Adult Basic Education (ABE)

Level III Mathematics

Mathematics 3102A

Measurement and Probability/Data/Linear Relationships

Curriculum Guide

Student Resource: *Math at Work 12. McGraw-Hill Ryerson. 2012. ISBN 13:978-1-25-901238-9*

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

Contents

General Information

Introduction

Mathematics 3102A when completed with **Mathematics 3102B and C** is equivalent to the Newfoundland and Labrador senior high school **Mathematics 3202 (Applied**) course.

Pre-requisite

Students must have completed **Mathematics 2102C**.

Resources

The student resource for this course is*:*

Math at Work 12. McGraw-Hill Ryerson. 2012. ISBN 13:978-1-25-901238-9

The instructor resources for this course are:

- *Math at Work 12 Teacher's Resource. McGraw-Hill Ryerson. 2012. ISBN 13:978-1-25-901242-6*
- *The Online Teacher's Resource Centre*
- *Math at Work 12 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 3102A Outcomes/Achievement Outcomes

Unit 1: Measurement and Probability

1. Demonstrate an understanding of the limitations of measuring instruments, including:
    i. precision
    ii. accuracy
    iii. uncertainty
    iv. tolerance

    a) Explain why, in a given context, a certain degree of precision is required.
    b) Explain why, in a certain context, a certain degree of accuracy is required.
    c) Explain, using examples, the difference between precision and accuracy.
    d) Analyze precision and accuracy in a contextual problem.
    e) Compare the degree of accuracy of two given instruments used to measure the same attribute.
    f) Describe, using examples, the limitations of measurements used in specific trade or industry.
    g) Relate the degree of precision to the uncertainty of a given measure.
    h) Calculate maximum and minimum values, using a degree of tolerance in context.
    i) Solve a problem that involves precision, accuracy or tolerance.
2. Analyze and interpret problems that involve probability.
    a) Calculate the probability of an event based on a data set.
    b) Express a given probability as a fraction, decimal and percent in a statement.
    c) Explain the difference between odds and probability.
    d) Determine the probability of an event, given the odds for or against.
    e) Explain, using examples, how decisions may be based on a combination of theoretical probability calculations, experimental results and subjective judgments.

f) Describe and explain the application of probability.
g) Solve a contextual problem that involves odds or probability.

Unit 2: Data

1. Solve problems that involve measures of central tendency, including:
    i. mean
    ii. median
    iii. mode
    iv. weighted mean
    v. trimmed mean
    a) Determine the mean, median and mode for a set of data.
    b) Solve a contextual problem that involves measures of central tendency.
    c) Identify and correct errors in a calculation of a measure of central tendency.
    d) Explain, using examples, the advantages and disadvantages of each measure of central tendency.
    e) Explain, using examples such course marks, why some data in a set would be given a greater weighting in determining the mean.
    f) Calculate the mean of a set of numbers allowing for different weights in the mean (weighted mean).
    g) Identify the outlier(s) in a set of data.
    h) Explain the effect of outliers on mean, median and mode.
    i) Calculate the trimmed mean for a set of data, and justify the removal of the outliers.
    j) Explain, using examples from print and other media, how measures of central tendency and outliers are used to provide different interpretations of data.
2. Analyze and describe percentiles.
    a) Explain the relationship between median and percentile.
    b) Explain, using examples, percentile ranks in a context.
    c) Explain, using examples, the difference between percent and percentile rank.
3. Demonstrate an understanding of linear relations by:
    i. recognizing patterns and trends
    ii. graphing
    iii. creating tables of values

iv. writing equations
v. interpolating and extrapolating
vi. solving problems

a) Describe the trends in the graph of a data set, including scatter plots.
b) Solve a contextual problem that requires interpolation or extrapolation of information.
c) Match given contexts with their corresponding graphs, and explain the reasoning.

Unit 3: Linear Relationships

1. Demonstrate an understanding of linear relations by:
    i. recognizing patterns and trends
    ii. graphing
    iii. creating a table of values
    iv. writing equations
    v. interpolating and extrapolating
    vi. solving problems

a) Create, with or without technology, a graph to represent a given or collected data set.
b) Solve a contextual problem that requires interpolation or extrapolation of information.
c) Sort a set of scatter plots according to the trends represented (linear, nonlinear or no trend).
d) Match given contexts with their corresponding graphs, and explain the reasoning.
e) Identify and describe the characteristics of a linear relation represented in a table of values or number pattern.
f) Sort a set of graphs, tables of values and/or number patterns into linear and nonlinear relations.
g) Explain why the points should or should not be connected on the graph for a context.
h) Relate slope and rate of change to linear relations.
i) Identify a linear equation as having a direct or partial variation relationship.
j) Create a table of values for a given equation of a linear relation.
k) Solve a contextual problem that involves the application of a formula for a linear relation.
l) Write an equation for a given context, including direct or partial variation.

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: Measurement and Probability—Suggestions for Teaching and Learning

- Ensure students understand the difference between precision and accuracy. Accuracy is the degree of closeness of a measured value to the true value and depends on how carefully the measuring device is used. Precision is the degree of exactness to which a measurement is expressed and depends on the smallest scale of the instrument used.
- Discuss with students the importance of accuracy and precision in daily life; e.g., consider a contractor purchasing baseboard for a room. The measurements need to be accurate, and when installing the baseboards, the measurements need to be precise.
- Discuss with students that different types of measurement devices may be more suitable for making certain measurements; e.g., a tape is useful for measuring length, but a caliper may be better for measuring diameter.
- Ensure students understand that there is a degree of uncertainty due to the limitations of measuring devices.
- Discuss with students why it is important for trades workers to understand measurement tolerances.
- Remind students that probability is determined by dividing the number of favorable outcomes by the total number of possible outcomes. This results in a value ranging from 0 to 1, where 0 refers to the event never occurring and 1 refers to the event always occurring.
- Remind students that probability should be expressed as a fraction, decimal or percent. Review how to convert between these representations.
- Review with students the contents of a regular pack of playing cards. Packs of playing cards are often useful for illustrating probabilities; e.g., a pack of cards has 52 cards, 26 red, 26 black, 13 cards organized into 4 suits, etc.
- Ensure students understand the difference between probability and odds: probability compares the number of favorable outcomes to the total number of outcomes, and odds compare the number of favorable outcomes to the number of unfavorable outcomes.

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

- Ensure students understand situations involving odds for and odds against. Odds for equals the ratio of favorable outcomes to unfavorable outcomes, and odds against equals the ratio of unfavorable outcomes to favorable outcomes.
- Ensure that students understand that when given the odds for/against, it is possible to calculate the probability of an event.
- Ensure students understand the difference between theoretical probability and experimental probability.
- Discuss probability with respect to buying lottery tickets and receiving a winning outcome. Encourage students to discuss and evaluate strategies they use to pick lottery numbers.
- Discuss a variety of situations involving odds and probability with students; e.g., selecting playing cards, rolling dice, flipping coins, games of chance, etc.

Unit 1: Measurement and Probability—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: Data —Suggestions for Teaching and Learning

- Remind students that measures of central tendency allow a data set to be described with a simple, meaningful number (mean, mode, median).
- Ensure students understand that data sets can have no mode, one, or more than one mode.
- Ensure students use calculators correctly when calculating the mean. A common error is to enter the last number in the sum and then press divide. This only divides the last number entered. Students must press the "=" button first, then the divide button.
- Some other common errors students make when calculating measures of central tendency are: not arranging the data is ascending/descending order, incorrectly identifying the median in an even-numbered data set, and stating the mode as 0 when no mode exists.
- Discuss and ensure students understand the advantages and disadvantages of the measures of central tendency.
- Discuss with students that sometimes straight-forward calculations of the mean is inappropriate to represent a given data set. In some cases, a weighted mean may be more appropriate to use. Weighted means are often used in school/college course evaluation schemes. Weighted means can also be used to score candidates in job interviews on specific criteria.
- Discuss with students outliers in data sets. Outliers are values significantly different from the others in a set.
- Ensure students understand the effect of outliers on measures of central tendency. Students should also recognize that some data sets will have only one outlier while other data sets will have more than one outlier.
- Discuss trimmed means with students and ensure they understand the calculation. The least and greatest value(s) in a data set is removed before calculating the mean. Note that trimmed mean is often used in Olympic scoring to help eliminate judging bias.
- Discuss with students that measures of central tendency are often used in the media to report statistics, and they can be presented in a way that emphasizes a particular viewpoint.
- Discuss with students why a particular measure of central tendency is reported in the media and the perspective that may be emphasized.

Unit 2: Data —Suggestions for Teaching and Learning

- Discuss with students the concepts of percentiles and percentile ranks. This measure is often used in reporting standardized test scores and birth weights.
- Ensure students are not confused by percentiles and percentages.
- Ensure students understand that a scatter plot is used to determine the type of relationship, if any, between two variables. Scatter plots are especially useful with large quantities of data because they help in visualizing trends.
- Students should be able to identify that as the independent variable increases, the dependent variable will increase, decrease or show no trend.
- Ensure students understand that interpolation is the prediction of a value between two known values, and that extrapolation is the prediction of a value which goes beyond the data that is given.

Unit 2: Data—Suggestions for Assessment

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Unit 3: Linear Relationships —Suggestions for Teaching and Learning

- Remind students that the independent variable is graphed along the horizontal axis while the dependent variable is represented on the vertical axis. By drawing a line of best fit, students will be able to determine linear or nonlinear trends.
- Discuss with students that interpolation is likely to be more accurate since it is between two known values, whereas extrapolation is less reliable because a new trend could occur.
- Ensure that students understand that a random scattering of data points indicates no relationship between the variables, but a cluster with a general tendency indicates a relationship.
- Review discrete and continuous data with students. Discrete data is data that can be counted and is indicated on a graph with a point. Continuous data has an infinite number of values between data points, and is represented on a graph with a line.
- Ensure students understand that a direct variation is a linear relationship in which one variable is always a fixed multiple of another variable. A partial variation is a linear relationship in which one variable is always a fixed multiple of another variable plus a constant.
- Point out to students that the graph of a direct variation always begins at the origin, but the graph of a partial variation does not start at the origin.

Unit 3: Linear Relationships—Suggestions for Assessment

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