Adult Basic Education (ABE)

Level III Mathematics

Mathematics 1101B

Roots and Powers/Relations and Functions Curriculum Guide

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

Newfoundland
Labrador

<u>Contents</u>

General Information

Introduction

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

Pre-requisite

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

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 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 1101B Outcomes/Achievement Indicators

Unit 1: Roots and Powers

1. Demonstrate an understanding of factors of whole numbers by determining the: prime factors, greatest common factor, least common multiple, square root and cube root.

    a) Determine the prime factors of a whole number.
    b) Explain why the numbers 0 and 1 have no prime factors.
    c) Determine, using a variety of strategies, the greatest common factor or least common multiple of a set of whole numbers, and explain the process.
    d) Solve problems that involve prime factors, greatest common factors, least common multiples, square roots or cube roots.
    e) Determine, concretely, whether a given whole number is a perfect square, a perfect cube or neither.
    f) Determine, using a variety of strategies, the square root of a perfect square, and explain the process.
    g) Determine, using a variety of strategies, the cube root or a perfect cube, and explain the process.

2. Demonstrate an understanding of irrational numbers by: representing, identifying and simplifying irrational numbers and ordering irrational numbers.

    a) Explain, using examples, the meaning of the index of a radical.
    b) Sort a set of numbers into rational and irrational numbers.
    c) Represent, using a graphic organizer, the relationship among the subsets of the real numbers (natural, whole, integer, rational and irrational).
    d) Determine an approximate value of a given irrational number.
    e) Approximate the locations of irrational numbers on a number line, using a variety of strategies, and explain the reasoning.
    f) Order a set of irrational numbers on a number line.
    g) Express a radical as a mixed radical in simplest form (limited to numerical radicands).

h) Express a mixed radical as an entire radical (limited to numerical radicands).
3. Demonstrate an understanding of powers with integral and rational exponents.
   a) Express powers with rational exponents as radicals and vice versa.
   b) Solve a problem that involves exponent laws or radicals.
   c) Apply the exponent laws.
   d) Identify and correct errors in a simplification of an expression that involves powers.

Unit 2: Relations and Functions

1. Demonstrate an understanding of relations and functions.
    a) Represent a relation in a variety of ways.
    b) Identify independent and dependent variables in a given context.
    c) Determine if a set of ordered pairs represents a function.
    d) Explain, using examples, why some relations are not functions, but all functions are relations.
    e) Sort a set of graphs as functions or non-functions.
    f) Generalize and explain rules for determining whether graphs and sets of ordered pairs represent functions.
2. Represent a linear function, using function notation.
    a) Express the equation of a linear function in two variables using function notation.
    b) Determine the related range value, given a domain value for a linear function.
    c) Determine the related domain value, given a range value for a linear function.
3. Interpret and explain the relationship among data, graphs and situations.
    a) Describe a possible situation for a given graph.
    b) Sketch a possible graph for a given situation.
    c) Explain why data points should or should not be connected on the graph for a given situation.
    d) Graph with, or without technology, a set of data, and determine the domain and range.
    e) Determine, and express in a variety of ways, the domain and range of a graph, a set or ordered pairs or a table of values.
4. Describe and represent linear relations, using: words, ordered pairs, table of values, graphs and equations.
    a) Match corresponding representations of linear relations.
    b) Determine whether a table of values or a set of ordered pairs represents a linear relation, and explain why or why not.
    c) Determine whether a graph represents a linear relation, and explain why or why not.

d) Draw a graph given a set of ordered pairs and determine whether the relationship is linear.

e) Determine whether an equation represents a linear relation, and explain why or why not.

5. Determine the characteristics of the graphs of linear relations, including the: intercepts, rate of change, domain and range.

    a) Determine the rate of change of the graph of a linear relation.

    b) Determine the intercepts of the graph of a linear relation, and state the intercepts as values or ordered pairs.

    c) Determine the domain and range of the graph of a linear relation.

    d) Identify the graph that corresponds to a given rate of change and vertical intercept.

    e) Identify the rate of change and vertical intercept that correspond to a given graph.

    f) Solve a contextual problem that involves intercepts, rate of change, domain or range of a linear relation.

    g) Sketch the graph of a linear function expressed in function notation.

    h) Sketch a linear relation that has one intercept, two intercepts or an infinite number of intercepts.

Recommended Evaluation

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

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

Unit 1: Roots and Powers—Suggestions for Teaching and Learning

- Review prime and composite with students, and ensure students understand prime factorization.
- Ensure students do not confuse factor and prime factorization.
- Ensure students understand how to use factor trees and repeated division to determine factors.
- Discuss with students why 0 and 1 have no prime factors.
- Ensure students understand how to determine the GCF. Students can write the factors of each number and choose the largest common factor, or they could write the prime factorization of each number and then multiply the common prime factors (this method is more efficient when using large numbers).
- Ensure students understand how to use the GCF to simplify fractions.
- Ensure students understand how to find the LCM. Students can list the multiples of each number and identify the smallest common number in both lists; also, students can write the prime factorization of each number.
- Note that students often have difficulty solving real-life problems when they have to determine whether to use GCF or LCM.
- Ensure students understand how to model and find the square root of a perfect square number.
- Ensure students understand how to model and find the cube root of a cubic number.
- Ensure students are able to calculate the square root of perfect square numbers and cube root of perfect cubic numbers before using calculators.
- Ensure that students know how to correctly use the square root and cube root functions on a calculator.
- Ensure that students understand the relationship between the exponent in a power and the index in a radical.
- Ensure that students understand the concept of irrational number.
- Ensure that students understand that the irrational numbers, along with the rational numbers, form the system of real numbers.

Unit 1: Roots and Powers—Suggestions for Teaching and Learning

- Discuss with students why the square root of a negative number does not belong to the real number system.
- Ensure that students understand how to work with mixed radicals and entire radicals.
- Ensure students understand how to write a mixed radical in simplest form.
- Encourage students to factor out the greatest perfect n^{th} factor.
- Ensure that students understand powers using fractional and negative exponents.
- A common error made by students is using the numerator rather than denominator as the index of the radical.
- Ensure that students understand how to apply the exponent laws.
- When simplifying expressions, students should consider the following: simplify the expressions in brackets, remove the brackets applying the exponent laws, and write in simplest form using positive exponents.
- Ensure students understand how to solve real-life problems involving exponent rules and radicals; e.g., problems involving finance, half-life, populations, etc.
- Ensure students understand how to evaluate algebraic expressions. Check to see that students substitute assigned values into variable expressions and evaluate using the order of operations.

Unit 1: Roots and Powers—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: Relations and Functions—Suggestions for Teaching and Learning

- Students should realize that when studying patterns, tables and graphs, a relation can be written in a variety of ways: words, ordered pairs, table of values, graphs, equations and arrow diagrams.
- Ensure that students understand that the domain represents values of the independent variable and the range represents values of the dependent variable.
- Ensure that students understand that a function is a relation in which each element in the domain is matched with exactly one element in the range.
- Students should understand the concept that all functions are relations, but not all relations are functions.
- Ensure that students are able to determine if a relation is a function. Some strategies to use are inspection of the ordered pairs for repeated y values in ordered pairs, and the vertical line test.
- Ensure that students are able to write functions using functional notation f(x).
- Ensure that students understand how to graph functions with and without technology.
- Ensure that students understand the domain and range of given graphs.
- Ensure that students understand set notation and that students understand whether data is continuous or discrete by reading the set notation.
- Ensure that students are able to determine whether a relation is linear or non-linear.
- Ensure that students understand how to determine the rate of change from a graph by finding the changes in the independent and dependent variables.
- Ensure that students can use graphs to determine the coordinates of the x and y intercepts.
- Ensure that students represent the horizontal and vertical intercepts as ordered pairs (x,0) and (0, y).
- Ensure that students understand how to graph linear functions using the following methods: the horizontal and vertical intercepts and the rate of change and vertical intercept.

Unit 2: Relations and Functions—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.