Adult Basic Education

Level II Mathematics

Mathematics 2020
Algebra Readiness II

Curriculum Guide

Suggested Resource: *Prism Math Purple Student Workbook (Canadian Edition). McGraw-Hill Ryerson. 2005. ISBN 13: 978-0-07-096047-3 (10:0-07-096047-X).*

Level II Mathematics Courses
Mathematics 2011: Whole Numbers
Mathematics 2012: Fractions
Mathematics 2013: Decimals
Mathematics 2014: Percents
Mathematics 2015: Interest
Mathematics 2016: Measurement
Mathematics 2017: Geometry
Mathematics 2018: Statistics and Probability
Mathematics 2019: Algebra Readiness I
Mathematics 2020: Algebra Readiness II

Newfoundland Labrador

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To the Instructor

Introduction to Mathematics 2020: Algebra Readiness II

This course is the tenth in series of ten ABE Level II Mathematics courses. This course, along with **Mathematics 2019: Algebra Readiness I**, is mandatory for any student who has not successfully completed Grade 9 Mathematics and who intends on completing the Academic Mathematics stream in Level III. These two courses are more challenging and have more content than the other Level II Mathematics courses. This course focuses on perimeter, area, volume, equations, integers, exponents and linear functions.

Students may/may not have to complete all ABE Level II Mathematics courses. Students are only required to complete sufficient Level II Mathematics courses to ensure success in one of the Level III graduation profiles. For example, a Level II student intending to complete the Degree-Technical Profile (Academic) in Level III may need to complete more Level II Mathematics courses than a student intending to complete the General College Profile (General) in Level III.

Mathematics 2020: Algebra Readiness II is divided into three units. The outcomes for this course are given below. By completing the **Required Work** in the Study Guide, students will fulfill the outcomes for this course.

The first unit, ***Perimeter, Area and Volume,*** will cover the following course outcomes:

1.01 Calculate perimeter of polygons.
1.02 Calculate the circumference of circles.
1.03 Calculate the area of rectangles.
1.04 Calculate the area of triangles.
1.05 Calculate the area of circles.
1.06 Calculate the area of parallelograms.
1.07 Calculate the surface area of rectangular prisms.
1.08 Calculate the surface area of triangular prisms.
1.09 Calculate the surface area of cylinders.
1.10 Calculate the surface area of triangular prisms.
1.11 Calculate the volume of a cylinder.
1.12 Calculate the volume of a cone.
1.13 Calculate the volume of a pyramid.
1.14 Solve word problems related to perimeter, area and volume.

To the Instructor

The second unit, ***Equations and Integers,*** will cover the following course outcomes:

2.01 Translate phrases into algebraic expressions.
2.02 Translate algebraic expressions into phrases.
2.03 Understand the following properties of numbers: commutative, associative, identity, and zero.
2.04 Use the distributive property in algebraic expressions.
2.05 Evaluate algebraic expressions using the Order of Operations.
2.06 Solve equations using addition and subtraction.
2.07 Solve equations using multiplication and division.
2.08 Solve two-step algebraic equations.
2.09 Solve algebraic equations requiring multiple steps.
2.10 Solve algebraic inequalities.
2.11 Compare and order integers.
2.12 Write the absolute value for a number.
2.13 Add and subtract integers.
2.14 Multiply and divide integers.

The third unit, ***Exponents and Linear Functions***, will cover the following course outcomes:

3.01 Write numbers using exponential and standard form.
3.02 Write numbers using negative exponents and standard form.
3.03 Evaluate expressions using negative exponents.
3.04 Multiply and divide exponents.
3.05 Write numbers using scientific notation.
3.06 Use ordered pairs to locate points on a coordinate plane.
3.07 Create a table of values given a function rule.
3.08 Graph linear functions using a table of values.
3.09 Find the slope for a given linear function.
3.10 Find the slope for a line passing through a pair of points.
3.11 Name the slope and y-intercept of a linear function.
3.12 Graph a linear function using the slope-intercept form.

To the Instructor

Students are required to complete three assignments and three unit tests in this course. Instructors have flexibility to substitute another assignment and/or tests, or to adjust the evaluation scheme to meet the needs of individual students.

Curriculum Guide

Each new ABE Level II Mathematics course has a Curriculum Guide for the instructor and a Study Guide for the student. The Curriculum Guide includes the specific curriculum outcomes for the course. Suggestions for teaching, learning and assessment are provided to support student achievement of the outcomes. Some suggestions for teaching, learning and assessment will be repeated in the curriculum guides for the Mathematics courses when appropriate. Each Level II Mathematics course is divided into two units except **Mathematics 2019: Algebra Readiness I** and **Mathematics 2020: Algebra Readiness II**. The two pre-algebra courses are required for any Level II student, who has not successfully completed Grade 9 Mathematics, intending to do the academic mathematics stream in Level III. These two courses are more challenging and have more content than the other Level II Mathematics courses. Each unit is presented in the Curriculum Guide as a **two-page layout of four columns** as illustrated in the figure below.

Curriculum Guide Organization
The Two-Page, Four-Column Spread

Unit Number – Unit Title	
Outcomes Specific curriculum outcomes for the unit.	**Notes for Teaching and Learning** Suggested activities, elaboration of outcomes, and background information.

Unit Number – Unit Title	
Suggestions for Assessment Suggestions for assessing students' achievement of outcomes.	**Resources** Recommended resources that address outcomes.

To the Instructor

Study Guide

The Study Guide provides the student with the name of the text required for the course and specifies the lessons and pages that the student will need to refer to in order to complete the **Required Work** for the course. It guides the student through the course by assigning relevant reading and exercises. 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. Instructors should note, however, that there is material in the Curriculum Guide in the *Notes for Teaching and Learning* and *Suggestions for Assessment* columns that is not included in the Study Guide, and instructors will need to review this information and decide how to include it.

Resources

Recommended student resources for this course:

- *Prism Math Purple Student Workbook (Canadian Edition)*. McGraw-Hill Ryerson. 2005. ISBN 13: 978-0-07-096047-3 (10:0-07-096047-X). http://www.mcgrawhill.ca

Recommended instructor resources:

- *Prism Math Purple Teacher's Edition (Canadian Edition)*. McGraw-Hill Ryerson. 2005. ISBN 007096048-8. http://www.mcgrawhill.ca

The *Prism Math Purple Student Workbook* is designed to help struggling students gain a solid understanding of and confidence in numeracy fundamentals. This is a non-grade specific text that is focused on easy-to-understand instructions as well as review materials and assessment opportunities. Feedback from Newfoundland and Labrador ABE instructors in 2010 indicated a desire for one Level II Mathematics student text, and this resource meets this purpose. This resource is also used in adult learning settings in other Atlantic jurisdictions.

The purple text is selected for the two Algebra Readiness courses because the content of the purple text is at a slightly higher level than the blue text.

To the Instructor

The *Prism Math Purple Teacher's Edition* mirrors the student workbook, but contains the following helpful additions:

- All answers are conveniently provided for each assigned exercise.
- Error Analysis at the bottom of each lesson gives suggestions for responding to and assessing student performance.
- Blackline Masters (BLM's) of chapter tests are contained in this resource. These masters can be photocopied and used by instructors for chapter tests/exams/etc.

Recommended Evaluation

Assigned Exercises	20%
Assignments	30%
Unit Tests	50%
	100%

The overall pass mark for the course is 50%.

Note: The evaluation scheme recommended above is presented as a suggestion. Institutions may choose an alternate evaluation scheme in order to meet the individual needs of adult learners. The Department of Education has no requirement that a final exam must be given in this course. Instructors/institutions can decide if a final exam is necessary based on their own policies and procedures.

Unit 1: Perimeter, Area and Volume —Suggestions for Teaching, Learning and Assessment

Outcomes	Notes for Teaching and Learning
1.01 Calculate perimeter of polygons. 1.02 Calculate the circumference of circles. 1.03 Calculate the area of rectangles. 1.04 Calculate the area of triangles. 1.05 Calculate the area of circles. 1.06 Calculate the area of parallelograms. 1.07 Calculate the surface area of rectangular prisms. 1.08 Calculate the surface area of triangular prisms. 1.09 Calculate the surface area of cylinders. 1.10 Calculate the surface area of triangular prisms. 1.11 Calculate the volume of a cylinder. 1.12 Calculate the volume of a cone.	• This course extends on material related to perimeter, area and volume introduced in **Mathematics 2017**. • Instructors may need to review the basic material related to perimeter, area and volume. • Perimeter is the distance around a shape and is measured in linear units. Area is the amount of surface a shape covers and is measured in square units. Volume is the capacity of a shape to hold a liquid or the amount of units a shape can contain. Volume is measured in cubic units. • Students should understand that circumference is the distance around a circle, and that the ratio of the circumference, C, to the diameter, d, of a circle, C/d is approximately 3. • The Greek letter pi (π) is used to represent this ratio, which can be expressed as pi = C/d. • Pi is an irrational number approximately equal to 3.14 for the purpose of our calculations. • Students will be working with more formulas in this course as compared to **Mathematics 2017**. Instructors should encourage students to record these formulas as they progress through this course. Students should also write an example of how to use each formula. • Instructors should point out to students that you can find the height of a triangle by measuring the distance from one vertex of the triangle to the opposite side (the base). The line used for the height must always be perpendicular to the base. Sometimes it is necessary to extend the base using a broken line. • Although students are familiar with circles, instructors may wish to define a circle in a mathematical sense. A circle is a figure with all points equidistant from a centre point. • Students also need to understand the relationship between the radius of a circle and the diameter.

Unit 1: Perimeter, Area and Volume —Suggestions for Teaching, Learning and Assessment

Outcomes	**Notes for Teaching and Learning**
	• Instructors should ensure that students understand that when finding the circumference of a circle, either the radius or diameter can be used; but, when finding the area of circle, it is the radius that must be used. If a circle area problem is given with a stated diameter, you must divide the diameter by 2 to get the radius. • Remind students that the height for a parallelogram is found in a similar manner as for a triangle. • In general, a prism has two congruent bases and is named for its bases; for example, rectangular and triangular prisms. • A pyramid has one base and the other faces are all congruent triangles. • Instructors can provide students with nets to concretely model the three dimensional shapes being studied in this unit. A net is a diagram that can be folded to make a shape. • The surface area of a rectangular prism is the total of the areas of its rectangular faces. Note that the surface area is the same as the area of the prism's net. • Students will be familiar with rectangular solids as many common objects such as cereal boxes are this shape. • Instructors should ensure that students remember to use cubic units when measuring volume. • Students will encounter right circular cylinders most often in their study of ABE mathematics. Right circular cylinders are figures where the top and bottom are circles, and the side makes a right angle with the top and bottom. Examples are pop cans and home hot water tanks. • Instructors should point out that the B used in the formulas for the volume of a cylinder and a pyramid represents the area of the base. For a cylinder, the B is the area of a circle, and for a pyramid, the B is the area of a square. • Instructors should encourage students to draw and label diagrams when solving word problems related to perimeter, area and volume.

Unit 1: Perimeter, Area and Volume —Suggestions for Teaching, Learning and Assessment	
Suggestions for Assessment	**Recommended resources that address outcomes.**
• Instructors may ask students to complete the *Chapter 11 Pre-test* to determine their prior knowledge of perimeter, area and volume. • If a student scores an acceptable grade on the pre-test(s), it is unnecessary for the student to complete the unit/course as competency will be established. The student should show all calculations on the pre-test(s), and complete it without using a calculator. It is recommended that this grade be 80% or above. • Instructors can use the grade on the pre-test(s) as the final grade for the course. In courses where there is more than one pre-test related to the material, the final course grade can be the average of the pre-tests. This grade can be entered on the ABE database as part of the official ABE transcript. • Instructors should follow the suggestions given in **Lesson Follow-up and Error Analysis** section found in the *Teacher's Edition*. This section is written in blue and is at the bottom of the page containing each lesson.	• *Prism Math (Purple)*, page 158. Answers on the same pages of the *Prism Math (Purple) Teacher's Edition*.
• Answers for all exercises and word problems are contained in the *Teacher's Edition*. Instructors can quickly assess and provide feedback on student performance. • A chapter test Blackline Master (BLM) corresponding to this unit is found in the assessment section of the *Teacher's Edition* (near the end of the book).This BLM is suitable to be administered to students as part of the official evaluation for the course. Answers are also provided in the *Teacher's Edition*. • Instructors can use their professional judgement to design their own assessment tools (additional exercises and word problems, assignments, tests, exams, etc) to meet the individual needs of students.	• *Prism Math (Purple) Teacher's Edition*, pages 265-277.

Unit 2: Equations and Integers —Suggestions for Teaching, Learning and Assessment

Outcomes	**Notes for Teaching and Learning**
2.01 Translate phrases into algebraic expressions. 2.02 Translate algebraic expressions into phrases. 2.03 Understand the following properties of numbers: commutative, associative, identity, and zero. 2.04 Use the distributive property in algebraic expressions. 2.05 Evaluate algebraic expressions using the Order of Operations. 2.06 Solve equations using addition and subtraction. 2.07 Solve equations using multiplication and division. 2.08 Solve two-step algebraic equations. 2.09 Solve algebraic equations requiring multiple steps. 2.10 Solve algebraic inequalities.	• The equations material in this unit is an extension of the material covered in **Mathematics 2019**. • Students should already be aware that algebraic expressions can be used to represent word statements. • Instructors can point out to students that in algebraic expressions, a letter such as x, y or n is used to represent a quantity. • Students should understand that when we want to indicate that a number is multiplied by a letter, we write the number followed by a letter; for example, 3x. • An equation is a statement that two algebraic expressions are equal; for example, $2x = 10$ and $5x + 2 = 12$. Equations will contain an equal sign (=), but an expression will not. • Expressions are evaluated by replacing (substituting) each variable (letter) with its given value. • Instructors can explain to students that when you solve an equation, you find the value of the variable that makes the equation true. • Trial and error and inspection are two basic methods of solving equations. Although some students may be able to quickly solve all the equations presented in the text by inspection, it is necessary for them to develop equation solving skills using mathematical operations. Students must not be permitted to simply solve by inspection and write a solution even if it is correct. • Students are required to show all calculations and all steps should be written in order along with the solution. • Instructors may need to explain, using examples, the number properties to students. • Instructors should ensure that students understand the distributive property as this property is often used in algebra, especially when solving equations and factoring. When using the distributive property, students often make the mistake of multiplying the first terms together but forget to multiply the second terms.

Unit 2: Equations and Integers —Suggestions for Teaching, Learning and Assessment

Outcomes	**Notes for Teaching and Learning**
2.11 Compare and order integers. 2.12 Write the absolute value for a number. 2.13 Add and subtract integers. 2.14 Multiply and divide integers.	• Instructors can use balance scale models/diagrams to represent the equations in this unit. Algebra tiles can also be used or drawn to represent the equations. • Instructors should ensure that students understand that when you use algebraic operations to solve an equation, the same operation is performed to both sides of the equation. • Instructors should encourage students to always verify their solutions by substituting their solution into the original equation. The left-hand side and right-hand side of the equation will be equal if the solution is correct. • Instructors may need to explain the inequality signs to students. Students may be familiar with less than and greater than in terms of comparing whole numbers, fractions, decimals and percents, but may be unfamiliar with inequality as applied to equations. • Instructors should introduce integers by discussing real-life situations that require signed numbers: describing the weather (temperature), height above/below sea level, directions, etc. • Instructors can explain to students that a positive number can be written in two ways—with or without a + sign in front of the number. • Number lines are useful for comparing and ordering integers. The lesser of the two integers is the one farther to the left on a number line. The greater of the two integers is the one farther to the right on a number line. • Students should understand that the absolute value of a number is always positive. This is because absolute value is the distance a number is from 0 on a number line. • Integer tiles can be used to represent integers. Students that learn in a more concrete manner will benefit from using or diagramming integer tiles. • Instructors can also show students how to model integer addition and subtraction using a number line.

Unit 2: Equations and Integers —Suggestions for Teaching, Learning and Assessment

Outcomes	**Notes for Teaching and Learning**
	• Instructors should teach students more than one method for modeling integer addition and subtraction as this will help students to solve problems one way and verify answers using another method. • There are rules for adding and subtracting integers, but it is more important for students to understand and apply the rules rather than spend too much time attempting to memorize them. • When adding two positive numbers, the answer is positive. • When adding two negative numbers, then answer is negative. • When adding two numbers with different signs, subtract the lesser absolute value from the greater absolute value, the answer has the sign of the number with the greater absolute value. • Instructors should explain to students the operation of subtraction: to subtract two numbers, add the first number to the opposite (additive inverse) of the second number. • To subtract two signed numbers, first change the subtraction sign to an addition sign; second, change the sign of the second number to its opposite; then, continue as for an addition problem. • A pattern that is used for subtraction of integers is: 1st number – 2nd number = 1st number + opposite of 2nd number. • The following rules are for multiplication and division of integers: The product/quotient of two non-zero integers with the same sign is positive; the product/quotient of two non-zero integers with different signs is negative.

Unit 2: Equations and Integers —Suggestions for Teaching, Learning and Assessment

Suggestions for Assessment	**Recommended resources that address outcomes.**
• There is no pre-test included in the text to cover the material presented in this unit. Instructors will have to construct their own pre-test to administer to students. • If a student scores an acceptable grade on the pre-test(s), it is unnecessary for the student to complete the unit/course as competency will be established. The student should show all calculations on the pre-test(s), and complete it without using a calculator. It is recommended that this grade be 80% or above. • Instructors can use the grade on the pre-test(s) as the final grade for the course. In courses where there is more than one pre-test related to the material, the final course grade can be the average of the pre-tests. This grade can be entered on the ABE database as part of the official ABE transcript. • Answers for all exercises and word problems are contained in the *Teacher's Edition*. Instructors can quickly assess and provide feedback on student performance. • The text does not contain a Blackline Master (BLM) corresponding to this unit in the assessment section of the *Teacher's Edition*. Instructors will have to construct a test to cover the material in this unit. • Instructors can use their professional judgement to design their own assessment tools (additional exercises and word problems, assignments, tests, exams, etc) to meet the individual needs of students.	

Unit 3: Exponents and Linear Functions —Suggestions for Teaching, Learning and Assessment

Outcomes	Notes for Teaching and Learning
3.01 Write numbers using exponential and standard form. 3.02 Write numbers using negative exponents and standard form. 3.03 Evaluate expressions using negative exponents. 3.04 Multiply and divide exponents. 3.05 Write numbers using scientific notation. 3.06 Use ordered pairs to locate points on a coordinate plane. 3.07 Create a table of values given a function rule. 3.08 Graph linear functions using a table of values. 3.09 Find the slope for a given linear function. 3.10 Find the slope for a line passing through a pair of points. 3.11 Name the slope and y-intercept of a linear function.	• Instructors should explain to students that exponents are used to show repeated multiplication. The exponent in the power is equal to the number of factors in the repeated multiplication. • Instructors should explain, using examples, the term "base" and "exponent". • Students should understand that any number with an exponent of 0 is equal to 1. • Instructors can show students how powers of 10 work; namely, that the exponent is equal to the number of zeros following the 1. • Students may not be as familiar with negative exponents. Instructors may explain, using examples, how to write negative exponents both in exponential and standard forms. • Instructors should explain to students the laws for multiplication and division for expressions having the same base and containing exponents: 1) when multiplying expressions with the same base, add the exponents; and 2) when dividing expressions with the same base, subtract the exponents. • Instructors should require students to write all answers without using negative exponents in the final answer. • Instructors should explain, using examples, the purpose of scientific notation: to write extremely large and extremely small numbers. Examples to consider: distance to stars, mass of the sun, mass of an electron, etc. • Instructors should review the following with students: 1) how to multiply and divide by powers of 10, and 2) the laws of exponents. • The steps to write a number in scientific notation are: 1) move the decimal point in the given number such that there is only one digit to its left—we'll call the resulting number A; 2) count the number of places you have to move the decimal point in step 1—if the decimal point is moved to the left, the exponent, n, is positive, it is moved to the right, n is negative; and 3) write the scientific notation $A \times 10^n$.

Unit 3: Exponents and Linear Functions —Suggestions for Teaching, Learning and Assessment

Outcomes	**Notes for Teaching and Learning**
3.12 Graph a linear function using the slope-intercept form.	• Instructors should explain to students that a coordinate grid has two perpendicular lines. The horizontal line is called the x-axis, and the vertical line is the y-axis. The point of intersection of the two lines is called the origin (0, 0). • An ordered pair, such as (2, 5), tells you the position of a point on a coordinate. The first number in the pair is the x-coordinate and it tells you the horizontal distance from the origin. The second number, the y-coordinate, tells you the vertical distance from the origin. • Students are expected to graph in the four quadrants in this course. Instructors should ensure that students understand how the quadrants are named. • Instructors should ensure that students understand how a given function rule is used to generate a table of values. Students should draw a table of values for each function rule given in the text. All calculations should be shown. • Instructors should discuss with students how to select appropriate x values to include in the table of values. • Students should understand that a linear function produces a straight line when graphed on a coordinate grid. • Instructors will have to ensure that students are able to correctly calculate slope. Ensure that students do not confuse where to place the x and y coordinates in the slope formula. • Instructors should explain and demonstrate, using positive and negative slopes, how to graph using the slope-intercept form of an equation. • As an extension to the material in the text, instructors should discuss linear functions with 0 slope (horizontal lines) and with undefined slope (vertical lines).

Unit 3: Exponents and Linear Functions —Suggestions for Teaching, Learning and Assessment

Suggestions for Assessment	**Recommended resources that address outcomes.**
• There is no pre-test included in the text to cover the material presented in this unit. Instructors will have to construct their own pre-test to administer to students. • If a student scores an acceptable grade on the pre-test(s), it is unnecessary for the student to complete the unit/course as competency will be established. The student should show all calculations on the pre-test(s), and complete it without using a calculator. It is recommended that this grade be 80% or above. • Instructors can use the grade on the pre-test(s) as the final grade for the course. In courses where there is more than one pre-test related to the material, the final course grade can be the average of the pre-tests. This grade can be entered on the ABE database as part of the official ABE transcript. • Answers for all exercises and word problems are contained in the *Teacher's Edition*. Instructors can quickly assess and provide feedback on student performance. • The text does not contain a Blackline Master (BLM) corresponding to this unit in the assessment section of the *Teacher's Edition*. Instructors will have to construct a test to cover the material in this unit. • Instructors can use their professional judgement to design their own assessment tools (additional exercises and word problems, assignments, tests, exams, etc) to meet the individual needs of students.	