

# Adult Basic Education (ABE)

## Level III Mathematics

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### Mathematics 1101A

### Measurement/Trigonometry/Factors and Products

### Curriculum Guide

**Student Resource:** *Foundations and Pre-calculus Mathematics 10. Pearson. 2010. ISBN-13-978-0-321-62684-4.*

**Level III Degree and Technical/Business-Related College Profiles Mathematics Courses (Academic)**

**Mathematics 1101A: Measurement/Trigonometry/Factors and Products**

Mathematics 1101B: Roots and Powers/Relations and Functions

Mathematics 1101C: Linear Functions/Systems of Linear Equations

Mathematics 2101A: Reasoning/Angles and Triangles/Trigonometry

Mathematics 2101B: Radicals/Statistics/Quadratic Functions

Mathematics 2101C: Quadratic Equations/Proportional Reasoning

Mathematics 3101A: Set Theory/Counting Methods/Probability

Mathematics 3101B: Rational Expressions and Equations/Polynomial Functions/Exponential Functions

Mathematics 3101C: Logarithmic Functions/Sinusoidal Functions/Borrowing Money



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## General Information

### ***Introduction***

**Mathematics 1101A** when completed with **Mathematics 1101B and C** is equivalent to the Newfoundland and Labrador senior high school **Mathematics 1201 (Academic)** course.

### ***Pre-requisite***

Students must have completed Grade 9 mathematics or **Mathematics 2019** and **Mathematics 2020**.

### ***Resources***

The student resource for this course is:

- *Foundations and Pre-calculus Mathematics 10. Pearson. 2010. ISBN-13-978-0-321-62684-4.*

The instructor resources for this course are:

- *Foundations and Pre-calculus Mathematics 10 Teacher Resource. 2010. ISBN-13:978-0-321-62685-1.*
- *Foundations and Pre-calculus Mathematics 10 Teacher Resource CD-ROM*

Instructors may also supplement with other resources at their discretion.

### ***Study Guide***

The Study Guide provides the student with Required Work for the course. It guides the student through the course by assigning relevant reading and exercises from the student resource. Sometimes the Study Guide provides important points for students to think about, to remember or to note. The Study Guide is designed to give students some degree of independence in their work. There is information in the Curriculum Guide applicable to teaching, learning and assessment that is not included in the Study Guide. Instructors should review this information and decide how to use it when teaching students.

Instructors can also exercise professional judgment and make minor alterations to the Required Work in the Study Guide. For example, an instructor may decide that it is unnecessary to assign students all the exercises to complete within each lesson.

### ***Curriculum Guide***

The Curriculum Guide includes the specific curriculum outcomes and achievement indicators for the course. The specific curriculum outcomes are listed in numerical order, and the achievement indicators are listed alphabetically. Suggestions for teaching, learning and assessment are also provided to support student achievement of the outcomes. Some of these suggestions will also be repeated in the curriculum guides for other mathematics courses as appropriate. The curriculum guide also states the pre-requisite for each Level III mathematics course.

# Mathematics 1101A Outcomes/Achievement Indicators

## ***Unit 1: Measurement***

1. Solve problems that involve linear measurement, using: SI and imperial units of measure, estimation strategies and measurement strategies.
  - a) Provide referents for linear measurements, including mm, cm, m, km, inch, foot, yard and mile, and explain choices.
  - b) Compare SI and imperial units, using referents.
  - c) Estimate a linear measure, using a referent, and explain the process used.
  - d) Justify the choice of units used for determining a measurement in a problem solving context.
  - e) Solve problems that involve linear measure, using instruments such as rulers, calipers or tape measures.
  - f) Describe and explain a personal strategy used to determine a linear measurement.
2. Apply proportional reasoning to problems that involve conversions between SI and imperial units of measure.
  - a) Using proportional reasoning, convert a measurement within or between SI and imperial systems.
  - b) Solve a problem that involves the conversion of units within or between SI and imperial units.
  - c) Verify, using unit analysis, a conversion within or between SI and imperial systems, and explain the conversion.
  - d) Justify, using mental mathematics, the reasonableness of a solution to a conversion problem.
3. Solve problems, using SI and imperial units that involve the surface area and volume of 3-D objects, including: right cones, right cylinders, right prisms, right pyramids and spheres.
  - a) Sketch a diagram to represent a problem that involves surface area or volume.
  - b) Determine the surface area of a right cone, right cylinder, right prism, or a right pyramid, using an object or its labelled diagram.

- c) Determine an unknown dimension of a right cone, right cylinder, right prism, or right pyramid, given the object's surface area and the remaining dimensions.
- d) Determine the volume of a right cone, right cylinder, right prism, or a right pyramid using an object or its labelled diagram.
- e) Describe the relationship between the volumes of: right cones and right cylinders with the same height and base, and right pyramids and right prisms with the same base and height.
- f) Determine an unknown dimension of a right cone, right cylinder, right prism, or right pyramid, given the object's volume and the remaining dimensions.
- g) Determine the surface area and volume of a sphere, using an object or its labelled diagram.
- h) Determine an unknown dimension of a sphere, given the object's surface area and remaining dimensions.
- i) Solve a problem that involves surface area or volume, using an object or a labelled diagram of a composite 3-D object.

## ***Unit 2: Trigonometry***

1. Develop and apply the primary trigonometric ratios (sine, cosine and tangent) to solve problems that involve right triangles.
  - a) Identify the hypotenuse of a right triangle and the opposite and adjacent sides for a given acute angle in the triangle.
  - b) Explain the relationships between similar right triangles and the definition of the primary trigonometric ratios.
  - c) Use the primary trigonometric ratios to determine the measure of a missing angle in a right triangle.
  - d) Use the primary trigonometric ratios to determine the length of a missing side in a right triangle.
  - e) Solve a problem that involves indirect and direct measurement, using the trigonometric ratios, the Pythagorean Theorem and measurement instruments.
  - f) Solve a problem that involves one or more right triangles by applying the primary trigonometric ratios or the Pythagorean Theorem.

### ***Unit 3: Factors and Products***

1. Demonstrate an understanding of the multiplication of polynomial expressions concretely, pictorially and symbolically.
  - a) Explain, using examples, the relationship between multiplication and factoring polynomials.
  - b) Express a polynomial as a product of its factors.
  - c) Determine the common factors in the terms of a polynomial, and express the polynomial in factored form, concretely, pictorially and symbolically.
  - d) Factor a polynomial and verify the solution by multiplying the factors.
  - e) Explain, using examples, the relationship between the multiplication of binomials and the multiplication of two digit numbers.
  - f) Model the multiplication of two given binomials, concretely or pictorially, and record the process symbolically.
  - g) Relate the multiplication of two binomial expressions to an area model.
  - h) Model the factoring of a trinomial, concretely or pictorially, and record the process symbolically.
2. Demonstrate an understanding of common factors and trinomial factoring, concretely, pictorially and symbolically.
  - a) Identify and explain errors in polynomial factorization.
  - b) Multiply two polynomials symbolically, and combine like terms in the product.
  - c) Verify a polynomial product by substituting numbers for the variables.
  - d) Generalize and explain a strategy for multiplication of polynomials.
  - e) Identify and explain errors in a solution for a polynomial multiplication.
  - f) Factor a polynomial that is a difference of two squares, and explain why it is a special case of trinomial factoring where  $b = 0$ .

## **Recommended Evaluation**

Written Notes (Including all the Required Work)	10%
Assignments	20%
Tests	20%
Final Exam (entire course)	50%
<b>Total</b>	<b>100%</b>

Instructors have the discretion to make minor changes to this evaluation scheme.

## Unit 1: Measurement—Suggestions for Teaching and Learning

- Discuss with students that the majority of countries in the world use the SI system of measurement.
- The US is an exception to this in that it still uses imperial units of measure.
- Discuss with students that they often use both SI and imperial units; e.g., we often measure our height in feet and inches and weight in pounds, but at a hospital our height and weight is often recorded in cm and Kg.
- Discuss with students that the ability to convert between SI and imperial units of measure is very important; e.g., tradespeople must be able to convert between units on a regular basis.
- Ensure that students understand that studying geometry involving 3-D objects is important for future secondary and post-secondary courses and for careers where spatial ability is necessary.
- Discuss with students that SI means System International (International System of Units) and is based on the metric system. This is the primary system of measurement used throughout the world and in science.
- Students will probably be familiar with the fact that sporting events such as the Olympics use metric measurements.
- Students may also be familiar with the fact that the construction industry often uses imperial units (a piece of 2 in x 4 in lumber). As well, wrenches often come in both metric and imperial units.
- A referent is an object that can be used to help estimate a measurement. Discuss with students how they can use a referent to help estimate a measurement.
- Discuss proportional reasoning with students and ensure they understand how to correctly write and solve the ratios.
- Discuss with students that the decimal system is used in SI units whereas fractions are used in imperial units. Students often find calculations involving fractions more challenging.

## Unit 1: Measurement—Suggestions for Teaching and Learning

- Ensure that students understand how to convert from SI units to imperial units and imperial units to SI units. Conversion between the units should be limited to those measurements commonly used; e.g., cm-in, m-ft, etc.
- Ensure students understand how to correctly use multiplication and proportional reasoning to convert between the different units.
- Discuss with students how to check their answers to determine whether they are reasonable when doing conversions.
- Ensure students understand the concepts of surface area and volume as they will extend these concepts to right pyramids, right cones and spheres in this unit.
- Discuss with students why understanding how to calculate surface area is useful in the real-world; e.g., estimating how much paint is required to paint a room, etc.
- Ensure that students understand the difference between the height of a right pyramid and its slant height.
- Ensure students understand how to differentiate the height and slant height of a cone.
- Ensure that students correctly draw and label diagrams before attempting any calculations. Students will have to apply the Pythagorean Theorem in some problems.
- Discuss with students how they use the formula to determine an unknown dimension. Students should first substitute the given information into a formula and then solve for the unknown.
- Discuss with students that prisms are named according to the shape of the base such as triangular/rectangular prism.
- Ensure that students can correctly find a square root.
- Discuss with students how to determine the surface area and volume of composite objects involving right prisms and right cylinders. Ensure students understand to take any overlapping areas into consideration.

## **Unit 1: Measurement—Suggestions for Assessment**

- Instructors can use the BLM's on the CD-ROM to further reinforce the unit concepts.
- The BLM's on the CD-ROM can be useful for developing unit tests and the final exam.
- Instructors have discretion to combine the last unit test with the final exam if beneficial to the student.
- Students must pass the final exam with a minimum grade of 50% to receive credit for this course.
- Instructors should encourage students to reflect on the math concepts in this unit to relate to everyday life.
- Instructors should engage students in discussions to verbalize student thinking on the math concepts.
- Instructors should require students to always show complete calculations with correct units when relevant.
- Instructors can use their own professional judgment to design assessment tools (additional exercises, word problems, assignments, reflections, math journals, etc.) to meet individual student needs.

## Unit 2: Trigonometry—Suggestions for Teaching and Learning

- Discuss with students that trigonometry is the measurement of triangles. It is the branch of mathematics that deals with the relationships between the sides of a triangle and its angles.
- Students may need a review of the Pythagorean Theorem and similarity in order to begin this unit.
- Discuss the terms hypotenuse, opposite and adjacent sides with students.
- Ensure students can correctly identify the hypotenuse, opposite and adjacent sides in right triangles with a variety of sizes, labels and orientations.
- Ensure that students understand that the tangent ratio is defined as the length of the opposite side divided by the length of the adjacent side.
- Discuss real world applications using the tangent ratio.
- Discuss the concept of angle of elevation with students. Ensure students can correctly identify the angle of elevation.
- Ensure that students understand that the sine ratio is defined as the length of the opposite side divided by the length of the hypotenuse.
- Ensure that students understand that the cosine ratio is defined as the length of the adjacent side divided by the length of the hypotenuse.
- Ensure students understand that the values for sine and cosine depend only on the angle and not on the size of the triangle.
- Ensure students understand how to select the correct trigonometric function to solve a given problem.
- Ensure students understand how to use the inverse trig functions to calculate missing angles.
- Ensure students understand how to solve problems involving the angle of elevation.
- Ensure students understand how to solve problems involving the angle of depression.
- Review complementary and supplementary angles.
- Instructors should note that students may have challenges deciding where to start when solving triangles. The order in which unknown measurements are found will depend on the specific problem itself. Here are some helpful guidelines:

## Unit 2: Trigonometry—Suggestions for Teaching and Learning

- Sketch/label and organize all given information correctly on the triangle being studied;
- Use the given information to select the correct trig ratio and/or apply the Pythagorean Theorem as required; and,
- Use the property that the sum of the angles in a triangle equals  $180^0$  as required.
- Encourage students to verify all calculations. Students should also show all steps in their calculations, including units if required.

## Unit 2: Trigonometry—Suggestions for Assessment

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- Instructors should require students to always show complete calculations with correct units when relevant.
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## Unit 3: Factors and Products—Suggestions for Teaching and Learning

- Discuss with students that an understanding of multiplying and factoring polynomials is important for work in future secondary and post-secondary mathematics.
- Ensure that students understand that multiplying and factoring are inverse operations.
- Ensure that students understand that the initial step when factoring a polynomial is identifying a common factor in every term
- Instructors can provide students with the option to use algebra tiles to help multiply and factor polynomials.
- Ensure that students can use the GCF to find the common factor and then write each term as a product of the GCF and another monomial. Students can then use the distributive property to write the expression as a product. Encourage students to expand the product to see if it's the same as the original binomial.
- Demonstrate how to use algebra tiles to correctly model multiplying and factoring polynomials. Some students may prefer using algebra tiles.
- Demonstrate how to use a factor tree to find a common factor. Discuss with students that not all polynomials have a common factor.
- Review with students how to find the GCF using prime factorization.
- Ensure that students completely factor the expression when factoring.
- Demonstrate how to use a rectangle model to illustrate the multiplication of two digit numbers, and extend this when multiplying binomials of the form  $(x+d)(x+e)$ .
- Ensure that students are able to model the multiplication of two binomials correctly using algebra tiles, pictorially using a rectangle model and symbolically using the distributive property.
- Encourage students to do some of the multiplying/factoring process mentally.
- Ensure students are able to factor trinomials that contain negative terms.
- Ensure that students write polynomials in descending order.
- Ensure that students understand that sometimes a trinomial has a common factor that should be removed before factoring the trinomial into two binomials.

## Unit 3: Factors and Products—Suggestions for Teaching and Learning

- Ensure that students understand factoring by decomposition. The decomposition method is an inverse procedure from multiplying binomials.
- Ensure that students check for and remove the GCF before using other methods to factor trinomials.
- Ensure that when students remove a GCF that is negative, they do not forget to divide all the terms in the trinomial by the negative.
- Ensure that students understand how to model polynomials concretely, pictorially and symbolically for perfect square trinomials and the difference of two squares.
- Ensure that students do not confuse expressions like  $X^2 + 9$  as a difference of two squares. Discuss with students that  $X^2 + 9$  can be written as  $X^2 + 0X + 9$ .

## **Unit 3 Factors and Products—Suggestions for Assessment**

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