

# Adult Basic Education (ABE)

## Level III Mathematics

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### Mathematics 2101A

## Reasoning/Angles and Triangles/Trigonometry Curriculum Guide

**Student Resource:** *Principles of Mathematics 11. Nelson. 2011. ISBN-13: 978-0-17-650412-0.*

**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 2101A** when completed with **Mathematics 2101B** and **C** is equivalent to the Newfoundland and Labrador senior high school **Mathematics 2201 (Academic)** course.

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

Students must have passed **Mathematics 1101C**.

### ***Resources***

The student resource for this course is:

- *Principles of Mathematics 11. Nelson. 2011. ISBN-13: 978-0-17-650412-0.*

The instructor resources for this course are:

- *Principles of Mathematics 11. Nelson. 2011. ISBN-13: 978-0-17-651402-0.*
- *Principles of Mathematics 11 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 2101A Outcomes/Achievement Indicators**

### ***Unit 1: Reasoning***

1. Analyze and prove conjectures, using inductive and deductive reasoning, to solve problems.
  - a) Make conjectures by observing patterns and identifying properties, and justify the reasoning.
  - b) Explain why inductive reasoning may lead to a false conjecture.
  - c) Determine if a given argument is valid, and justify the reasoning.
  - d) Provide and explain a counterexample to disprove a given conjecture.
  - e) Prove a conjecture; using deductive reasoning (not limited two column proofs).
  - f) Prove the algebraic and number relationships such as divisibility rules, number properties, mental mathematics strategies or algebraic number tricks.
  - g) Compare, using examples, inductive and deductive reasoning.
  - h) Identify errors in a given proof; e.g., a proof that ends with  $2=1$ .
  - i) Solve a contextual problem that involves inductive or deductive reasoning.

## *Unit 2: Angles and Triangles*

1. Derive proofs that involve the properties of angles and triangles.
  - a) Generalize, using inductive reasoning, the relationships between pairs of angles formed by transversals and parallel lines, with or without technology.
  - b) Verify, with examples, that if lines are not parallel, the angle properties do not apply.
2. Solve problems that involve properties of angles and triangles.
  - a) Construct parallel lines, given a compass or a protractor, and explain the strategy used.
  - b) Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle.
  - c) Identify and correct errors in a given proof of a property that involves angles.
  - d) Determine the measures of angles in a diagram that includes parallel lines, angles and triangles and justify the reasoning.
  - e) Determine if lines are parallel given the measure of an angle at each intersection formed by the lines and a transversal.
  - f) Identify and correct errors in a given solution to a problem that involves the measures of angles.
  - g) Solve a contextual problem that involves angles or triangles.
  - h) Generalize, using inductive reasoning, a rule for the relationship between the sum of the interior angles and the number of sides ( $n$ ) in a polygon, with or without technology.
  - i) Prove, using deductive reasoning, that two triangles are congruent.

### ***Unit 3: Trigonometry***

1. Solve problems that involve the cosine law and the sine law, excluding the ambiguous case.
  - a) Explain the steps in a given proof of the sine law or cosine law.
  - b) Draw a diagram to represent a problem that involves the sine law or cosine law.
  - c) Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
  - d) Solve a contextual problem that involves more than one triangle.

## **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: Reasoning—Suggestions for Teaching and Learning

- Ensure that students understand that inductive reasoning is a form of reasoning in which a conclusion is reached based on a pattern present in a number of observations.
- Ensure that students understand that deductive reasoning is the process of coming up with a conclusion based on facts that have already been shown to be true.
- Ensure that students understand that a conjecture is a testable expression that is based on evidence available but is not proven.
- Discuss with students that sometimes inductive reasoning can lead to false conjectures. Ask students to think of examples.
- Discuss with students strategies such as drawing diagrams or pictures when looking for a counterexample.
- Discuss with students that inability to find a counterexample does not automatically prove a conjecture.
- Ensure that students use proper mathematical terminology when constructing proofs.
- Discuss with students that certain strategies are more efficient when constructing proofs than others; for example, when giving a conjecture involving a geometric figure, a two-column proof is appropriate.
- Ensure that students understand how to analyze proofs that have errors. Students should be able to identify errors in a given proof and make necessary corrections.
- Ensure students understand how to problem solve requiring inductive and/or deductive reasoning.

## **Unit 1: Reasoning—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: Angles and Triangles—Suggestions for Teaching and Learning

- Discuss with students when in real life you would see parallel and perpendicular lines.
- Ensure students understand the term, “transversal.”
- Ensure students are able to name the angles formed when two parallel lines are intersected by transversal.
- Ensure students understand the various angle properties relative to two parallel lines intersecting by a transversal.
- Ensure students realize that the angle properties do not apply when a transversal intersects a pair of non-parallel lines. **Note:** the property vertically opposite angles do apply.
- Ensure students are able to construct parallel lines and verify the angle relationships found by the intersecting transversal.
- Ensure that students understand various methods for constructing parallel lines: using a compass, protractor, etc.
- Ensure students are able to determine the measurements of unknown angles using the angle properties.
- Ensure that students are able to prove, using deductive reasoning, that the sum of the interior angles of a triangle is  $180^\circ$ .
- Ensure that students are able to distinguish between convex and non-convex (concave) polygons.
- Ensure students discuss the relationship between the sums of the interior angles the number of sides in a convex polygon using the angle property.
- Ensure that students understand the side-side-side (SSS) relationships of congruent triangles.
- Ensure that students understand the angle-side-angle (ASA) relationship of congruent triangles.
- Ensure that students understand the side-angle-side (SAS) and side-angle-angle (SAA) relationships of congruent triangles.
- Ensure that students understand that angle-angle-angle (AAA) relationship produces similar triangles but not congruent triangles.

## **Unit 2: Angles and Triangles—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 3: Trigonometry—Suggestions for Teaching and Learning**

- Ensure that students are able to derive the law of sines using the area formula of a right triangle.
- Ensure that students are able to apply the sine law to determine unknown lengths and angle measurements in acute and right angles.
- Ensure students realize that the law of sines will not work if no angle of the triangle is known and its appropriate side is not given.
- Ensure students do not incorrectly identify the side and opposite angle pairs when using the law of sines.
- Ensure students can derive, prove, and use the cosine law to solve a triangle.
- Discuss with students what information is needed to use the cosine law. They should consider why the cosine law is the only option to find the unknown angle if only sides known or if two sides and the included angle are known.
- Ensure that students understand that if they know two sides and a non-included angle, they can use the cosine law and the sine law to find the other side; or they can use the sine law twice.

### **Unit 3: 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.
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