

Adult Basic Education (ABE)

Level III Mathematics

Mathematics 1102C

Pythagorean Relationship/Trigonometry Curriculum Guide

Student Resource: *Math at Work 10. McGraw-Hill Ryerson. 2011. ISBN 13:978-007109106-0.*

Level III General College Profile Mathematics (General)

Mathematics 1102A: Consumerism and Travel/Measuring Length/Measuring Area

Mathematics 1102B: Getting Paid/Angles

Mathematics 1102C: Pythagorean Relationship/Trigonometry

Mathematics 2102A: Surface Area/Drawing and Design/Volume and Capacity

Mathematics 2102B: Interpreting Graphs/Banking and Budgeting

Mathematics 2102C: Slope/Right Triangles and Trigonometry

Mathematics 3102A: Measurement and Probability/Data/Linear Relationships

Mathematics 3102B: Real Life Decisions/Properties of Figures

Mathematics 3102C: Transformations/Trigonometry



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General Information

Introduction

Mathematics 1102C when completed with **Mathematics 1102A and B** is equivalent to the Newfoundland and Labrador senior high school **Mathematics 1202 (Applied)** course.

Pre-requisite

Students must have completed **Mathematics 1102B**.

Resources

The student resource for this course is:

- *Math at Work 10. McGraw-Hill Ryerson. 2011. ISBN 13:978-007109106-0.*

The instructor resources for this course are:

- *Math at Work 10 Teacher's Resource. McGraw-Hill Ryerson. 2011. ISBN 13:978-007109116-9*
- *The Online Teacher's Resource Centre*
- *Math at Work 10 Teacher's 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 numerically, 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 1102C Outcomes/Achievement Outcomes

Unit 1: Pythagorean Relationship

1. Demonstrate an understanding of the Pythagorean Theorem by:
 - i. identifying situations that involve right triangles
 - ii. verifying the formula
 - iii. applying the formula
 - iv. solving problems.
 - a) Describe historical and contemporary applications of the Pythagorean Theorem.
2. Solve problems that require the manipulation and application of formulas related to:
 - i. perimeter
 - ii. area
 - iii. the Pythagorean Theorem**
 - iv. primary trigonometric ratios
 - v. income
 - a) Describe, using examples, how a given formula is used in a trade or an occupation.
 - b) Explain, using illustrations, why the Pythagorean Theorem only applies to right triangles.
 - c) Verify the Pythagorean Theorem using examples and counterexamples, including drawings, concrete materials and technology.
 - d) Determine if a given triangle is a right triangle, using the Pythagorean Theorem.
 - e) Explain why a triangle with the side length ratio of 3:4:5 is a right triangle.
 - f) Explain how the ratio of 3:4:5 can be used to determine if a corner of a given 3-D object is square (90°) or if a given parallelogram is a rectangle.
 - g) Solve a problem, using the Pythagorean Theorem.

- h) Solve a contextual problem that involves the application of a formula that does not require manipulation.
- i) Solve a contextual problem that involves the application of a formula that requires a manipulation.
- j) Create and solve a contextual problem that involves a formula.
- k) Explain and verify why different forms of the same formula are equivalent.

Unit 2: Trigonometry

1. Demonstrate an understanding of similarity of convex polygons, including regular and irregular polygons.
 - a) Determine if two or more regular or irregular are similar.
 - b) Explain why two or more right triangles with a shared acute angle are similar.
 - c) Explain the relationships between the corresponding sides of two polygons that have corresponding angles of equal measure.
 - d) Explain why two given polygons are not similar.
 - e) Solve a contextual problem that involves similarity of polygons.
 - f) Draw a polygon that is similar to a given polygon.
2. Demonstrate an understanding of primary trigonometric ratios (sine, cosine, tangent) by:
 - i. applying similarity to right triangles
 - ii. generalizing patterns from similar right triangles
 - iii. applying the primary trigonometric ratios
 - iv. solving problems
3. Solve problems that require the manipulation and application of formulas related to:
 - i. perimeter
 - ii. area
 - iii. the Pythagorean Theorem
 - iv. primary trigonometric ratios
 - v. income
 - a) Show, for a specified acute angle in a set of right triangles, that the ratios of a length of the side opposite to the length of side adjacent are equal, and generalize a formula for the tangent ratio.
 - b) Show, for a specified acute angle in a set of right triangles, that the ratios of length of the side opposite to the length of the hypotenuse are equal, and generalize a formula for the sine ratio.

- c) Show, for a specified acute angle in a set of right triangles, that the ratios of length of the side adjacent to the length of the hypotenuse are equal, and generalize a formula for the cosine ratio.
- d) Identify situations where the trigonometric ratios are used for indirect measurements of angles and lengths.
- e) Solve a contextual problem that involves right triangles, using the primary trigonometric ratios.
- f) Solve a contextual problem that involves the application of a formula that does not require manipulation.
- g) Solve a contextual problem that involves the application of a formula that requires manipulation.
- h) Explain and verify why different forms of the same formula are equivalent.
- i) Describe, using an example, how a given formula is used in a trade or an occupation.
- j) Create and solve a contextual problem that involves a formula.
- k) Identify and correct errors in a solution to a problem that involves a formula.
- l) Determine if a solution to a problem that involves primary trigonometric ratios is reasonable.

Recommended Evaluation

Written Notes (Including all the Required Work)	10%
Assignments	30%
Tests/Quizzes	60%
Total	100%

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

Unit 1: Pythagorean Relationship—Suggestions for Teaching and Learning

- Instructors should emphasize real-life applications of the Pythagorean Theorem.
- Students should understand how to represent the Pythagorean Theorem: $(\text{hypotenuse})^2 = (\text{leg})^2 + (\text{leg})^2$.
- Instructors may have to review the concepts of determining the square and square root of a number.
- Instructors may encourage students to research Pythagoras online.
- Instructors can encourage students to use grids that contain right and non-right triangles to verify that the Pythagorean Theorem works only for right triangles.
- Discuss with students a Pythagorean triple. A Pythagorean triple consist of three positive integers a , b and c such that $c^2=a^2 + b^2$. A well-known triple is $(3, 4, 5)$, another is $(6, 8, 10)$. These ratios are used often in carpentry.
- To classify a parallelogram as a rectangle it is sufficient to identify one right angle. Students should be able to the 3:4:5 ratio to show one of the triangles in a parallelogram is a right triangle, thereby proving the parallelogram is a rectangle.
- Ensure students know how to manipulate the Pythagorean Theorem formula in order to find missing sides of the right triangle.
- Ensure students understand how to apply the Pythagorean Theorem to diagrams in various orientations. Students should always be able to identify the hypotenuse regardless of diagram orientation.

Unit 1: Pythagorean Relationship—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

- Ensure that students do not confuse similarity with equality. Students should recognize that similar polygons are polygons where angles are congruent and whose corresponding sides are proportional.
- Ensure students understand that if polygons are similar, corresponding sides length are all enlarged or reduced by the same factor.
- Students should recognize that the concept of similarity is very useful in measuring the heights of inaccessible objects such as buildings, trees and mountains.
- Instructors should recognize that this may be the first exposure to trigonometry for students.
- Instructors may wish to encourage students to research a history of trigonometry online.
- Students often have difficulties correctly identifying the opposite and adjacent sides in relation to the reference angle.
- Ensure students know how to use the inverse trigonometric functions in order to determine the measure of a missing acute angle in a right triangle.
- Ensure that students understand how to correctly use a calculator to find trigonometric ratios and angle measurements for given trigonometric ratios. Note that students must keep the calculator set in the degree mode.
- Students should understand that trigonometric ratios are used in many different trades and occupations; for example, carpentry, pipefitting, surveying, navigating etc.

Unit 2: Trigonometry—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.