0312
20	0.4351	2 5/64	0.4531	2 3/8-4	2.0502	2 1/8	2.1250
24	0.4459	2 5/64	0.4531	2 1/2-4	2.1752	2 1/4	2.2500

Machinery's Handbook Pocket Companion, Industrial Press Inc., New York, 2008

NAME: _____

DATE: _____

- Below is a schematic of a machine part. Identify the 3 dimensional views: the top view, the end view and the front view.



NAME:

DATE:

1. The chart below is a description of how thread designations are made. Use the chart and the sample illustration to describe the following:

1/4-28 UNF-2A LH

Major diameter of thread

- Number of threads per inch
 - • Thread series symbols
 - • • Class of thread
 - • • • External thread
 - • • • • Left hand
 - • • • • •
- 3/4 10 UNC 2 A LH

Sample:

No. 12 (0.216) - 24 NC-3. This is a number 12 (0.216 inch diameter) thread, 24 National Coarse threads per inch, and a Class 3 fit.

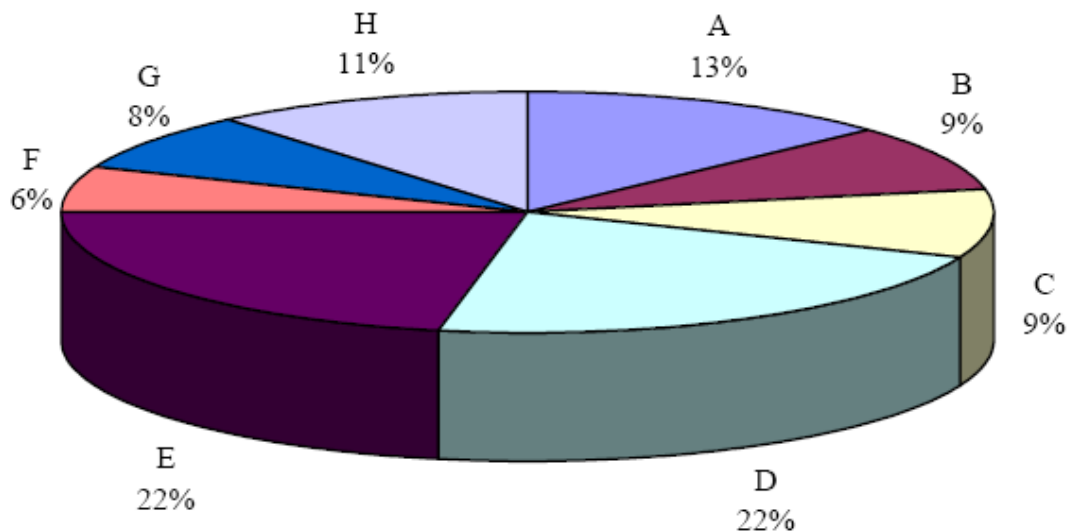
Lathe Operations, Subcourse OD1645, Edition 8, US Army Correspondence Program

NAME: _____

DATE: _____

The licensing exam for your trade consists of 135 multiple choice questions. The pie chart below indicates the percentage of questions on each exam topic.

- Underline or circle the two topics that have the greatest number of questions.
- How many questions are on:
Occupational skills? _____
CNC machines? _____



Block A Occupational Skills

Block E Mills

Block B Bench Work

Block F Saws

Block C Drill Presses

Block G Grinders

Block D Lathes

Block H Computer Numerical Control (CNC)
Machines

Machinist, Occupational Analyses Series, 2005, Human Resources Partnerships Directorate

NAME: _____

DATE: _____

Calculate the following:

1. $\begin{array}{r} 13812 \text{ mm} \\ +16442 \text{ mm} \end{array}$ 2. $\begin{array}{r} 3401 \text{ in.} \\ - 1824 \text{ in.} \end{array}$ 3. $\begin{array}{r} 2465 \text{ ft.} \\ \times 98 \end{array}$ 4. $\begin{array}{r} 10\,024 \text{ km} \\ \div 24 \text{ km} \end{array}$

5. $\begin{array}{r} .0067 \text{ mm} \\ + .2543 \text{ mm} \end{array}$ 6. $\begin{array}{r} 26 \text{ cm} \\ - .03 \text{ cm} \end{array}$ 7. $\begin{array}{r} .034 \text{ m} \\ \times .025 \text{ m} \end{array}$ 8. $\begin{array}{r} 13.25 \text{ mm} \\ \div 25 \text{ mm} \end{array}$

9. $6 + (-3)'' =$ _____ 10. $-4 - (-3)'' =$ _____ 11. $4(-3) \text{ mm} =$ _____ 12. $\begin{array}{r} 12 \text{ mm} \\ \div (-4) \text{ mm} \end{array}$

The number line below represents positive and negative integers. (see question #13).



13. $72 \div 6 + 4 \times 3^\circ\text{C} =$ _____ $^\circ\text{C}$ 14. $6(25-5) + 16 - 2(8-6)^\circ\text{C}$ _____ $^\circ\text{C}$

Calculate the following

15. $6^3 \text{ mm} =$ _____ 16. $10^6 =$ _____ 17. $10^{-3} =$ _____ 18. $\sqrt{(16^3)} =$ _____

19. $\frac{7}{8}'' - \frac{5}{8}'' =$ _____ 20. $\frac{9}{5} \times \frac{7}{8} =$ _____ 21. $1\frac{1}{5}' \div 2\frac{1}{2}' =$ _____

22. Complete the chart with the missing measurements.

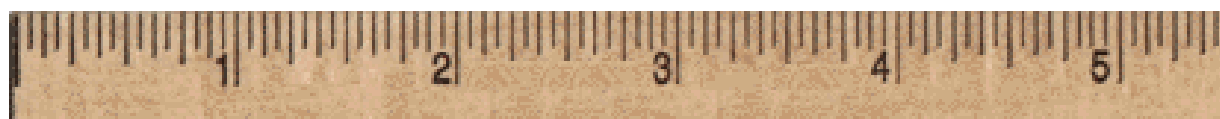
Fraction	Decimal	Percent
$\frac{1}{2}$	.5	50%
	.75	75%
$\frac{3}{16}$		
$\frac{1}{32}$		

23. Complete the table below with the missing measurements.

1 inch = 25.4 mm

Fractional inch	Decimal inch	Millimeters
$\frac{1}{64}$	0.015625	
	0.1875	
$\frac{9}{32}$		
	0.375	
		1.27

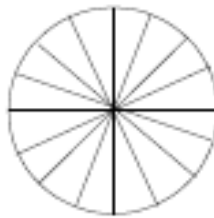
24. On the steel rules below, mark a) 25.4 mm, b) 1 in., c) $4\frac{15}{16}$ in. and d) 2.54 cm.



Convert the following measurements of length:

25. 1.046 mm = _____ cm 26. 0.0086 m = _____ mm
27. 144 in. = _____ yds. 28. 0.92 km = _____ m
29. 96 in. = _____ ft. 30. 0.090 m = _____ mm
31. $\frac{1}{2}$ in. = _____ mm 32. 8.000 m = _____ ft.

33. The circle below is divided into equal parts. State the fraction that represents each of the following:



- a) 3 parts _____
- b) $\frac{1}{2}$ of one part _____
- c) $\frac{3}{4}$ of one part _____
- d) $\frac{1}{16}$ of one part _____
- e) $\frac{1}{10}$ of one part _____
- f) 16 parts _____

34. Calculate the range of measurement for the following:

2.05 with a tolerance of ± 0.3 mm _____

3.6 with a tolerance of ± 0.6 in. _____

NAME: _____

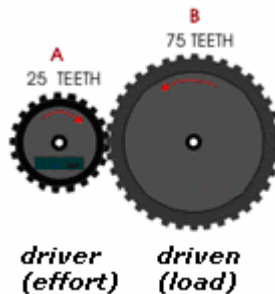
DATE: _____

1. A motor is said to be 85% efficient if the output (power delivered) is 85% of the input (power received). How many horsepower does a motor receive if it is 85% efficient with a 7.7 horsepower output?

_____ hp

2. On a production run of castings, 7% of the castings produced are rejected. If 420 units are rejected, how many units were produced?

3. What is the ratio of gear A to gear B? (give your answer in lowest terms) (Gear ratio is always expressed as driven:drive)



4. How would you determine the ratio of the longer piece of stock to the shorter one?

14 in

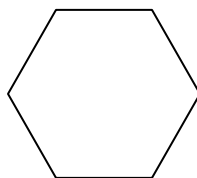
1.5 ft

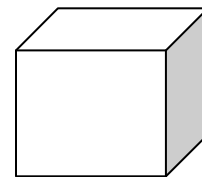
5. If you can produce 240 parts in 4 hours, how many can you make in 5 ½ hours?

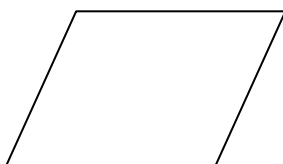
6. If it takes 5 machines 1.6 hours to produce the required number of pieces of product, how long would it take 3 machines to produce the same number if the conditions remain the same?

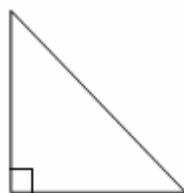
7. Identify each of the geometric shapes shown below:

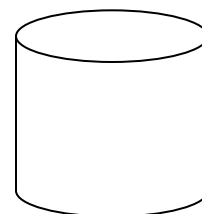


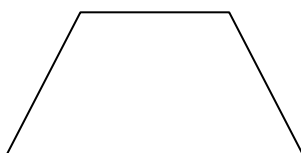


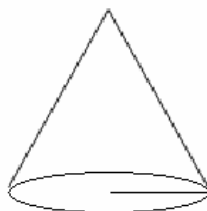


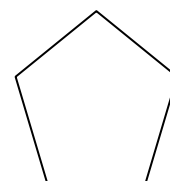












8. Label the parts on the cover plate. For example, AB is the diameter.

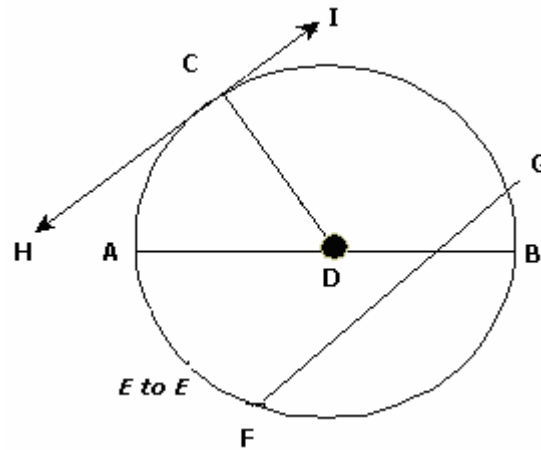
AD = _____

E to E = _____

AC = _____

FG = _____

HI = _____

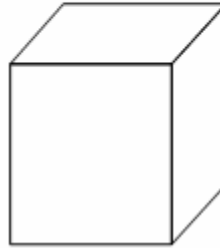
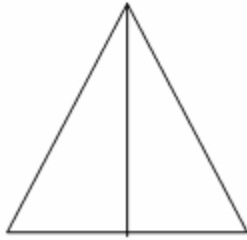
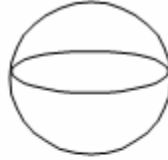


The number of degrees in a circle is _____.

The number of degrees in a straight line is _____.

The sum of the angles in a triangle is _____.

9. Match the formula to the problem it will help you solve. Use the diagrams as a reference.



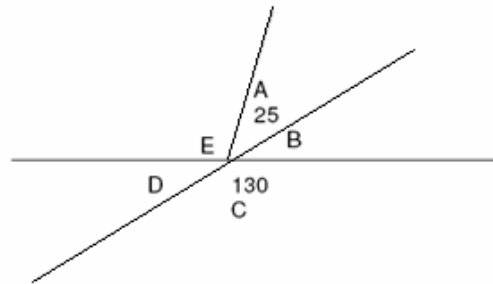
1. $p = 2l + 2w$ _____
2. $A = \pi r^2$ _____
3. $A = \frac{1}{2}bh$ _____
4. $C = \pi d$ _____
5. $A = lw$ _____

- a. area of a triangle
- b. circumference of a circle
- c. area of a circle
- d. area of a rectangle
- e. perimeter of a rectangle

NAME: _____

DATE: _____

1. According to the diagram below, what is the value of $\angle E$? _____



2. a) The formula for the volume of a cylinder is $V = \pi r^2 h$. If a cylinder is 12 cm high and has a radius of 7 cm, what is its volume?

- b) What would be the formula needed to calculate the height of the cylinder?

3. You are required to machine a 275 mm diameter gear blank. The cutting speed (V) is 28 metres per minute. How many revolutions per minute (rpms) (N) are required to complete the task? Round your answer to the nearest whole number. Use the formula shown.

$N = \frac{1000 \times V}{3.1416 \times D}$

4. You need to know the diameter (D) of a piece of stock to be machined. The cut metre shows the surface speed (V) to be 52 feet per minute (f/m) and the stock is being turned at 50 revolutions per minute (rpms, N). Round your answer to the nearest ten thousandth of an inch.

NAME: _____

DATE: _____

Calculate the following:

1. $14x + 6x =$ _____

2. $22x \times 2x =$ _____

3. $4x^2 \div 2x =$ _____

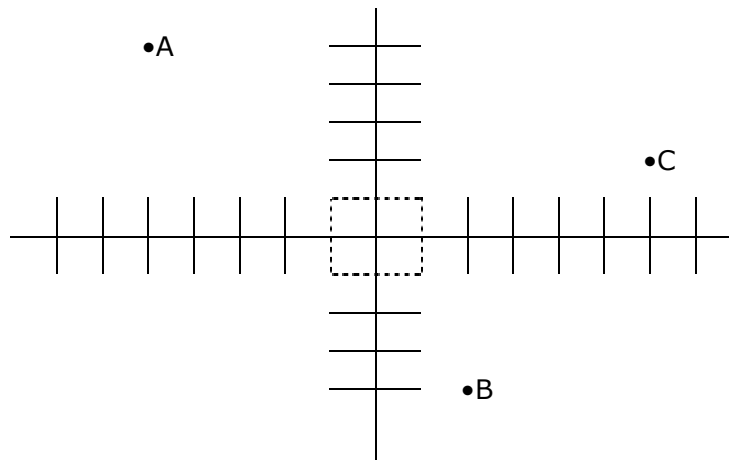
4. $6x - 33 =$ _____

5. State the coordinates of points A, B and C on the graph below.

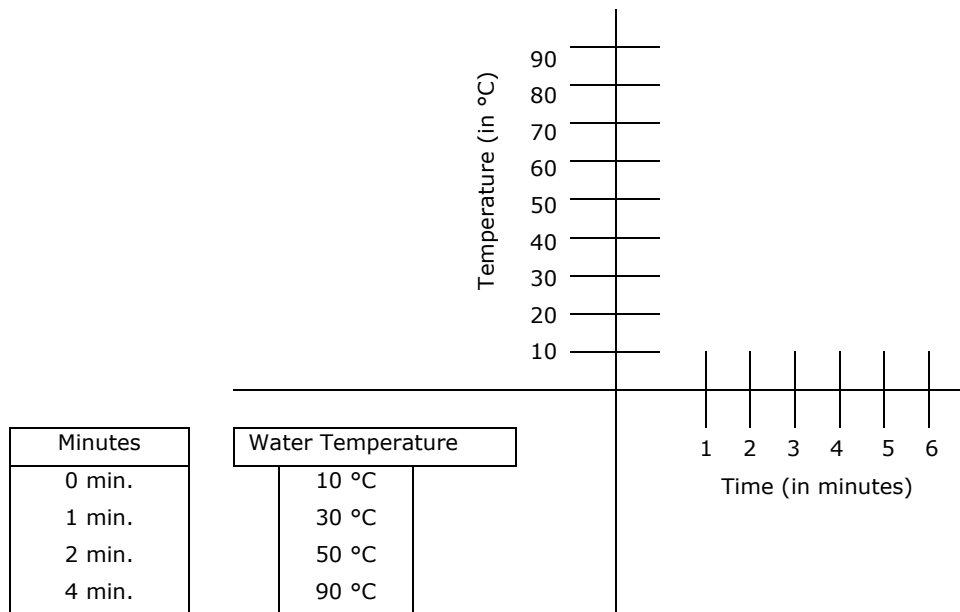
A = _____

B = _____

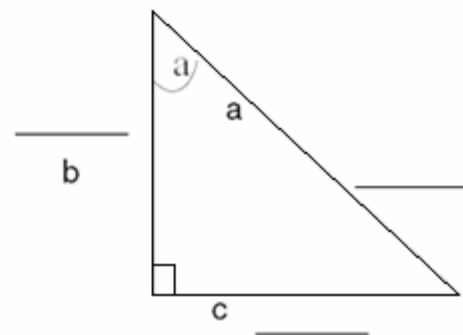
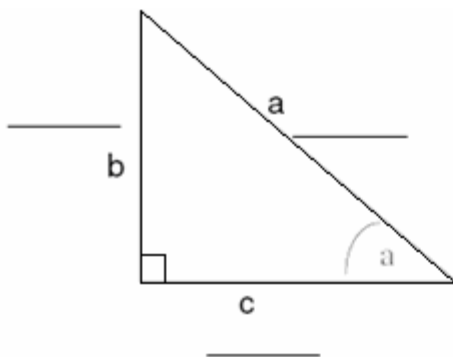
C = _____



6. Use the table to plot the points on the grid.



7. In the right triangles below, use the angle marked to name the sides of each of the triangles as adjacent, opposite, or hypotenuse.



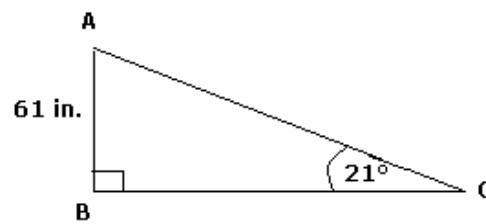
8. In the first triangle above, if $b = 3$ and $c = 5$, what is the length of side a ?

9. The formula for a tangent ratio is:

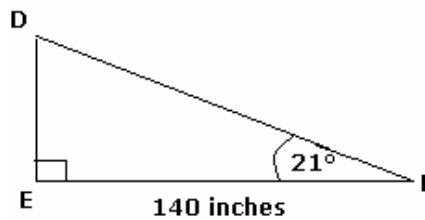
$$\tan = \frac{\text{opposite side}}{\text{adjacent side}}$$

What would be the formula for finding the length of an opposite side when you already know the tangent and the length of the adjacent side?

10. a) Using the diagram, calculate the length of side BC.



- b) Using the diagram, calculate the length of DE.



NAME: _____

DATE: _____

** To be completed by the Assessor – not the Learner***Speaking Skills Rating Scale**

		Improvement Needed	Acceptable	Very good
1.	Is comfortable communicating orally (i.e., body posture and facial expressions are appropriate)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Maintains eye contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Waits for his/her turn to speak	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Willingly and confidently engages in conversation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Performs social courtesies, such as greeting others, using titles and making introductions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Speaks at an appropriate volume	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Rate of speech is understandable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Adjusts voice inflection for statements, requests, directions, exclamations and questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Pronounces words clearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Does not use stalling devices such as "uh", "you know", etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Does not say the same thing twice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Uses words and phrases related to the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Has a good vocabulary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Speaks in complete sentences of appropriate length	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Uses good grammar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Maintains focus on the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Gives appropriate responses to questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Is aware of listener's reaction and responds appropriately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Talks "with" rather than "at" a person	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In your work as a Machinist, you need excellent communication skills for both speaking and listening.

Please rate yourself in the following situations:

		Need help	Can do alone	Can help an apprentice
1.	Share information and opinions with other machinists.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Clarify work instructions with supervisors or other staff when scale drawings of work orders are unclear or incomplete.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Discuss machining jobs during meetings with supervisors and other team members.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Present information to a group.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<http://srv108.services.gc.ca>, *Essential Skills Profile, Machinist, 2008*

NAME:

DATE:

		YES	NO
1.	Do you use a computer at home?	<input type="checkbox"/>	<input type="checkbox"/>
	at work?	<input type="checkbox"/>	<input type="checkbox"/>
2.	Do you use any computerized equipment/ systems at work, for example, computer assisted design, manufacturing or machining software?	<input type="checkbox"/>	<input type="checkbox"/>
3.	Do you know the "language" used to describe computers, for example, monitor, software, hardware, word processing, data base, virus and SPAM	<input type="checkbox"/>	<input type="checkbox"/>
4.	Do you use a computer to:	Need help	Can do alone
			Can help an apprentice
	Search for information on the internet?	<input type="checkbox"/>	<input type="checkbox"/>
	Send and receive email, including attachments?	<input type="checkbox"/>	<input type="checkbox"/>
	Write a memo, letter or report (use word processing software)?	<input type="checkbox"/>	<input type="checkbox"/>
	Manage files and folders?	<input type="checkbox"/>	<input type="checkbox"/>
	Use a data base?	<input type="checkbox"/>	<input type="checkbox"/>

NAME:

DATE:

Please rate your ability to perform the following writing tasks that you will encounter in your work as a Machinist.

		Need help	Can do alone	Can help an apprentice
1.	Write emails and memos to supervisors, engineers or computer programmers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Write reports describing problems encountered on the job, corrective actions and recommendations for improvements.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Write lengthy instructions for machining jobs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Prepare a resumé.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Please write 5-6 sentences about yourself.

<http://srv108.services.gc.ca>, *Essential Skills Profile, Machinist, 2008*

TABLE OF CONTENTS

MACHINIST NOC 7231

	PAGE
Learning Styles Checklist	1
Technical Reading (Reading Text)	
Word Lists	3
Pseudowords	4
Section 1	5
Section 2	6
Section 3	7
Section 4	8
Document Use	
Section 1	10
Section 2	12
Section 3	13
Section 4	14
Numeracy	
Section 1	15
Section 2	18
Section 3	22
Section 4	24
Oral Communication	27
Computer Use	29
Writing	30

ASSESSOR'S ANSWER KEY**MACHINIST****Learning Styles**

After the apprentice has completed the learning styles checklist, note the sections that contain **three or more** checkmarks. Those sections indicate the preferred learning style of that apprentice. The majority of apprentices will show preference for more than one learning style.

Learning Environment

Group and individual learning environments: If an apprentice indicates a strong preference for one environment over another, an instructor needs to be aware of the implications this has for a teaching environment.

NAME:

DATE:

LEARNING STYLES CHECKLIST**Learning by hearing (auditory)**

- ☐ I remember the things I hear better than the things I see.
- ☐ I learn better when someone explains to me how to do something better than when I follow a diagram.
- ☐ I find it easier to remember a telephone number I have heard than one I have read.
- ☐ I prefer to listen to the news on the radio than to read the newspaper.
- ☐ I remember the times tables by saying them to myself.
- ☐ After I am introduced to someone, I'm good at remembering his/her name.

Learning by seeing (visual)

- ☐ I remember what I've seen, better than what I have heard.
- ☐ I remember what happened by seeing the incident in my head.
- ☐ I remember what I hear by picturing it in my head.
- ☐ I am good at remembering faces.
- ☐ When someone says a number, I don't understand it until I see it written down.
- ☐ I can add simple numbers which are written down better than numbers that are in my head (e.g., $16+24+10+98$).
- ☐ To remember a car license number, I picture it in my head.

Learning by doing (kinesthetic)

- ☐ When I put something together, I remember how it works.
- ☐ I remember certain directions after I have done something once or twice.
- ☐ I like to do things like simple repairs where I can use my hands.
- ☐ I can learn best if the instructor uses models, experiments and other practical tools to show what he/she is talking about.
- ☐ Using concrete examples is a good way for me to improve my math or spelling skills.
- ☐ I remember telephone numbers if I've dialed them a few times.

Learning in a group

- ☐ I like learning in a group so I can discuss the work with others.
- ☐ I enjoy helping other people in the group with their work.
- ☐ If I need to do something, I don't mind asking the person next to me.

Learning Alone

- ☐ I can concentrate best if I work on my own.
- ☐ It's hard to work if people are talking around me.
- ☐ I'd be embarrassed to show my mistakes to anyone other than an instructor.
- ☐ I can't concentrate if people are moving around the room.

(Adapted from SGL Handbook, ALSO, Ottawa)

ASSESSOR'S ANSWER KEY**MACHINIST****TECHNICAL LANGUAGE***1. Word Lists*

Have the apprentice begin reading aloud a list with which he/she is comfortable. If an apprentice has difficulty with more than three words in list one, **stop** the inventory. If the apprentice has 7/10 words correct in any list, move up to the next list. The lists have been written in a simple-to- more complex order and include words contextualized to each trade.

2. Pseudowords

The apprentice should not have major difficulty with the pronunciation of these pseudowords. The reason for inclusion of this list is that it tells the assessor if the apprentice has major difficulty with phonics, which can affect his/her ability to learn to read technical language at the required level.

3. Reading Excerpts

The reading passages are *not* leveled by Essential Skill complexity level but are arranged from simple to complex using a readability index. Apprentices should be able to answer both the recall questions as well as those questions requiring "reading between the lines." Apprentices need to be comfortable reading and answering questions at the highest level in the inventory.

1	2	3	4
pitch	helix	diameter	micrometer
crest	knurling	vernier	counterbore
drill	alloy	radial	centrifugal
thread	shackle	parallel	numerical
depth	cotter	pedestal	comparator
gauge	coolant	abrasive	adjustable
lathe	grinder	turnbuckle	compensations
force	reamer	trepanning	material
grit	chisel	calipers	capacity
dies	mandrels	optical	indexable

poy

meef

fesh

moyp

toof

koyth

hafe

tibe

hoysh

thoop

marp

theg

yome

zule

NAME:

DATE:

From the article below, answer the following questions.

1. Of which two elements is steel made?

Steel is a material made of iron and carbon.

2. What would be the number used to describe steel with 40% carbon content and combined with the alloy nickel (number 23)?

The description number would be 2340.

Steel

Steel is a material that is made up of iron. Most steel contains over 90% iron, and many carbon steels contain more than 99%. In addition to iron, steel is made up of a second element: carbon. Other alloys are contained in steel, but iron and carbon are only two elements that exist in steel. Steels that contain the least carbon are more ductile than others but not as strong. When carbon is added, strength, hardness, and brittleness increase.

Steel is made by dissolving the carbon in iron. Sometimes, there is too much carbon for the iron to "digest". In this case, the alloy can no longer be called steel. The carbon will precipitate out and remain as carbon flakes. There are many different types of steel and each has a name containing four numbers. The first two digits tell us the alloy content and the last two (or three) digits refer to the percent of carbon in the steel.

*Evaluating Academic Readiness for Apprenticeship Training, Communication Skills # 5, Ontario Ministry of Education, 2008
FOG Index 6.5*

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. What is the meaning of torque?

Torque means turning power.

2. Which type of gear would you choose when you need high torque?

Internal gears are used for high torque demands.

3. Why can helical gears run more smoothly than spur gears?

The action of the teeth is progressive rather than intermittent.

Gears and Gearing

Gears transmit power positively from one shaft to another. When the matching teeth of two gears engage, they can maintain power and exact speed ratios. They can increase or decrease the speed of the driven shaft which results in an increase or decrease to the turning power (torque) of the shaft. Although shafts in a gear drive are usually parallel, they can be driven at any angle by gears designed to do this. Different types of gears are used in industry:

Spur gears generally transmit power between two parallel shafts. Teeth on these gears are straight and parallel to the shafts to which they are attached. They are used where slow to moderate speed drives are needed.

Internal gears are used where shafts are parallel but where the centres must be closer than possible with spur (or helical) gears. Because of a greater area of contact, a stronger drive than with conventional gear drive is possible. Speed reductions are also possible with minimum of space requirements. These gears are suited for heavy-duty tractors for high torque demands.

Helical gears can contact parallel or shafts at an angle. The action of the teeth is termed progressive rather than intermittent and for this reason these gears run more smoothly and quietly than spur gears. Also, because more than one gear is engaged at any time, these gears are stronger than spur gears of the same size and pitch. Special bearings may be required of shafts to overcome the end thrust produced as these gears turn.

*Evaluating Academic Readiness for Apprenticeship Training Communication Skill #10, Ontario Ministry of Education 2008
FOG Index 10.4*

NAME: _____

DATE: _____

From the article below, answer the following questions.

1. Nickel and copper share many of the same properties. Why is copper used more often?

Copper is less expensive.

2. What is an *alloy* as referred to in the article?

An alloy is a compound containing two or more metals.

3. What is the meaning of *dimensionally stable*?

It means that the metal will not shrink or expand as the temperature changes.

Nickel (NI)

Nickel is valued for its good resistance to corrosion and oxidation. Pure nickel is used for metal plating, electrical contacts, food processing components and coinage. When used as an alloying element, it imparts toughness, ductility, high strength and wear-resistance. Austenitic stainless steels, for example, have nickel added to achieve many of these properties.

Although nickel has many of the same properties as copper, it is much more expensive, so it is used only where properties unique to nickel are required.

Monel is an alloy of nickel and copper, used widely in marine applications because of its high strength and resistance to salt-water corrosion.

Invar is an alloy of nickel and iron. It is unique among metals in that it is dimensionally stable over an ordinary range of temperatures. In other words, it does not shrink or expand as the temperature changes, making it useful for length standards and bimetal strips.

Inconel, *Chromel* and *Nichrome* are trade names for alloys containing nickel and chromium. These metals are used in heating elements, thermocouples and other high-temperature applications.

Superalloys, containing nickel, chromium and molybdenum, are used in applications where temperatures as high as 1800°F (1000°C) are anticipated.

*Individual Learning Module 150203b, Metal Specifications and Testing, 2008
FOG Index 12.2.*

NAME:

DATE:

From the article below, answer the following questions.

1. Name four changes in today's machine tools.
 - *Capable of higher speeds*
 - *machined in multiple axes*
 - *Allow for quick tool change*
 - *have multi-spindle capability*
2. Name two examples of incremental advancements in cutting tool technology.
 - A new geometry*
 - A new grade*
 - Or a new coating on a cutter*
3. What does "more revolutionary than evolutionary" mean?
 - Answers will vary. Need to make reference to the degree/time of change.*

New Technology addresses insert wear resistance, toughness dilemma

A new methodology addresses the long-standing dilemma of increasing both the wear resistance and toughness of a cutting insert at the same time.

Achieving greater productivity and improving competitiveness is important across all of manufacturing. Within the metal cutting industry, research and development efforts continue to be focused on developing increasingly productive technologies. Success has come over the years with frequent incremental increases in machine tool, tool holding and cutting tool capability.

For example, advancements in machine tools have been noticeable and numerous. Today's equipment is capable of higher speeds, machining in multiple axes, quick tool change, multi-spindle capability and much more.

Tool holding, the critical connection between machine and tool, can be accomplished using a number of methods and continues to improve, providing accuracy and runnout in the tenths of thousandths. And, cutting tools continue to evolve for all materials and intended applications.

In the past, advancements in cutting tool technology have typically been incremental. A new geometry, a new grade, a new coating on a cutter body all designed to improve quality, productivity or reduce cost.

However, a recent introduction in the world of indexable carbide that is much more than a slight improvement has been pioneered. The tool is a coated cemented carbide grade developed for steel turning that provides results that are more revolutionary than evolutionary for this significantly large and important marketing segment. However, the real development was in the process used to develop the coating.

www.metalworkingcanada.com/index.php/Magazine10/30/08
(FOG Index 14.2)

NAME: _____

DATE: _____

1. In Column 2, sketch the geometric shapes pictured in Column 1 as they would appear in 3 dimensions. In column 3, name the 3-dimensional figure.

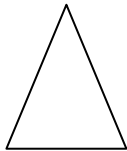
Column 1



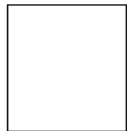
Column 2

Column 3

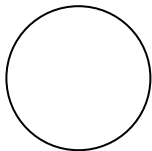
Rectangular prism



Tetrahedron



cube



Sphere

2. From the table on the next page, determine the correct pipe size for #4-20 thread.

3. Find the correct pipe size for a 5/8-11 thread.

TAP DRILL SIZES

Table 6. Tap Drill Sizes for Threads of American National Form

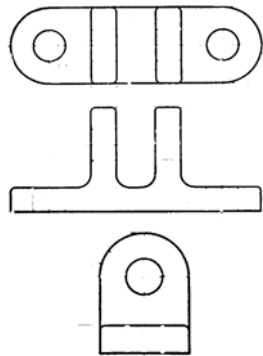
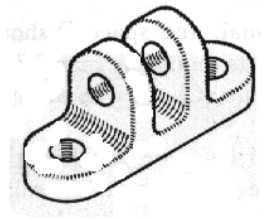
Screw Thread		Commercial Tap Drills ^a		Screw Thread		Commercial Tap Drills ^a	
Outside Diam. Pitch	Root Diam.	Size or Number	Decimal Equiv.	Outside Diam. Pitch	Root Diam.	Size or Number	Decimal Equiv.
1/16-64	0.0422	3/64	0.0469	27	0.4519	1 1/32	0.4687
72	0.0445	3/64	0.0469	9/16-12	0.4542	3 1/64	0.4844
3/64-60	0.0563	1/16	0.0625	18	0.4903	3 3/64	0.5156
72	0.0601	52	0.0635	27	0.5144	1 7/32	0.5312
3/32-48	0.0667	49	0.0730	5/8-11	0.5069	1 7/32	0.5312
50	0.0678	49	0.0730	12	0.5168	3 5/64	0.5469
7/64-48	0.0823	43	0.0890	18	0.5528	3 7/64	0.5781
1/8-32	0.0844	3 1/32	0.0937	27	0.5769	1 9/32	0.5937
40	0.0925	38	0.1015	1 1/16-11	0.5694	1 9/32	0.5937
3/32-40	0.1081	32	0.1160	16	0.6063	5/8	0.6250
36	0.1157	1/8	0.1250	3/4-10	0.6201	2 1/32	0.6562
1 1/16-32	0.1202	30	0.1285	12	0.6418	4 3/64	0.6719
3/16-24	0.1313	9/64	0.1406	16	0.6688	1 1/16	0.6875
32	0.1334	26	0.1470	27	0.7019	2 3/32	0.7187
1 3/16-24	0.1469	22	0.1570	1 1/16-10	0.6826	2 3/32	0.7187
7/32-24	0.1490	20	0.1610	7/8-9	0.7307	4 9/64	0.7656
32	0.1646	16	0.1770	12	0.7668	5 1/64	0.7969
1 5/16-24	0.1782	12	0.1890	14	0.7822	1 5/16	0.8125
1/4-20	0.1806	10	0.1935	18	0.8028	3 5/64	0.8281
24	0.1850	7	0.2010	27	0.8269	2 7/32	0.8437
27	0.1959	4	0.2090	1 5/16-9	0.7932	3 5/64	0.8281
28	0.2019	3	0.2130	1-8	0.8376	7/8	0.8750
32	0.2036	3	0.2130	12	0.8918	3 7/64	0.9219
3 1/16-18	0.2094	7/32	0.2187	14	0.9072	1 5/16	0.9375
20	0.2403	F	0.2570	27	0.9519	3 1/32	0.9687
24	0.2476	1 7/64	0.2656	1 1/8-7	0.9394	6 3/64	0.9844
27	0.2584	I	0.2720	12	1.0168	1 3/64	1.0469
32	0.2644	J	0.2770	1 1/4-7	1.0644	1 7/64	1.1094
3 3/8-16	0.2719	9/32	0.2812	12	1.1418	1 11/64	1.1719
20	0.2938	5/16	0.3125	1 3/8-6	1.1585	1 7/32	1.2187
24	0.3100	2 1/64	0.3281	12	1.2668	1 19/64	1.2969
27	0.3209	Q	0.3320	1 1/2-6	1.2835	1 11/32	1.3437
7/16-14	0.3269	R	0.3390	12	1.3918	1 27/64	1.4219
20	0.3447	U	0.3680	1 5/8-5 1/2	1.3888	1 29/64	1.4531
24	0.3726	2 5/64	0.3906	1 3/4-5	1.4902	1 9/16	1.5625
27	0.3834	X	0.3970	1 7/8-5	1.6152	1 11/16	1.6875
2 1/2-12	0.3894	Y	0.4040	2-4 1/2	1.7113	1 25/32	1.7812
13	0.3918	2 7/64	0.4219	2 1/8-4 1/2	1.8363	1 29/32	1.9062
20	0.4001	2 7/64	0.4219	2 1/4-4 1/2	1.9613	2 1/32	2.0312
24	0.4351	2 9/64	0.4531	2 3/8-4	2.0502	2 1/8	2.1250
	0.4459	2 9/64	0.4531	2 1/2-4	2.1752	2 1/4	2.2500

Machinery's Handbook Pocket Companion, Industrial Press Inc., New York, 2008

NAME: _____

DATE: _____

1. Below is a schematic of a machine part. Identify the 3 dimensional views: the top view, the end view and the front view.



top

side

end

NAME:

DATE:

1. The chart below is a description of how thread designations are made. Use the chart and the sample illustration to describe the following:

1/4-28 UNF-2A LH

This is a 1/4" diameter thread, 28 unified threads per inch, left-hand thread and has a class 2A fit.

Major diameter of thread

•	•	•	•	•	•
	•				
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
3/4	10	UNC	2	A	LH

Sample:

No. 12 (0.216) - 24 NC-3. This is a number 12 (0.216 inch diameter) thread, 24 National Coarse threads per inch, and a Class 3 fit.

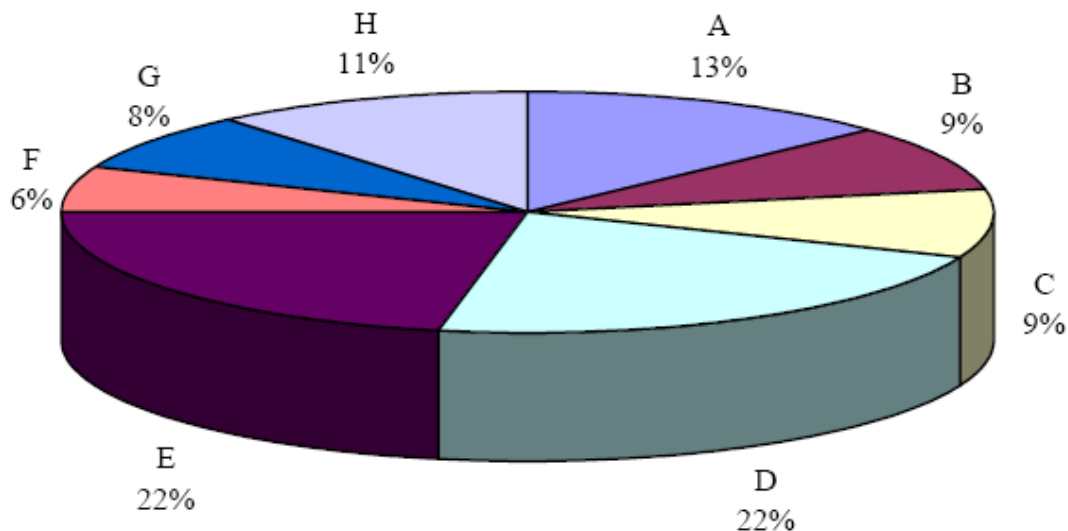
Lathe Operations, Subcourse OD1645, Edition 8, US Army Correspondence Program

NAME: _____

DATE: _____

The licensing exam for your trade consists of 135 multiple choice questions. The pie chart below indicates the percentage of questions on each exam topic.

1. Underline or circle the two topics that have the greatest number of questions.
2. How many questions are on:

Occupational skills? 17CNC machines? 15

Block A Occupational Skills

Block B Bench Work

Block C Drill Presses

Block D Lathes

Block E Mills

Block F Saws

Block G Grinders

Block H Computer Numerical Control (CNC)
Machines

Machinist, Occupational Analyses Series, 2005, Human Resources Partnerships Directorate

SECTION	CONCEPT	QUESTION NUMBERS
1	Whole numbers	1-4
	Decimals	5-8
	Positive and negative numbers	9-12, 34
	Order of operations	13-14
	Exponents, square root, scientific notation	15-18
	Fractions	19-21, 33
	Conversions (fractions, decimals, percents)	22
	Metric and Imperial measures	23-32
2	Percents	1-2
	Ratio and proportion	3-6
	Geometric figures	7, 8
	Formulae	9
3	Formulae	2-4
	Geometry (angles)	1
4	Equations	1-4
	Coordinate graphing	5, 6
	Trigonometry laws	7-10

NAME: _____

DATE: _____

Calculate the following:

- | | | | |
|---|---|--|---|
| 1. $\begin{array}{r} 13812 \text{ mm} \\ + 16442 \text{ mm} \\ \hline 30254 \text{ mm} \end{array}$ | 2. $\begin{array}{r} 3401 \text{ in.} \\ - 1824 \text{ in.} \\ \hline 1577 \text{ in.} \end{array}$ | 3. $\begin{array}{r} 2465 \text{ ft.} \\ \times 98 \\ \hline 241570 \text{ ft.} \end{array}$ | 4. $\begin{array}{r} 10\,024 \text{ km} \\ \div 24 \text{ km} \\ \hline 417.667 \text{ km} \end{array}$ |
| 5. $\begin{array}{r} .0067 \text{ mm} \\ + .2543 \text{ mm} \\ \hline .2610 \text{ mm} \end{array}$ | 6. $\begin{array}{r} 26 \text{ cm} \\ - .03 \text{ cm} \\ \hline 25.97 \text{ cm} \end{array}$ | 7. $\begin{array}{r} .034 \text{ m} \\ \times .025 \text{ m} \\ \hline .00085 \text{ m} \end{array}$ | 8. $\begin{array}{r} 13.25 \text{ mm} \\ \div 25 \text{ mm} \\ \hline 0.53 \text{ mm} \end{array}$ |
| 9. $6 + (-3)'' =$
<u>3''</u> | 10. $-4 - (-3)'' =$
<u>-1''</u> | 11. $4(-3) \text{ mm} =$
<u>-12 mm</u> | 12. $\begin{array}{r} 12 \text{ mm} \\ \div (-4) \text{ mm} \\ \hline -3 \text{ mm} \end{array}$ |

The number line below represents positive and negative integers. (see question #13).



13. $72 \div 6 + 4 \times 3^\circ\text{C} =$ 24 $^\circ\text{C}$ 14. $6(25-5) + 16 - 2(8-6)^\circ\text{C} =$ 132 $^\circ\text{C}$

Calculate the following:

- | | | | |
|---|--|---|---------------------------------|
| 15. $6^3 \text{ mm} =$
<u>216 mm³</u> | 16. $10^6 =$
<u>1,000,000</u> | 17. $10^{-3} =$
<u>.001</u> | 18. $\sqrt{(16^3)} =$ <u>64</u> |
| 19. $7/8'' - 5/8''$

$=$ <u>1/4''</u> | 20. $9/5 \times 7/8$

$=$ <u>1²³/40</u> | 21. $1\frac{1}{5}''$
$\div 2\frac{1}{2}''$

$=$ <u>12/25''</u> | |

22. Complete the chart with the missing measurements.

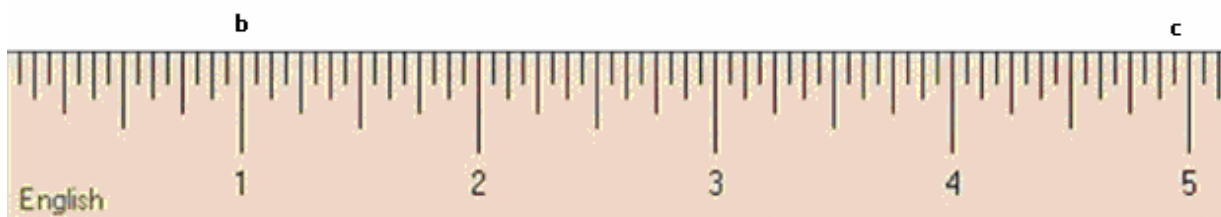
Fraction	Decimal	Percent
$\frac{1}{2}$	.5	50%
$\frac{3}{4}$	.75	75%
$\frac{3}{16}$	.1875	18.75%
$\frac{1}{32}$	.03125	3.125%

23. Complete the table below with the missing measurements.

1 inch = 25.4 mm

Fractional inch	Decimal inch	Millimeters
$\frac{1}{64}$	0.015625	0.396875
$\frac{3}{16}$	0.1875	4.7625
$\frac{9}{32}$	0.28125	7.14375
$\frac{3}{8}$	0.375	9.525
$\frac{1}{20}$	0.05	1.27

24. On the steel rules below, mark a) 25.4 mm, b) 1 in., c) $4\frac{15}{16}$ in. and d) 2.54 cm.





Convert the following measurements of length:

25. $1.046 \text{ mm} = \underline{.1046} \text{ cm}$

26. $0.0086 \text{ m} = \underline{8.6 \text{ mm}}$

27. $144 \text{ in.} = \underline{4 \text{ yds.}}$

28. $0.92 \text{ km} = \underline{920 \text{ m}}$

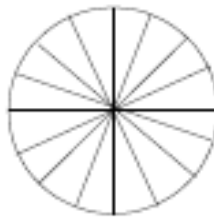
29. $96 \text{ in.} = \underline{8 \text{ ft.}}$

30. $0.090 \text{ m} = \underline{900 \text{ mm}}$

31. $\frac{1}{2} \text{ in.} = \underline{12.7 \text{ mm}}$

32. $8.000 \text{ m} = \underline{2.4384 \text{ ft.}}$

33. The circle below is divided into equal parts. State the fraction that represents each of the following:



a) 3 parts $\underline{3/16}$

b) $\frac{1}{2}$ of one part $\underline{1/32}$

c) $\frac{3}{4}$ of one part $\underline{3/64}$

d) $\frac{1}{16}$ of one part $\underline{1/256}$

e) $\frac{1}{10}$ of one part $\underline{1/160}$

f) 16 parts $\underline{16/16 (1)}$

34. Calculate the range of measurement for the following:

2.05 with a tolerance of $\pm 0.3 \text{ mm}$ $\underline{1.75 \text{ to } 2.35 \text{ mm}}$

3.6 with a tolerance of $\pm 0.6 \text{ in.}$ $\underline{3.1 - 4.2 \text{ in.}}$

NAME: _____

DATE: _____

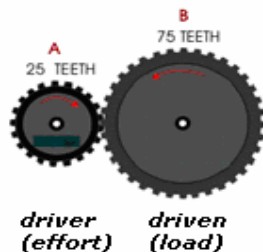
1. A motor is said to be 85% efficient if the output (power delivered) is 85% of the input (power received). How many horsepower does a motor receive if it is 85% efficient with a 7.7 horsepower output?

9.05 hp

2. On a production run of castings, 7% of the castings produced are rejected. If 420 units are rejected, how many units were produced?

6000 units

3. What is the ratio of gear A to gear B? (give your answer in lowest terms) (Gear ratio is always expressed as driven:drive)



3:1 (driven:drive)

4. How would you determine the ratio of the longer piece of stock to the shorter one?

14 in
[]

1.5 ft
[]

Step 1: convert to common measurement

Step 2: 14" : 18"66

Step 3: 7" : 9"

5. If you can produce 240 parts in 4 hours, how many can you make in 5½ hours?

330 parts

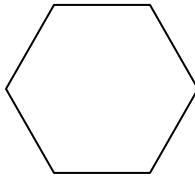
6. If it takes 5 machines 1.6 hours to produce the required number of pieces of product, how long would it take 3 machines to produce the same number if the conditions remain the same?

2.666 hours (2 hours, 40 min.) $5/3 = X/1.6$
 $3X = 5 \times 1.6$
 $3X = 8 = X = 2.6$

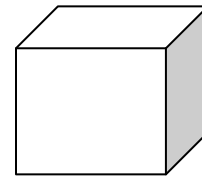
7. Identify each of the geometric shapes shown below:



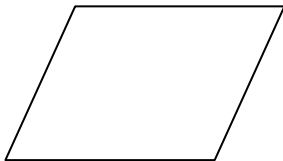
rectangle



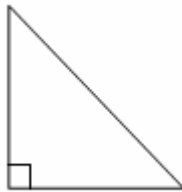
hexagon



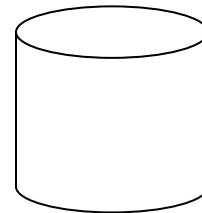
cube



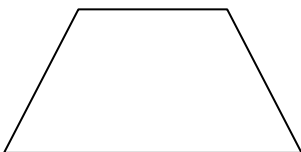
parallelogram



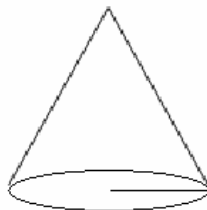
Right triangle



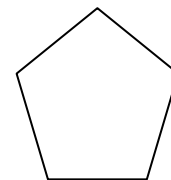
cylinder



trapezoid



cone



pentagon

8. Label the parts on the cover plate. For example, AB is the diameter.

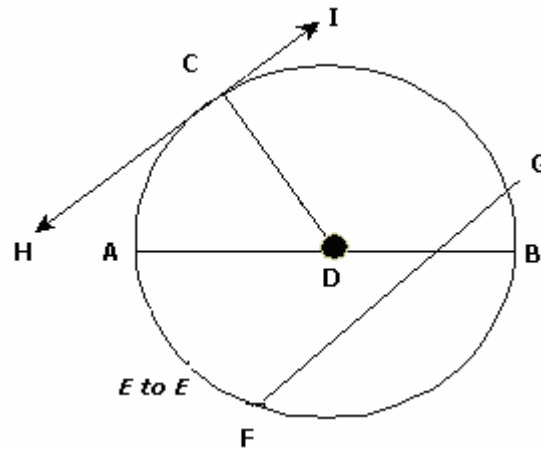
AD = radius

E to E = circumference

AC = arc

FG = chord

HI = tangent

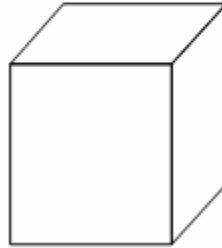
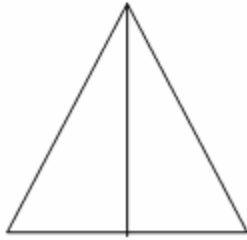


The number of degrees in a circle is 360°.

The number of degrees in a straight line is 180°.

The sum of the angles in a triangle is 180°.

9. Match the formula to the problem it will help you solve. Use the diagrams as a reference.



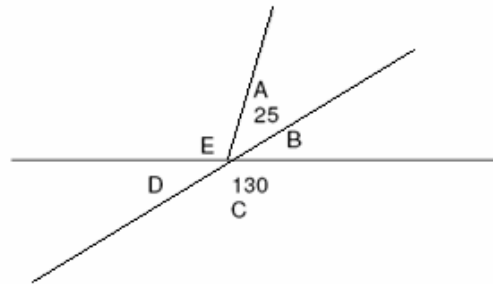
- | | | |
|----|---------------------|--------------|
| 1. | $p = 2l + 2w$ | <u> e </u> |
| 2. | $A = \pi r^2$ | <u> c </u> |
| 3. | $A = \frac{1}{2}bh$ | <u> a </u> |
| 4. | $C = \pi d$ | <u> b </u> |
| 5. | $A = lw$ | <u> d </u> |

- | | |
|----|---------------------------|
| a. | area of a triangle |
| b. | circumference of a circle |
| c. | area of a circle |
| d. | area of a rectangle |
| e. | perimeter of a rectangle |

NAME: _____

DATE: _____

1. According to the diagram below, what is the value of $\angle E$? 105°



2. a) The formula for the volume of a cylinder is $V = \pi r^2 h$. If a cylinder is 12 cm high and has a radius of 7 cm, what is its volume?

1846.32 cm^3

- b) What would be the formula needed to calculate the height of the cylinder?

$$h = \frac{V}{\pi r^2}$$

3. You are required to machine a 275 mm diameter gear blank. The cutting speed (V) is 28 metres per minute. How many revolutions per minute (rpms) (N) are required to complete the task? Round your answer to the nearest whole number. Use the formula shown.

$$N = \frac{1000 \times 28 \text{ m/min.}}{3.1416 \times 275 \text{ mm}} = \frac{2800}{863.94} = 32.41$$

Rounded to 32 rpms

$N = \frac{1000 \times V}{3.1416 \times D}$

4. You need to know the diameter (D) of a piece of stock to be machined. The cut metre shows the surface speed (V) to be 52 feet per minute (f/m) and the stock is being turned at 50 revolutions per minute (rpms, N). Round your answer to the nearest ten thousandth of an inch.

Step 1.
$$D = \frac{V \times 12}{3.1416 \times N}$$

Step 2.
$$D = \frac{52 \text{ f/m} \times 12}{3.1416 \times 50} = \frac{624}{157.08} = 3.9724 = 3.97 \text{ inches}$$

NAME: _____

DATE: _____

Calculate the following:

1. $14x + 6x = \underline{20x}$

2. $22x \times 2x = \underline{44x^2}$

3. $4x^2 \div 2x = \underline{2x}$

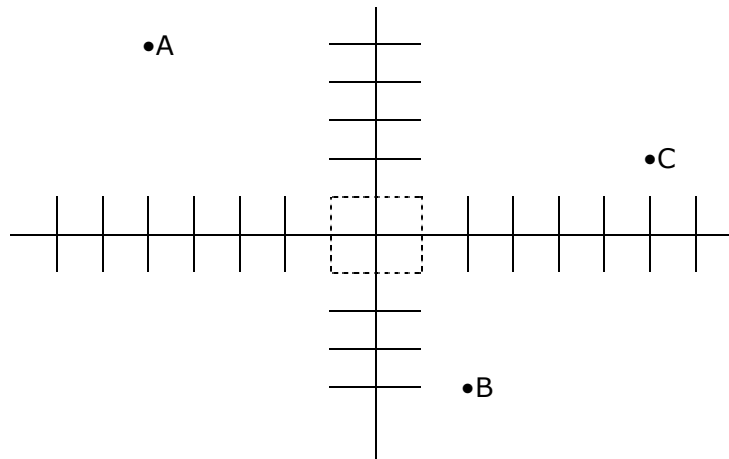
4. $6x - 33 = \underline{x = 7.5}$

5. State the coordinates of points A, B and C on the graph below.

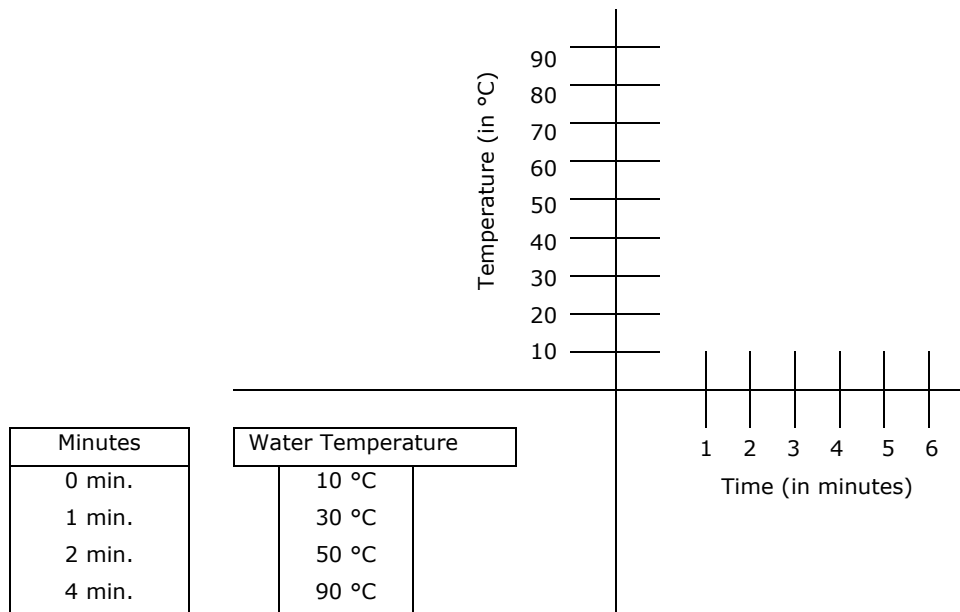
A = $\underline{(-5, 5)}$

B = $\underline{(1, -4)}$

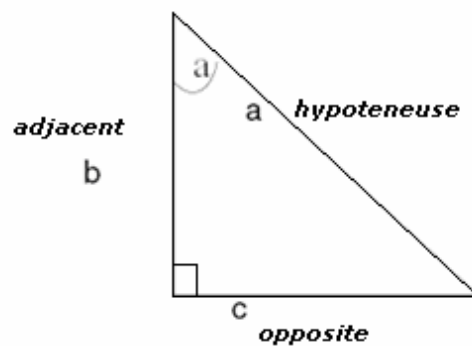
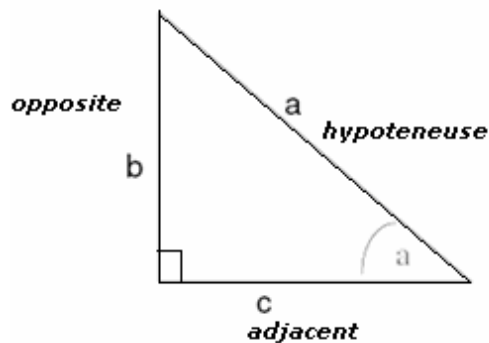
C = $\underline{(5, 2)}$



6. Use the table to plot the points on the grid.



7. In the right triangles below, use the angle marked to name the sides of each of the triangles as adjacent, opposite, or hypotenuse.



8. In the first triangle above, if $b = 3$ and $c = 5$, what is the length of side a ?

5.8 cms

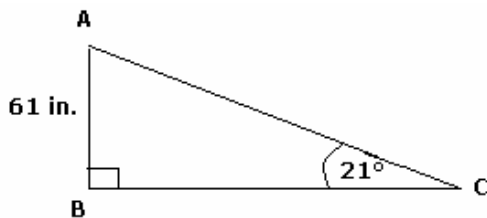
9. The formula for a tangent ratio is:

$$\tan = \frac{\text{opposite side}}{\text{adjacent side}}$$

What would be the formula for finding the length of an opposite side when you already know the tangent and the length of the adjacent side?

$$\text{opposite side} = \tan \times \text{adjacent side}$$

10. a) Using the diagram, calculate the length of side BC.



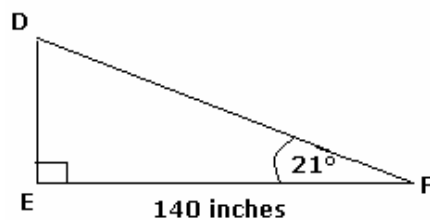
$$\tan = \frac{\text{opposite}}{\text{adjacent}}$$

$$0.38386 = \frac{61}{X}$$

$$X = \frac{61}{0.38386}$$

$$X = 158.912 \text{ inches}$$

- b) Using the diagram, calculate the length of DE.



$$\tan = \frac{\text{opposite}}{\text{adjacent}}$$

$$0.38386 = \frac{DE}{140''}$$

$$DE = .38386 \times 140$$

$$DE = 53.74''$$

ASSESSOR'S ANSWER KEY**MACHINIST****Oral Communication****Speaking scale**

This scale is to be completed by you, the assessor, during the course of the Essential Skills Inventory. While you may not have the opportunity to assess all the skills, you will be able to rate most of them. This scale may also be particularly helpful with those for whom English is not their first language, and it may be used for different cultural norms.

Examples of oral communication tasks

These are examples taken directly from the Essential Skill Profiles and range in complexity from simple to complex. The self-rating scale mirrors the stages of learning or skill-building.

NAME:

DATE:

** To be completed by the Assessor – not the Learner***Speaking Skills Rating Scale**

		Improvement Needed	Acceptable	Very good
1.	Is comfortable communicating orally (i.e., body posture and facial expressions are appropriate)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Maintains eye contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Waits for his/her turn to speak	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Willingly and confidently engages in conversation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Performs social courtesies, such as greeting others, using titles and making introductions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Speaks at an appropriate volume	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Rate of speech is understandable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Adjusts voice inflection for statements, requests, directions, exclamations and questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Pronounces words clearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Does not use stalling devices such as "uh", "you know", etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Does not say the same thing twice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Uses words and phrases related to the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Has a good vocabulary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Speaks in complete sentences of appropriate length	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Uses good grammar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Maintains focus on the subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Gives appropriate responses to questions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Is aware of listener's reaction and responds appropriately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Talks "with" rather than "at" a person	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In your work as a Machinist, you need excellent communication skills for both speaking and listening.

Please rate yourself in the following situations:

		Need help	Can do alone	Can help an apprentice
1.	Share information and opinions with other machinists.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Clarify work instructions with supervisors or other staff when scale drawings of work orders are unclear or incomplete.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Discuss machining jobs during meetings with supervisors and other team members.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Present information to a group.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<http://srv108.services.gc.ca>, *Essential Skills Profile, Machinist, 2008*

ASSESSOR'S ANSWER KEY

MACHINIST

Computer use

The computer use scale is not reflective of the computer use referenced in the Essential Skills Profile. However, there are basic computer skills required for survival in today's economy.

The scale used in this inventory reflects those very basic skills.

NAME:

DATE:

		YES	NO
1.	Do you use a computer at home?	<input type="checkbox"/>	<input type="checkbox"/>
	at work?	<input type="checkbox"/>	<input type="checkbox"/>
2.	Do you use any computerized equipment/ systems at work, for example, computer assisted design, manufacturing or machining software?	<input type="checkbox"/>	<input type="checkbox"/>
3.	Do you know the "language" used to describe computers, for example, monitor, software, hardware, word processing, data base, virus and SPAM	<input type="checkbox"/>	<input type="checkbox"/>
4.	Do you use a computer to:	Need help	Can do alone
			Can help an apprentice
	Search for information on the internet?	<input type="checkbox"/>	<input type="checkbox"/>
	Send and receive email, including attachments?	<input type="checkbox"/>	<input type="checkbox"/>
	Write a memo, letter or report (use word processing software)?	<input type="checkbox"/>	<input type="checkbox"/>
	Manage files and folders?	<input type="checkbox"/>	<input type="checkbox"/>
	Use a data base?	<input type="checkbox"/>	<input type="checkbox"/>

ASSESSOR'S ANSWER KEY**MACHINIST****Writing**

The first questions in the writing section are examples taken directly from the Essential Skills Profile for the trade and range in difficulty from simple to more complex. The scale used for self assessment of these skills reflects the stages of learning: "need help, can do alone and can help an apprentice."

The second part requires the apprentice to provide a brief personal writing sample by composing 5-6 sentences.

Criteria for evaluating the sample are:

- Does the apprentice use print or cursive writing?
- Is the writing legible?
- Can the apprentice do the activity easily or does he/she struggle to write a sentence or two?
- Can the apprentice put his/her thoughts on paper in a logical order?
- Can the apprentice use punctuation correctly?
- Can the apprentice spell correctly?
- Can the apprentice use correct grammar?

NAME:

DATE:

Please rate your ability to perform the following writing tasks that you will encounter in your work as a Machinist.

		Need help	Can do alone	Can help an apprentice
1.	Write emails and memos to supervisors, engineers or computer programmers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Write reports describing problems encountered on the job, corrective actions and recommendations for improvements.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Write lengthy instructions for machining jobs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Prepare a resumé.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Please write 5-6 sentences about yourself.

<http://srv108.services.gc.ca>, *Essential Skills Profile, Machinist, 2008*

Table of Contents

1.	Introduction	108
2.	Why Essential Skills?	108
3.	Instructor Requirements.....	109
4.	Curriculum Development	109
5.	Curriculum Resources	112
6.	Preparation and Delivery	112
7.	Measuring Learning: Instructor's Role in Evaluation.....	114
8.	Intervention Timeframe.....	114

Appendix A - Lesson Plan Template

Appendix B – Essentials Skills for All Apprentices

1. Introduction

The Curriculum Guidebook is designed to provide support and practical advice to instructors who are delivering Essential Skills training, as well as to those who wish to incorporate Essential Skills into technical training. Currently, this Guidebook has been prepared for thirteen trades; however, the template can be adapted for use in any trade.

The thirteen trades include:

- Automotive Service Technician
- Cabinetmaker
- Carpenter
- Cook
- Construction Electrician
- Industrial Electrician
- Machinist
- Metal Fabricator
- Oil Burner Mechanic
- Plumber
- Refrigeration and Air Conditioning Mechanic
- Steamfitter-Pipefitter
- Welder

2. Why Essential Skills?

Essential Skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in every occupation and throughout daily life in different ways.

- Reading Text
- Document Use
- Numeracy
- Oral Communication
- Writing
- Computer Use
- Thinking Skills
- Working with Others
- Continuous Learning

*The Trade Essentials curriculum materials currently uses **six** of these Essential Skills: **Reading, Document Use, Numeracy, Oral Communication, Writing and Computer Use***

For more information on Essential Skills, visit the website at www.hrsdc.gc.ca/essentialskills

Although the term 'Essential Skills' has been around for a number of years, there is growing recognition of the link between Essential Skills and success in the trades. Essential Skills are used in every occupation and more specifically, in every trade, but they are used in different ways and at varying degrees of difficulty.

These skills are not technical skills though they may be taught using materials or examples from a particular trade. Rather, they are the foundational skills that exist in all occupations. The six Essential skills outlined above were used in the creation of materials for the Trade Essentials project.

The Curriculum Frameworks identify the Essential Skills requirements for thirteen trades and provide concrete examples of how these skills are utilized in each trade.

The Essential Skill requirements are based primarily on HRSDC's Essential Skills profiles www.hrsdc.gc.ca/essentialskills and the National Occupational Analyses.

(<http://www.red-seal.ca/tr.1d.2n.4adeta.3l@-eng.jsp?tid=230>)

They have been reviewed and validated by certified tradespeople and supplemented by additional research gathered from the Trade Essentials project.

3. Instructor Requirements

To be effective, curriculum development and delivery must be guided by the principles of adult education. Learners in the Essential Skills programs will have a wide variety of backgrounds, work experience, education and work-related credentials. Many of these learners will be employed in full time positions with additional responsibilities outside of work. It is critical for the instructor to understand the unique requirements of adult learners and be prepared with challenging, relevant and engaging learning activities.

- Instructors must have knowledge and experience in the area of adult education.
- Instructors should have experience in working in a multi-level classroom environment.
- Instructors must be familiar with Essential Skills, how Essential Skills are used in the trades, and with the trade itself. Red Seal certification is encouraged.
- Instructors must be able to provide the link between Essential Skills and the trade and will provide a trade context from their own experience and expertise. In some instances a team approach with both an Essential Skills and a trades instructor may be preferable.
- It is important that those who presently provide technical training also receive training to increase their understanding of Essential Skills.

4. Curriculum Development

The curriculum frameworks are derived from an outcomes-based approach to learning focusing on the *outcome* of the intervention or course of study-what the learner will be able to do or will know at the end of the intervention. They have been developed to

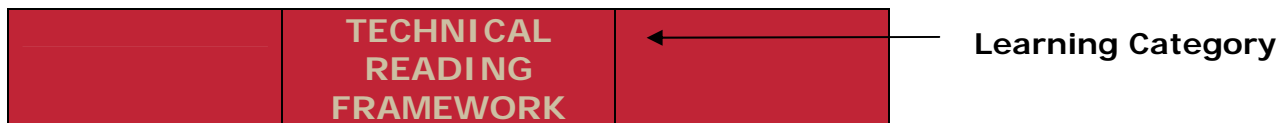
support individual learning needs in each of the six Essential Skills and are the generic **Essential Skills Maps** for all thirteen trades included in the Trade Essentials project.

The following describes the structure and components of the curriculum frameworks developed for apprentices at the Trade Essentials Centre.

Learning Category

A Learning Category (as defined by Trade Essentials) is a general curriculum outcome and is one of the six Essential Skills identified for development in the Trade Essentials project: Reading Text, Document Use, Numeracy, Oral Communication, Computer Use and Writing. It appears in the top band across each of the six frameworks as shown in the example below.

Note: Reading Text will be referred to as Technical Reading in all frameworks



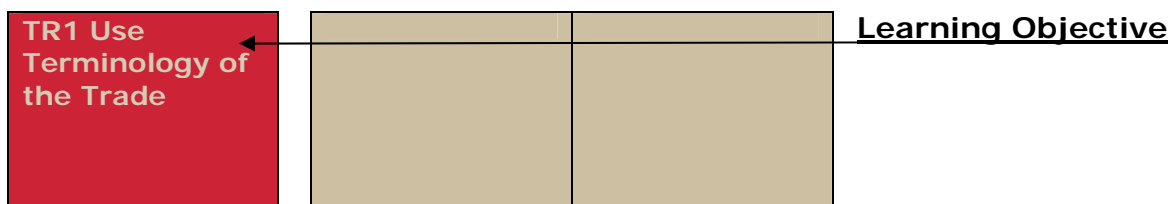
Learning Outcome

A Learning Outcome is a specific curriculum outcome and describes what a learner should know or be able to do as the result of a course of study. Trade Essentials has identified one Learning Outcome for each Learning Category. The learning outcome statement appears below the Learning Category. For example, the learning outcome in the Trade Essentials Technical Reading Framework is:

Learners will locate, recall, understand and interpret information in written text

Learning Objective

Learning objectives are the standards or benchmarks that identify what learners will know or will be able to do as the result of the completion of a number of related competencies in a particular "band". In the example below, the objective for the band is:
TR1 – Use Terminology of the Trade (Burgundy Box).



Competency

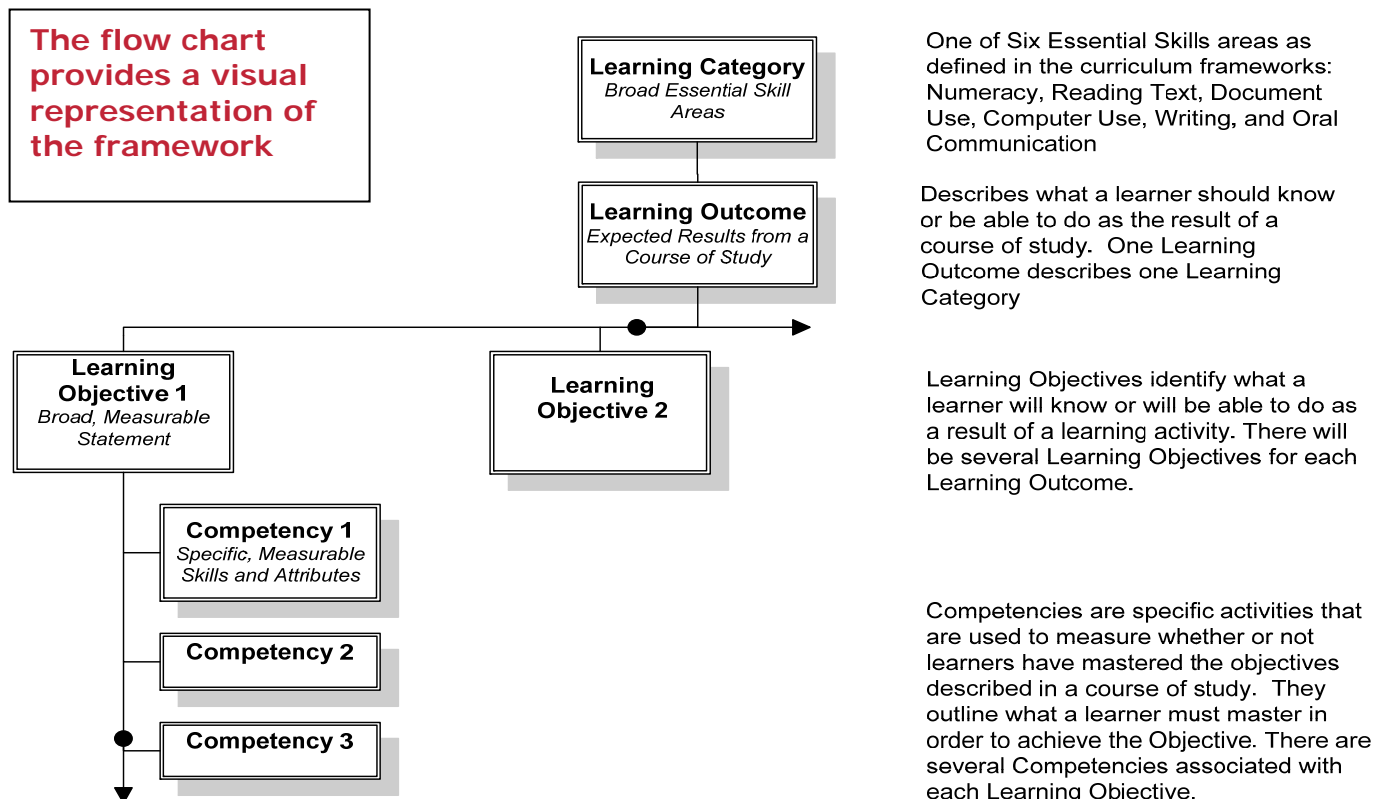
While an objective describes ‘what’ we expect learners to achieve, competencies identify ‘how’ learners can achieve that objective. Competencies are specific activities used to measure whether or not learners have mastered the objective. In Table 1 below, the learner must master competencies 2.1 and 2.2 (taupe boxes) to demonstrate mastery of the objective. Where objectives demonstrate the end result, competencies are a means to that end.

Competencies provide a framework for selecting instructional materials and techniques and provide a basis for determining when instruction has been successful.

Table 1

TR2 Use Strategies to Improve Understanding and Recall	2.1 Identify strategies to improve understanding and recall of written information	2.2 Implement strategies to improve understanding and recall of written information	<u>Competency</u>
--	--	---	-------------------

Curriculum Overview



5. Curriculum Resources

Three types of resources are identified in the curriculum guidelines: *non-contextualized*, *contextualized*, and *technical*. These resources have been listed throughout the guidelines. It is not intended that instructors use all of the resources outlined but, instead, choose material and deliver its content as it best suits individual learner needs.

Non-contextualized resources are not related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials. They can be useful when learners have identified literacy challenges or when basic strategies need to be understood before applying them to higher order learning.

Contextualized resources provide Essential Skills applications in the context of a specific trade or occupation and are generally written at a more basic level than technical materials. They are particularly useful when learners have identified Essential Skills gaps but can only identify relevance/motivation to the task if it is related to their specific trade.

Technical resources are trades training materials from which Essential Skills can be extracted. These resources are written at a higher reading level than non-contextualized and contextualized resources and can often be found in block release training and college trade programs. Generally, learners who would benefit from these materials have few Essential Skills gaps in their learning.

6. Preparation and Delivery

Instructors will be provided with a complete copy of the Essential Skills Frameworks associated with the trades/courses for which they are responsible. Instructors will use essential skills assessment information to build a learning session for one client or a group of clients.

The instructor will be required to prepare lesson plans as a tool to organize and plan the delivery of training. A lesson plan template is included in Appendix A. A brief description of each section of the lesson plan is included in the attached template to serve as a guide. The instructor may add additional notes and documents as required. Completed lesson plans should be kept on file to provide continuity in subsequent sessions.

It is important to note that, even though objectives and competencies progress from least to most difficult, instruction need not move in a linear fashion. In recognition of their prior knowledge, learners may begin their study at any objective in the curriculum frameworks, may not require instruction in all of the competencies in each band, and/or may simultaneously complete competencies in all six Essential Skill curriculum frameworks.

Learners who have extensive Essential Skills gaps may require that the curriculum framework be followed using a linear approach beginning with the least complex objectives.

The curriculum frameworks are applicable to all thirteen trades identified for the project. For instance, though *“Using Documents”* is identified as important to both cooks and carpenters; however, the way documents are used in the trade is what makes them relevant to that specific trade.

The exception is “Numeracy” where not all objectives listed are required in all thirteen trades. For example, a cook may not be required to master all of the learning objectives outlined in the framework whereas a machinist requires mastery of all. Appendix B includes a checklist of the skills required for each particular trade.

The guidelines define objectives and competencies and identify matching resources. The instructor can then use these resources to develop lesson plans that best suit the needs of their particular audience.

Though frameworks are written in academic language (at an academic level), the intent is that the objectives and competencies be taught using **trade specific examples**. Curriculum frameworks may be delivered one-on-one or in a group learning environment.

6.1 Approaches to Delivery

The delivery approach can be **stand alone** or **cross curricular**, depending on the needs of the client or client group.

A **stand alone approach** involves using any one of the curriculum frameworks in its entirety as a stand alone course. For example, carpenters who have been away from the classroom for a long time may benefit from a review of the complete Numeracy framework and focus solely on that Essential Skill.

Others, including those who have achieved journey person status, may require a Computer Course or a course in Oral Communication to improve their skills in dealing with customers or in mentoring new apprentices.

It is assumed that in many classroom situations instructors will use a **cross-curricular approach** to develop a number of skills at the same time.

All students will benefit from instruction in how to understand and retain information from trade-related materials. For example, using the codebook for locating information can address both technical reading and document use. An activity which requires the learner to complete an invoice may provide the opportunity to incorporate technical reading, writing, document use and numeracy in one exercise.

It is intended that Essential Skills can be embedded in the curriculum wherever possible and that instruction in many of the skill areas will not be time-tabled as such. It has

been proven that a learning environment that provides opportunity for discussion and interaction among learners will improve comprehension and long-term memory.

7. Measuring Learning: Instructor's Role in Evaluation

There are a number of informal methods that could be used periodically by the instructor to ensure progress. It is important to note that measurement is not based on a "Pass-Fail;" it is understood that the learner sees the value in improving their skill level and will continue to develop their skills until they are comfortable and confident in performing the required tasks.

Informal Evaluation Methods:

- Provide opportunities and simple recording forms for the learner to assess their progress.
- Review individual assessments on a regular basis against the curricula framework
- Pay particular attention to those identified as potential "early leavers" to ensure they are moving forward as anticipated.
- Pay attention to those who experience unanticipated difficulties in the group environment.
- Document observations of performance in class
- Develop a rubrics for a particular objective that can be shared with students

Formal Evaluation:

- Where a more formal evaluation approach is desired, the instructors or learners could design and complete a structured checklist (see sample checklist in Appendices). Mastery of skills at the highest level using the application to the trade would demonstrate that the learner meets trade requirements.

8. Intervention Timeframe

The Trade Essentials interventions have been developed for individualized learning; therefore, no set time period has been determined for the delivery of the material. Learners' prior knowledge and time necessary to learn or relearn skills should determine the length of time spent in the intervention. For that purpose, a continuous exit policy should be implemented into all programs. There may be a mixture of "early leavers" (those identified as having few or isolated essential skills gaps), with those who have broader range of needs.

Appendix A

Trade Essentials Lesson Plan Template

Course Title:		Dates:	
Instructor:		Location:	

Session Topic(s):		Duration:	
--------------------------	--	------------------	--

Session Description:
Describe what you plan to accomplish during the session or group of sessions. Why is this learning important? What is the context for the learning?

Learning Outcomes, Objectives, and Competencies:
List or attach the specific or related Learning Outcomes, Objectives, and Competency statements (from the framework) here.

Assessment and Evaluation Strategies:
Outline or attach learner evaluation strategies that align with specific Learning Outcome, Objectives, and Competencies. Pre- or post-tests; in-class exercises; individual skill inventories; etc.

Teaching Points and Organization:

Time	Content and Delivery Method
	Use this section to prepare a schedule of learning activities and events. For example:
7:00-7:15	Use bridge-in activity (describe activity) to gain student interest and prepare them to learn
7:15-8:00	Using carpentry estimating handout, have students work on assignment in groups of 2 then debrief assignment
8:00-8:15	Break
8:15-8:20	Energizer activity (describe activity) to refocus students on learning

Resources and Materials Required:

List resources and materials you will use during this session. If applicable, attach copies, descriptions or links to items such as handouts, assignments, demonstration equipment, websites, readings, activities or other specific resources for instructor and/or student use.

Accommodations:

Describe any teaching/learning accommodations that may be implemented in this session to support learner diversity.

Reflective Notes:

How did the session go? What worked well and what work not so well? Outline any ideas for improvement that can be made for the next session.

Appendix B – Essential Skills for All Apprentices

	Automotive Service Tech	Carpenter	Cabinet Maker	Construction Electrician	Cook	Industrial Electrician	Machinist
PM1 Use Calculators	✓	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	Whole numbers only	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓	✓
PM7 Use Percent	✓	✓	✓	✓	✓	✓	✓
PM8 Use Conversion	✓	✓	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	✓	✓	✓	✓	✓	✓	✓
PM11 Use Square Root and Exponents	✓	✓	-	✓	-	✓	✓
PM12 Solve Equations	✓	✓	✓	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	-	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	-	✓	✓
PM18 Analyze Numerical Data	✓	-	-	-	✓	-	✓

CURRICULUM GUIDEBOOK

	Metal Fabricator	Plumber	Refrigeration & Air Conditioning Mechanic	Oil Burner Mechanic	Steamfitter/ Pipefitter	Welder
PM1 Use Calculators	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓
PM7 Use Percent	-	-	✓	✓	✓	✓
PM8 Use Conversion	-	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	-	No proportion	✓	✓	✓	No proportion
PM11 Use Square Root and Exponents	-	-	✓	✓	✓	✓
PM12 Solve Equations	-	Plus quadratic equations	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	✓	✓
PM18 Analyze Numerical Data	-	-	✓	✓	-	-

TABLE OF CONTENTS

CURRICULUM FOR

MACHINIST
NOC 7231

	PAGE
Technical Reading	
Framework	121
Guidelines	122
Document Use	
Framework	136
Guidelines	137
Principles of Mathematics	
Framework	154
Numeracy – Essential Skills for Apprentices	158
Numeracy Checklist	160
Guidelines	164
Oral Communications	
Framework	199
Guidelines	200
Computer Use	
Framework	210
Guidelines	212
Writing	
Framework	221
Guidelines	222

Technical Reading (TR) Learning Outcome: Learners will locate, recall, understand and interpret information in written text

TR1 Use Terminology of the Trade

1.1 Identify strategies to organize and remember new terminology

1.2 Implement strategies to organize and remember new terminology

TR2 Use Strategies to Improve Understanding and Recall

2.1 Identify strategies to improve understanding and recall of written information

2.2 Implement strategies to improve understanding and recall of written information

TR3 Read to Perform Job Tasks

3.1 Identify purpose of reading information to perform job tasks

3.2 Locate specific information

3.3 Skim for overall meaning

3.4 Read to understand and learn

3.5 Read to critique

3.6 Read to evaluate

TR4 Improve Examination Performance

4.1 Identify barriers to successful examination performance

4.2 Identify strategies to improve examination performance

4.3 Implement strategies to improve examination performance

Learners will locate, recall, understand and interpret information in written text

Introduction

Success in technical training and in the trade requires that apprentices understand, connect with and recall important information. Knowing the language of the trade and developing strategies to quickly locate specific information in reading materials such as code books, manuals and texts will not only increase reader comprehension but also productivity on the job.

Just as it is important to think about reading habits, it is important for apprentices to think about and develop strategies for exam preparation. Whether writing tests that are required during technical training or getting ready to write the Red Seal Certification exam, adequate test preparation is essential. As multiple choice testing is the most common form of assessment for certification, knowing how multiple choice questions are constructed and applying strategies for responding can significantly improve test scores.

Technical Reading in the Machining Trade

Machinists use technical reading on a daily basis to complete job tasks. According to Human Resources and Skills Development Canada's Essential Skills Profile (<http://srv108.services.gc.ca/>), the reading tasks performed by machinists range from reading short texts to locate a single piece of information (i.e., read shift notes and log book entries about the status of various jobs) to integrating and synthesizing information from multiple sources or from complex and lengthy text (i.e., read sections of manuals to learn how to carry out job tasks).

Machinists read a wide range of material as part of their daily job. As their work includes moving parts, sharp edges, manufacturing chemicals and extreme heat from materials, they read Workplace Health and Safety Regulations to ensure risk of injury is minimized. They read technical data, tool and material specifications, and reference material, for instance, to determine fastener size and type, counterbore diameter and corresponding pilot diameter. They read and interpret technical terminology as well as translate technical information into layperson's terms. In many cases, the text is often complex, lengthy, and technical.

Introduction to the Curriculum Guide

Success in technical training and performance on the job requires that apprentices have strong Essential Skills. Although all Essential Skills contribute to success, this guide is intended to help apprentices in the machining trades develop the reading strategies necessary to locate, understand, interpret and recall information presented in a variety of text formats common to the trade.

It is assumed that the instruction for the Technical Reading course will not be time-tabled as such, but instructors will use a cross-curricular approach to incorporate reading strategies using the materials of the trade.

The following guide outlines a list of recommended resources (see Appendix A) for each objective in the Technical Reading curriculum framework and, where possible, includes online website materials that complement these resources. Three formats are provided to allow learners the opportunity to review competencies in a way that best suits their needs. These resources are categorized as follows:

- **Non-contextualized** - Curriculum resources that are **not** related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials.
- **Contextualized** - Curriculum resources that provide Essential Skills applications in the context of a specific trade or occupation.
- **Technical** - Trade training materials from which Essential Skills are extracted. For the purpose of the Trade Essentials project, **Individual Learning Modules** from Alberta Advanced Education were used as the primary technical resource.

Note: Though only some modules are outlined as resources for specific objectives, all Individual Learning Modules can be used for the instruction of Essential Skills.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

The following websites contain both machining-related and generic content which may be used as an additional reading forum.

Machining Related Online Websites:

- www.matweb.com/index.aspx (Database of Material Properties)
- www.metalsuppliersonline.com/research/Default.asp (Machinist-related Information on Various Topics)
- www.jjjtrain.kanabco.com/vms/ (Machine Tool Training and Instruction)
- www.metalinfo.com/partners/amm/metalglossary.cfm (Glossary of Metals)
- www.americanmachinist.com/ (Machinist-related Information on Various Topics)
- www.216.119.73.43/about_us/index.php (Kreg Tool Company)

- www.iamaw.ca/ (International Association of Machinists and Aerospace Workers)
- www.ctma.com/careers/careers_careers.asp (Canadian Tooling and Machining Association)
- www.etmachinist.com/dec_06/E-wasteManagement.htm (The Machinist Magazine)
- www.ntma.org/eweb/StartPage.aspx (National Tooling and Machining Association)
- <http://www.khake.com/page88.html> (Machining Information on Various Topics)

Generic Resources:

- www.nationalcodes.ca (National Research Center)
- www.red-seal.ca/Site/index_e.htm (The Interprovincial Standards Red Seal Program)
- <http://trades.exambank.com> (Trades Exam Bank)
- http://www.hrsdc.gc.ca/en/labour/workplace_health/index.shtml (Workplace Health and Safety)
- www.hrsdc.gc.ca/en/hip/hrp/essential_skills/essential_skills_index.shtml (Human Resources and Social Development Canada-Essential Skills Website)
- www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php (WHMIS)
- www.wcb.pe.ca/index.php3?number=60189 (Worker's Compensation Board of PEI)
- www.gov.pe.ca/educ/index.php3?number=74951 (PEI Apprenticeship Training)
- www.nationalcodes.ca/ (National Code Documents)
- www.canoshweb.org/ (Canada's National Occupational Health and Safety Website)
- <http://employment.alberta.ca/cps/rde/xchg/hre/hs.xsl/364.html#1> (Alberta Employment and Immigration; Health and Safety Publications with Links to other Associations)
- <http://www.matweb.com/index.aspx> (Material Property Data)

TR1 Use Terminology of the Trade

Upon completion of this objective, learners will be able to:

- 1.1 identify strategies to organize and remember new terminology
 - use context clues to find the meaning of new terms
 - use word parts to create meaning
 - use trades glossary to find meaning of technical terms
 - use standard dictionary to find meaning of non-technical terms
- 1.2 implement strategies to organize and remember new terminology
 - define terms
 - use terminology in context

Suggested Strategies and Activities:

- Identify and define terms unique to the trade
- Highlight unfamiliar terms in trade-related reading
- Choose appropriate strategy to find meaning of unfamiliar terms
- Demonstrate understanding of new terms by using in sentences, providing examples, or providing illustrations
- Create a personal dictionary
- Use graphic organizers to remember terms of the trade

Non-contextualized Resources:

- Shape Up Your Reading
- Cross Curricular Reading Tools (Vocabulary Study)
- Navigating Texts and Documents in Technical Training

Contextualized Resources:

- EARAT (Communications for Carpenters: Skill # 2)

Technical Resources:

- Machine Tool Practices, *8th Edition*
- Technology of Machine Tools, *5th Edition*
- Machinery's Handbook, *28th Edition*
- Modern Metalworking
- Blueprint Reading for the Machine Trades, *Revised 6th Edition*
- Machining Fundamentals
- Machine Trades Blueprint Reading, *2nd Edition*
- Welding Print Reading
- All Individual Learning Modules, especially:

- Individual Learning Module 150101h- Machinist – Hand-Held Cutting Tools- Theory- First Period
- Individual Learning Module 150101i- Machinist – Screw Thread Terminology- Theory- First Period
- Individual Learning Module 150206a-Machinist- Machinery's Handbook- Machinery's Handbook- Second Period
- Individual Learning Module 150301d-Machinist- Introduction to Gearing- Theory- Third Period
- Individual Learning Module 150301e-Machinist- Gear Manufacturing Methods- Theory- Third Period
- Individual Learning Module 150401a-Machinist- Spur Gears and Milling- Theory- Fourth Period
- Individual Learning Module 150401d-Machinist- Bevel Gears- Theory- Fourth Period
- Individual Learning Module 150401l-Machinist- Introduction to Limits and Fits- Theory- Fourth Period
- Individual Learning Module 150401m-Machinist- Surface Finish- Theory- Fourth Period
- Individual Learning Module 150402d -Machinist- Programming Concepts, Codes and Structure – Computer Numerical Control Machines- Fourth Period

Online Resources:

- <http://www.edu.gov.on.ca/ca/eng/studentsuccess/thinkliteracy/files/Reading.pdf> (Reading Strategies for using context clues)
- http://www.red-seal.ca/Site/english/pdf/Machinist_2005.pdf (National Occupational Analysis-Machinist)

Online Glossaries:

- http://www.tradesecrets.gov.ab.ca/trades/pdf/trade_glossaries/015_glossary.pdf
- <http://www.metalinfo.com/partners/amm/metalglossary.cfm>
- <http://www.4crawler.com/Welding/Glossary.shtml>
- <http://www.airgas.com/content/details.aspx?id=7000000000111>
- <http://www.homeshopmachinist.net/?page=main.help.glossary>
- <http://www.tradesinfo.ca/en/trade-information/machinist/terminology>

TR2 Use Strategies to Improve Understanding and Recall

Upon completion of this objective, learners will be able to:

- 2.1 identify strategies to improve understanding and recall of written information
 - use prior knowledge to make sense of new information
 - use SQ3R
 - use KWL
 - use note-taking strategies
 - use memory strategies
- 2.2 implement strategies to improve understanding and recall of written information

Suggested Strategies and Activities:

- Identify individual learning style
- Incorporate learning strategies for individual learning style for study and class participation
- Model strategies and encourage learners to use them
- Explain the steps to the SQ3R strategy
- Explain and the steps to the KWL strategy
- Create and Use Charts for SQ3R and KWL
- Use KWL in group settings to introduce new concepts

Non-contextualized Resources:

- Shape Up Your Reading
- Study Smarter, Not Harder
- Cross Curricular Reading Tools
- Navigating Texts and Documents in Technical Training

Technical Resources:

- All Individual Learning Modules
- Machinery's Handbook, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Technology of Machine Tools, *5th Edition*
- Modern Metalworking
- Machining Fundamentals

Online Resources:

- <http://www.bucks.edu/~specpop/Lrnprfil.htm> (Learning Styles and Study Skills)
- <http://www.ldpride.net/learningstyles.MI.htm#Learning%20Styles%20Explained> (Learning Styles)
- <http://www.learning-styles-online.com/> (Learning Styles)
- http://www.support4learning.org.uk/education/learning_styles.cfm (Learning Styles)
- <http://www.edu.gov.on.ca/eng/studentssuccess/thinkliteracy/files/Reading.pdf> (Reading Strategies)
- http://www.mindtools.com/pages/main/newMN_ISS.htm (Reading and Study Skills)
- <http://www.studygs.net/> (Reading and Study Strategies)
- <http://www.khake.com/page3.html> Study Skills
- http://www.mindtools.com/pages/article/newISS_02.htm (SQ3R)

TR3 Read to Perform Job Tasks

Upon completion of this objective, learners will be able to:

- 3.1 identify purpose of reading information to perform job tasks
- 3.2 locate specific information
 - scan to locate specific information
 - locate information using organizational features of text
- 3.3 skim for overall meaning
- 3.4 read to understand and learn
- 3.5 read to critique
- 3.6 read to evaluate

Suggested Strategies and Activities:

- Use organizational features to predict content and relevance of text
- Locate information using key words
- Scan for information in trade-related material (i.e., texts, memos, newsletters, safety information, equipment manuals, codes and regulations)
- Practice skimming to get the main idea in reading material of the trade (i.e., texts, memos, newsletters, safety information, equipment manuals, codes, specifications and regulations)
- Use Table of Contents, Indices, Appendices, Headings and Sub-headings to locate information in material of the trade (i.e., texts, collective agreements, manuals, codes, specifications and regulations)
- Read selections of text and provide a verbal or written summary
- Read specification sheets to determine project requirements
- Read installation manuals to follow procedures
- Compare the advantages and disadvantages of various tools or materials for a particular situation
- Read Occupational Health and Safety regulations to determine safe work practices
- Read and interpret codes, regulations and standards to comply with national, provincial and municipal regulations

Non-contextualized Resources:

- Shape Up Your Reading
- Navigating Texts and Documents in Technical Training
- Cross Curricular Reading Tools
- Study Smarter, Not Harder
- Navigating Texts and Documents in Technical Training

Contextualized Resources:

- EARAT (Communications for Precision Machining and Tooling: Skills # 1, 3, 4, 5, 7, 9-12)
- Interprovincial 'Red Seal' Welder Upgrade Program

Technical Resources:

- Machine Tool Practices, *8th Edition*
- Technology of Machine Tools, *5th Edition*
- All Individual Learning Modules
- Machinery's Handbook, *28th Edition*
- Modern Metalworking
- Machining Fundamentals

Online Resources:

- <http://www.edu.gov.on.ca/eng/studentssuccess/thinkliteracy/files/Reading.pdf> (Reading Strategies)
- <http://www.keyskillssupport.net/teacandlearresoa/> (Learning Resources-see Construction Sector)
- <http://www.42explore.com/skim.htm> (Skimming and Scanning)
- <http://www.edu.gov.on.ca/eng/studentssuccess/thinkliteracy/files/Reading.pdf> (Strategies for Reading Graphical Text)
- www.open.ac.uk/skillsforstudy/active-reading.php (Active Reading)

TR4 Improve Examination Performance

Upon completion of this objective, learners will be able to:

- 4.1 identify barriers to successful examination performance
- 4.2 identify strategies to improve examination performance
 - identify ways to prepare for exams
 - identify test taking strategies
 - identify strategies to reduce test anxiety
- 4.3 implement strategies to improve examination performance

Note: Learners preparing for the Interprovincial Red Seal exam should review the National Occupational Analysis for Machinists.

Suggested Strategies and Activities:

- Analyze past tests
- Provide opportunity to complete practice questions
- Provide information on testing locations and procedures for your province
- Review the NOA for machinist
- Discuss test-taking strategies
- Discuss strategies to reduce test anxiety
- Discuss steps in test preparation

Non-contextualized Resources:

- Shape Up Your Reading
- Study Smarter Not Harder
- National Electrical Trade Council (NETCO) Instructor's Guide: Test-Taking Strategies for Interprovincial Red Seal Exams (Generic Version)

Contextualized Resources:

- Tools for the Trade: A Guide to Success in Apprenticeship
- Interprovincial 'Red Seal' Welder Upgrade Program

Technical Resources:

- All Individual Learning Modules (Self Tests)
- Trades Exam Bank (online)
- Technology of Machine Tools, 5th Edition
- Machine Tool Practices, 8th Edition
- Machinery's Handbook, 28th Edition
- Machining Fundamentals
- Modern Metalworking

Online Resources:

- http://www.tradesecrets.gov.ab.ca/trades/pdf/trade_practice_exams/012_IP_PracticeExam.pdf (Practice Red Seal Exam)
- <http://www.red-seal.ca/Site/english> (National Occupational Analysis)
- www.ceca.org/netco (Preparing for Red Seal: Instructor Guide and Power Point Presentation)
- <http://www.itabc.ca/documents/Preparing%20For%20Success.pdf> (Preparing for the Red Seal Exam, BC Industry Training Authority)
- <http://trades.exambank.com> (Trades Exam Bank)
- www.testtakingtips.com (Test-taking Skills)
- www.studygs.net/tsttak3.htm (Study and Test-taking strategies)
- www.ucc.vt.edu/stdysk (Study Skills)
- www.d.umn.edu/kmc/student/loon/acad/strat/testcheck.html (Test-Taking Checklist)
- www.uic.edu/depts/counselctr/ace/multiple.htm (Multiple Choice Test Strategies)
- www.collegeboard.com/student/testing/clep/prep_hint_mc.html (Multiple Choice Tips)

Appendix A

Resource Materials:

Alberta Individual Learning Modules for Machinist

Alberta Apprenticeship and Industry Training, 1998

Tel: 1-800-232-7215

<http://www.tradesecrets.gov.ab.ca/>

Blueprint Reading for the Machine Trades, Revised 6th Edition

Russ Schultz and Larry Smith

Pearson Education Inc., 2009

ISBN: 978-0-13-503878-9

Cross Curricular Reading Tools

CAMET

P.O. Box 2044; Halifax, NS B3J 1M7

ISBN 1-895660-77-4

Evaluating Academic Readiness for Apprenticeship Training (EARAT)

Communications for Precision Machining and Tooling

Workplace Support Services Branch

Ontario Ministry of Training, Colleges and Universities, October 2000

Tel 416-325-2929 or 1-800-387-5514

Email: info@edu.gov.on.ca

Interprovincial 'Red Seal' Welder Upgrade Program

Books 1-4

CWB Learning Centre, 2008

Instructor's Guide: Test-Taking Strategies for Interprovincial Red Seal Exams (Generic Version: Applicable to all Red Seal Trades)

National Electrical Trade Council (NETCO), 2008

www.ceca.org/netco

Machine Tool Practices, 8th Edition

Richard R. Kibbe et al

Pearson Education Inc., 2006

ISBN: 0-13-118896-8

Machine Trades Blueprint Reading, 2nd Edition

David L. Taylor
Delmar Cengage Learning, 2005
ISBN: 13-978-1-4018-9998-1

Machinery's Handbook, 28th Edition

Erik Oberg et al
Industrial Press, 2008
ISBN: 978-0-8311-2800-5

Machining Fundamentals

John R. Walker
The Goodheart-Willcox Company, Inc., 2004
ISBN: 13-978-1-59070-249-9
ISBN (Instructor's Resource CD): 1-59070-252-2

Modern Metalworking

John R. Walker
The Goodheart-Willcox Company, Inc., 2004
ISBN: 13-978-1-59070-224-6

Navigating Texts and Documents in Technical Training

Manitoba Competitiveness Training and Trade
Tel 1-877-978-7233 (1-877-97-TRADE)
Email: apprenticeship@gov.mb.ca

Study Smarter, Not Harder

Kevin Paul
Self-Counsel Press 1996
ISBN 1-55180-059-4

Shape Up Your Reading

Sheila Trant
Harcourt Brace & Company, Canada 1997
ISBN 0-7747-3296-2

Technology of Machine Tools, 5th Edition

Steve F. Krar and Albert F. Check
Glencoe McGraw-Hill, 1997
ISBN: 0-02-803071-0

Tools for the Trade: A Guide to Success in Apprenticeship

Sue Grecki
Skillplan-BC Construction Industry Skills Improvement Council
Burnaby, BC 2000

Welding Print Reading

John R. Walker and W. Richard Polanin

The Goodheart-Willcox Company Inc., 2007

ISBN: 1-59070-642-0

ISBN (Instructor's Guide): 13-978-1-59070-643-5

All online resources listed in this document were operational at time of publication.

Document Use (DU) Learning Outcome: Learners will use strategies for locating, retrieving, interpreting, and entering information in/from documents and will create trade documents

DU 1 Use Lists	1.1 Define lists	1.2 Identify purpose	1.3 Locate information in lists	1.4 Interpret information in lists	1.5 Create lists	1.6 Evaluate lists for effectiveness
DU 2 Use Tables	2.1 Define tables	2.2 Identify purpose	2.3 Locate information in tables	2.4 Interpret information in tables	2.5 Create tables	2.6 Evaluate tables for effectiveness
DU 3 Use Forms	3.1 Define forms	3.2 Identify purpose	3.3 Locate information in forms	3.4 Interpret information in forms	3.5 Enter information into forms	3.6 Create forms
	3.7 Evaluate forms for effectiveness					
DU 4 Use Charts	4.1 Define charts	4.2 Identify purpose	4.3 Locate information in charts	4.4 Interpret information in charts	4.5 Create charts	4.6 Evaluate charts for effectiveness
DU 5 Use Graphic Documents	5.1 Define graphic documents	5.2 Identify purpose	5.3 Locate information in graphic documents	5.4 Interpret information in graphic documents	5.5 Create graphic documents	5.6 Evaluate graphic documents for effectiveness

Learners will use strategies for locating, retrieving, interpreting and entering information in/from documents and for creating trade documents

Introduction

Document Use (DU) tasks involve the process of locating, organizing and using information in different visual displays that include words, numbers and diagrams. These visual materials efficiently summarize large amounts of information in a small amount of space and are widely used in trade occupations.

Apprentices must be proficient document users if they are to be successful in technical training and in job performance. This guide has been developed to provide apprentices with strategies to use trade documents quickly, efficiently and accurately. Learners will locate, interpret and evaluate information in documents and will create documents common to their trade. Understanding document structure and the strategies for using them will lead to more efficient information processing. For the purpose of the Trade Essentials project, documents have been categorized and defined as follows:

- **List** – A document that records items in a row
- **Table** – A document that arranges information in rows and columns
- **Form** – A document which contains blanks for the insertion of pre-specified information
- **Chart** – A document that is used primarily to make large quantities of data easier to understand, illustrates the relationship between different parts of the data, and commonly presents information as plots with reference to an axis. Charts are generally graphical in nature and contain very little text. Examples of charts include pie chart, flow chart, bar graph, line graph, histogram and pictogram
- **Graphic Document** – A document which portrays information as an imitation of the real world. Examples of graphic documents include pictures, diagrams, drawings, blueprints, schematics, maps, symbols, signs and icons

The following guide outlines a list of recommended resources (see Appendix A) for each objective in the Document Use curriculum framework and, where possible, includes online website materials that complement these resources. Three formats are provided to allow learners the opportunity to review competencies in a way that best suits their needs. These resources are categorized as follows:

- **Non-contextualized** - Curriculum resources that are **not** related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials.

- **Contextualized** - Curriculum resources that provide Essential Skills applications in the context of a specific trade or occupation.
- **Technical** - Trade training materials from which Essential Skills are extracted. For the purpose of the Trade Essentials project, **Individual Learning Modules** from Alberta Advanced Education were used as the primary technical resource.

Note: Though only a few modules are outlined as resources for specific objectives, all Individual Learning Modules can be used for the instruction of Essential Skills.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Document Use in the Machining Trade

Machinists use documents on a daily basis to complete job tasks. The complexity of these tasks, according to Human Resources and Skills Development Canada's Essential Skills profile (<http://srv108.services.gc.ca/>), ranges from using very simple, brief text combined with uncomplicated structure (i.e., complete checklists and other administrative forms to document completed work, identify problems and place requests) to using complex documents with multiple pieces of information organized into multiple sections (i.e., interpret scale drawings at various points throughout the machining process).

Machinists read and interpret blueprints, engineering's drawings, and sketches and work from drawings, specifications and their own measurements to calculate tolerances and dimensions. They use sketches and photographs to estimate measurements and often view three-dimensional parts and machining processes on CNC machinery. Additionally, machinists frequently sketch parts, for instance, to verify how different sub-parts will fit together on a job and, therefore, are knowledgeable in sketching techniques, dimensioning practices and third angle projection.

For background information on Document Use and how documents are used in the machining trades, visit these sites:

- http://srv108.services.gc.ca/awm/main/c_tf_doc1_e.shtml#whatis (Understanding Document Use- Human Resource Skills Development Canada)
- http://www.red-seal.ca/Site/trades/analist_e.htm (The Interprovincial Standards Red Seal Program)
- http://www.thelearningpartnership.ca/Passport_to_Prosperty/onlineresources_teacher/UsingDocuments.pdf (Background Information on Document Use)

The following websites contain machining-related content which may be used as an additional document use forum.

Machining Online Websites:

- <http://siast.ca.libguides.com/content.php?pid=12602&sid=84428> (SIAST Library and Testing Services)
- <http://www.khake.com/page88.html> (Machining Resources)
- www.matweb.com/index.aspx (Database of Material Properties)
- www.metalsuppliersonline.com/research/Default.asp (Machinist-related Information on Various Topics)
- www.jjjtrain.kanabco.com/vms/ (Machine Tool Training and Instruction)
- www.metalinfo.com/partners/amm/metalglossary.cfm (Glossary of Metals)
- www.americanmachinist.com/ (Machinist-related Information on Various Topics)
- www.iamaw.ca/ (International Association of Machinists and Aerospace Workers)
- www.ctma.com/careers/careers_careers.asp (Canadian Tooling and Machining Association)
- www.ntma.org/eweb/StartPage.aspx (National Tooling and Machining Association)
- <http://forums.americanmachinist.com/showthread.php?t=27> (The US Machine Tool Training Manual)

DU1 Use Lists

Upon completion of this objective, learners will be able to:

- 1.1 define lists
- 1.2 identify purpose
- 1.3 locate information in lists
- 1.4 interpret information in lists
- 1.5 create lists
- 1.6 evaluate lists for effectiveness

Suggested Strategies and Activities:

- Identify presence and uses of lists in documents of the trade
- Find examples and extract information from the four types of lists (simple, combined, intersected and nested)
- Create lists to organize and compare information by category (i.e., tools, materials and special equipment for each installation)
- Create material lists from specification sheets
- Differentiate between lists and tables
- Analyze lists and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of lists
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- The Language of Documents- A Guide to Information Display in the Workplace
- Field Safety - Volume One
- Document Use Refresher for Apprentices (Module 2)
- Applied Communication Skills for the Construction Trades

Contextualized Resources:

- IPT's Safety First Handbook (Book One)

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Individual Learning Module 150101c- Machinist – Precision Measuring Tools- Theory- First Period
- Individual Learning Module 150101tB-Machinist- Machine Shop Rigging-Part B- Theory- First Period
- Individual Learning Module 150201g-Machinist- Lathe Attachments and Accessories- Theory- Second Period

- Individual Learning Module 150201c-Machinist- Tool and Workholding Devices- Theory- Second Period
- Individual Learning Module 150201d-Machinist- Milling Operations- Theory- Second Period
- Individual Learning Module 150301g- Machinist – Grinding Machines and Processes- Theory- Third Period
- Individual Learning Module 150401i-Machinist- Belts and Pulleys- Theory- Fourth Period

DU2 Use Tables

Upon completion of this objective, learners will be able to:

- 2.1 define tables
- 2.2 identify purpose
- 2.3 locate information in tables
- 2.4 interpret information in tables
- 2.5 create tables
- 2.6 evaluate tables for effectiveness

Suggested Strategies and Activities:

- Brainstorm to identify the use of tables and schedules in the trade
- Create tables to sort and separate materials, supplies and equipment
- Discuss various types of data sheets used in the trade
- Analyze tables and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of tables
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- Field Safety- Volume One
- Applied Communication Skills for the Construction Trades
- Workplace Communications-The Basics, *3rd Edition* (Chapter 3)

Contextualized Resources:

- IPT's Safety First Handbook (Book One)

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Modern Metalworking
- Technology of Machine Tools, *5th Edition*
- Machining Fundamentals (and Resource CD)
- Print Reading for Industry
- Interpreting Engineering Drawings, *7th Edition*
- Welding Print Reading
- Individual Learning Module 150206a-Machinist- Machinery's Handbook- Machinery's Handbook- Second Period
- Individual Learning Module 150201j-Machinist- Using Carbide Inserts- Theory- Second Period

- Individual Learning Module 150202c-Machinist- CNC Turning Centres: Program and Machine Co-ordinate Systems- Computer Numerical Control Machines- Second Period
- Individual Learning Module 150202e-Machinist- CNC Turning Centres: Programming Concepts and Codes- Computer Numerical Control Machines- Second Period
- Individual Learning Module 150302a- Machinist -CNC Turning Centres: Program Codes and Formats- Computer Numerical Control Machines-Third Period
- Individual Learning Module 150302c- Machinist – Linear and Circular Interpolation- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150302g- Machinist – CNC Threading II : Programming and Troubleshooting-Computer Numerical Control Machines- Third Period
- Individual Learning Module 150402d -Machinist- Programming Concepts, Codes and Structure – Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402f-Machinist- Canned Cycles: Theory- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150401I-Machinist- Introduction to Limits and Fits- Theory- Fourth Period

Online Resources:

- http://www.twi.co.uk/content/main_about_us_index.html (World Centre for Materials Joining Technology)
- <http://www.pro-fusiononline.com/welding/troubleshooting.htm> (Troubleshooting Guide for Arc Welding Systems)
- http://www.osha.gov/SLTC/etools/machineguarding/appendices/appendix_g.html (Sample employer self-inspection checklist for safeguards and other hazards)

DU3 Use Forms

Upon completion of this objective, learners will be able to:

- 3.1 define forms
- 3.2 identify purpose
- 3.3 locate information in forms
- 3.4 interpret information in forms
- 3.5 enter information into forms
- 3.6 create forms
- 3.7 evaluate forms for effectiveness

Suggested Strategies and Activities:

- Define entry forms as documents which both share information and require input of information
- Identify features common to workplace forms
- Identify audience for workplace forms
- Interpret vocabulary of workplace forms
- Extract information from forms common to the trade (i.e., accident/incident reports, expense forms, daily time sheets, daily logs, invoices, application forms, purchase orders and material take off sheets)
- Define entry forms as documents which both share information and require input of information
- Use title of form to predict purpose and kinds of information requested
- Distinguish between primary and secondary information
- Enter information into forms common to the trade (i.e., accident/incident reports, expense forms, daily time sheets, daily logs, invoices, application forms, purchase orders and material take off sheets)
- Analyze forms and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of forms
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- The Language of Documents- A Guide to Information Display in the Workplace
- Document Use Refresher for Apprentices (Module 6)
- Writing at Work (Module 2-Entry Forms)
- Tools for Success- Soft Skills for the Construction Industry

Online Resources:

- http://www.gov.pe.ca/photos/original/edu_appl_appren.pdf (Application for Apprenticeship)
- <http://www.wcb.pe.ca/index.php3?number=60190&lang=E> (Workers Compensation Forms)
- http://books.google.ca/books?id=DBhILgGvCakC&pg=PA36&lpg=PA36&dq=how+to+complete+construction+invoices&source=web&ots=RLEjAHWmQ9&sig=UTLvWpFGyC5mWNYPWNnLOIWY1CU&hl=en&sa=X&oi=book_result&resnum=1&ct=result (Examples of Forms)

DU4 Use Charts

Upon completion of this objective, learners will be able to:

- 4.1 define charts
- 4.2 identify purpose
- 4.3 locate information in charts
- 4.4 interpret information in charts
- 4.5 create charts
- 4.6 evaluate charts for effectiveness

Suggested Strategies and Activities:

- Identify the presence and use of charts in the trade
- Identify the basic types: pie chart, bar graph and line graph, etc. and in what circumstance each may be used
- Discuss the use of charts in a variety of trade-related and safety workplace documents
- Review workplace charts common to the trade
- Analyze charts and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of charts
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- The Language of Documents- A Guide to Information Display in the Workplace
- Field Safety- Volume One
- Document Use Refresher for Apprentices (Modules 4 and 5)
- Workplace Communications-The Basics, *3rd Edition* (Chapter 3)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Modern Metalworking
- Welding Print Reading
- Technology of Machine Tools, *5th Edition*
- Individual Learning Module 150206a-Machinist- Machinery's Handbook- Machinery's Handbook- Second Period
- Individual Learning Module 150201j-Machinist- Using Carbide Inserts- Theory- Second Period
- Individual Learning Module 150202c-Machinist- CNC Turning Centres: Program and Machine Co-ordinate Systems- Computer Numerical Control Machines- Second Period

Online Resources:

- https://www.advancededucation.gov.ab.ca/k_12/curriculum/bysubject/ke/ReadtoLive/Tools/Reading%20Diagrams.pdf (Reading Charts and Graphs)
- http://www42.statcan.ca/smr02/smr02_022_e.htm (Statistics Canada)

DU5 Use Graphic Documents

Upon completion of this objective, learners will be able to:

- 5.1 define graphic documents
- 5.2 identify purpose
- 5.3 locate information in graphic documents
- 5.4 interpret information in graphic documents
- 5.5 create graphic documents
- 5.6 evaluate graphic documents for effectiveness

Suggested Strategies and Activities:

- Identify symbols commonly used in the trade including WHMIS
- Interpret signals
- Interpret signs for safety information
- Interpret product or packaging labels
- Recognize lines used on drawings
- Recognize significance of symbols
- Take measurements from drawings
- Distinguish between orthographic, isometric, and oblique drawings
- Create schedules to coordinate with other trades
- Make sketches to communicate ideas
- Practice drawing to scale using metric and imperial systems
- Analyze graphic documents and determine degree of difficulty (i.e., simple or complex)
- Examine structure and components of a variety of graphic documents
- Encourage learners to share their knowledge and experiences

Non-contextualized Resources:

- The Language of Documents- A Guide to Information Display in the Workplace
- Field Safety- Volume One
- Document Use Refresher for Apprentices (Modules 1 and 3)
- Applied Communication Skills for the Construction Trades
- Workplace Communications-The Basics, 3rd Edition (Chapter 3)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Communications for Precision Machining and Tooling: Skills # 6)
- Blueprint Fundamentals: Interpreting Symbols and Specs (CD-ROM)
- IPT's Safety First Handbook (Book One)

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Blueprint Reading for the Machine Trades, *Revised 6th Edition*
- Modern Metalworking
- Machining Fundamentals (and Resource CD)
- Machine Trades Print Reading
- Print Reading for Industry
- Interpreting Engineering Drawings, *7th Edition*
- Machine Trades Blueprint Reading, *2nd Edition*
- Machine Tool Practices, *8th Edition*
- Welding Print Reading
- All Individual Learning Modules, especially:
 - Individual Learning Module 150101a- Machinist – WHMIS- Theory- First Period
 - Individual Learning Module 150104a- Machinist – Introduction to Print Reading- Blueprint Reading- First Period
 - Individual Learning Module 150104b- Machinist – Dimensioning Methods- Blueprint Reading- First Period
 - Individual Learning Module 150104c- Machinist – Isometric Drawings- Blueprint Reading- First Period
 - Individual Learning Module 150104d- Machinist – Sections- Blueprint Reading- First Period
 - Individual Learning Module 150104e- Machinist – Applied Print Reading- Blueprint Reading- First Period
 - Individual Learning Module 150301f- Machinist - abrasives- Theory- Third Period
 - Individual Learning Module 150301k- Machinist – Jigs and Fixtures- Theory- Third Period
 - Individual Learning Module 150304a- Machinist – Interpret and Sketch Prints- Blueprint Reading- Third Period
 - Individual Learning Module 150302c- Machinist – Linear and Circular Interpolation- Computer Numerical Control Machines- Third Period
 - Individual Learning Module 150302f- Machinist – CNC Threading 1: Introduction and Calculations-Computer Numerical Control Machines- Third Period
 - Individual Learning Module 150402d -Machinist- Programming Concepts, Codes and Structure – Computer Numerical Control Machines- Fourth Period
 - Individual Learning Module 150401j-Machinist- Basic Hydraulics- Theory- Fourth Period
 - Individual Learning Module 150401m-Machinist- Surface Finish- Theory- Fourth Period
 - Individual Learning Module 150205a-Machinist- Interpret and Sketch Prints- Blueprint Reading- Second Period

- Individual Learning Module 150205b-Machinist- Symbols and Abbreviations- Blueprint Reading- Second Period
- Individual Learning Module 150205c-Machinist- Assembly and Sub-Assembly Drawings- Blueprint Reading- Second Period
- Individual Learning Module 150304c-Machinist- Print Reading: Jigs and Fixtures- - Blueprint Reading- Third Period Individual Learning Module 150304b-Machinist- Print Reading: Casting- Blueprint Reading- Third Period
- Individual Learning Module 150301c-Machinist- Multiple Start Threads- Theory- Third Period

Online Resources:

- http://en.wikipedia.org/wiki/Geometric_Tolerancing
- <http://trades.exambank.com/cgi-bin/examinator2/1440> (Trades Exam Bank Blueprint Reading)
- <http://www.tpub.com/content/draftsman/14040/> (Integrated Publishing- Drafting)
- www.gowelding.com/weld/symbol/symbol.htm (Welding Symbols)
- <http://www.khake.com/page89.html> (Various Topics on Blueprint Reading and Symbols)
- http://www.metallicfusion.com/symbols_and_definitions.htm#Welding%20Test%20Positions (Welding Symbols and Definitions)
- http://www.millerwelds.com/pdf/safety/quick_eng_200704.pdf (Safety Quick Guide)

Appendix A

Resource Materials:

Alberta Individual Learning Modules for Machinist

Alberta Apprenticeship and Industry Training 1998

Tel: 1-800-232-7215

<http://www.tradesecrets.gov.ab.ca/>

Applied Communications Skills for the Construction Trades

Stephan A. Rigolosi

Pearson Education Inc. 2002

ISBN 0-13-093355-4

Blueprint Fundamentals: Interpreting Symbols and Specs (CD-ROM)

Shopware, 2004

www.shopware-usa.com

Blueprint Reading for the Machine Trades, Revised 6th Edition

Russ Schultz and Larry Smith

Pearson Education Inc., 2009

ISBN: 978-0-13-503878-9

Document Use Refresher for Apprentices

Nova Scotia Department of Education

Apprenticeship Training and Skills Development

Tel: 902-424-0492

Evaluating Academic Readiness for Apprenticeship Training (EARAT)

Communications for Precision Machining and Tooling Apprentices

Workplace Support Services Branch

Ontario Ministry of Training, Colleges and Universities, October 2000

Tel: 416-325-2929 or 1-800-387-5514

Email: info@edu.gov.on.ca

Field Safety, Volume One

Participant Guide

Contren Learning Series

National Center for Construction Education and Research, 2003

ISBN: 0-13-106760-5

Interpreting Engineering Drawings, 7th Edition

Cecil H. Jenson and Jay D. Helsel

Thomson Delmar Learning, 2007

ISBN: 1-4180-5573-5

IPT's Safety First Handbook (Book One)

Bruce M. Basaraba
IPT Publishing and Training Ltd., 1999
ISBN: 0-920855-34-2

Machinery's Handbook, 28th Edition

Erik Oberg et al
Industrial Press, 2008
ISBN: 978-0-8311-2800-5

Machine Tool Practices, 8th Edition

Richard R. Kibbe et al
Pearson Education Inc., 2006
ISBN: 0-13-118896-8

Machine Trades Blueprint Reading, 2nd Edition

David L. Taylor
Delmar Cengage Learning, 2005
ISBN: 13-978-1-4018-9998-1

Machine Trades Print Reading

Michael A. Barsamian; Richard A. Gizelbach
The Goodheart-Willcox Company, Inc., 2001
ISBN: 13-978-1-56637-594-8
ISBN (Instructor's Manual): 13-978-1-56637-595-5

Machining Fundamentals

John R. Walker
The Goodheart-Willcox Company, Inc., 2004
ISBN: 13-978-1-59070-249-9
ISBN (Instructor's Resource CD): 1-59070-252-2

Modern Metalworking

John R. Walker
The Goodheart-Willcox Company, Inc., 2004
ISBN: 13-978-1-59070-224-6
ISBN (Instructor's Manual): 1-59070-226-3
ISBN (Workbook): 13-978-1-59070-225-3

The Language of Documents- A Guide to Information Display in the Workplace

Lynda Fownes
Skillplan – The B.C. Construction Industry Skills Improvement Council, 1999
ISBN: 0-9685027-0-9

Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Jack Martin and Mary Serich

Jack Martin and Associates, 2006

ISBN: 0-9649530-1-3

Print Reading for Industry

Walter C. Brown; Ryan K. Brown

The Goodheart-Willcox Company, Inc., 2002

ISBN: 1-56637-807-9

ISBN (Instructor's Guide): 13-978-1-56637-808-6

Technology of Machine Tools, 5th Edition

Steve F. Krar and Albert F. Check

Glencoe McGraw-Hill, 1997

ISBN: 0-02-803071-0

Tools for Success- Soft Skills for the Construction Industry

Stephen A Rigolosi

Pearson Education Inc. 2004

ISBN: -13-160000-1

Welding Print Reading (and Instructor's Guide)

John R. Walker and W. Richard Polanin

The Goodheart-Willcox Company Inc., 2007

ISBN: 1-59070-642-0

ISBN (Instructor's Guide): 13-978-1-59070-643-5

Workplace Communications-The Basics, 3rd Edition

George J. Searles

Pearson Education, Inc., 2006

ISBN: 0-321-33068-4

Writing at Work

Sue Grecki, Sheila Whincup

Skillplan- The BC Construction Skills Improvement Council 1996

ISBN 0-9685027-4-1

All online resources listed in this document were operational at time of publication.

Principles of Mathematics (PM) Learning Outcome – Learners will understand, interpret, and manipulate mathematical concepts in order to solve problems and complete job tasks.

PM1 Use Calculators

1.1 Identify the benefits and risks involved in using calculators in the trade	1.2 Describe how calculators are used in the trade	1.3 Determine the best calculator for the trade	1.4 Use calculators to solve problems
--	--	---	---------------------------------------

PM2 Use Positive and Negative Numbers

2.1 Read positive and negative numbers	2.2 Write positive and negative numbers	2.3 Round positive and negative numbers	2.4 Estimate positive and negative numbers	2.5 Order positive and negative numbers	2.6 Compare positive and negative numbers
2.7 Add positive and negative numbers	2.8 Subtract positive and negative numbers	2.9 Multiply positive and negative numbers	2.10 Divide positive and negative numbers	2.11 Use knowledge of positive and negative numbers to solve problems	

PM3 Use Order of Operations

3.1 Identify the necessary steps in performing order of operations	3.2 Calculate answers Using correct order of operations	3.3 Use order of operations to solve problems
--	---	---

PM4 Use Fractions

4.1 Read fractions	4.2 Write fractions	4.3 Compare fractions	4.4 Round fractions	4.5 Simplify fractions	4.6 Add fractions
4.7 Subtract fractions	4.8 Multiply fractions	4.9 Divide fractions	4.10 Use knowledge of fractions to solve problems		

**PM5 Use Mixed
Numbers**

5.1 Read mixed numbers	5.2 Write mixed numbers	5.3 Compare mixed numbers	5.4 Round mixed numbers	5.5 Simplify mixed numbers	5.6 Add mixed numbers
5.7 Subtract mixed numbers	5.8 Multiply mixed numbers	5.9 Divide mixed numbers	5.10 Use knowledge of mixed numbers to solve problems		

**PM6 Use
Decimals**

6.1 Read decimals	6.2 Write decimals	6.3 Estimate decimals	6.4 Round decimals	6.5 Add decimals	6.6 Subtract decimals
6.7 Multiply decimals	6.8 Divide decimals	6.9 Use knowledge of decimals to solve problems			

PM7 Use Percent

7.1 Use formulae to calculate percent	7.2 Use knowledge of percent to solve problems
---------------------------------------	--

**PM8 Use
Conversion**

8.1 Explain the purpose of mathematical conversion	8.2 Convert among fractions, decimals, and percent	8.3 Use automatic recall of decimal and percent equivalents of common fractions	8.4 Use knowledge of conversion to solve problems
--	--	---	---

PM9 Use Measurement Systems	9.1 Demonstrate uses of specific measurements	9.2 Perform conversions within the metric measurement system	9.3 Perform conversions within the imperial measurement system	9.4 Perform conversions between the metric and imperial measurement systems	9.5 Perform time conversions	9.6 Use knowledge of measurement and time conversion to solve problems
PM10 Use Rate, Ratio, and Proportion	10.1 Describe the differences among rate, ratio, and proportion	10.2 Give examples of how rate, ratio, and proportion, are used in the trade	10.3 Write numbers as proportions	10.4 Use knowledge of rate to solve problems	10.5 Use knowledge of ratio to solve problems	10.6 Use knowledge of proportion to solve problems
PM11 Use Square Root and Exponents	11.1 Determine square root of positive numbers that are perfect squares	11.2 Determine approximate square root of positive numbers that are not perfect squares	11.3 Use knowledge of square root to solve problems	11.4 Use knowledge of exponent laws to solve problems	11.5 Determine significant digits	11.6 Use knowledge of scientific notation to solve problems
PM12 Solve Equations	12.1 Write variable expressions and equations from sentences	12.2 Simplify variable expressions	12.3 Write equations from sentences	12.4 Solve one-step equations	12.5 Solve two-step equations	12.6 Solve multi-step equations
PM13 Use Trade-Related Formulae	13.1 Identify formulae common to the trade	13.2 Solve problems using formulae as written	13.4 Solve problems by rearranging formulae			

**PM14 Use
Estimation**

14.1 Identify estimation rules	14.2 Use estimation rules to solve single-step problems	14.3 Use estimation rules to solve multi-step problems
--------------------------------	---	--

PM15 Use Angles

15.1 Identify various types of angles common to the trade	15.2 Compare angles common to the trade	15.3 Measure angles	15.4 Use knowledge of angles to solve problems
---	---	---------------------	--

**PM16 Use
Geometric
Shapes**

16.1 Identify geometric shapes	16.2 Use knowledge of geometric shapes to solve problems
--------------------------------	--

**PM17 Use
Trigonometry**

17.1 Identify the value of trigonometry in the trade	17.2 Set Up trigonometric ratios	17.3 Use trigonometric functions to solve problems
--	----------------------------------	--

**PM18 Analyze
Numerical Data**

18.1 Identify ways to organize data	18.2 Organize information into charts and graphs	18.3 Extract information from charts and graphs	18.4 Evaluate information found in charts and graphs	18.5 Make predictions and draw conclusions
-------------------------------------	--	---	--	--

	Automotive Service Tech	Carpenter	Cabinet Maker	Construction Electrician	Cook	Industrial Electrician	Machinist
PM1 Use Calculators	✓	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	Whole numbers only	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓	✓
PM7 Use Percent	✓	✓	✓	✓	✓	✓	✓
PM8 Use Conversion	✓	✓	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	✓	✓	✓	✓	✓	✓	✓
PM11 Use Square Root and Exponents	✓	✓	-	✓	-	✓	✓
PM12 Solve Equations	✓	✓	✓	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	-	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	-	✓	✓
PM18 Analyze Numerical Data	✓	-	-	-	✓	-	✓

	Metal Fabricator	Plumber	Refrigeration & Air Conditioning Mechanic	Oil Burner Mechanic	Steamfitter/ Pipefitter	Welder
PM1 Use Calculators	✓	✓	✓	✓	✓	✓
PM2 Use Positive and Negative Numbers	✓	✓	✓	✓	✓	✓
PM3 Use Order of Operations	✓	✓	✓	✓	✓	✓
PM4 Use Fractions	✓	✓	✓	✓	✓	✓
PM5 Use Mixed Numbers	✓	✓	✓	✓	✓	✓
PM6 Use Decimals	✓	✓	✓	✓	✓	✓
PM7 Use Percent	-	-	✓	✓	✓	✓
PM8 Use Conversion	-	✓	✓	✓	✓	✓
PM9 Use Measurement Systems	✓	✓	✓	✓	✓	✓
PM10 Use Rate, Ratio and Proportion	-	No proportion	✓	✓	✓	No proportion
PM11 Use Square Root and Exponents	-	-	✓	✓	✓	✓
PM12 Solve Equations	-	Plus quadratic equations	✓	✓	✓	✓
PM13 Use Trade-Related Formulae	✓	✓	✓	✓	✓	✓
PM14 Use Estimation	✓	✓	✓	✓	✓	✓
PM15 Use Angles	✓	✓	✓	✓	✓	✓
PM16 Use Geometric Shapes	✓	✓	✓	✓	✓	✓
PM17 Use Trigonometry	✓	✓	✓	✓	✓	✓
PM18 Analyze Numerical Data	-	-	✓	✓	-	-

The following checklist represents an overview of the Essential Skills necessary for Machinist apprentices and identifies areas requiring review.

Learner Name: _____

Instructor Name: _____

Inventory Date: _____

Post-Inventory Date: _____

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					

OBJECTIVE 1: USE CALCULATORS

- 1.1 Identify the risks and benefits involved in using calculators in the trade
- 1.2 Describe how calculators are used in the trade
- 1.3 Determine the best calculator for the trade
- 1.4 Use knowledge of calculators to solve problems

☐ ☐ ☐ ☐ ☐

OBJECTIVE 2: USE POSITIVE AND NEGATIVE NUMBERS

- 2.1 Read positive and negative numbers
- 2.2 Write positive and negative numbers
- 2.3 Round positive and negative numbers
- 2.4 Estimate positive and negative numbers
- 2.5 Order positive and negative numbers
- 2.6 Compare positive and negative numbers
- 2.7 Add positive and negative numbers
- 2.8 Subtract positive and negative numbers
- 2.9 Multiply positive and negative numbers
- 2.10 Divide positive and negative numbers
- 2.11 Use knowledge of positive and negative numbers to solve problems

☐ ☐ ☐ ☐ ☐

OBJECTIVE 3: USE ORDER OF OPERATIONS

- 3.1 Identify the necessary steps in performing order of operations
- 3.2 Calculate answers using correct order of operations
- 3.3 Use order of operations to solve problems

☐ ☐ ☐ ☐ ☐

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					
OBJECTIVE 4: USE FRACTIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.1 Read fractions					
4.2 Write fractions					
4.3 Compare fractions					
4.4 Round fractions					
4.5 Simplify fractions					
4.6 Add fractions					
4.7 Subtract fractions					
4.8 Multiply fractions					
4.9 Divide fractions					
4.10 Use knowledge of fractions to solve problems					
OBJECTIVE 5: USE MIXED NUMBERS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.1 Read mixed numbers					
5.2 Write mixed numbers					
5.3 Compare mixed numbers					
5.4 Round mixed numbers					
5.5 Simplify mixed numbers					
5.6 Add mixed numbers					
5.7 Subtract mixed numbers					
5.8 Multiply mixed numbers					
5.9 Divide mixed numbers					
5.10 Use knowledge of mixed numbers to solve problems					
OBJECTIVE 6: USE DECIMALS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.1 Read decimals					
6.2 Write decimals					
6.3 Estimate decimals					
6.4 Round decimals					
6.5 Add decimals					
6.6 Subtract decimals					
6.7 Multiply decimals					
6.8 Divide decimals					
6.9 Use knowledge of decimals to solve problems					
OBJECTIVE 7: USE PERCENT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.1 Use formulae to calculate percent					
7.2 Use knowledge of percent to solve problems					
OBJECTIVE 8: USE CONVERSION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.1 Explain the purpose of mathematical conversion					
8.2 Convert among fractions, decimals and percents					
8.3 Use automatic recall of decimal and percent equivalents of common fractions					
8.4 Use knowledge of conversion to solve problems					

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					
OBJECTIVE 9: USE MEASUREMENT SYSTEMS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.1 Demonstrate uses of specific measurements					
9.2 Perform conversions within the Metric Measurement System					
9.3 Perform conversions within the Imperial Measurement System					
9.4 Perform conversions between the Metric and Imperial Measurement System					
9.5 Perform time conversions					
9.6 Use knowledge of measurement and time conversion to solve problems					
OBJECTIVE 10: USE RATE, RATIO AND PROPORTION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.1 Describe the differences among rate, ratio and proportion					
10.2 Give examples of how rate, ratio and proportion are used in the trade					
10.3 Write numbers as proportions					
10.4 Use knowledge of rate to solve problems					
10.5 Use knowledge of ratio to solve problems					
10.6 Use knowledge of proportion to solve problems					
OBJECTIVE 12: SOLVE EQUATIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.1 Write variable expressions and equations from sentences					
12.2 Simplify variable expressions					
12.3 Write equations from sentences					
12.4 Solve one-step equations					
12.5 Solve two-step equations					
12.6 Solve multi-step equations					
OBJECTIVE 13: USE TRADE-RELATED FORMULAE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.1 Identify formulae common to the trade					
13.2 Solve problems using formulae as written					
13.3 Solve problems by rearranging formulae					
OBJECTIVE 14: USE ESTIMATION					
14.1 Identify estimation rules					
14.2 Use estimation rules to solve single-step problems					
14.3 Use estimation rules to solve multi-step problems					
OBJECTIVE 15: USE ANGLES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.1 Identify various types of angles common to the trade					
15.2 Compare angles common to the trade					
15.3 Measure angles					
15.4 Use knowledge of angles to solve problems					
OBJECTIVE 16: USE GEOMETRIC SHAPES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.1 Identify geometric shapes					
16.2 Use knowledge of geometric shapes to solve problems					

	(Assessor Use) Learning Needs Indicated from ES inventory	(Instructor Use) Learning Needs Identified by Instructor	Learning Needs Addressed Through Instruction	(Assessor Use) Learning Needs Require More Review	Skill Level Meets Trade Requirements (Post-Inventory)
PRINCIPLES OF MATHEMATICS					

OBJECTIVE 17: USE TRIGONOMETRY

- 17.1 Identify the value of trigonometry in the trade
 17.2 Set up trigonometric ratios
 17.3 Use trigonometric functions to solve problems

OBJECTIVE 18: ANALYZE NUMERICAL DATA

- 18.1 Identify ways to organize data
 18.2 Organize information into charts and graphs
 18.3 Extract information from charts and graphs
 18.4 Evaluate information found in charts and graphs
 18.5 Make predictions and draw conclusions

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

Assessor/s Signature

Date

Learners will understand, interpret and manipulate mathematical concepts in order to solve problems and complete tasks.

Introduction

The Principles of Mathematics (PM) is an introduction to the foundational math skills necessary for successful technical training and effective job task completion. The intent of the unit is twofold: to review and to further develop the concepts and strategies necessary for solving problems and completing tasks in the machining trade.

The following guide outlines a list of recommended resources (See Appendix A) for each objective in the mathematics curriculum framework and, where possible, includes online website materials that complement these resources. Three formats are provided to allow learners the opportunity to review competencies in a way that best suits their needs. These resources are categorized as follows:

- **Non-contextualized** - Curriculum resources that are **not** related to any trade or occupation. These resources may be used to review the competencies in a stand-alone manner before transferring the skill to trade-related materials.
- **Contextualized** - Curriculum resources that provide Essential Skills applications in the context of a specific trade or occupation.
- **Technical** - Trade training materials from which Essential Skills are extracted. For the purpose of the Trade Essentials project, **Individual Learning Modules** from Alberta Advanced Education were used as the primary technical resource.

Note: Though only some modules are outlined as resources for specific objectives, all Individual Learning Modules can be used for the instruction of Essential Skills.

The information presented here has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Machinists and Numeracy

Machinists often use the skills outlined in the Principles of Mathematics on a daily basis to complete job tasks. The complexity of these tasks, according to Human Resources and Skills Development Canada's Essential Skills profile (<http://srv108.services.gc.ca/>), ranges from simple, clearly-defined mathematical operations (i.e., compare measurements of machined parts to measurements on scale drawings to ensure parts are machined within specified tolerances) to tasks that involve multiple steps of calculation (i.e., use formulae to calculate the placement of holes, sprocket teeth and shaft threads).

Contextualized Online Resources:

- <http://www.swtc.edu:8082/mscenter/apldmath.htm> (Applied Math Workbook)
- <http://www.khake.com/page88.html> (Machining Resources)
- <http://forums.americanmachinist.com/showthread.php?t=27> (The US Machine Tool Training Manual)
- http://www.filedudes.com/Machinist_MathGuru-screenshot-39593.html (Math Activities)

PM1 Use Calculators

Upon completion of this objective, learners will be able to:

- 1.1 identify the risks and benefits involved in using calculators in the trade
- 1.2 describe how calculators are used in the trade
- 1.3 determine the best calculator for the trade
- 1.4 use knowledge of calculators to solve problems

Note: Calculators are used to improve speed and accuracy of calculations; however, it is important to note that calculators are tools and are only accurate if they are used properly. It is very important to have an understanding of order of operations when using calculators.

Only resources that specifically refer to calculators are outlined here; however, calculator use skills should be practiced with all identified resources.

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition* (pp. xx-xxi)
- Fundamentals of Mechanical and Electrical Mathematics
- NWT Apprenticeship Support Materials Module 1 (Foundations)

Contextualized Resources:

- Mathematics for Machine Technology, *6th Edition*

Online Resources:

- <http://www.shodor.org/unchem/math/calc/index.html>
- <http://www.how2begin.com/business/how-to-use-a-scientific-calculator-3.html>
- <http://www.uccs.edu/~energy/courses/calculator.html>
- <http://www.khake.com/page89.html>

PM2 Use Positive and Negative Numbers

Upon completion of this objective, learners will be able to:

- 2.1 read positive and negative numbers
- 2.2 write positive and negative numbers
- 2.3 round positive and negative numbers
- 2.4 estimate positive and negative numbers
- 2.5 order positive and negative numbers
- 2.6 compare positive and negative numbers
- 2.7 add positive and negative numbers
- 2.8 subtract positive and negative numbers
- 2.9 multiply positive and negative numbers
- 2.10 divide positive and negative numbers
- 2.11 use knowledge of positive and negative numbers to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skills # 1 and 16)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Math for Welders
- Mathematics for Machine Technology, *6th Edition*
- Print Reading for Industry (and Instructor's Guide)

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Technology of Machine Tools, *5th Edition*
- Modern Metalworking
- Individual Learning Module 150206a-Machinist- Machinery's Handbook- Machinery's Handbook- Second Period
- Individual Learning Module 150202c-Machinist- CNC Turning Centres: Program and Machine Co-ordinate Systems- Computer Numerical Control Machines- Second Period

- Individual Learning Module 150304a- Machinist – Interpret and Sketch Prints- Blueprint Reading- Third Period
- Individual Learning Module 150302c- Machinist – Linear and Circular Interpolation- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150401I-Machinist- Introduction to Limits and Fits- Theory- Fourth Period
- Individual Learning Module 150401p-Machinist- Calibration of Measuring Tools- Metrology- Fourth Period
- Welding Print Reading

Online Resources:

- <http://www.math.com/school/subject1/lessons/S1U1L11DP.html>
- <http://www.mathleague.com/help/integers/integers.htm#subtractingintegers>
- <http://www.math.com/school/subject1/lessons/S1U1L12DP.html>
- <http://www.mathleague.com/help/integers/integers.htm#dividingintegers>
- <http://www.khake.com/page89.html>
- <http://www.math-drills.com/orderofoperations.shtml>
- <http://www.mathleague.com/help/integers/integers.htm#multiplyingintegers>
- <http://www.kutasoftware.com/free.html>

PM3 Use Order of Operations

Upon completion of this objective, learners will be able to:

- 3.1 identify the necessary steps in performing order of operations
- 3.2 calculate answers using correct order of operations
- 3.3 use order of operations to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 1 (Foundations)

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 2)
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*

Online Resources:

- <http://www.tpub.com/math2/index.htm>
- <http://www.khake.com/page89.html>
- <http://www.kutasoftware.com/free.html>
- <http://www.purplemath.com/modules/orderops.htm>
- <http://www.math-drills.com/orderofoperations.shtml>
- http://amby.com/educate/ord-op/ex_set-1.html

PM4 Use Fractions

Upon completion of this objective, learners will be able to:

- 4.1 read fractions
- 4.2 write fractions
- 4.3 compare fractions
- 4.4 round fractions
- 4.5 simplify fractions
- 4.6 add fractions
- 4.7 subtract fractions
- 4.8 multiply fractions
- 4.9 divide fractions
- 4.10 use knowledge of fractions to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition* (Unit 2)
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 3)
- Math for Welders
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*
- Print Reading for Industry

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Technology of Machine Tools, *5th Edition*
- Individual Learning Module 150101I-Machinist- Taper Systems- Theory- First Period
- Individual Learning Module 150101tA-Machinist- Machine Shop Rigging-Part A- Theory- First Period
- Individual Learning Module 150201e-Machinist- Dividing Head and Indexing- Theory- Second Period

- Individual Learning Module 1500301a-Machinist- Advanced Milling- Theory- Third Period
- Individual Learning Module 150301b-Machinist- Threads- Theory- Third Period
- Individual Learning Module 150301l- Machinist - Estimating- Theory- Third Period
- Individual Learning Module 150402i-Machinist- Cutter Radius Compensation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150401a-Machinist- Spur Gears and Milling- Theory- Fourth Period
- Individual Learning Module 150401d-Machinist- Graduating- Theory- Fourth Period
- Individual Learning Module 150401g-Machinist- Splines- Theory- Fourth Period

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page89.html>
- <http://www.math-drills.com/fractions.shtml>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM5 Use Mixed Numbers

Upon completion of this objective, learners will be able to:

- 5.1 read mixed numbers
- 5.2 write mixed numbers
- 5.3 compare mixed numbers
- 5.4 round mixed numbers
- 5.5 simplify mixed numbers
- 5.6 add mixed numbers
- 5.7 subtract mixed numbers
- 5.8 multiply mixed numbers
- 5.9 divide mixed numbers
- 5.10 use knowledge of mixed numbers to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition* (Unit 2)
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 3)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*
- Print Reading for Industry

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Machine Tool Practices, *8th Edition*
- Individual Learning Module 150101tA-Machinist- Machine Shop Rigging-Part A-Theory- First Period
- Individual Learning Module 150201e-Machinist- Dividing Head and Indexing-Theory- Second Period
- Individual Learning Module 1500301a-Machinist- Advanced Milling- Theory-Third Period

- Individual Learning Module 150301b-Machinist- Threads- Theory- Third Period
- Individual Learning Module 150301i- Machinist - Estimating- Theory- Third Period
- Individual Learning Module 150401a-Machinist- Spur Gears and Milling- Theory- Fourth Period
- Individual Learning Module 150401d-Machinist- Graduating- Theory- Fourth Period
- Individual Learning Module 150401g-Machinist- Splines- Theory- Fourth Period

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page89.html>
- <http://www.math-drills.com/fractions.shtml>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM6 Use Decimals

Upon completion of this objective, learners will be able to:

- 6.1 read decimals
- 6.2 write decimals
- 6.3 estimate decimals
- 6.4 round decimals
- 6.5 add decimals
- 6.6 subtract decimals
- 6.7 multiply decimals
- 6.8 divide decimals
- 6.9 use knowledge of decimals to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 4)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Math for Welders
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*
- Print Reading for Industry

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Technology of Machine Tools, *5th Edition*
- Modern Metalworking
- Individual Learning Module 150206a-Machinist- Machinery's Handbook- Machinery's Handbook- Second Period
- Individual Learning Module 150201e-Machinist- Dividing Head and Indexing- Theory- Second Period
- Individual Learning Module 150301b-Machinist- Threads- Theory- Third Period

- Individual Learning Module 150301I- Machinist - Estimating- Theory- Third Period
- Individual Learning Module 150402e-Machinist- Machining Conditions- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402g-Machinist- Canned Cycles: Program Applications- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402h-Machinist- Linear and Circular Interpolation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402i-Machinist- Cutter Radius Compensation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150401d-Machinist- Graduating- Theory- Fourth Period
- Individual Learning Module 150401n-Machinist- Precision Measurement- Theory- Fourth Period

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page89.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM7 Use Percent

Upon completion of this objective, learners will be able to:

- 7.1 use formulae to calculate percent
- 7.2 use knowledge of percent to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 5)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Math for Welders
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Individual Learning Module 150101tA-Machinist- Machine Shop Rigging-Part A- Theory- First Period
- Individual Learning Module 150301I- Machinist - Estimating- Theory- Third Period
- Individual Learning Module 150401d-Machinist- Bearings and Seals- Theory- Fourth Period

Online Resources:

- <http://www.khake.com/page89.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM8 Use Conversion

Upon completion of this objective, learners will be able to:

- 8.1 explain the purpose of mathematical conversion
- 8.2 convert among fractions, decimals and percent
- 8.3 use automatic recall of decimal and percent equivalents of common fractions
- 8.4 use knowledge of conversion to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Fundamental Mathematics, *4th Edition*
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 6)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Math for Welders
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Individual Learning Module 150201e-Machinist- Dividing Head and Indexing- Theory- Second Period
- Individual Learning Module 150401d-Machinist- Graduating- Theory- Fourth Period
- Individual Learning Module 150401g-Machinist- Splines- Theory- Fourth Period
- Individual Learning Module 150401n-Machinist- Precision Measurement- Theory- Fourth Period

Online Resources:

- <http://www.khake.com/page89.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM9 Use Measurement Systems

Upon completion of this objective, learners will be able to:

- 9.1 demonstrate uses of specific measurements
- 9.2 perform conversions within the metric measurement system
- 9.3 perform conversions within the imperial measurement system
- 9.4 perform conversions between the metric and imperial measurement systems
- 9.5 perform time conversions
- 9.6 use knowledge of measurement and time conversion to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition* (Units 8 and 9)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 8, 9, 10)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Math for Welders
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*
- Print Reading for Industry

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Modern Metalworking
- Individual Learning Module 150101j- Machinist – Screw Thread Measurement and Gauging- Theory- First Period
- Individual Learning Module 150201b-Machinist- Milling Cutters- Theory- Second Period
- Individual Learning Module 150201j-Machinist- Using Carbide Inserts- Theory- Second Period
- Individual Learning Module 150202d-Machinist- CNC Turning Centres: Cutting Conditions and Operations- Computer Numerical Control Machines- Second Period
- Individual Learning Module 150401p-Machinist- Calibration of Measuring Tools- Metrology- Fourth Period

Online Resources:

- <http://www.khake.com/page89.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM10 Use Rate, Ratio and Proportion

Upon completion of this objective, learners will be able to:

- 10.1 describe the differences among rate, ratio and proportion
- 10.2 give examples of how rate, ratio, and proportion are used in the trade
- 10.3 write numbers as proportions
- 10.4 use knowledge of rate to solve problems
- 10.5 use knowledge of ratio to solve problems
- 10.6 use knowledge of proportion to solve problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 7)
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Individual Learning Module 150201e-Machinist- Dividing Head and Indexing- Theory- Second Period
- Individual Learning Module 150201j-Machinist- Using Carbide Inserts- Theory- Second Period
- Individual Learning Module 1500301a-Machinist- Advanced Milling- Theory- Third Period
- Individual Learning Module 150301c-Machinist- Multiple Start Threads- Theory- Third Period
- Individual Learning Module 150401b-Machinist- Helical Gears- Theory- Fourth Period
- Individual Learning Module 150401d-Machinist- Graduating- Theory- Fourth Period

Online Resources:

- <http://www.khake.com/page89.html>
- <http://www.mathleague.com/help/ratio/ratio.htm#ratio>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM11 Use Square Root and Exponents

Upon completion of this objective, learners will be able to:

- 11.1 determine the square root of positive numbers that are perfect squares
- 11.2 determine approximate square root of positive numbers that are not perfect squares
- 11.3 use knowledge of square root to solve problems
- 11.4 use knowledge of exponent laws to solve problems
- 11.5 determine significant digits
- 11.6 use knowledge of scientific notation to solve problems

Non-contextualized Resources:

- Math to Build On-A Book for Those Who Build
- Introductory Technical Mathematics, *5th Edition* (Unit 13)
- NWT Apprenticeship Support Materials Module 1 (Foundations)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 18, 19, and 20)
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Machine Tool Practices, *8th Edition*
- Individual Learning Module 150201d-Machinist- Milling Operations- Theory- Second Period
- Individual Learning Module 150302f- Machinist – CNC Threading 1: Introduction and Calculations-Computer Numerical Control Machines- Third Period
- Individual Learning Module 150401j-Machinist- Basic Hydraulics- Theory- Fourth Period
- Individual Learning Module 150401k-Machinist- Non-Traditional Manufacturing Processes- Theory- Fourth Period

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page89.html>
- <http://www.kutasoftware.com/free.html>

PM12 Solve Equations

Upon completion of this objective, learners will be able to:

- 12.1 write variable expressions and equations from sentences
- 12.2 simplify variable expressions
- 12.3 write equations from sentences
- 12.4 solve one-step equations
- 12.5 solve two-step equations
- 12.6 solve multi-step equations

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition* (Units 14-18)
- NWT Apprenticeship Support Materials Module 3 (Variables and Equations)
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 11)
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Individual Learning Module 150302f- Machinist – CNC Threading 1: Introduction and Calculations-Computer Numerical Control Machines- Third Period

Online Resources:

- <http://www.khake.com/page89.html>
- <http://www.kutasoftware.com/free.html>

PM13 Use Trade-Related Formulae

Upon completion of this objective, learners will be able to:

- 13.1 identify formulae common to the trade
- 13.2 solve problems using formulae as written
- 13.3 solve problems by rearranging formulae

General Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Modern Metalworking
- Individual Learning Module 150206a-Machinist- Machinery's Handbook- Machinery's Handbook- Second Period
- Individual Learning Module 150201b-Machinist- Milling Cutters- Theory- Second Period
- Individual Learning Module 150201e-Machinist- Dividing Head and Indexing- Theory- Second Period
- Individual Learning Module 150201d-Machinist- Milling Operations- Theory- Second Period
- Individual Learning Module 150201e-Machinist- Dividing Head and Indexing- Theory- Second Period
- Individual Learning Module 150201j-Machinist- Using Carbide Inserts- Theory- Second Period
- Individual Learning Module 150202d-Machinist- CNC Turning Centres: Cutting Conditions and Operations- Computer Numerical Control Machines- Second Period
- Individual Learning Module 150301b-Machinist- Threads- Theory- Third Period
- Individual Learning Module 150302f- Machinist – CNC Threading 1: Introduction and Calculations-Computer Numerical Control Machines- Third Period
- Individual Learning Module 150301e-Machinist- Gear Manufacturing Methods- Theory- Third Period
- Individual Learning Module 150401b-Machinist- Helical Gears- Theory- Fourth Period
- Individual Learning Module 150401c-Machinist- Worm Gears- Theory- Fourth Period
- Individual Learning Module 150402e-Machinist- Machining Conditions- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402f-Machinist- Canned Cycles: Theory- Computer Numerical Control Machines- Fourth Period

- Individual Learning Module 150402g-Machinist- Canned Cycles: Program Applications- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150401a-Machinist- Spur Gears and Milling- Theory- Fourth Period
- Individual Learning Module 150401g-Machinist- Splines- Theory- Fourth Period
- Individual Learning Module 150401i-Machinist- Belts and Pulleys- Theory- Fourth Period
- Individual Learning Module 150401j-Machinist- Basic Hydraulics- Theory- Fourth Period
- Individual Learning Module 150401k-Machinist- Non-Traditional Manufacturing Processes- Theory- Fourth Period

Perimeter, Area, Circumference

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition* (Units 8-9; 25-30)
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes and Space)
- Formulas at Work (SkillPlan)
- Measurement and Calculation for the Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 14 and 15)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Math for Welders
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Individual Learning Module 1500301a-Machinist- Advanced Milling- Theory- Third Period
- Individual Learning Module 150402e-Machinist- Machining Conditions- Computer Numerical Control Machines- Fourth Period

Volume and Surface Area

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes, and Space)
- Formulas at Work (SkillPlan)

- Measurement and Calculation for the Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 13,14, and 15)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Math for Welders
- Mathematics for Machine Technology, *6th Edition*

Pythagorean Theorem

Learners should be able to apply the Pythagorean Theorem to determine whether or not a triangle is a right triangle, to determine the measure of the third side of a right triangle when the measures are given for the two other sides, and to determine the distance between two points on a coordinate plane.

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes and Space)
- Formulas at Work (SkillPlan)
- Measurement and Calculation for the Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 12 and 13)
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Individual Learning Module 150402h-Machinist- Linear and Circular Interpolation- Computer Numerical Control Machines- Fourth Period
- Welding Print Reading

Online Resources:

- <http://www.grbwelding.com/content/study/math-formulas.htm>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>
- <http://www.swtc.edu:8082/mscenter/tutorial.htm#Formulas>
- <http://www.khake.com/page89.html>

PM14 Use Estimation

Upon completion of this objective, learners will be able to:

- 14.1 identify estimation rules
- 14.2 use estimation rules to solve single-step problems
- 14.3 use estimation rules to solve multi-step problems

Non-contextualized Resources:

- Fundamental Mathematics, *4th Edition*
- Introductory Technical Mathematics, *5th Edition* (Unit 7)
- NWT Apprenticeship Support Materials Module 4 (Measuring Time, Shapes, and Space)

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 17)

Technical Resources:

- Individual Learning Module 150301I- Machinist - Estimating- Theory- Third Period

Online Resources:

- <http://www.welding-advisers.com/Welding-cost.html>

PM15 Use Angles

Upon completion of this objective, learners will be able to:

- 15.1 identify various types of angles common to the trade
- 15.2 compare angles common to the trade
- 15.3 measure angles
- 15.4 use knowledge of angles to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition*
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 12)
- Practical Problems in Mathematics for Welders, *5th Edition*
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Machine Tool Practices, *8th Edition*
- Individual Learning Module 150101d- Machinist – Angular Measuring Tools- Theory- First Period
- Individual Learning Module 150302e- Machinist – CNC Turning Centres: Tool Nose Radius Compensation- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150302g- Machinist – CNC Threading II : Programming and Troubleshooting-Computer Numerical Control Machines- Third Period
- Individual Learning Module 1500301a-Machinist- Advanced Milling- Theory- Third Period
- Individual Learning Module 150301c-Machinist- Multiple Start Threads- Theory- Third Period
- Individual Learning Module 150301c-Machinist- Multiple Start Threads- Theory- Third Period
- Individual Learning Module 150302c- Machinist – Linear and Circular Interpolation- Computer Numerical Control Machines- Third Period

- Individual Learning Module 150402g-Machinist- Canned Cycles: Program Applications- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402h-Machinist- Linear and Circular Interpolation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402i-Machinist- Cutter Radius Compensation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150401c-Machinist- Worm Gears- Theory- Fourth Period
- Individual Learning Module 150401d-Machinist- Bevel Gears- Theory- Fourth Period
- Individual Learning Module 150401d-Machinist- Graduating- Theory- Fourth Period
- Individual Learning Module 150401g-Machinist- Splines- Theory- Fourth Period
- Individual Learning Module 150401k-Machinist- Non-Traditional Manufacturing Processes- Theory- Fourth Period

Online Resources:

- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page89.html>
- <http://www.math-drills.com/orderofoperations.shtml>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM16 Use Geometric Shapes

Upon completion of this objective, learners will be able to:

- 16.1 identify geometric shapes
- 16.2 use knowledge of geometric shapes to solve problems

Learners should identify and name the various types of triangles and understand the concept of similar triangles.

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition* (Units 22-30)
- Measurement and Calculation for the Trades
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 13, 14, and 15)
- Math for Welders
- Welding Print Reading
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Technology of Machine Tools, *5th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Modern Metalworking
- Individual Learning Module 150101tA-Machinist- Machine Shop Rigging-Part A- Theory-First Period
- Individual Learning Module 150205a-Machinist- Interpret and Sketch Prints- Blueprint Reading- Second Period
- Individual Learning Module 1500301a-Machinist- Advanced Milling- Theory- Third Period
- Individual Learning Module 150302c- Machinist – Linear and Circular Interpolation- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150302e- Machinist – CNC Turning Centres: Tool Nose Radius Compensation- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150302g- Machinist – CNC Threading II : Programming and Troubleshooting-Computer Numerical Control Machines- Third Period

- Individual Learning Module 150402g-Machinist- Canned Cycles: Program Applications- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402h-Machinist- Linear and Circular Interpolation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402i-Machinist- Cutter Radius Compensation- Computer Numerical Control Machines- Fourth Period

Online Resources:

- <http://www.tpub.com/math2/index.htm>
- <http://www.khake.com/page89.html>
- <http://xpmath.com/careers/jobsresult.php?groupID=7&jobID=16>

PM17 Use Trigonometry

Upon completion of this objective, learners will be able to:

- 17.1 identify the value of trigonometry in the trade
- 17.2 set up trigonometric ratios
- 17.3 use trigonometric functions to solve problems

Non-contextualized Resources:

- Introductory Technical Mathematics, *5th Edition* (Section VII)
- Measurement and Calculation for the Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 21)
- Mathematics for Machine Technology, *6th Edition*

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Machinery's Handbook Guide, *28th Edition*
- Machine Tool Practices, *8th Edition*
- Technology of Machine Tools, *5th Edition*
- Individual Learning Module 150302b- Machinist – Fixed Canned Cycles- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150302c- Machinist – Linear and Circular Interpolation- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150302e- Machinist – CNC Turning Centres: Tool Nose Radius Compensation- Computer Numerical Control Machines- Third Period
- Individual Learning Module 150302g- Machinist – CNC Threading II : Programming and Troubleshooting-Computer Numerical Control Machines- Third Period
- Individual Learning Module 150402g-Machinist- Canned Cycles: Program Applications- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402h-Machinist- Linear and Circular Interpolation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150402i-Machinist- Cutter Radius Compensation- Computer Numerical Control Machines- Fourth Period
- Individual Learning Module 150401n-Machinist- Precision Measurement- Theory- Fourth Period

Online Resources:

- <http://www.jimdesu.us/pages/trigonometry.html>
- <http://www.swtc.edu:8082/mscenter/tutorial.htm#Introduction%20to%20Trigonometry>
- <http://www.tpub.com/math2/index.htm>
- <http://www.onlinemathlearning.com/basic-trigonometry.html>
- <http://mathforum.org/%7esarah/hamilton/>
- <http://www.khake.com/page89.html>
- http://www.funmaths.com/worksheets/math_trigonometry_05.htm
- <http://www.xpmath.com/exercises/files/sincos.pdf>
- <http://www.xpmath.com/exercises/files/tan.pdf>

PM18 Analyze Numerical Data

Upon completion of this objective, learners will be able to:

- 18.1 identify ways to organize data
- 18.2 organize information into charts and graphs
- 18.3 extract information from charts and graphs
- 18.4 evaluate information found in charts and graphs
- 18.5 make predictions and draw conclusions

Non-contextualized Resources

- Workplace Communications-The Basics, *3rd Edition*
- Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Contextualized Resources:

- EARAT (Mathematics for Precision Machining and Tooling: Skill # 22 and 23)

Technical Resources:

- Machinery's Handbook, *28th Edition*
- Individual Learning Module 150202c-Machinist- CNC Turning Centres: Program and Machine Co-ordinate Systems- Computer Numerical Control Machines- Second Period
- Individual Learning Module 050402c -Machinist- Machine and Workpiece Co-ordinate Systems – Computer Numerical Control Machines- Fourth Period

Appendix A

Resource Materials:***Alberta Individual Learning Modules for Machinists***

Alberta Apprenticeship and Industry Training, 1998

Tel: 1-800-232-7215

<http://www.tradesecrets.gov.ab.ca>

Evaluating Academic Readiness for Apprenticeship Training (EARAT)

Mathematics for Precision Machining and Tooling Apprentices

Workplace Support Services Branch

Ontario Ministry of Training, Colleges and Universities, October 2000

Tel: 416-325-2929 or 1-800-387-5514

Email: info@edu.gov.on.ca

Formulas at Work: Tradesworkers on the Job

Sue Grecki

SkillPlan: BC Construction Industry Skills Improvement Council, 2007

ISBN: 978-0-9739232-6-1

www.skillplan.ca

Fundamental Mathematics 4th Edition

Marvin L. Bittinger

Pearson Education, Inc., 2007

ISBN: 0-321-31907-9

Fundamentals of Mechanical and Electrical Mathematics

National Centre for Construction Education and Research

Prentice Hall, Inc., 1996

ISBN: 0-13-910142-X

Introductory Technical Mathematics, 5th Edition

Robert Smith & John C. Peterson

Thomson, Delmar Learning, 2007

ISBN: 1-4180-1543-1

www.delmarlearning.com

Machinery's Handbook, 28th Edition

Erik Oberg et al

Industrial Press, 2008

ISBN: 978-0-8311-2800-5

Machinery's Handbook Guide, 28th Edition

John M. Amiss, Franklin D. Jones, Henry H. Ryffel
Industrial Press Inc.,
ISBN: 13-978-0-8311-2899-9

Machine Tool Practices, 8th Edition

Richard R. Kibbe et al
Pearson Education Inc., 2006
ISBN: 0-13-118896-8

Mathematics for Machine Technology, 6th Edition

Robert D. Smith; John C. Peterson
Delmar Cengage Learning, 2009
ISBN: 13-978-1-4283-3656-8

Math for Welders

Nino Marion
Goodheart –Willcox Company Inc., 2006
ISBN: 978-1-59070-583-1

Measurement and Calculation for the Trades

Sue Grecki and Bob Whitaker
SkillPlan: BC Construction Industry Skills Improvement Council, 2006
ISBN: 0-9685027-9-2
www.skillplan.ca

Modern Metalworking***Modern Metalworking (Instructor's Guide)***

John R. Walker
The Goodheart-Willcox Company, Inc., 2004
ISBN: 13-978-1-59070-224-6
ISBN (Instructor's Guide): 1-59070-226-3

NWT Apprenticeship Support Materials

Thomas O'Connor
Genesis Group Ltd., Yellowknife, NWT, 2003

Practical Problems in Mathematics for Welders, 5th Edition

Robert Chasan
Delmar Publishing, 1996
ISBN: 13-978-1-4018-7215-1

Pre-Apprentice Training-A Test Preparation Manual for the Skilled Trades

Jack Martin and Mary Serich

Jack Martin and Associates, 2006

ISBN: 0-9649530-1-3

Print Reading for Industry***Print Reading for Industry (Instructor's Guide)***

Walter C. Brown; Ryan K. Brown

The Goodheart-Willcox Company, Inc., 2002

ISBN: 13-978-1-56637-807-9

ISBN (Instructor's Guide): 13-978-1-56637-808-6

Technology of Machine Tools, 5th Edition

Steve F. Krar and Albert F. Check

Glencoe McGraw-Hill, 1997

ISBN: 0-02-803071-0

Welding Print Reading***Welding Print Reading (Instructor's Guide)***

John R. Walker and W. Richard Polanin

The Goodheart-Willcox Company Inc., 2007

ISBN: 1-59070-642-0

ISBN (Instructor's Guide): 13-978-1-59070-643-5

Workplace Communications-The Basics, Third Edition

George J. Searles

Pearson Education, Inc., 2006

ISBN: 0-321-33068-4

All online resources listed in this document were operational at time of publication.

Oral Communication (OC) Learning Outcome: Learners will perform tasks which use speech to give and exchange thoughts and information.

OC1 Demonstrate an Understanding of Oral Communication	1.1 Differentiate between oral and other forms of communication	1.2 Identify purpose of oral communication	1.3 Identify the benefits of effective oral communication	1.4 Identify barriers to effective oral communication	1.5 Identify the risks associated with ineffective oral communication	1.6 Outline ways to reduce the risk of ineffective communication
OC2 Communicate Effective Messages	2.1 Identify audience	2.2 Identify the purpose of communicating effective messages	2.3 Organize thoughts and ideas	2.4 Communicate effectively to a variety of audiences		
OC3 Listen Effectively	3.1 Identify the difference between listening and active listening	3.2 Identify the purpose of effective listening	3.3 Identify active listening strategies	3.4 Implement active listening strategies		
OC4 Respond to Oral Communication	4.1 Identify the main idea	4.2 Interpret verbal messages	4.3 Clarify received verbal messages	4.4 Respond appropriately to verbal messages		

Learners will perform tasks which use speech to give and exchange thoughts and information

Introduction

Success in technical training and effective job performance requires strong Essential Skills. Although all Essential Skills contribute to success, this guide is intended to help apprentices develop positive oral communication (OC) for their trade. Competence in oral communication provides the foundation for better performance in technical training, on the job, and when mentoring new apprentices.

Strong oral communication skills are required in every occupation. In fact, many surveys indicate that it is one of the most highly valued skills among employers as it is intimately tied to everyday workplace functions. Oral Communication in trade occupations is usually presented face to face, by telephone, or by two-way radio with a number of factors affecting the transfer of the message.

The following guide is an introduction to the basic principles and methods of oral communication with an emphasis on the importance of speaking, listening and interacting in the context of customer service and interpersonal communication.

A list of resources (see Appendix A) has been outlined for each objective in the Oral Communication Curriculum Framework and, where possible, includes online website materials that complement these resources. All information is presented in a generic manner; the contextualization to specific trades will be found in the expected tasks of each trade, determined by the instructor.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Oral Communication in Trades Occupations

To make the most of technical training, apprentices need to develop strategies for effective listening, as well as the confidence and speaking skills to ask for help. These same strategies are used in the workplace to interact with co-workers, supervisors, workers in other trades, suppliers and customers. Understanding the many elements in the communications process helps apprentices send clear messages and understand the messages received.

Tradespeople communicate orally on a daily basis to complete job tasks. The complexity of these tasks, according to Human Resources and Skills Development Canada's Essential Skills Profiles (<http://srv108.services.gc.ca/>), varies slightly among the thirteen trades outlined in the Trade Essentials project (See Curriculum Guidebook), though all thirteen trades describe the least complex oral communication tasks as those containing some or all of the following characteristics:

- Limited oral communication demands
- Narrow range of subject matter
- Familiar topic
- One main issue
- Factual, literal, or concrete language
- Narrow range of content and context-specific or technical vocabulary
- Clearly defined role of speaker
- Interaction with one person at a time
- Low risk
- Brief exchange (less than 10 minutes)

The most difficult tasks vary among the trades. The most complex tasks performed by cooks, welders, carpenters, automotive service technicians, steamfitters-pipefitters, cabinetmakers, machinists, industrial and construction electricians and metal fabricators contain some or all the following characteristics:

- Extensive oral communication demands
- Significant range of subject matter
- Professional, organizational, theoretical social issues
- Abstract and conceptual language
- Extensive range of technical vocabulary and idiom
- Complex and detailed information content
- Unpredictable context
- Various communication venues used
- Significant range of formats and styles
- Communicator may have more than one role
- New and unfamiliar situation and setting
- Medium to extended (30+ minutes) exchange
- Significant noise or interference
- Significant level of risk

The most complex oral communication tasks performed by plumbers, oil burner mechanics, and refrigeration and air conditioning mechanics contain some or all of the following characteristics:

- Moderate oral communication demands
- Narrow range of subject matter
- Familiar topic

- Usually one main issue
- Factual or concrete and abstract language
- Moderate range of general and context-specific or technical vocabulary and idiom
- Moderately complex and detailed content
- Less predictable context
- Interaction is frequently one-on-one or with several people
- Give directions to a small group
- Select from a moderate range of formats and styles
- Established rules
- Brief to moderate (10-30 minutes) exchange
- Physical conditions may impede communication
- Moderate level of risk
- May be one-on-one hostility

Upon completion of this course, apprentices will better understand how communication skills impact safety, productivity, job satisfaction and job progression. Effective communication skills will benefit apprentices as they reach journey person status and as they accept additional responsibility for supervising and mentoring new employees.

For specific information and examples of the use of oral communication for each trade, instructors should refer to the Essential Skills Profile and the National Occupational Analysis. It should be noted that, according to HRSDC's Essential Skills profiles, oral communication is one of the most important Essential Skills for cooks, plumbers and automotive service technicians as these tradespeople interact frequently with customers.

Note: It is intended that the oral communication curriculum be embedded in other Essential Skills curriculum where possible. Many of the competencies in oral communication and the five other essential skills may be mastered concurrently.

General Online Resources:

Essential Skills Profile and Readers Guide

Human Resources and Skills Development Canada

http://srv108.services.gc.ca/english/general/home_e.shtml

National Occupational Analysis

http://www.red-seal.ca/Site/trades/analyst_e.htm

Trade Specific Resources:

<http://www.ific.org/tools/> (International Food Information)

OC1 Demonstrate an Understanding of Oral Communication

Upon completion of this objective, learners will be able to:

- 1.1 differentiate between oral and other forms of communication
 - distinguish between verbal and non-verbal communication
- 1.2 identify the purpose of oral communication
- 1.3 identify the benefits of effective oral communication
 - project a professional image through oral communication
- 1.4 identify barriers to effective oral communication
 - identify how the following can produce barriers: sender, listener, content, environment
 - outline personal habits that may interfere with effective oral communication: tone, volume, voice speed, facial expression, eye contact, etc.
- 1.5 identify the risks associated with ineffective oral communication
- 1.6 outline ways to reduce the risk of ineffective oral communication

Suggested Strategies and Activities:

- Hold a general discussion on benefits of effective oral communication
- Ask learners for examples of workplace communication, both effective and ineffective, and the consequences of each
- Refer to Essential Skills profile for the trade and find examples of the various types of communication and the purpose
- Discuss the factors that determine whether the communication is either simple or complex
- Explain the elements of communication
- Discuss the difference between, and the importance of, both verbal and non-verbal communication
- Discuss specific, common barriers as they relate to the trade
- Provide learners with an opportunity to assess areas of strength and those areas where they should improve
- Establish some rules for effective communication in class
- Have learners reflect upon communicative challenges in everyday life

Resources:

- Applied Communication Skills for the Construction Trades
- Tools for Success: *Soft Skills for the Construction Industry*
- Business English and Communication, *5th Canadian Edition*
- Effective Workplace Communication, *3rd Edition*
- Communicating in the Workplace, *6th Canadian Edition*
- HVACR 101 (Chapter 10)

Online Resources:

- <https://www.lseducation.org.uk/user/order.aspx?code=060014> (Teaching speaking and listening; a toolkit for practitioners)
- <http://www.mindtools.com/page8.html> (Mind Tools: Communication Skills)
- <http://www.khake.com/page66.html>
- <https://www.lseducation.org.uk/user/login.aspx?code=078838&P=078838PD&action=pdfdl&src=XOWEB> (Key Skills Support Program: Communication)

OC2 Communicate Effective Messages

Upon completion of this objective, learners will be able to:

- 2.1 identify audience
- 2.2 identify purpose
- 2.3 organize thoughts and ideas
- 2.4 communicate effectively to a variety of audiences
 - use non-verbal techniques to reinforce the verbal message
 - use appropriate terminology
 - communicate one-on-one
 - participate in group discussions
 - present information to groups

Suggested Strategies and Activities:

- Ask learners to identify the different people they speak with at work (i.e., project managers, supervisors, foremen, co-workers, workers in other trades, customers, suppliers)
- Discuss the differences in communicating with each
- Ask learners to think about the jargon, technical language and abbreviations that are used in their trade and the appropriateness of using this language with each audience
- Increase awareness of poor speech habits by creating a list of those that learners have observed
- Identify and discuss significance of non-verbal communication such as facial expression, posture and gestures
- Identify strategies for effective telephone communication, use of cellular telephone and two-way radio
- Provide opportunities for learners to give instructions in class setting by giving oral instructions to others one-on-one or to the group
- Provide opportunities for engaging learners in discussion
- Encourage speaking in class to increase learner confidence
- Hand out materials on effective participation in meetings/group discussions
- Provide opportunities for learners to share information in the form of a short presentation on a topic that they are comfortable with using a visual aid such as a picture, sketch, diagram to increase understanding
- Use the process of giving and receiving of feedback in a communication situation
- Create a safe atmosphere for giving and receiving feedback on communication style
- Assign learners the task of leading the class through some of the assigned material

Resources:

- Tools for Success: *Soft Skills for the Construction Industry*
- Applied Communications Skills for the Construction Trades
- Business English and Communication, *5th Canadian Edition*
- Communicating in the Workplace, *6th Canadian Edition*
- HVACR 101 (Chapter 10)
- Effective Workplace Communication, *3rd Edition*

Online Resources:

- <https://www.lseducation.org.uk/user/order.aspx?code=060014> (Teaching speaking and listening; a toolkit for practitioners)
- <https://www.lseducation.org.uk/user/login.aspx?code=078838&P=078838PD&action=pdfdl&src=XOWEB> (Key Skills Support Program: Communication)
- <http://www.mindtools.com/page8.html> (Mind Tools: Communication Skills)
- <http://www.khake.com/page66.html>

OC3 Listen Effectively

Upon completion of this objective, learners will be able to:

- 3.1 identify the difference between listening and active listening
- 3.2 identify the purpose of active listening
- 3.3 identify active listening strategies
- 3.4 implement active listening strategies

Suggested Strategies and Activities:

- Discuss the importance of good listening skills in a variety of situations at work
- Define active listening
- Identify barriers to effective listening
- Have learners think about and monitor their listening skills
- Identify strategies for active listening including paraphrasing, questioning and note-taking
- Practice strategies for active listening
- Encourage learners to implement active listening strategies during training and on the job
- Have learners receive and follow-up on messages and instruction

Resources:

- Effective Workplace Communication, *3rd Edition*
- Tools for Success: *Soft Skills for the Construction Industry*
- Applied Communications Skills for the Construction Trades
- Business English and Communication, *5th Canadian Edition*
- Communicating in the Workplace, *6th Canadian Edition*
- HVACR 101 (Chapter 10)

Online Resources:

- <https://www.lseducation.org.uk/user/order.aspx?code=060014> (Teaching speaking and listening; a toolkit for practitioners)
- <https://www.lseducation.org.uk/user/login.aspx?code=078838&P=078838PD&action=pdfdl&src=XOWEB> (Key Skills Support Program: Communication)
- <http://www.mindtools.com/page8.html> (Mind Tools: Communication Skills)
- <http://www.khake.com/page66.html>
- http://www.cte.uwaterloo.ca/teaching_resources/teaching_tips/tips_challenges/effective_communication.pdf (Teaching Tips)

OC4 Respond to Oral Communication

Upon completion of this objective, learners will be able to:

- 4.1 identify the main idea
- 4.2 interpret verbal messages
 - differentiate among fact, opinion and feeling
 - distinguish between relevant and irrelevant information
 - identify the role of non-verbal messages in oral communication
- 4.3 clarify received messages
 - ask questions to understand
 - summarize and restate information
- 4.4 respond appropriately to verbal messages

Suggested Strategies and Activities:

- Discuss the role of intonation, posture, gestures, tone of voice, facial expression, and eye movement
- Have learners recognize and interpret visual cues (i.e., gestures, facial expression) to help understand messages
- Discuss 'vocally produced noises' (i.e., ah)
- Have learners brainstorm common 'vocally produced noises'
- Discuss how emotion can impact oral communication
- Have learners listen and respond to the viewpoints of others by asking relevant questions, offering opinions, and/or interpretations
- Use suitable resources for discussion (i.e., newspaper or magazine article on trade-related material)
- Have learners judge what information is relevant in verbal messages and trade-related material

Resources:

- Applied Communication Skills for the Construction Trades
- Tools for Success: *Soft Skills for the Construction Industry*
- Effective Workplace Communication, *3rd Edition*
- Business English and Communication, *5th Canadian Edition*
- Communicating in the Workplace, *6th Canadian Edition*

Online Resources:

- <http://www.khake.com/page66.html>

Appendix A

Resources:

Applied Communications Skills for the Construction Trades

Stephan A. Rigolosi
Pearson Education Inc. 2002
ISBN 0-13-093355-4

Business English and Communication, 5th Canadian Edition

Lyn R. Clark et al
McGraw-Hill Ryerson Limited, 1996
ISBN: 0-07-551777-9 (Teacher's Edition)

Communicating in the Workplace, 6th Canadian Edition

Margaret Dombeck et al
McGraw-Hill Ryerson Limited, 2003
ISBN: 978-0-07090-814-7

Effective Workplace Communications-Skills for Success in Life and on the Job, 3rd Edition

Marsha Ludden
JIST Works, 2007
ISBN: 978-1-59357-433-8
www.jist.com

HVACR 101

Air Conditioning Contractors of America
PHCC Educational Foundation
Refrigeration Service Engineers Society
Delmar CENGAGE Learning, 2009
ISBN: 13-978-1-4180-663-5

Tools for Success- Soft Skills for the Construction Industry, 2nd Edition

National Centre for Construction Education and Research
Pearson Education, Inc., 2004
ISBN: 0-13-109194-8

All online resources listed in this document were operational at time of publication.

Computer Use (CU) Learning Outcome: Learners will use computer technology to access and interpret information and to communicate.

**CU1 Use
Computer
Operations**

1.1 Identify the primary components of a computer	1.2 Describe the function of the primary components of a computer	1.3 Start up the computer, monitor, and printer	1.4 Shut down the computer, monitor, and printer	1.5 Log onto a network using a personal password	1.6 Demonstrate basic trouble-shooting strategies
---	---	---	--	--	---

**CU2 Use Word
Processing Skills**

2.1 Open and close software	2.2 Create written documents	2.3 Create tables, graphs, and charts	2.4 Open existing written documents, tables, graphs, and charts	2.5 Save written documents, tables, graphs, and charts	2.6 Preview and print written documents, tables, graphs, and charts
2.7 Copy and move text	2.8 Delete text	2.9 Format text	2.10 Set tabs	2.11 Set margins	2.12 Add and delete headers and footers
2.13 Add and delete page numbers	2.14 Set page layout	2.15 Check and correct spelling	2.16 Check and correct grammar	2.17 Use thesaurus	

**CU3 Use File
Management
Skills**

3.1 Distinguish between files and folders	3.2 Create files and folders	3.3 Save files	3.4 Copy files and folders	3.5 Move files and folders	3.6 Organize files and folders
3.7 Rename files and folders	3.8 Delete files and folders				

**CU4 Use
Spreadsheets**

4.1 Identify the purpose of spreadsheets in the trade	4.2 Interpret information in existing spreadsheets	4.3 Enter data into existing spreadsheets	4.4 Manipulate data within existing spreadsheets	4.5 Create spreadsheets	4.6 Create and copy formulas to perform calculations
4.7 Print spreadsheets	4.8 Print selected parts of spreadsheets				

**CU5 Read and
Write Email
Messages**

5.1 Open messages	5.2 Reply to messages	5.3 Write, send, and forward messages	5.4 Print messages	5.5 Add attachments to messages	5.6 Delete messages
5.7 Create folders	5.8 Move messages to folders	5.9 Delete folders	5.10 Identify and manage common email problems		

**CU6 Use Web
Search Skills**

6.1 Define web browser	6.2 Access a specific website	6.3 Use a search engine	6.4 Evaluate information found on the World Wide Web	6.5 Download information from the World Wide Web	6.6 Copy information from the World Wide Web
6.7 Save information from the World Wide Web	6.8 Share information from the World Wide Web	6.9 Print information from the World Wide Web			

Learners will use computer technology to access and interpret information and to communicate

Introduction

The workforce is constantly changing. Today's employees are highly mobile, expect continuous learning to be an integral part of their job and are adapting to a technological world. In fact, technology has changed the very fabric of the workplace and, as a result, workers are expected to acquire a broad range of skills if they are to remain current, accurate and competitive. Trades occupations are no exception. For example: automation in plants and factories has demanded an increased knowledge of networking and software use; lathes and cutting tools are often linked to computers; and entrepreneurs require skills in word processing, accounting, email and internet use, and database management.

This Computer Use (CU) course has been designed to help workers adapt to this ever-changing society. It is intended for individuals who are inexperienced computer users but who want to gain some hands-on skill and confidence. It assumes no previous knowledge of computers and will provide learners with a broad overview of computer and Internet technology. The following major topic areas are explored:

- Computer Operations
- Word Processing
- File Management
- Spreadsheets
- Email
- Web Browsing
- Safe Use of Computers

This following guide outlines a list of recommended resources (See Appendix A) for each objective in the Computer Use curriculum framework and, where possible, includes online website materials that complement these resources. Because computer skills are generic in the workplace, this course is not contextualized to specific trades. Apprentices, however, should be provided with examples of how computers are used in their respective trade. Contextualized website lists are provided in Appendix B.

The list of resources has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Note: *The computer use curriculum can be used in one of two ways: as a stand-alone course or embedded in other Essential Skills curriculum. For instance, computer use competencies (i.e., email, word processing) and writing competencies may be mastered concurrently.*

CU1 Use Computer Operations

Upon completion of this objective, learners will be able to

- 1.1 identify the primary components of a computer – monitor, keyboard, mouse, system unit, ports, disk drives, printers
- 1.2 describe the function of the primary components of a computer
- 1.3 start up the computer, monitor and printer
- 1.4 shut down the computer, monitor and printer
- 1.5 log onto a network using a personal password
- 1.6 demonstrate basic troubleshooting strategies
 - protect and care for flash drives, CD-ROMs and other media
 - clean computer components
 - maintain back-up copies of documents
 - perform basic maintenance

Resources:

- Essential Skills for Digital Literacy- IC3 Module A ~ Courseware 2105-2 - Computing Fundamentals using Windows XP

Online Resources:

- www.ctdlc.org/remediation/indexComputer.html
- www.homepages.ed.ac.uk/calarks/arks/materials.html
- www.functionx.com/windows/Lesson01.htm
- www.bcot1.com/

CU2 Use Word Processing Skills

Upon completion of this objective, learners will be able to:

- 2.1 open and close software
- 2.2 create written documents
- 2.3 create tables, graphs, and charts
- 2.4 open existing written documents, tables, graphs and charts
- 2.5 save written documents, tables, graphs and charts
- 2.6 preview and print written documents, tables, graphs and charts
- 2.7 copy and move text
- 2.8 delete text
- 2.9 format text
 - change font
 - highlight text
 - italicize, bold, and underline text
- 2.10 set tabs
- 2.11 set margins
- 2.12 add and delete headers and footers
- 2.13 add and delete page numbers
- 2.14 set page layout
- 2.15 check and correct spelling
- 2.16 check and correct grammar
- 2.17 use thesaurus

Resources:

- Essential Skills for Digital Literacy IC3 Module B ~ Courseware 2109-2 - Key Applications using Microsoft Office 2003

Online Resources:

- <http://www.baycongroup.com/wlesson0.htm>
- www.ctdlc.org/remediation/indexWord.html
- www.shaunakelly.com/word/concepts/starttyping/index.html
- www.baycongroup.com/tutorials.htm
- www.itrainonline.org/itrainonline/english/computers.shtml
- www.homepages.ed.ac.uk/calarks/arks/materials.html
- <http://www.hilc.ns.ca/downloads/pdfs/resources/ESLComputerBookWord2000.pdf>
- www.nald.ca/library/learning/WPerfect/WP8.pdf
- www.bcot1.com/

CU3 Use File Management Skills

Upon completion of this objective, learners will be able to:

- 3.1 distinguish between files and folders
- 3.2 create files and folders
- 3.3 save files
- 3.4 copy files and folders
- 3.5 move files and folders
- 3.6 organize files and folders
- 3.7 rename files and folders
- 3.8 delete files and folders

Resources:

- Essential Skills for Digital Literacy- IC3 Module A ~ Courseware 2105-2 - Computing Fundamentals Using Windows XP

Online Resources:

- www.onlinecomputertips.com/tutorials/file_mgmt.html
- www.inet4.swtjc.net/nmasters/Orientation/Topic05.htm
- www.cter.ed.uiuc.edu/tutorials/filemanagmt/
- www.facweb.furman.edu/~pecoy/mfl195/tutorial/index.htm
- www.bcot1.com/

CU4 Use Spreadsheets

Upon completion of this objective, learners will be able to:

- 4.1 identify the purpose of spreadsheets in the trade
- 4.2 interpret information in existing spreadsheets
- 4.3 enter data into existing spreadsheets
- 4.4 manipulate data within an existing spreadsheet
- 4.5 create a spreadsheet
- 4.6 create and copy formulas to perform calculations
- 4.7 print spreadsheets
- 4.8 print selected parts of spreadsheets

Resources:

- Essential Skills for Digital Literacy- IC3 Module B ~ Courseware 2109-2 - Key Applications Using Microsoft Office 2003

Online Resources:

- <http://www.baycongroup.com/el0.htm>
- www.homepages.ed.ac.uk/calarks/arks/Materials/it2001/Database_2001.pdf
- <http://www.swtc.edu:8082/mscenter/tutorial.htm#Editing%20in%20Excel>
- www.nald.ca/CLR/Excel2k2/Excel2k2.pdf
- <http://www.wcu.edu/199.asp>
- www.bcot1.com/

CU5 Read and Write Email Messages

Upon completion of this objective, learners will be able to:

- 5.1 open messages
- 5.2 reply to messages
- 5.3 write, send, and forward messages
- 5.4 print messages
- 5.5 add attachments to messages
- 5.6 delete messages
- 5.7 create folders
- 5.8 move messages to folders
- 5.9 delete folders
- 5.10 identify and manage common email problems

Resources:

- Essential Skills for Digital Literacy- IC3 Module C ~ Courseware 2118-2 - Living Online Using Windows XP
- Tools for Success Soft Skills for the construction Industry, *2nd Edition*, Module 6
- Effective Workplace Communications-Skills for Success in Life and on the Job, *3rd Edition* (Chapter 7)

Online Resources:

- www.ctdlc.org/remediation/indexe-mail.html (tutorial)
- <http://www.scs.nevada.edu/support/tutorials/nettutor/>
- www.colc.co.uk/new/index.html (tutorial)
- www.homepages.ed.ac.uk/calarks/arks/Materials/it2001/e-mail.pdf
- www.misa.ns.ca/downloads/pdfs/resources/newESLComputerBookTheInternet.pdf
- www.bcot1.com/

CU6 Use Web Search Skills

Upon completion of this objective, learners will be able to:

- 6.1 define web browser
- 6.2 access a specific website
- 6.3 use a search engine
- 6.4 evaluate information found on the World Wide Web
- 6.5 download information from the World Wide Web
- 6.6 copy information from the World Wide Web
- 6.7 save information from the World Wide Web
- 6.8 share information from the World Wide Web
- 6.9 print information from the World Wide Web

Resources:

- Essential Skills for Digital Literacy- IC3 Module C ~ Courseware 1103-1 - Living Online Using Windows XP
- Applied Communication Skills for the Construction Trades (Module 6)

Online Resources:

- www.ctdlc.org/remediation/indexWeb.html (tutorial)
- www.scs.nevada.edu/support/tutorials/
- www.colc.co.uk/new/index.html (tutorial)
- www.homepages.ed.ac.uk/calarks/arks/Materials/it2001/internet_explorer.pdf
- www.nald.ca/CLR/Internet/internet.pdf
- www.bcot1.com/
- http://www.newbie.org/internet_explorer/

General Search Engines:

- www.a9.com (Powered by Amazon)
- www.google.ca/ (Google Canada)
- www.live.com/ (MSN Search)
- ca.yahoo.com/?p=us (Yahoo)
- en-us.start.mozilla.com (Firefox)

Appendix A

Resources:

Effective Workplace Communications-Skills for Success in Life and on the Job, 3rd Edition

Marsha Ludden

JIST Works, 2007

ISBN: 978-1-59357-433-8

www.jist.com

Essential Skills for Digital Literacy- IC3 Module A ~ Courseware 2105-2 - Computing Fundamentals Using Windows XP

CCI Learning Solutions Inc., 2004

ISBN: 1-55332-086-7

www.ccilearning.com

Essential Skills for Digital Literacy- IC3 Module B ~ Courseware 2109-2 - Key Applications Using Microsoft Office 2003

CCI Learning Solutions Inc., 2004

ISBN: 1-55332-087-5

www.ccilearning.com

Essential Skills for Digital Literacy- IC3 Module C ~ Courseware 2118-2 - Living Online Using Windows XP

CCI Learning Solutions Inc., 2004

ISBN: 1-55332-088-3

www.ccilearning.com

Tools for Success - Soft Skills for the Construction Industry, 2nd Edition

National Centre for Construction Education and Research

Pearson Education, Inc., 2004

ISBN: 0-13-109194-8

Appendix B

General Websites

- www.red-seal.ca/Site/index_e.htm (The Interprovincial Standards Red Seal Program)
- www.ccohs.ca/ (Canadian Centre for Occupational Health and Safety)
- trades.exambank.com/index.html (Trades Exam Bank)
- www.hrsdc.gc.ca/en/labour/workplace_health/index.shtml (Workplace Health and Safety)
- www.hrsdc.gc.ca/en/hip/hrp/essential_skills/essential_skills_index.shtml (Human Resources and Social Development Canada-Essential Skills Website)
- www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simudut/index-eng.php (WHMIS)
- www.wcb.pe.ca/index.php3?number=60189 (Worker's Compensation Board of PEI)
- www.gov.pe.ca/educ/index.php3?number=74951 (PEI Apprenticeship Training)
- www.irc.nrc-cnrc.gc.ca/codes/home_E.shtml (Canadian Codes Centre)
- www.canoshweb.org/ (Canada's National Occupational Health and Safety Website)
- www.oshweb.com/ (Index of Occupational Health and Safety Resources)
- www.iapa.on.ca/about_iapa/about_intro.asp (Industrial Accident Prevention Association)
- www.cos-mag.com/ (Canadian Occupational Safety Magazine)
- www.nationalcodes.ca/ (National Code Documents)
- www.theglobeandmail.com/ (The Globe and Mail)
- www.nationalpost.com/ (National Post)
- www.theguardian.pe.ca/ (The Guardian)
- www.cbc.ca/pei/ (CBC-PEI)
- www.cbc.ca (CBC-National)

Websites for Machinists

- www.matweb.com/index.aspx (Database of Material Properties)
- www.metalsuppliersonline.com/research/Default.asp (Machinist-related Information on Various Topics)
- www.jjjtrain.kanabco.com/vms/ (Machine Tool Training and Instruction)
- www.metalinfo.com/partners/amm/metalglossary.cfm (Glossary of Metals)
- www.americanmachinist.com/ (Machinist-related Information on Various Topics)
- www.iamaw.ca/ (International Association of Machinists and Aerospace Workers)
- www.ctma.com/careers/careers_careers.asp (Canadian Tooling and Machining Association)
- www.ntma.org/eweb/StartPage.aspx (National Tooling and Machining Association)
- <http://www.americanmachinist.com/> (American Machinist)

All online resources listed in this document were operational at time of publication.

Writing (W) Learning Outcome – Learners will write to communicate for a variety of purposes.

W1 Plan the Writing Process

1.1 Identify purpose	1.2 Identify audience	1.3 Identify the most effective writing format for task
----------------------	-----------------------	---

W2 Write Clear Words, Sentences and Paragraphs

2.1 Use words effectively	2.2 Write effective sentences	2.3 Write effective paragraphs
---------------------------	-------------------------------	--------------------------------

W3 Use Correct Mechanics

3.1 Use correct spelling	3.2 Use correct punctuation	3.3 Use correct capitalization	3.4 Use correct grammar
--------------------------	-----------------------------	--------------------------------	-------------------------

W4 Write Business Communications

4.1 Write lists	4.2 Complete forms	4.3 Write notes	4.4 Write memos	4.5 Write letters	4.6 Write resumés
4.7 Write reports					

W5 Edit Business Communications

5.1 Proofread for clarity, tone, accuracy and brevity	5.2 Rewrite for clarity, tone, accuracy and brevity
---	---

Learners will write to communicate for a variety of purposes

Introduction

Effective written communication is the backbone of any workplace or organization. More specifically, good communication skills reduce the chance of faulty interpretation which, in turn, allow for maximum productivity.

As the economy changes so too does the workplace. Necessary reorganization and technological change demand that workers who would generally not be responsible for a high level of workplace writing are now expected to communicate internally and externally on a regular basis through memos, emails, faxes and reports.

The following guide is an introduction to the key writing skills workers need to deal effectively with everyday written correspondence and business communications and provides strategies to help learners improve their ability to write.

A list of resources (see Appendix A) has been outlined for each objective in the Writing Curriculum Framework and, where possible, includes online website materials that complement these resources. All information is presented in a generic manner; the contextualization to specific trades will be found in the expected writing tasks of each trade, determined by the instructor.

The following information has been designed to act only as a guide and may, therefore, need to be adapted to meet the needs of individuals or groups. It is the role of you, the instructor, to choose material and deliver its content as it best suits individual learner needs. A variety of materials are listed under each set of competencies for this purpose.

Outlined below are examples of writing tasks performed by tradespeople. These tasks may be used as a basis for writing expectations.

Examples of Writing Tasks

- | | |
|--|-----------------------------------|
| ✓ Incident/accident reports | ✓ Emails/memos |
| ✓ Detailed lists of materials needed for a job | ✓ Quotations |
| ✓ Inventory lists | ✓ Material requests |
| ✓ Brief descriptions of work for invoices | ✓ Daily logbook |
| ✓ Progress notes | ✓ Informative notes to co-workers |
| ✓ Proposals | ✓ Safety guidelines |
| ✓ Meeting minutes | ✓ Technical service reports |

WR1 Plan the Writing Process

Upon completion of this objective, learners will be able to:

- 1.1 identify purpose
- 1.2 identify audience
- 1.3 identify the most effective writing format for task

Resources:

- Making Choices: Teaching Writing in the Workplace
- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, Third Edition

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

WR2 Write Clear Words, Sentences and Paragraphs

Upon completion of this learning objective, learners will be able to:

- 2.1 use words effectively
- 2.2 write effective sentences
- 2.3 write effective paragraphs

Resources:

- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Workplace Communications- The Basics, *3rd Edition*

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

WR3 Use Correct Mechanics

Upon completion of this objective, learners will be able to:

- 3.1 use correct spelling
- 3.2 use correct punctuation
- 3.3 use correct capitalization
- 3.4 use correct grammar

Resources:

- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, 3rd Edition

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.ucalgary.ca/UofC/eduweb/grammar/>
- <http://www.khake.com/page66.html>

WR4 Write Business Communications

Upon completion of this objective, learners will be able to:

- 4.1 write lists
- 4.2 complete forms
- 4.3 write notes
- 4.4 write memos
- 4.5 write letters
- 4.6 write resumés
- 4.7 write reports

Resources:

- Making Choices: Teaching Writing in the Workplace
- Applied Communication Skills for the Construction Trades
- Tools for Success: Soft Skills for the Construction Industry, *2nd Edition*
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Effective Workplace Communications-Skills for Success in Life and on the Job, *3rd Edition* (Chapter 6)
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, *3rd Edition*

Online Resources:

- http://oregonstate.edu/dept/eli/buswrite/Business_Writing_Help.html
- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

WR5 Edit Business Communications

Upon completion of this objective, learners will be able to:

- 5.1 proofread written work
- 5.2 rewrite written work for clarity, tone, accuracy and brevity

Resources:

- Applied Communication Skills for the Construction Trades
- Write for Business: A Compact Guide to Writing and Communicating in the Workplace
- Successful Technical Writing- A Practical Approach
- Workplace Communications- The Basics, *3rd Edition*

Online Resources:

- <http://www.scribd.com/doc/63429/GP-BUSINESS-WRITING>
- <http://www.keyskillssupport.net/teacandlearresoa/>
- <http://www.learnatest.com/LearningExpressEBooks/download.cfm?b=1576854647&CFID=11332069&CFTOKEN=e85e76858482c2-E02C2DF7-BCDF-04A2-B71D21CCD13D388C>
- <http://www.khake.com/page66.html>

Appendix A

Resource Materials:

Applied Communication Skills for the Construction Trades

Steven A. Rigolosi
Pearson Education, Inc., 2002
ISBN: 0-13-093355-4

Effective Workplace Communications-Skills for Success in Life and on the Job, 3rd Edition

Marsha Ludden
JIST Works, 2007
ISBN: 978-1-59357-433-8
www.jist.com

Making Choices: Teaching Writing in the Workplace

Diane Millar
Instructional Activities Manual (ISBN: 1-894593-13-8)
Reference Manual (ISBN: 1-894593-12-X)
Grass Roots Press, 2002

Successful Technical Writing- A Practical Approach

Bill Wesley Brown
The Goodheart-Willcox Company Inc., 2000
ISBN: 1-56637-696-3
ISBN (Instructor's Guide): 13-978-1-56637-697-6

Tools for Success: Soft Skills for the Construction Industry, 2nd Edition

National Centre for Construction Education and Research
Contren Learning Series
Pearson Education, Inc., 2004
ISBN: 0-13-160000-1

Workplace Communications- The Basics, 3rd Edition

George J. Searles
Pearson Education, Inc., 2006
ISBN: 0-321-33068-4

Write for Business: A Compact Guide to Writing and Communicating in the Workplace

Verne Meyer, Pat Sebranek, John Van Rys

UpWrite Press, 2004

ISBN (hardcover): 1-932436-00-6

ISBN (spiral): 1-932436-01-4

All online resources listed in this document were operational at time of publication.

TABLE OF CONTENTS

MACHINIST NOC 7231

SECTION	PAGE
1. Introduction	232
2. National Occupational Analysis (NOA) – Technical Skills Inventory (TSI) Diagram	233
3. Assessor's Guide	234
4. Learners' Guide	244
5. Technical Skills Inventory (TSI)	246
6. TSI Group Summary Spreadsheet	255
7. Group Learning Plan and Pie Chart (Sample)	260
8. Individual Learning Plan and Pie Chart (Sample)	262

SECTION 1 - INTRODUCTION

Points to Consider

- 80% of learning in a trade happens in the workplace.
- Every workplace in every province and territory has its own unique learning culture.
- Each journey person has their individual approach to guiding an apprentice.
- Every apprentice will write the **same** National exam.

Background

The road to a trade certification has many paths. For an apprentice who has not taken the pre-apprentice training and Block/Period/Level in-school route, it can be a difficult road to navigate. The primary focus appears to be accumulating enough hours for eligibility to challenge the Interprovincial (Red Seal) exam.

The one tool that is available, if an apprentice chooses the Block/Period/Level route, is the Provincial Log Book. This Log Book tracks the Blocks, Tasks and Sub-tasks that an apprentice has learned in the workplace. For apprentices who have chosen the route on which 100% of their learning happens in the workplace, it can be difficult to “know what you don’t know.” On this path the apprentices never had a Log Book so in order to challenge, they have their journey person sign off on the Blocks when they have accumulated the hours required to challenge the IP certification exam in their trade.

Provincial/Territorial Log Books are developed from the National Occupational Analysis (NOA) in a trade. Most apprentices are never introduced to the NOA of their trade even though it is used to develop trades curriculum, block/period/level tests and the IP exam.

Technical Skills Inventory (TSI)

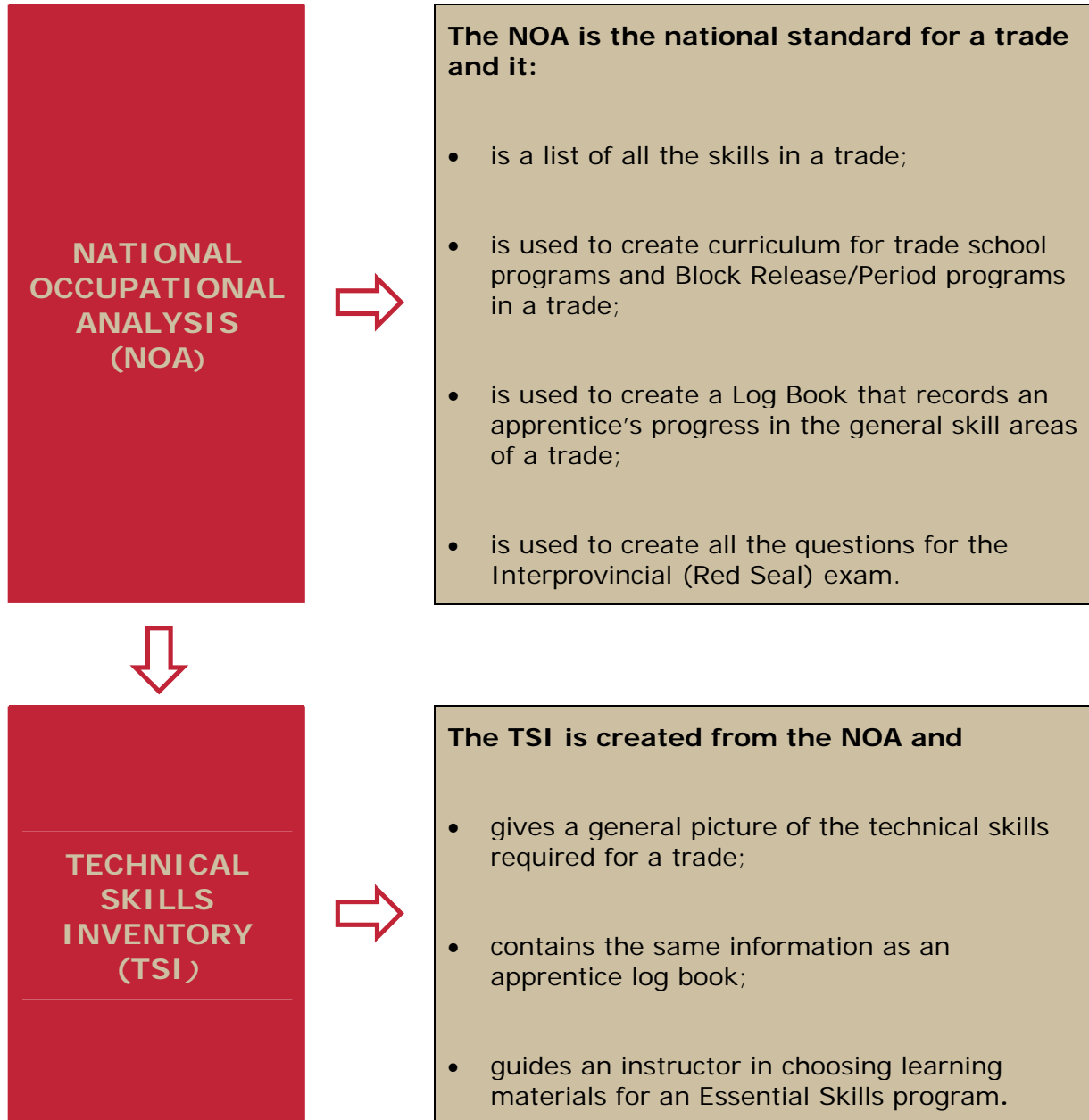
The Technical Skills Inventory (TSI) is created from the NOA. It is a self-assessment tool designed to give the apprentices the opportunity to reflect on their technical skills, identify skills gaps and make a plan to fill those gaps, **before** they challenge the IP exam.

The TSI also provides information for Essential Skills assessors to create technical skills learning plans for individual apprentices and Essential Skills program instructors. These learning plans are used by the instructor and the apprentice to select technical skills resources that support Essential Skills learning programs.

Feature

The TSI “Group Summary” has formulas imbedded so data can be easily extracted and manipulated for presentation in a pie chart format.

**SECTION 2 - NATIONAL OCCUPATIONAL ANALYSIS (NOA) –
TECHNICAL SKILLS INVENTORY (TSI) DIAGRAM**



SECTION 3 - ASSESSOR'S GUIDE

STEP ONE: INTRODUCE PARTICIPANTS TO THE NATIONAL OCCUPATIONAL ANALYSIS (NOA)

Rationale

National Occupational Analysis (NOA)

The NOA is recognized as the national standard for all trades. There is an NOA for each trade in Canada and, although the NOAs are readily accessible online, few tradespeople take advantage of this information. (To access NOAs on line, go to www.red-seal.ca and click on national occupational analysis)

NOA Background

An NOA is reviewed and revised at least every 5 years. Each NOA is developed by a Joint Planning Committee and the Interprovincial Program Guide Working Group, comprised of industry and instructional representatives in a specific trade from each province and territory in Canada. All Joint Planning Committees operate under the auspices of the Canadian Council of Directors of Apprenticeship (CCDA) who recognize the NOA as the key document in an occupation. The CCDA consists of directors/managers of apprenticeship from every province and territory in Canada.

The NOA:

- Lists every technical skill requirement in a trade;
- Is used to create the Apprentice Log Book in a trade;
- Is used to develop curriculum for trades training programs; and
- Is used to develop the questions for Inter Provincial Exam (Red Seal).

Activity

Preparation

Have an NOA printed for each participant. Ensure each NOA has page indicators at these sections:

- Analysis
- Tools and Equipment
- Glossary
- Exam Components

NOTE: Move Pie Chart to the first page of the Exam Component section.

Timeline

The first night of class

Direction

Ask the participants if they have ever used or worked in an NOA before. If so, engage him/her in a discussion of where they used it and in what context. Then:

- Distribute an NOA to each participant;
- Review the development and layout of the document;
- Emphasize the use of the document, e.g., creating a log book, curriculum, possible exam questions, etc.; and
- Review each section of the document with particular attention to the Blocks, Tasks and sub-tasks in the Analysis section.

STEP TWO: INTRODUCE PARTICIPANTS TO THE TECHNICAL SKILLS INVENTORY (TSI)

Rationale

Technical Skills Inventory (TSI)

The TSI is created from the NOA. It gives a general picture of the technical skills required for a trade by listing the **Blocks**, **Tasks** and **Sub-tasks** in the trade. The TSI:

- Contains the same information as the Apprentice Log Book in a trade;
- Provides the participant with an opportunity to **self-assess** his/her general skills in their trade; and
- Guides the instructor in choosing contextualized resources for the Essential Skills program.

TSI Terminology

Two sets of terms can be used depending on where a participant learns and works in their trade. In this TSI Document, you will find the **common terminology** listed first. It is followed by the **competency-based terminology** in italics and underlined.

TSI Terminology

Blocks - Learning Categories: Tasks - Learning Outcomes:
Sub-tasks - Learning Objectives

By completing this Technical Skills Inventory (TSI) the participant will:

- be introduced to the **blocks** (*learning categories*), the **tasks** (*learning outcomes*), and the **sub-tasks** (*learning objectives*) in the NOA;
- reflect on his/her technical skills, then list what he/she knows and can do;
- document any technical skills gaps the participant may have;
- help create a group learning needs profile to assist curriculum developers and the instructor gather learning materials specific to a trade for an Essential Skills Program; and
- help the participant make a plan for any technical skills they may need to learn or improve

Activity

Preparation

Print an NOA Analysis Diagram for each participant.

Print a Learners Guide – Technical Skills Inventory (TSI).

Print a personalized TSI for each participant.

Timeline

The first night of class

Direction

Distribute an NOA Analysis Diagram to each participant in the program and review the content with him/her. Then:

- Distribute the Learner's Guide – Technical Skills Inventory (TSI) to each participant;
- Distribute the personalized TSI to each participant;
- Summarize the directions for completing the TSI;
- Advise the participants to review each sub-task and put a ✓ in the column that best describes their self-assessment of their skill:
 - Yes, I did this
 - I need to work on this
 - Not sure what this means
- Advise participants to include any comments they may have; and
- Collect TSIs when participants have completed them.

It should take approximately 20 minutes for a participant to complete their individual TSI. If some take longer, do not rush them.

Advise participants that you will meet with them at the **half-way** point of the program to give them feedback on their TSI. Advise them that in the meantime, you will be collecting the information from each TSI and compiling it for the instructor so he/she can prepare materials for the Essential Skills Program.

STEP THREE: COMPILE DATA FOR THE INSTRUCTOR

Rationale

The Essential Skills Programs at Trade Essentials are contextualized to the trade. This results in participants being easily engaged in their learning because they relate to the materials that support concepts and applications in their trade. Data collected through the TSI guides the instructor as to what contextual and technical resources will best engage his/her participants.

Timeline

Within 24 to 48 hours of the participants completing the TSI, provide the instructor with a **TSI Group Summary Chart** and **Group Learning Plan**.


Activity

Preparation

Develop a TSI Group Summary Chart

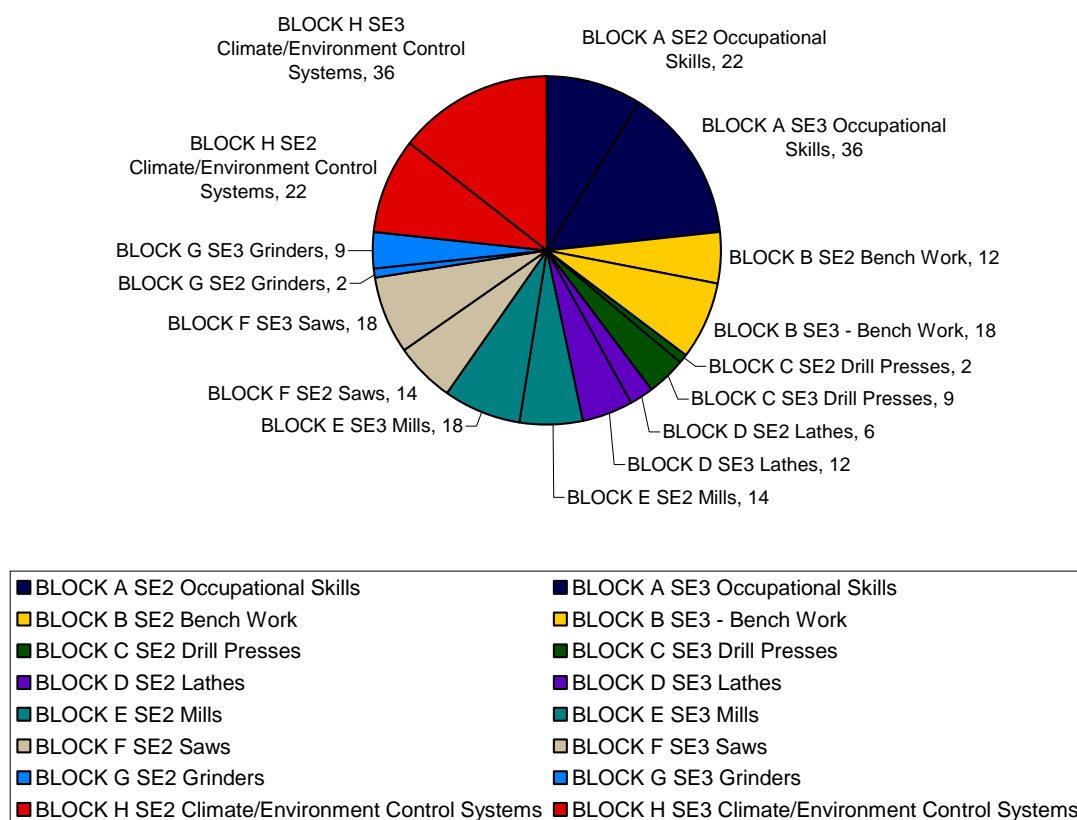
- Complete an Excel spreadsheet assigning one column to each participant;
- Assign the number code to each TSI column
 - 0 to the first column – Yes, I did this
 - 2 to the second column – I need to work on this
 - 3 to the third column – Not sure what this means
- Collect the data from the TSI and transfer it to the spreadsheet; and
- The 2s will automatically highlight in **yellow** and the 3s in **blue** so the instructor can easily identify a participant who has a learning need that differs significantly from the group;
- A group summary chart will appear at the bottom of your spreadsheet.

Direction

- Create a Pie Chart to produce a visual depiction of a group's learning needs
 - Highlight the entire "Summary Chart" on the last page of your spreadsheet.
 - On the tool bar, choose the "Chart Wizard" (Microsoft Office Excel 2003) 
 - Under chart "Chart type" choose "Pie"
 - Under "Chart Sub-Type" choose the first Pie picture
 - Click "Next"
 - Choose "Data Range" and "Columns" then click "Next"
 - Choose "Titles" and fill in "Chart Name" (Group Location and Trade)
 - On the same tool bar, choose "Legend" then "Bottom"
 - On the same tool bar choose "Data Labels" then choose "Category Name," "Value," and "Legend Key," then click "Next"
 - Under Chart Location choose "As New Sheet" and click "Finish"
 - To change a colour of a piece of the pie chart so 2s and 3s in the same piece of the pie match,
 - click inside the pie
 - click on the piece of pie you want to change
 - double click on that same piece and the colour chart will appear
 - choose your colour
 - To move or adjust items in the pie chart, right click on the pie chart, choose "Edit" then choose the item you want to adjust or move. Click outside the chart when you are finished
 - Choose "Edit", then "Copy" the pie chart and "Paste" it into the "Group Learning Plan"
- Provide the instructor with a copy of both the **TSI Group Summary Chart** and the **Group Learning Plan** within 24 to 48 hours so he/she can choose appropriate learning resources; and put one copy of the TSI Group Summary and the Group Learning Plan Pie Chart in the office files.

Sample Pie Chart

Group Learning Plan Machinist, Summerside



STEP FOUR: ASSIST THE PARTICIPANT TO DEVELOP AN INDIVIDUAL TECHNICAL SKILLS LEARNING PLAN

Rationale

Information from the TSI is used to create an individual report for each participant. This report includes:

- Information on the TSI so the participant has a record of how he/she completed this tool;
- A Pie Chart that provides a visual depiction of the participant's learning needs; and
- A series of questions that result in each participant developing an individual technical skills learning plan.

Timeline

At the **mid-point** of the Essential Skills Program, provide participants with feedback on their TSI. This timeline:


- gives the participant an opportunity to focus entirely on their Essential Skills for the first few weeks of the program;
- gives the participant time to evaluate if, through their Essential Skills studies, they have discovered that their technical learning needs are more extensive than they previously assessed through their TSI;
- creates an opportunity for the participant to share how they are adjusting to a learning environment with someone other than the instructor; and
- provides an opportunity for the assessor to gather information from each participant to determine if resources and instruction are meeting their learning needs.

Activity

Preparation

Develop an Individual Learning Needs Plan Pie Chart for each participant to produce a visual depiction of a participant's learning needs.

Direction

- Transfer each participant's total for each Block both SE 2 - I need to work on this and SE 3 - Not sure what this means into a Pie Chart;
 - Highlight all of the Block titles in the "Summary Chart" on the last page of the spreadsheet
 - Hold down the Control Key (Ctrl) on your keyboard
 - Highlight one client column
 - On the tool bar, choose the "Chart Wizard" (Microsoft Office Excel 2003) 
 - Under chart "Chart type" choose "Pie"
 - Under "Chart Sub-Type" choose the first Pie picture
 - Click "Next"
 - Choose "Data Range" and "Columns" then click "Next"
 - Choose "Titles" and fill in "Chart Name" (Client name and Trade)
 - On the same tool bar, choose "Legend" then "Bottom"
 - On the same tool bar choose "Data Labels" then choose "Category Name," "Value," and "Legend Key," then click "Next"
 - Under Chart Location choose "As New Sheet" and click "Finish"
 - To change a colour of a piece of the pie chart so 2s and 3s in the same piece of the pie match,
 - click inside the pie
 - click on the piece of pie you want to change
 - double click on that same piece and the colour chart will appear
 - choose your colour
 - To move or adjust items in the pie chart, right click on the pie chart, choose "Edit" then choose the item you want to adjust or move. Click outside the chart when you are finished.
 - Choose "Edit", then "Copy" the pie chart and "Paste" it into the "Individual Learning Plan"

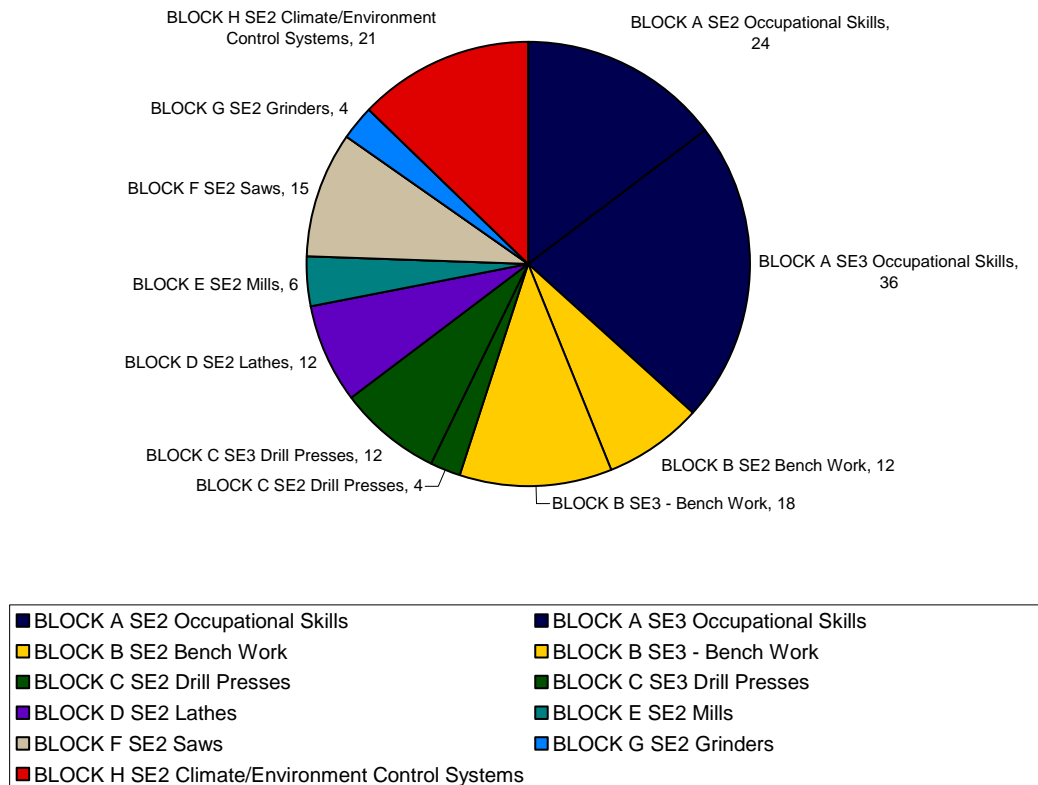
Feedback

- Schedule a one-on-one TSI feedback appointment with each participant during which you compare and discuss their Individual Learning Needs Pie Chart with the group Learning Needs Pie Chart
- Complete the **Individual Learning Plan** with the participant.
- Make 2 copies of the Individual Learning Plan. Put one copy in office file and one copy in your files.
- Give the original TSI and the original Individual Learning Plan back to the participant.

Each one-on-one meeting with a client should average 20 to 30 minutes.

Sample Pie Chart

J. Doe - Individual Learning Plan - Machinist Summerside



SECTION 4 - LEARNER'S GUIDE

Key Document in your Trade

The National Occupational Analysis (NOA) is a trade document approved nationally and used in each Province and Territory across Canada. The NOA lists every technical skill required to be successful in your trade. Each NOA is used to:

- create the Apprentice Log Book in your trade;
- develop curriculum for trades training programs; and
- prepare questions for Red Seal exams.

Technical Skills Inventory (TSI)

The TSI is created from the NOA. It gives a general overview of the technical skills required for your trade by listing the Blocks, Tasks and Sub-Tasks in your trade. The TSI:

- contains the same information as the Apprentice Log Book in your trade; and
- gives you the opportunity to self-assess your general skills in your trade.

TSI Terms

Two sets of terms can be used depending on where you learn and work in your trade. In this TSI document you will find the **common terms** listed first. It is followed by the **competency-based terms** in italics and underlined. *(In the future, all NOA updates will be using competency-based terms.)*

TSI Terms

Common Terms

Blocks _____

Tasks _____

Sub-tasks _____

Competency-based Terms

Learning Categories

Learning Outcomes

Learning Objectives

Why complete a TSI?	
	<p>By completing this Technical Skills Inventory (TSI) you will:</p> <ul style="list-style-type: none"> ➤ be introduced to the blocks (<i>learning categories</i>), the tasks (<i>learning outcomes</i>), and the sub-tasks (<i>learning objectives</i>) in the NOA; ➤ help you think about your technical skills, then help you list what you know and can do; ➤ help you highlight any technical skills gaps you may have; ➤ help create a group learning needs profile to assist the instructor gather learning materials specific to your trade and your learning needs for your Essential Skills Program; and ➤ help you make a plan to get any technical skills you may need to learn or skills you may want to improve.
Directions	
	<p>Review each sub-task and put a ✓ in the column that best describes your self-assessment of your skills:</p> <ul style="list-style-type: none"> ○ Yes, I did this ○ I need to work on this ○ Not sure what this means <p>Include any comments that may help the instructor choose learning materials for you.</p>

NAME:

DATE:

Block A – *Learning Category*
OCCUPATIONAL SKILLS

Task 1 – Block A <i>Learning Outcome</i> Uses tools and equipment		Yes I did this	I need to work on this	Not sure what this means	Comments
A 1.01	Uses hand tools				
A 1.02	Uses power tools				
A 1.03	Uses measuring tools				
A 1.04	Uses hoisting, lifting and rigging equipment				
A 1.05	Uses layout tools and equipment				
A 1.06	Uses personal protective equipment (PPE) and safety equipment				
A 1.07	Uses basic welding equipment				
Task 2 – Block A <i>Learning Outcome</i> Organizes work					
A 2.01	Interprets documentation				
A 2.02	Plans sequence of operation				
A 2.03	Maintains safe work environment				
A 2.04	Communicates with others				

Task 3 – Block A <i>Learning Outcome</i> Processes material		Yes I did this	I need to work on this	Not sure what this means	Comments
A 3.01	Selects workpiece material				
A 3.02	Performs layout				
A 3.03	Marks workpiece for identification				
A 3.04	Performs basic heat treatment				
A 3.05	Applies material testing				
A 3.06	Deburr workpiece				
A 3.07	Inspects workpiece				
A 3.08	Sketches parts				
Task 4 – Block A <i>Learning Outcome</i> Maintains machines and tooling					
A 4.01	Cleans machines				
A 4.02	Lubricates machines				
A 4.03	Sharpens tooling				
A 4.04	Applies cutting fluid and coolant				
A 4.05	Troubleshoots equipment				
A 4.06	Maintains machine alignment				

Block B – *Learning Category*
BENCH WORK

Task 5 – Block B <i>Learning Outcome</i> Performs hand processes		Yes I did this	I need to work on this	Not sure what this means	Comments
B 5.01	Files workpiece				
B 5.02	Saws workpiece				
B 5.03	Performs hole making operations				
B 5.04	Performs threading operations				
B 5.05	Installs thread inserts				
B 5.06	Broaches workpiece				
B 5.07	Performs pressing operations				
B 5.08	Bends workpiece				
B 5.09	Finishes workpiece				
Task 6 – Block B <i>Learning Outcome</i> Refurbishes components					
B 6.01	Analyzes components				
B 6.02	Plans procedures				
B 6.03	Disassembles components				
B 6.04	Assembles components				

Block C – *Learning Category*
DRILL PRESSES

Task 7 – Block C <i>Learning Outcome</i> Sets up drill presses		Yes I did this	I need to work on this	Not sure what this means	Comments
C 7.01	Selects drill press types				
C 7.02	Plans drill press sequence				
C 7.03	Selects jigs, fixtures and work holding devices				
C 7.04	Sets up jigs, fixtures and work holding devices				
C 7.05	Selects tooling				
C 7.06	Sets up tooling				
C 7.07	Sets up workpiece				
C 7.08	Selects speeds and feeds				
Task 8 – Block C <i>Learning Outcome</i> Operates drill presses					
C 8.01	Drills holes				
C 8.02	Cuts countersinks, counterbores, chamfers and spot faces				
C 8.03	Performs tapping				
C 8.04	Finishes holes				

Block D – Learning Category
LATHES

Task 9 – Block D <u>Learning Outcome</u> Sets up lathes		Yes I did this	I need to work on this	Not sure what this means	Comments
D 9.01	Selects lathe types				
D 9.02	Plans lathe sequence				
D 9.03	Selects work holding devices				
D 9.04	Sets up work holding devices				
D 9.05	Selects tooling				
D 9.06	Sets up tooling				
D 9.07	Selects lathe accessories				
D 9.08	Sets up lathe accessories				
D 9.09	Sets up workpiece				
D 9.10	Selects speeds and feeds				
Task 10 – Block D <u>Learning Outcome</u> Operates lathes					
D 10.01	Turns surfaces				
D 10.02	Faces surfaces				
D 10.03	Turns tapers				
D 10.04	Knurls				
D 10.05	Parts off workpiece				
D 10.06	Drills				
D 10.07	Finishes holes				
D 10.08	Cuts grooves				
D 10.09	Cuts threads				
D 10.10	Turns eccentrics				

Block E – Learning Category
MILLS

Task 11 – Block E <u>Learning Outcome</u> Sets up milling machines		Yes I did this	I need to work on this	Not sure what this means	Comments
E 11.01	Selects mill types				
E 11.02	Plans milling sequence				
E 11.03	Selects work holding devices				
E 11.04	Sets up work holding devices				
E 11.05	Selects tooling				
E 11.06	Sets up tooling				
E 11.07	Selects milling accessories				
E 11.08	Sets up milling accessories				
E 11.09	Sets up workpiece				
E 11.10	Selects speeds and feeds				
Task 12 – Block E <u>Learning Outcome</u> Operates milling machines					
E 12.01	Faces surfaces				
E 12.02	Mills profiles and pockets				
E 12.03	Drills holes				
E 12.04	Cuts countersinks, counterbores, chamfers and spot faces				
E 12.05	Performs tapping				
E 12.06	Finishes holes				

Block F – Learning Category
SAWS

Task 13 – Block F <u>Learning Outcome</u> Sets up power saws		Yes I did this	I need to work on this	Not sure what this means	Comments
F 13.01	Selects saw types				
F 13.02	Selects saw blades				
F 13.03	Installs blades				
F 13.04	Selects speeds and feeds				
F 13.05	Makes saw adjustments				
F 13.06	Sets up workpiece				
Task 14 – Block F <u>Learning Outcome</u> Operates power saws					
F 14.01	Saws straight and angle cuts				
F 14.02	Cuts irregular shapes				

Block G – *Learning Category*
GRINDERS

Task 15 – Block G <i>Learning Outcome</i> Sets up grinders		Yes I did this	I need to work on this	Not sure what this means	Comments
G 15.01	Selects grinder types				
G 15.02	Plans grinding sequence				
G 15.03	Selects work holding devices				
G 15.04	Sets up work holding devices				
G 15.05	Selects grinding wheel				
G 15.06	Mounts grinding wheel				
G 15.07	Selects grinding accessories				
G 15.08	Sets up grinding accessories				
G 15.09	Sets up workpiece				
G 15.10	Selects speeds and feeds				
Task 16 – Block G <i>Learning Outcome</i> Operates grinders					
G 16.01	Grinds flat surfaces				
G 16.02	Grinds profiles				
G 16.03	Grinds cylindrical and tapered surfaces				
G 16.04	Grinds tools and cutters				

Block H – *Learning Category*
CLIMATE/ENVIRONMENT CONTROL SYSTEMS

Task 17 – Block H <i>Learning Outcome</i> Performs basic CNC programming		Yes I did this	I need to work on this	Not sure what this means	Comments
H 17.01	Reviews process documentation				
H 17.02	Calculates coordinates for tool path				
H 17.03	Inputs program data into control memory				
H 17.04	Interprets program codes				
H 17.05	Edits program				
Task 18 – Block H <i>Learning Outcome</i> Sets up CNC machines					
H 18.01	Selects tooling and tool holders				
H 18.02	Sets up tooling and tool holders				
H 18.03	Establishes work datum				
H 18.04	Sets up workpiece				
H 18.05	Verifies program				
Task 19 – Block H <i>Learning Outcome</i> Operates CNC machines					
H 19.01	Adjusts offsets				
H 19.02	Loads/unloads workpiece				
H 19.03	Monitors machining processes				
H 19.04	Interrupts program cycle				
H 19.05	Restarts program cycle				

Trade Essentials

Technical Skills Inventory (TSI) Group Summary

Machinist - (NOA) National Occupational Analysis 2005)

NOC 7231 (National Occupational Classification)



		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10		
BLOCK A (Learning Category) OCCUPATIONAL SKILLS													
Task 1 (Learning Outcome) - Uses tools and equipment													
Sub-Tasks (Learning Objectives)												TOTALS	
A 1.01	Uses hand tools											0	A 1.01
A 1.02	Uses power tools											0	A 1.02
A 1.03	Uses measuring tools											0	A 1.03
A 1.04	Uses hoisting, lifting and rigging equipment											0	A 1.04
A 1.05	Uses layout tools and equipment											0	A 1.05
A 1.06	Uses personal protective equipment (PPE) and safety equipment											0	A 1.06
A 1.07	Uses basic welding equipment											0	A 1.07
Task 2 (Learning Outcome) - Organizes work												Task Total	0
Sub-Tasks (Learning Objectives)													
A 2.01	Interprets documentation											0	A 2.01
A 2.02	Plans sequence of operation											0	A 2.02
A 2.03	Maintains safe work environment											0	A 2.03
A 2.04	Communicates with others											0	A 2.04
Task 3 (Learning Outcome) - Processes material												Task Total	0
Sub-Tasks (Learning Objectives)													
A 3.01	Selects workpiece material											0	A 3.01
A 3.02	Performs layout											0	A 3.02
A 3.03	Marks workpiece for identification											0	A 3.03
A 3.04	Performs basic heat treatment											0	A 3.04
A 3.05	Applies material testing											0	A 3.05
A 3.06	Deburrs workpiece											0	A 3.06
A 3.07	Inspects workpiece											0	A 3.07
A 3.08	Sketches parts											0	A 3.08
Task 4 (Learning Outcome) - Maintains machines and tooling												Task Total	0
Sub-Tasks (Learning Objectives)													
A 4.01	Cleans machines											0	A 4.01
A 4.02	Lubricates machines											0	A 4.02
A 4.03	Sharpens tooling											0	A 4.03
A 4.04	Applies cutting fluid and coolant											0	A 4.04
A 4.05	Troubleshoots equipment											0	A 4.05
A 4.06	Maintains machine alignment											0	A 4.06
												Task Total	0
BLOCK A TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	
SE 3		0	0	0	0	0	0	0	0	0	0	0	

Date:
Group Identification:
Instructor:
MACHINIST

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10		
BLOCK B (Learning Category) BENCH WORK													
Task 5 (Learning Outcome) - Performs hand processes													
Sub-Tasks (Learning Objectives)												TOTALS	
B 5.01	Files workpiece											0	B 5.01
B 5.02	Saws workpiece											0	B 5.02
B 5.03	Performs hole making operations											0	B 5.03
B 5.04	Performs threading operations											0	B 5.04
B 5.05	Installs thread inserts											0	B 5.05
B 5.06	Broaches workpiece											0	B 5.06
B 5.07	Performs pressing operations											0	B 5.07
B 5.08	Bends workpiece											0	B 5.08
B 5.09	Finishes workpiece											0	B 5.09
Task 6 (Learning Outcome) - Refurbishes components												Task Total	0
Sub-Tasks (Learning Objectives)													
B 6.01	Analyzes components											0	B 6.01
B 6.02	Plans procedures											0	B 6.02
B 6.03	Disassembles components											0	B 6.03
B 6.04	Assembles components											0	B 6.04
												Task Total	0
BLOCK B TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	
SE 3		0	0	0	0	0	0	0	0	0	0	0	
BLOCK C (Learning Category) DRILL PRESSES													
Task 7 (Learning Outcome) - Sets up drill presses													
Sub-Tasks (Learning Objectives)												TOTALS	
C 7.01	Selects drill press types											0	C 7.01
C 7.02	Plans drill press sequence											0	C 7.02
C 7.03	Selects jigs, fixtures and work holding devices											0	C 7.03
C 7.04	Sets up jigs, fixtures and work holding devices											0	C 7.04
C 7.05	Selects tooling											0	C 7.05
C 7.06	Sets up tooling											0	C 7.06
C 7.07	Sets up workpiece											0	C 7.07
C 7.08	Selects speeds and feeds											0	C 7.08
Task 8 (Learning Outcome) - Operates drill presses												Task Total	0
Sub-Tasks (Learning Objectives)													
C 8.01	Drills holes											0	C 8.01
C 8.02	Cuts countersinks, counterbores, chamfers and spot faces											0	C 8.02
C 8.03	Performs tapping											0	C 8.03
C 8.04	Finishes holes											0	C 8.04
												Task Total	0
BLOCK C TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	
SE 3		0	0	0	0	0	0	0	0	0	0	0	

Date:
Group Identification:
Instructor:
MACHINIST

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10	TOTALS	
BLOCK D (Learning Category) LATHES													
Task 9 (Learning Outcome) - Sets up lathes													
Sub-Tasks (Learning Objectives)													
D 9.01	Selects lathe types											0	D 9.01
D 9.02	Plans lathe sequence											0	D 9.02
D 9.03	Selects work holding devices											0	D 9.03
D 9.04	Sets up work holding devices											0	D 9.04
D 9.05	Selects tooling											0	D 9.05
D 9.06	Sets up tooling											0	D 9.06
D 9.07	Selects lathe accessories											0	D 9.07
D 9.08	Sets up lathe accessories											0	D 9.08
D 9.09	Sets up workpiece											0	D 9.09
D 9.10	Selects speeds and feeds											0	D 9.10
Task 10 (Learning Outcome) - Operates lathes													
Sub-Tasks (Learning Objectives)													
D 10.01	Turns surfaces											0	D 10.01
D 10.02	Faces surfaces											0	D 10.02
D 10.03	Turns tapers											0	D 10.03
D 10.04	Knurls											0	D 10.04
D 10.05	Parts off workpiece											0	D 10.05
D 10.06	Drills											0	D 10.06
D 10.07	Finishes holes											0	D 10.07
D 10.08	Cuts grooves											0	D 10.08
D 10.09	Cuts threads											0	D 10.09
D 10.10	Turns eccentrics											0	D 10.10
BLOCK D TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	0
SE 3		0	0	0	0	0	0	0	0	0	0	0	0

		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10	TOTALS	
BLOCK E (Learning Category) MILLS													
Task 11 (Learning Outcome) - Sets up milling machines													
Sub-Tasks (Learning Objectives)													
E 11.01	Selects mill types											0	E 11.01
E 11.02	Plans milling sequence											0	E 11.02
E 11.03	Selects work holding devices											0	E 11.03
E 11.04	Sets up work holding devices											0	E 11.04
E 11.05	Selects tooling											0	E 11.05
E 11.06	Sets up tooling											0	E 11.06
E 11.07	Selects milling accessories											0	E 11.07
E 11.08	Sets up milling accessories											0	E 11.08
E 11.09	Sets up workpiece											0	E 11.09
E 11.10	Selects speeds and feeds											0	E 11.10
Task 12 (Learning Outcome) - Operates milling machines													
Sub-Tasks (Learning Objectives)													
E 12.01	Faces surfaces											0	E 12.01
E 12.02	Mills profiles and pockets											0	E 12.02
E 12.03	Drills holes											0	E 12.03
E 12.04	Cuts countersinks, counterbores, chamfers and spot faces											0	E 12.04
E 12.05	Performs tapping											0	E 12.05
E 12.06	Finishes holes											0	E 12.06
BLOCK E TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	0
SE 3		0	0	0	0	0	0	0	0	0	0	0	0

Date:
Group Identification:
Instructor:
MACHINIST

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10		
BLOCK F (Learning Category) SAWS													
Task 13 (Learning Outcome) - Sets up power saws													
Sub-Tasks (Learning Objectives)												TOTALS	
F 13.01	Selects saw types											0	F 13.01
F 13.02	Selects saw blades											0	F 13.02
F 13.03	Installs blades											0	F 13.03
F 13.04	Selects speeds and feeds											0	F 13.04
F 13.05	Makes saw adjustments											0	F 13.05
F 13.06	Sets up workpiece											0	F 13.06
Task 14 (Learning Outcome) - Operates power saws												Task Total	0
Sub-Tasks (Learning Objectives)													
F 14.01	Saws straight and angle cuts											0	F 14.01
F 14.02	Cuts irregular shapes											0	F 14.02
												Task Total	0
BLOCK F TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	
SE 3		0	0	0	0	0	0	0	0	0	0	0	

		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10		
BLOCK G (Learning Category) GRINDERS													
Task 15 (Learning Outcome) - Sets up grinders													
Sub-Tasks (Learning Objectives)												TOTALS	
G 15.01	Selects grinder types											0	G 15.01
G 15.02	Plans grinding sequence											0	G 15.02
G 15.03	Selects work holding devices											0	G 15.03
G 15.04	Sets up work holding devices											0	G 15.04
G 15.05	Selects grinding wheel											0	G 15.05
G 15.06	Mounts grinding wheel											0	G 15.06
G 15.07	Selects grinding accessories											0	G 15.07
G 15.08	Sets up grinding accessories											0	G 15.08
G 15.09	Sets up workpiece											0	G 15.09
G 15.10	Selects speeds and feeds											0	G 15.10
Task 16 (Learning Outcome) - Operates grinders												Task Total	0
Sub-Tasks (Learning Objectives)													
G 16.01	Grinds flat surfaces											0	G 16.01
G 16.02	Grinds profiles											0	G 16.02
G 16.03	Grinds cylindrical and tapered surfaces											0	G 16.03
G 16.04	Grinds tools and cutters											0	G 16.04
												Task Total	0
BLOCK G TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	
SE 3		0	0	0	0	0	0	0	0	0	0	0	

Date:
Group Identification:
Instructor:
MACHINIST

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

		Client 1	Client 2	Client 3	Client 4	Client 5	Client 6	Client 7	Client 8	Client 9	Client 10		
BLOCK H (Learning Category) COMPUTER NUMERICAL CONTROL (CNC) MACHINING													
Task 17 (Learning Outcome) - Performs basic CNC programming													
Sub-Tasks (Learning Objectives)												TOTALS	
H 17.01	Reviews process documentation											0	H 17.01
H 17.02	Calculates coordinates for tool path											0	H 17.02
H 17.03	Inputs program data into control memory											0	H 17.03
H 17.04	Interprets program codes											0	H 17.04
H 17.05	Edits program											0	H 17.05
Task 18 (Learning Outcome) - Sets up CNC machines												Task Total	0
Sub-Tasks (Learning Objectives)													
H 18.01	Selects tooling and tool holders											0	H 18.01
H 18.02	Sets up tooling and tool holders											0	H 18.02
H 18.03	Establishes work datum											0	H 18.03
H 18.04	Sets up workpiece											0	H 18.04
H 18.05	Verifies program											0	H 18.05
Task 19 (Learning Outcome) - Operates CNC machines												Task Total	0
Sub-Tasks (Learning Objectives)													
H 19.01	Adjusts offsets											0	H 19.01
H 19.02	Loads/unloads workpiece											0	H 19.02
H 19.03	Monitors machining processes											0	H 19.03
H 19.04	Interrupts program cycle											0	H 19.04
H 19.05	Restarts program cycle											0	H 19.05
												Task Total	0
BLOCK H TOTALS		0	0	0	0	0	0	0	0	0	0	0	0
SE 2		0	0	0	0	0	0	0	0	0	0	0	0
SE 3		0	0	0	0	0	0	0	0	0	0	0	0

Group Summary Chart

BLOCK A SE2 Occupational Skills	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK A SE3 Occupational Skills	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK B SE2 Bench Work	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK B SE3 - Bench Work	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK C SE2 Drill Presses	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK C SE3 Drill Presses	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK D SE2 Lathes	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK D SE3 Lathes	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK E SE2 Mills	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK E SE3 Mills	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK F SE2 Saws	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK F SE3 Saws	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK G SE2 Grinders	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK G SE3 Grinders	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK H SE2 Climate/Environment Control Systems	0	0	0	0	0	0	0	0	0	0	0	0
BLOCK H SE3 Climate/Environment Control Systems	0	0	0	0	0	0	0	0	0	0	0	0

Date:
Group Identification:
Instructor:
MACHINIST

Technical Skills Inventory
Self-Assessment Rating

0 - Yes, I did this
2 - I need to work on this
3 - Not sure what this means

SECTION 7 - GROUP LEARNING PLAN AND PIE CHART (SAMPLE)

Group Learning Plan – Group ID	
Date TSI Completed	
Instructor	

The Technical Skills Inventory (TSI) is designed to:

- introduce apprentices to the blocks (*learning categories*), the tasks (*learning outcomes*), and sub-tasks (*learning objectives*) in the National Occupational Analysis (NOA).
- have apprentices **reflect** and then **self-assess** their tasks (*learning outcomes*) and sub-tasks (*learning objectives*) in their trade.
- compile information from the TSI to **create a group profile** of technical skills learning needs.
- provide information from the TSIs to assist instructors in choosing contextualized and technical skills resources to support Essential Skills curriculum that will support client needs.

The TSI assessment tool lists the block (*learning categories*), tasks (*learning outcomes*) and sub-tasks (*learning objectives*) identified in the National Occupational Analysis (NOA) of each trade. The TSI is a **self-assessment** tool through which an apprentice reflects and records their personal evaluation on each task and sub-task. Self Evaluation (SE) categories for the tasks (*learning outcomes*) and sub-tasks (*learning objectives*) are:

SE 0 – Yes, I did this

SE 2 – I need to work on this

SE 3 – Not sure what this means

GENERAL GROUP PROFILE: **Machinist Group Summerside**

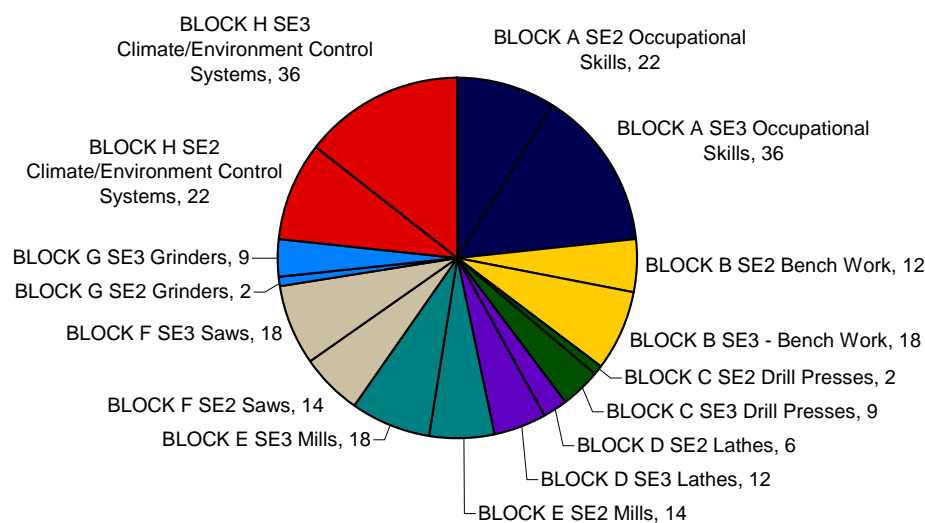
Twelve Machinist learners are participating in this program. The geographic territory covers from Charlottetown to the Western tip of PEI. Trade expertise within the group ranges from those working in specific sections of the trade to those who own their own business. All have attended pre-apprenticeship training in a post-secondary institution. Three have previously challenged but were unsuccessful in the Red Seal exam. Nine have written Block exams but have been unsuccessful past Block One.

Group Learning Plan Pie Chart Technical Skills Inventory (TSI) Group Learning Needs Profile

NOTE: Any divided sections with the same colour that may occur in the chart, highlights where both SE 2 and SE 3 are recorded in the same block.

Self-evaluation (SE)	0 – Yes, I can do this
Self-evaluation (SE)	2 – I need to work on this
Self-evaluation (SE)	3 – Not sure what this means

Group Learning Plan Machinist, Summerside



BLOCK A SE2 Occupational Skills	BLOCK A SE3 Occupational Skills
BLOCK B SE2 Bench Work	BLOCK B SE3 - Bench Work
BLOCK C SE2 Drill Presses	BLOCK C SE3 Drill Presses
BLOCK D SE2 Lathes	BLOCK D SE3 Lathes
BLOCK E SE2 Mills	BLOCK E SE3 Mills
BLOCK F SE2 Saws	BLOCK F SE3 Saws
BLOCK G SE2 Grinders	BLOCK G SE3 Grinders
BLOCK H SE2 Climate/Environment Control Systems	BLOCK H SE3 Climate/Environment Control Systems

SECTION 8 - INDIVIDUAL LEARNING PLAN AND PIE CHART (SAMPLE)

The Technical Skills Inventory (TSI) is designed to:

- introduce you to the **blocks** (*learning categories*), the **tasks** (*learning outcomes*), and **sub-tasks** (*learning objectives*) in the National Occupational Analysis (NOA).

These three sections of the NOA are used in provinces and territories to create an Apprenticeship Log Book. The log book is used by apprentices and journeypersons to record and sign- off technical skill areas learned on the job.

- help you **think about** your technical skills, then help you **list** what you know and can do;
- help you **know what technical skills to focus** on as you go through both your **school training** and while you are working under the **direction of a journeyperson**
- help you make a **technical skills learning plan** to highlight your technical skills learning needs
- help you prepare to complete a Professional Skills Record (PSR) (if needed) which lists the details and all the skill requirements in your trade

Self-Assessment (SE) ratings assigned to interpret and record data are:

- SE 0 – Yes, I did this
- SE 2 – I need to work on this
- SE 3 – Not sure what this means

Through the completion of your TSI, you have indicated you do not have any immediate learning needs in the following block(s):

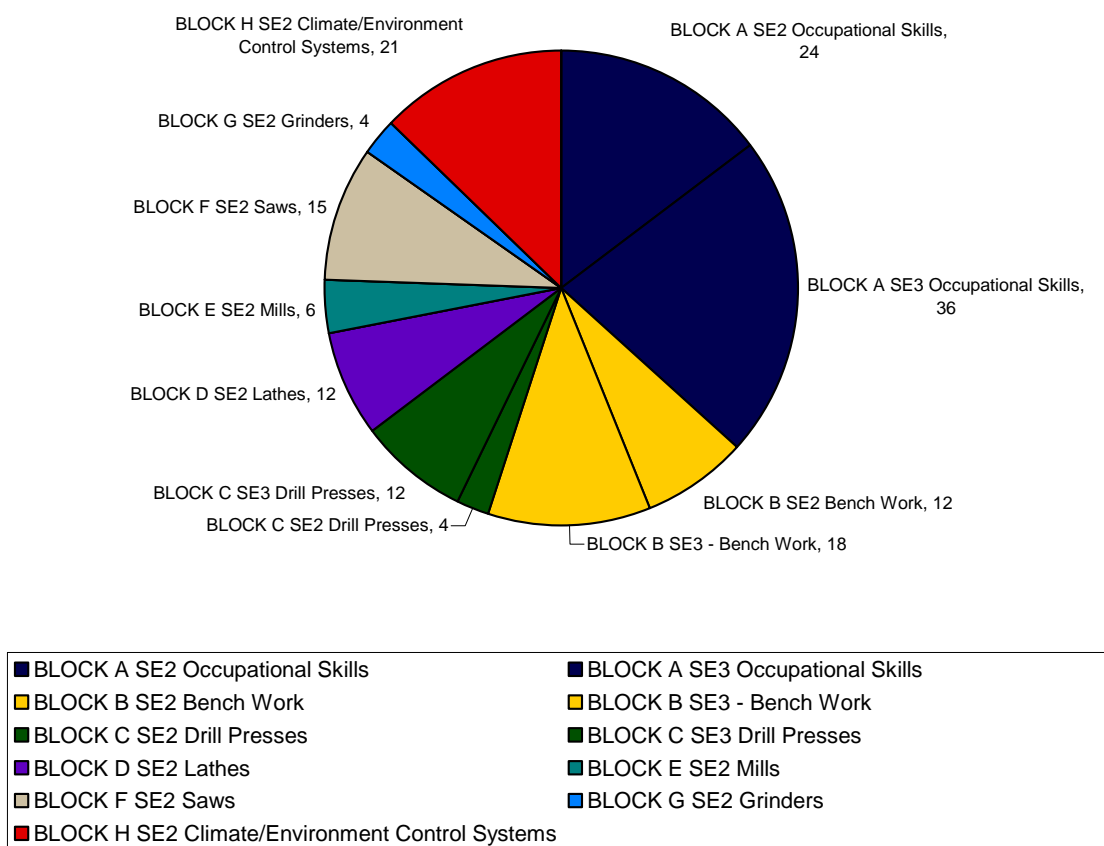
- **Block C - Drill Press**
- **Block G - Grinders**

Individualized Learning Plan

The pie chart represents the learning needs you have identified in your TSI are listed from the most need to the least need.

NOTE: Any divided section of the same colour, that may occur in your chart, highlights where you recorded both SE 2 and SE 3 in the same block.

J. Doe - Individual Learning Plan - Machinist Summerside



Technical Skills Personal Learning Plan _____ NAME _____

Technical Skills Goal:

Path to reach goal	Yes	No	How will I reach my goal?
Enter an apprenticeship Block Release program			
Enter a 6-week IP exam preparation (technical skills trade refresher program			
Technical skills self-study			
Other (explain)			

NOTE: To complete an in-depth, detailed self-assessment of technical skills in a trade, a Professional Skills Record (PSR) is available. (A PSR is the self-assessment tool used in a Recognizing Prior Learning (RPL) Assessment Process). Information on this process is available through the Apprenticeship Section through the Department of Innovation and Advanced Learning. This document is designed to be used by an Apprentice in the workplace and must be signed off by a Licensed Journeyperson.)

Additional Comments:

Apprentice Signature_____
Date_____
Trade Essential Signature(s)

