

Adult Basic Education  
**Mathematics**

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# **Mathematics 3107A**

## **Measurement Technology Design and Measurement**

# **Study Guide**

**Prerequisites:** Mathematics 2105A, 2105B and 2105C

**Credit Value:** 1

**Texts:** *Essentials of Mathematics 11*, Baron, Celia; Pacific Educational Press, 2002.  
*Essentials of Mathematics 12*, Baron, Celia; Pacific Educational Press, 2003.

### **Mathematics Courses [General College Profile]**

Mathematics 2105A  
Mathematics 2105B  
Mathematics 2105C  
**Mathematics 3107A**  
Mathematics 3107B  
Mathematics 3107C  
Mathematics 3109A  
Mathematics 3109B  
Mathematics 3109C



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## To the Student

### I. Introduction to Mathematics to 3107A

The first unit, Measurement Technology will give you experience with linear measurement in both metric (SI) and Imperial systems. Although Canada has adopted the metric system, measurements in trades areas are often given using Imperial units. For example, in carpentry, you will find most measurements in feet and inches. Therefore, you should be comfortable with both systems. You will also convert from one system to the other, (e.g. metres to feet) but conversion charts and technology will help you with this. You should not memorize conversions. You will also learn how to use Vernier calipers and micrometers in this unit. Be sure to obtain these tools before you begin.

In the second unit, Design and Measurement, you will draw simple objects in perspective and also in “exploded” format. When you purchase a piece of furniture, (e.g. desk) which must be assembled, the instruction book usually shows a diagram of the item in “exploded” format as well as a constituents parts diagram.

### II. Resources

You will require the following:

- *Essentials of Mathematics 11* and *Essentials of Mathematics 12*
- scientific calculator
- caliper
- micrometer
- grid paper

#### Notes concerning the textbook:

**Glossary:** Knowledge of mathematical terms is essential to understand concepts and correctly interpret questions. Written explanations will be part of the work you submit for evaluation, and appropriate use of vocabulary will be required.

Your text for this course includes a Glossary where definitions for mathematical terms are found. Be sure you understand such definitions and can explain them in your own words. Where appropriate, you should include examples or sketches to support your definitions.

**Examples:** You should study the **Examples** in each section carefully and see your instructor if you have any questions. These **Examples** have full solutions to problems that will be a great help when answering assigned questions from **Notebook Assignment**.

**Chapter Project:** Unless your instructor directs you differently, you should omit all **Chapter Projects** and **Project Activity**.

## To the Student

### Notes concerning technology:

You should have a scientific calculator (the word “scientific” should be written on it) and the instruction booklet that belongs with it. Scientific calculators are fairly inexpensive. Even though your calculator will be a useful tool, you should be able to solve most exercises by using paper and pencil.

### **III. Study Guide**

**This Study Guide is required at all times.** It will lead you through the course and you should take care to complete each unit of study in the order given in this Guide.

To be successful, you should read the **References and Notes** first and then, when indicated by the ☐☐ symbols, complete the **Work to Submit** problems. Many times you will be directed to see your instructor, and this is vital, especially in a Mathematics course. If you have only a hazy idea about what you just completed, nothing will be gained by continuing on to the next set of problems.

## To the Student

The Study Guide has the following format:



**Reading for this Unit:** In this box, you will find the name of the text, and the chapters, sections and pages used to cover the material for this unit. As a preliminary step, skim the referenced section, looking at the name of the section, and noting each category. Once you have completed this overview, you are ready to begin.

### References and Notes

This left hand column guides you through the material to read from the text.

It will also refer to specific **Examples** found in each Exploration. You are directed to carefully study these **Examples** with solutions and see your instructor if you have any questions. The **Examples** are important in that they not only explain and demonstrate a concept, but also provide techniques or strategies that can be used in the assigned questions.

You should read and understand the **Hints** and **New Terms** that are at the bottom of selected pages in the textbook.

The symbols   direct you to the column on the right which contains the work to complete and submit to your instructor. You will be evaluated on this material.

This column will also contain general notes which are intended to give extra information and are not usually specific to any one question.

### Work to Submit

There are two basic categories included in this column that correspond to the same categories in the sections of the text. They are **Mental Math** and **Notebook Assignment**.

**Mental Math:** These problems should be completed using pencil and paper. If you have difficulty, you should see your instructor for extra practice problems. Usually the skills that are applied in **Mental Math** are those required to successfully complete **Notebook Assignment**.

Your instructor will provide the answers to **Mental Math** exercises.

**Notebook Assignment:** This section provides a series of problems similar to those in the **Exploration**. You should attempt these problems only after the **Exploration** problems have been understood and all assigned **Mental Math** and practice worksheets have been completed.

The textbook contains answers to **Notebook Assignment**. Your instructor will provide more detailed solutions with workings and some explanations.

This column will also contain **Notes** which give information about specific questions.

## IV. Recommended Evaluation

Written Notes	10%
Assignments	10%
Test(s)	30%
Final Exam ( <i>entire course</i> )	<u>50%</u>
	100%





## Unit 1 - Measurement Technology

To fulfill the objectives of this unit, students should complete the following:

**Reading for this unit:** *Essentials of Mathematics 11*

Chapter 4: Exploration 1: pages 193, 195 - 200

Exploration 2: pages 201 - 208

Exploration 3: pages 209 - 214

Exploration 4: pages 215 - 219

Exploration 5: pages 222 - 229

Exploration 6: pages 230 - 237

Chapter Review: pages 238 - 240

Case Study: pages 242 - 244

### References and Notes

Omit all references to **Chapter Project** and **Project Activity**.

Read page 193 and **Exploration 1**.

Answer the following questions.



Ask your instructor for a copy of **Practice Exercise 1**, *Suitable Units of Linear Measure*.

Read **Exploration 2**.

**Note:** **Example 2** does the calculations with fractions using a scientific calculator which has a  $[A \frac{b}{c}]$  key. You should be able to do the same calculations using pencil and paper.

### Work to Submit

1.1 **Notebook Assignment**, pages 198 - 200  
Answer questions 1 - 7.

1.2 **Practice Exercise 1**, *Suitable Units of Linear Measure*  
Answer questions 1 - 3.

## Unit 1 - Measurement Technology

References and Notes	Work to Submit
<p>Ask your instructor for review questions on adding, subtracting and multiplying fractions.</p> <p>Study and work through the calculations given in <b>Examples 1 - 3</b>.</p> <p>If necessary, ask your instructor for review questions on finding the perimeter and area of figures similar to <b>Example 3</b>.</p> <p>Answer the following questions. ▶▶</p> <p>Ask your instructor for a copy of <b>Practice Exercise 2, Imperial and SI Measure</b> and <b>Practice Exercise 3, Word Problems</b>.</p> <p>Read <b>Exploration 3</b>.</p> <p>Study <b>Examples 1 - 4</b>.</p> <p>The easiest way to convert from one unit or another is by using a unit conversion method. This method is explained on page 210.</p> <p>You can use the sentence below to help you remember the metric system.</p> <p><b>King Henry Drank My Delicious Chocolate Milk kilo hecto deca metre deci centi milli</b></p>	<p>1.3 <b>Notebook Assignment</b>, pages 205 - 208 Answer questions 1 - 8.</p> <p>1.4 <b>Practice Exercise 2, Imperial and SI Measure</b> Answer questions 1 and 2.</p> <p>1.5 <b>Practice Exercise 3, Word Problems</b> Answer questions 1 - 4.</p>

## Unit 1 - Measurement Technology

### References and Notes

Each word in the sentence represents one decimal place. For example, 45.6 kilometres = 4, 560,000 centimetres because centi is 5 spaces to the right, therefore you move the decimal 5 places to the right.

**Note:** Decametre is dam and decimetre is dm.

Answer the following questions.



Ask your instructor for a copy of **Practice Exercise 4, Metric Prefixes**.

Read **Exploration 4**.

Ask your instructor for a copy of a conversion table similar to the one on page 216. You will need this table for frequent referral.

For this **Exploration**, you should make conversions using information in the table. Do not memorize the conversions.

The website [www.onlineconversion.com](http://www.onlineconversion.com) should be useful. Conversions between SI (metric) units and imperial units are extremely important for students interested in a career in trades.

### Work to Submit

1.6 **Practice Exercise 4, Metric Prefixes**

1.7 **Notebook Assignment**, pages 213 and 214  
Answer questions 1 - 9.  
(See note below on question 9.)

**Question 9:** Use the conversion 1 mile = 1.6093 km.

## Unit 1 - Measurement Technology

References and Notes	Work to Submit
<p>Study <b>Examples 1</b> and <b>2</b>.</p> <p>Answer the following questions. ▶▶</p> <p>Study <b>Exploration 5</b>.</p> <p>If possible, work in pairs throughout this <b>Exploration</b>.</p> <p>See your instructor to obtain a Vernier caliper. It takes a little practice to properly use Vernier calipers.</p> <p>Compare the diagram on page 223 with actual calipers.</p> <p>The Vernier caliper applet found at the following website will help you learn to read a Vernier caliper. <a href="http://www.ronblond.com/M10/Vern.APPLET/index.html">www.ronblond.com/M10/Vern.APPLET/index.html</a></p> <p>Study <b>Examples 1</b> and <b>2</b>.</p> <p><b>Note:</b> The reading for <b>Example 2</b> on page 225 is 4.61 cm NOT 4.68 cm as given in the textbook.</p> <p>Try to reproduce the measurements in these examples on your own Vernier caliper.</p>	<p>1.8 <b>Notebook Assignment</b>, pages 218 and 219 Answer questions 1 - 6.</p>

## Unit 1 - Measurement Technology

### References and Notes

Answer the following questions.



#### Read **Exploration 6**.

If possible, work in pairs or small groups. Obtain a micrometer from your instructor.

Micrometers are more precise than Vernier calipers. Compare the diagram on page 231 with the actual micrometer.

The following applet will help you learn to read a micrometer.  
[www.ronblond.com/M10/Micrometer.APPLET/index.html](http://www.ronblond.com/M10/Micrometer.APPLET/index.html)

Study **Examples 1 to 4**. Try to reproduce the measurements in these examples on an actual micrometer.

Answer the following questions.



### Work to Submit

1.9 **Class Activity**, page 225

**Note:** Check with your instructor to make sure that you are reading the calipers properly.

1.10 **Notebook Assignment**, pages 227 - 229  
Answer questions 1 - 4.

1.11 **Notebook Assignment**, pages 235 - 237  
Answer questions 1 - 5.

1.12 **Chapter Review**, pages 238 - 240  
Answer questions 1 - 10.

## Unit 2 - Design and Measurement

To fulfill the objectives of this unit, students should complete the following:

Reading for this unit: *Essentials of Mathematics 12*

Chapter 2:	Exploration 1:	pages 71, 73 - 77
	Exploration 2:	pages 78 - 81
	Exploration 3:	pages 82 - 88
	Exploration 4:	pages 89 - 93
	Exploration 5:	pages 96 - 98
	Exploration 6:	pages 100 - 106
	Chapter Review:	pages 107 and 108

### References and Notes

#### Study **Exploration 1**.

Obtain several sheets of grid paper from your instructor. Make sure that your drawings for this unit are neat and accurate.

#### Work through **Examples 1** and **2**.

If you cannot reproduce the drawings you should see your instructor. It will help if you label the vertices.

Study the **New Terms** on pages 73 and 75. You should become very familiar with using these terms appropriately.

### Work to Submit

## Unit 2 - Design and Measurement

### References and Notes

Answer the following questions.



Read **Exploration 2**.

You will need grid paper or square dot paper for this **Exploration**.

Work through **Examples 1** and **2**. Reproduce the given solutions.

Answer the following questions.



### Work to Submit

- 2.1 **Notebook Assignment**, page 77  
Answer questions 1 - 3.  
(See notes below on these questions.)

**Questions 1 and 2:** Label the vertices. You may need some extra guidance in creating one-point and two-point perspective drawings. Your instructor should be able to help you draw lines in the correct sequence.

Your instructor has detailed solutions to these problems which show the drawing and give the order in which the lines should be drawn.

**Question 3:** Don't choose a complicated object. Your instructor will be able to give you some ideas.

- 2.2 **Mental Math**, page 79  
Answer questions 1 and 2.

## Unit 2 - Design and Measurement

### References and Notes

Read **Exploration 3**.

Study **New Terms** on pages 82 and 85.

**Note:** An oblique view uses lines usually drawn at a  $45^\circ$  angle to give a sense of depth. However, the lines are not drawn to a vanishing point. You will need grid paper to create an exploded view of an object.

**Note:** An exploded view is not drawn to scale. Constituent parts, however, should be drawn to scale. Each part needs to be drawn only once with the required number of that part included in the diagram.

Study **Examples 1** and **2**. Try to reproduce the solutions.

### Work to Submit

2.3 **Notebook Assignment**, page 81  
Answer question 1.  
(See note below on question 1.)

Answer questions 2 and 3.

**Question 1:** Draw this hexagonal nut using a one-point perspective where the horizon is below the object.



## Unit 2 - Design and Measurement

References and Notes	Work to Submit
<p>Answer the following questions. ▶▶</p> <p>Ask your instructor for a copy of <b>Practice Exercise 5, Exploded Views and Constituent Parts.</b></p> <p>Read <b>Exploration 4.</b></p> <p>You will need isometric dot paper and grid paper for this exploration.</p> <p>You should note that in isometric drawings:</p> <ul style="list-style-type: none"><li>i) all vertical lines are drawn to scale</li><li>ii) the object is drawn from a corner and</li><li>iii) lines that are not vertical are at <math>30^\circ</math> angles to the vertical.</li></ul> <p>Study <b>Example 1</b> under <b>Isometric Drawings.</b> Reproduce the solution given.</p>	<p>2.4 <b>Practice Exercise 5, Exploded Views and Constituent Parts</b> Answer questions 1 - 4.</p> <p>2.5 <b>Mental Math</b>, page 85 Answer questions 1 - 3. (See note below on question 2.)</p> <p><b>Question 2:</b> Draw a diagram.</p> <p>2.6 <b>Notebook Assignment</b>, pages 86 - 88 Answer questions 1 - 5.</p>

## Unit 2 - Design and Measurement

### References and Notes

Notice the similarities and differences in the two styles of oblique drawings, cavalier and cabinet.

Ask your instructor for a copy of *Oblique Cavalier and Oblique Cabinet Drawings*.

This sheet will show the steps necessary to create these drawings.

Study **Example 1** under **Oblique Drawings**. Reproduce each of the given drawings in the solution.

Answer the following questions.  
▶▶

Read **Exploration 5**.

Work through **Example 1**, making sure that you can understand each step.

Answer the following questions.  
▶▶

### Work to Submit

2.7 **Notebook Assignment**, page 93  
Answer questions 1 - 3.

2.8 **Notebook Assignment**, page 98  
Answer question 1.

**Note:** The answers for 1b) and 1c) in the back of the text are incorrect. The correct solutions are: 1b) 42" and 1c)  $\frac{4}{3}$  yard, \$19.93.

## Unit 2 - Design and Measurement

### References and Notes

Read **Exploration 6**.

See your instructor if you cannot follow each step in **Example 1**.

**Note:** In **Example 1**, the side panels of the box are 5" by 5" and not 6" by 6" because the thickness of the wood must be considered.

Answer the following questions.



### Work to Submit

2.9 **Notebook Assignment**, pages 105 and 106  
Answer questions 1 and 2.

**Note:** The answers to question 2 in the back of the text are incorrect.

2.10 **Chapter Review**, pages 107 and 108  
Answer questions 1 - 5.