Outcomes with Assessment Standards
for
Mathematics 30-3

2014

This resource is intended to assist teachers with the
provincial implementation of Mathematics 30-3.

Alberta

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The primary audience for this resource is:

Teachers	✓
Administrators	
Students	
Parents	

Acknowledgements

Table of Contents

INTRODUCTION

Mathematics 30-3 was provincially implemented in September 2012. Teachers participating in focus groups during the development of the program of studies expressed a need for a common understanding of the curriculum and assessment standards. In response to this need, and in keeping with Alberta Education's goal of establishing and effectively communicating clear outcomes and high standards, this standards resource was developed.

This resource is designed to support the implementation of the Alberta Mathematics Grades 10–12 Program of Studies, which can be found at http://education.alberta.ca/media/655889/math10to12.pdf. Teachers are strongly encouraged to consult the program of studies for details about the philosophy of the program.

PURPOSE

Outcomes with Assessment Standards for Mathematics 30-3 links the achievement indicators for the specific outcomes from the program of studies with information and commentaries about standards. Its purpose is to provide teachers of Mathematics 30-3 with clearly stated standards to use as guidelines in their classroom instruction and assessment practices.

DEFINITIONS AND TERMINOLOGY

Standards

A *standard* is a reference point used in planning and evaluation. In evaluating educational performance, the following standards apply:
- *Curriculum* and *assessment standards* apply to the assessment of individual students.
- *Achievement standards* apply to the assessment of student populations.

In this resource, only curriculum and assessment standards are discussed.

Curriculum Standards

Curriculum standards are outcomes for a course within a program. The curriculum standards for Mathematics 30-3 are defined by the general and specific outcomes outlined in the program of studies. They are further clarified by the achievement indicators, which reflect the scope of each specific outcome.

Outcomes

General outcomes are concise statements identifying what it is that students are expected to know and be able to do upon completion of a course within a program.

Specific outcomes are statements identifying the component knowledge, skills and attitudes of a general outcome. Specific outcomes identify a range of contexts in which the general outcomes apply.

In the specific outcomes, the word *including* indicates that any ensuing items must be addressed to fully meet the learning outcome. The phrase *such as* indicates that the ensuing items are provided for clarification and are not requirements that must be addressed to fully meet the learning outcome.

The word *and* used in an outcome indicates that both ideas must be addressed to fully meet the learning outcome, although not necessarily at the same time or in the same question.

Achievement Indicators

Achievement indicators are samples of how students may demonstrate their achievement of the goals of a specific outcome. The range of samples provided is meant to reflect the scope of the specific outcome.

The word *and* used in an achievement indicator implies that both ideas should be addressed at the same time or in the same question.

Assessment Standards

Assessment standards are the criteria used for judging individual student achievement relative to the curriculum standards.

STANDARDS FOR MATHEMATICS 30-3

Mathematics 30-3 is designed to follow directly from Mathematics 20-3, so students taking Mathematics 30-3 are presumed to have reached the acceptable standard or better in the outcomes of Mathematics 20-3.

The assessment standards for Mathematics 30-3 include an acceptable and an excellent level of performance. Student performance should be measured on a range of tasks, some of which are routine and obvious tasks in familiar contexts, and others which are non-routine tasks in unfamiliar contexts. In many cases, a correlated example from the authorized resources is referenced to assist in assessing student performance. The authorized resources for Mathematics 30-3, published by Pacific Educational Press, are:
• MathWorks 12: Student Resource
• MathWorks 12: Teacher Resource.

Note that unless otherwise stated in the achievement indicator, correlated examples are from the Student Resource.

Acceptable Standard

The *acceptable standard* of achievement in Mathematics 30-3 is met by students who receive a course mark between and including 50 percent and 79 percent. Typically, these students have gained new skills and a basic knowledge of the concepts and procedures relative to the general and specific outcomes defined for Mathematics 30-3 in the program of studies. These students can apply this knowledge to a limited range of familiar problem contexts.

Standard of Excellence

The *standard of excellence* for achievement in Mathematics 30-3 is met by students who receive a course mark at or above 80 percent. Typically, these students have gained a breadth and depth of understanding regarding the concepts and procedures, as well as the ability to apply this knowledge to a broad range of familiar and unfamiliar problem contexts.

Description of Standards

The following statements describe what is expected of Mathematics 30-3 students who meet the *acceptable standard* or the *standard of excellence* on independent work. The statements represent the standards against which student achievement is measured.

Acceptable Standard	*Standard of Excellence*
Students who meet the *acceptable standard* in Mathematics 30-3 consistently perform acceptable work on routine and obvious tasks in familiar contexts.	Students who meet the *standard of excellence* in Mathematics 30-3 consistently perform excellent work on routine and obvious tasks in familiar contexts, and acceptable work on non-routine tasks in unfamiliar contexts.
These students have a basic understanding of the concepts and procedures outlined in the program of studies. They demonstrate their understanding in concrete, pictorial and symbolic modes, and can translate from one mode to another. They perform the mathematical operations and procedures that are fundamental to Mathematics 30-3 and apply what they know in daily living contexts.	These students have a comprehensive understanding of the concepts and procedures outlined in the program of studies. They demonstrate their understanding in concrete, pictorial and symbolic modes, and can translate from one mode to another. They perform the mathematical operations and procedures that are fundamental to Mathematics 30-3, apply what they know in daily living contexts and provide alternative solution procedures to verify results.
To meet the *acceptable standard*, students communicate about mathematical situations in an understandable way, using appropriate everyday and mathematical terms. They understand mathematical questions containing objects, diagrams or numbers in familiar contexts, and they construct mathematical models.	To meet the *standard of excellence,* students communicate about mathematical situations in a clear way, using numbers, diagrams and appropriate mathematical terms. They understand mathematical questions containing objects, diagrams or numbers in familiar and unfamiliar contexts, and they construct mathematical models using multiple representations.
Students meeting the *acceptable standard* apply what they know in solving straightforward problems in familiar settings and in analyzing simple mathematical models. They describe the steps they used to solve a particular problem, and verify and defend their solution to the problem.	Students meeting the *standard of excellence* apply what they know in solving routine and non-routine problems in a broad range of settings. They describe the steps they used to solve a particular problem, defend their solution to the problem, and, where appropriate, provide alternative solution procedures to verify results.
Students meeting the *acceptable standard* have a positive attitude toward mathematics and a sense of personal competence in using mathematics. They demonstrate confidence when using common mathematical procedures and when applying problem-solving strategies in familiar settings.	Students meeting the *standard of excellence* have a positive attitude toward mathematics and show confidence in using mathematics meaningfully. They are self-motivated risk takers who persevere when solving novel problems. They take initiative in trying new methods and are creative in their approach to problem solving.

GENERAL NOTES

- All mathematical processes should be used and integrated throughout the outcomes.
- Teachers should try to provide students with illustrative examples and contextual problems that are representative of the trades.
- In problems that involve multiple steps, complete solutions include carrying full answers until the final solution.
- Technology [T], including calculators and computers, has been listed as one of the mathematical processes to be emphasized for some outcomes, with the expectation that students will have access to technology when completing the outcomes. If technology has not been specifically listed for a particular outcome, teachers may, at their discretion, use it to assist students in exploring patterns and relationships when learning a concept. It is expected, however, that technology will not be considered when assessing students' understandings of such outcomes.
- All of the specific outcomes are accompanied by notes that address some of the questions that may arise when teaching the concepts. The assessment standards for each outcome are described in a chart that indicates, for each achievement indicator, whether the acceptable standard, the standard of excellence or, in some cases, both standards may be applicable (✓). Some check marks are accompanied by qualifying statements. Shaded regions indicate that the standard does not apply for the given achievement indicator.
- A *partial solution* to a problem is a solution in which a student demonstrates a basic understanding of the problem and the mathematical concepts required in solving the problem. However, the student is unable to complete the solution correctly for a variety of reasons, such as not being able to correctly connect the concepts involved or not being able to avoid procedural errors. For example, in solving a problem using the cosine law, given the measure of the three sides of a triangle, a student may be able to draw a diagram to correctly represent the situation and identify the appropriate equation needed to solve the problem, but then makes procedural errors in solving for the measure of an angle. Note that assessment of student learning is the responsibility of the teacher, and what is considered a partial solution may vary according to the question or task presented.
- Teachers may choose to have students develop a formula sheet that can be used throughout the course.

Topic: Measurement

General Outcome: Develop spatial sense through direct and indirect measurement.

Specific Outcome

It is expected that students will:

1. Demonstrate an understanding of the limitations of measuring instruments, including:
    *   precision
    *   accuracy
    *   uncertainty
    *   tolerance
    and solve problems.
    [C, PS, R, T, V]
    [ICT: C6–4.4, C6–4.5]

Notes

*   Students have been working with SI units of measure since Grade 3. Imperial units were first introduced in Mathematics 10-3 and Mathematics 10C.
*   Prior knowledge includes the application of formulas to solve problems involving perimeter, area, surface area, volume and capacity.
*   Students are expected to perform the four arithmetic operations on decimals and fractions with and without the use of technology.
*   Denominators for fractional measurements should be contextually appropriate; e.g., in various trades: halves, quarters, eighths, and sixteenths, .
*   Measurements in the imperial system are expressed primarily in fraction form, whereas measurements in the SI system are expressed in decimal form.

*   This is the first time precision, accuracy, uncertainty and tolerance are formally addressed in the Kindergarten to Grade 12 Mathematics curriculum. However, some students may be familiar with these terms through Career and Technology Studies or life experiences.
*   Students should be provided with opportunities to use a variety of measuring instruments in both imperial and SI systems of measurement.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
1.1 Explain why, in a given context, a certain degree of precision is required.	✓ p. 86, Discuss the Ideas #3	
1.2 Explain why, in a given context, a certain degree of accuracy is required.	✓ pp. 86-87, Activity 2.2 #2	
1.3 Explain, using examples, the difference between precision and accuracy.	✓ Use a given example to explain the difference. p. 105, #2	✓ Create an example to explain the difference.
1.4 Compare the degree of accuracy of two given instruments used to measure the same attribute.	✓ Provide a partial comparison of factors that affect the degree of accuracy. pp. 86-87, Activity 2.2	✓ Provide a complete comparison of factors that affect the degree of accuracy. pp. 86-87, Activity 2.2
1.5 Relate the degree of accuracy to the uncertainty of a given measure.	✓ p. 89, #4	
1.6 Analyze precision and accuracy in a contextual problem.	✓ p. 106, #5	
1.7 Calculate maximum and minimum values, using a given degree of tolerance in context.	✓ p. 100, #2	
1.8 Describe, using examples, the limitations of measuring instruments used in a specific trade or industry; e.g., tape measure versus Vernier caliper.	✓ Provide a partial explanation. p. 105, #3	✓ Provide a complete explanation. p. 105, #3
1.9 Solve a problem that involves precision, accuracy or tolerance.	✓ Solve simple problems involving precision, accuracy or tolerance. p. 106, #8	✓ Solve complex problems involving precision, accuracy and/or tolerance. p. 107, #10

Topic: Geometry

General Outcome: Develop spatial sense.

Specific Outcome

It is expected that students will:

1. Solve problems by using the sine law and cosine law, excluding
    the ambiguous case.
    [CN, PS, V]

Notes

- To connect mathematical ideas to the real world, students should
  be provided with opportunities to work with manipulatives,
  digital resources and concrete materials.
- Right-angle trigonometry is included in specific outcomes for
  both Mathematics 10-3 and Mathematics 20-3.
- Students are expected to visualize and model information to
  assist in problem solving.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
1.1 Identify and describe the use of the sine law and cosine law in construction, industrial, commercial and artistic applications.	✓ Identify the use of the sine law or cosine law in a scenario. p. 265, #1a	✓ Identify and describe the use of the sine law or cosine law in a scenario. p. 265, #1b
1.2 Solve a problem, using the sine law or cosine law, when a diagram is given.	✓ Solve problems for one unknown. p. 271, #1	✓ Solve problems for two or more unknowns. p. 273, #6

Geometry (continued)

Specific Outcome

It is expected that students will:

2. Solve problems that involve:
   - triangles
   - quadrilaterals
   - regular polygons.
   [C, CN, PS, V]

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Notes

- Students have studied the properties of triangles, quadrilaterals and regular polygons from previous grade levels in the mathematics programs of study. The focus of this outcome should be on applications of the properties in construction, industrial, commercial, domestic and artistic contexts.
- Students are expected to visualize and model information to assist in problem solving.

Achievement Indicators	Acceptable Standard	Standard of Excellence
2.1 Describe and illustrate properties of triangles, including isosceles and equilateral.	✓ p. 183 Discuss the idea	
2.2 Describe and illustrate properties of quadrilaterals in terms of angle measures, side lengths, diagonal lengths and angles of intersection.	✓ pp. 196-197, Activity 5.2 #1	
2.3 Describe and illustrate properties of regular polygons.	✓ p. 204, Discuss the Ideas	
2.4 Explain, using examples, why a given property does or does not apply to certain polygons.	✓ Provide a partial explanation. p. 207, Build your skills #1	✓ Provide a complete explanation. p. 207, Build your skills #1
2.5 Identify and explain an application of the properties of polygons in construction, industrial, commercial, domestic and artistic contexts.	✓ Identify and explain application of the properties of polygons in a familiar context. p. 209, # 6	✓ Identify and explain an application of the properties of polygons in an unfamiliar contexts. p. 209, #7a

2.6	Solve a contextual problem that involves the application of the properties of polygons.	✓ Solve a problem that includes a single shape. p. 212, #2	✓ Solve a problem that includes multiple shapes. p. 212, #4

Geometry (continued)

Specific Outcome

It is expected that students will:

3. Demonstrate an understanding of transformations on a 2-D shape
    or a 3-D object, including:
    *   translations
    *   rotations
    *   reflections
    *   dilations.
    [C, CN, R, T, V]
    [ICT: C6–3.4]

Notes

*   Prior knowledge from previous grade levels/courses includes the
    following:
    –   single transformations (translations, rotations and
        reflections) of a 2-D shape in all four quadrants of a
        Cartesian plane (Grade 7)
    –   drawing and interpreting scale diagrams of 2-D shapes, and
        demonstrating an understanding of line and rotation
        symmetry (Grade 9)
    –   solve problems that involve scale diagrams (Mathematics
        20-3)
    –   interpreting and drawing different views of 2-D shapes and
        3-D objects (Mathematics 20-3).
*   Dilations of 2-D shapes and 3-D objects are not to be performed
    on coordinate grids.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
3.1 Identify a single transformation that was performed, given the original 2-D shape or 3-D object and its image.	✓ p. 219, Activity 6.1 #1	
3.2 Draw the image of a 2-D shape that results from a given single transformation.	✓ p. 227, #3	
3.3 Draw the image of a 2-D shape that results from a given combination of successive transformations.	✓ Apply translations and/or reflections. p. 238, Build your Skills #2ab	✓ Apply transformations, including rotations or dilations. p. 240, #4a–b
3.4 Create, analyze and describe designs, using translations, rotations and reflections in all four quadrants of a coordinate grid.	✓ Describe the transformations on a design, using translations, rotations and reflections. p. 239, #3	✓ Create a design and analyze the transformations, using translations, rotations and reflections. p. 241, #7
3.5 Identify and describe applications of transformations in construction, industrial, commercial, domestic and artistic contexts.	✓ p. 230, The Works of MC Escher	
3.6 Explain the relationship between reflections and lines or planes of symmetry.	✓ Provide a full explanation of the relationship for 2-D shapes. p. 244, #5b	✓ Provide a full explanation of the relationship for 3-D objects. p. 225, Discuss the Ideas
3.7 Determine and explain whether a given image is a dilation of another given shape, using the concept of similarity.	✓ Determine and explain why a given image is a dilation of another shape with the same orientation. p. 237, Mental Math and	✓ Determine and explain why a given image is a dilation of another shape with a different orientation.

		Estimation	
3.8	Draw, with or without technology, a dilation image for a given 2-D shape or 3-D object, and explain how the original 2-D shape or 3-D object and its image are proportional.	✓ Work with dilations that involve 2-D shapes. TEACHER RESOURCE p. 370, #13	✓ Work with dilations that involve 3-D objects.
3.9	Solve a contextual problem that involves transformations.	✓ Solve problems in 2-D including translations and/or reflections. ✓ Solve problems with one transformation in 3-D. p. 228, #6	✓ Solve problems in 2-D including rotations or dilations. ✓ Solve problems with two or more transformations 3-D. p. 239, #3

Topic: Number

General Outcome: Develop number sense and critical thinking skills.

Specific Outcome

It is expected that students will:

1. Analyze puzzles and games that involve logical reasoning, using problem-solving strategies.
   [C, CN, PS, R]

Notes

- Prior knowledge from previous courses includes the following:
  – analyzing puzzles and games that involve spatial reasoning (Mathematics 10-3)
  – analyzing puzzles and games that involve numerical reasoning (Mathematics 20-3).
- It is intended that this outcome be integrated throughout the course.
- A variety of puzzles and games that involve logical reasoning should be used. They may include commercial games, such as Sudoku, Einstein puzzles, Clue, Mancala, Factory Balls, Pebble Jump, Nim and Mastermind, Set; cribbage, solitaire or other card games; chess; or puzzles and games designed by students.
- It is expected that students will be exposed to a wide variety of puzzles and games that involve different skills and that can be played alone, in pairs or in groups.

- Problem-solving strategies are crucial and will vary depending on the puzzle or game.
- Verifying a strategy to solve a puzzle or game could include successfully using the strategy.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
(It is intended that this outcome be integrated throughout the course by using puzzles and games such as Sudoku, Mastermind, Nim and logic puzzles.)

Achievement Indicators	Acceptable Standard	Standard of Excellence
1.1 Determine, explain and verify a strategy to solve a puzzle or to win a game; e.g., • guess and check • look for a pattern • make a systematic list • draw or model • eliminate possibilities • simplify the original problem • work backward • develop alternative approaches.	✓ Determine and verify a strategy. p. 45, Puzzle It Out (guess and check) p. 87, Puzzle It Out p. 241, Puzzle It Out (Guess and check) p. 87, Puzzle It Out (guess and check) p. 172, Puzzle It Out (model) p. 132, Puzzle It Out (Systematic list) p. 269, Puzzle It Out (look for a pattern) p. 286, Puzzle It Out (draw and model and guess and check)	✓ Determine a strategy, and explain the logical reasoning to others. p. 45, Puzzle It Out (guess and check) p. 87, Puzzle It Out p. 241, Puzzle It Out (Guess and check) p. 87, Puzzle It Out (guess and check) p. 172, Puzzle It Out (model) p. 132, Puzzle It Out (Systematic list) p. 269, Puzzle It Out (look for a pattern) p. 286, Puzzle It Out (draw and model and guess and check)
1.2 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game.	✓ Identify errors.	✓ Identify and correct errors.
1.3 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.		✓

Number (continued)

Specific Outcome

It is expected that students will:

2. Solve problems that involve the acquisition of a vehicle by:
    *   buying
    *   leasing
    *   leasing to buy.
    [C, CN, PS, R, T]

Notes

*   Prior knowledge from previous courses includes the following:
    –   sale price, markup and payment methods (Mathematics 10-3)
    –   personal budgets, compound interest and financial institution
        services and credit options (Mathematics 20-3).

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
2.1 Describe and explain various options for buying, leasing and leasing to buy a vehicle.	✓ p. 303, Activity 8.4	
2.2 Solve, with or without technology, problems that involve the purchase, lease or lease to purchase of a vehicle.	✓ Solve problems involving the total cost of purchasing or leasing a vehicle. p. 304, #4	✓ Solve problems involving purchasing versus leasing to purchase a vehicle. p. 305, #8 a,b,c
2.3 Justify a decision related to buying, leasing or leasing to buy a vehicle, based on factors such as personal finances, intended use, maintenance, warranties, mileage and insurance.	✓ Provide a partial justification. p. 305, #8 d	✓ Provide a complete justification. p. 305, #8 d

Number (continued)

Specific Outcome

It is expected that students will:

3. Critique the viability of small business options by considering:
   - expenses
   - sales
   - profit or loss.
   [C, CN, R]
   [ICT: F2–4.7]

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
3.1 Identify expenses in operating a small business, such as a hot dog stand.	✓ Identify a partial list of expenses. pp. 280-281, Activity 8.1 #1	✓ Identify a complete list of expenses. ✓ pp. 280-281, Activity 8.1 #2
3.2 Identify feasible small business options for a given community.	✓ p. 277, Example #1	
3.3 Generate options that might improve the profitability of a small business.	✓ p. 290, Discuss the Ideas	
3.4 Determine the break-even point for a small business.	✓ p. 293, Activity 8.3	
3.5 Explain factors, such as seasonal variations and hours of operation, that might impact the profitability of a small business.	✓ List the factors p. 284, #7a	✓ List and explain how the factors impact the profitability. p. 290, Discuss the Ideas

Topic: Algebra

General Outcome: Develop algebraic reasoning.

Specific Outcome

It is expected that students will:

1. Demonstrate an understanding of linear relations by:
    - recognizing patterns and trends
    - graphing
    - creating tables of values
    - writing equations
    - interpolating and extrapolating
    - solving problems.
    [CN, PS, R, T, V]
    [ICT: C6–4.1, C6–4.3, C7–4.2]

Notes

- Prior knowledge from previous grade levels/courses includes the following:
    – graphing and analyzing linear relations (Grade 7)
    – interpolation and extrapolation (Grade 9)
    – slope and rate of change (Mathematics 20-3)
    – graphing and interpreting data (Mathematics 20-3).
- Unless otherwise stated in the achievement indicators, this outcome only addresses linear relations.
- Integration of this specific outcome into the number topics of the course is recommended.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
1.1 Identify and describe the characteristics of a linear relation represented in a graph, table of values, number pattern or equation.	✓ p. 14, Discuss the Ideas #5	
1.2 Sort a set of graphs, tables of values, number patterns and/or equations into linear and nonlinear relations.	✓ p. 20, Example # 3a	
1.3 Write an equation for a given context, including direct or partial variation.	✓ p. 30, Example #1d	
1.4 Create a table of values for a given equation of a linear relation.	✓	
1.5 Sketch the graph for a given table of values.	✓ p. 25, #8	
1.6 Explain why the points should or should not be connected on the graph for a context.	✓ p. 23, #4c	
1.7 Create, with or without technology, a graph to represent a data set, including scatterplots.	✓ p. 63, #5a	
1.8 Describe the trends in the graph of a data set, including scatterplots.	✓ p. 61, #2b	.
1.9 Sort a set of scatterplots according to the trends represented (linear, nonlinear or no trend).	✓ p. 70, #1	
1.10 Solve a contextual problem that requires interpolation or extrapolation of information.	✓ Solve a contextual problem where a graph is provided. p. 56, Discuss the Ideas #1	✓ Solve a contextual problem where a graph is not provided. p. 75, #8e
1.11 Relate slope and rate of change to linear relations.	✓ p. 14, #4	
1.12 Match given contexts with their corresponding graphs, and explain the reasoning.	✓ p. 42, #4	

1.13 Solve a contextual problem that involves the application of a formula for a linear relation.	✓ Solve problems that do not require formula manipulation. pp. 36-37, Example #3b	✓ Solve problems that require formula manipulation. p. 43, #8

Topic: Statistics

General Outcome: Develop statistical reasoning.

Specific Outcome

It is expected that students will:

1. Solve problems that involve measures of central tendency, including:
    *   mean
    *   median
    *   mode
    *   weighted mean
    *   trimmed mean.
    [C, CN, PS, R]

Notes

*   Prior knowledge from previous grade levels includes the following:
    –   mean, median and mode (Grade 7).
*   The use of technology is encouraged but should not replace mathematical understanding.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
1.1 Explain, using examples, the advantages and disadvantages of each measure of central tendency.	✓ Explain the advantages and disadvantages of mean, median and mode. pp. 117-118, Discuss the Ideas	✓ Explain the advantages and disadvantages of weighted and trimmed mean. ✓ Determine the best measure of central tendency for a specific set of data. p. 128, Discuss the Ideas #1–2
1.2 Determine the mean, median and mode for a set of data.	✓ pp. 112–113, Example #1a,b,c	
1.3 Identify and correct errors in a calculation of a measure of central tendency.	✓ Identify and correct errors in the calculation of mean, median or mode. p. 128, Discuss the Ideas #1	✓ Identify and correct errors in the calculation of weighted or trimmed mean. p. 128, Discuss the Ideas #2
1.4 Identify the outlier(s) in a set of data.	✓ p. 130, Build Your Skills #1b	
1.5 Explain the effect of outliers on mean, median and mode.	✓ Explain the effect of outliers on mean only p. 128, Discuss the Ideas #1–2	✓ Explain the effect of outliers on mean, median and mode. TEACHER RESOURCE p. 199, #10
1.6 Calculate the trimmed mean for a set of data, and justify the removal of the outliers.	✓ Calculate the trimmed mean. p. 124, Example #1ab	✓ Provide justification for the removal of the outliers.

			p. 124, Example #1cd
1.7	Explain, using examples such as course marks, why some data in a set would be given a greater weighting in determining the mean.		✓ pp. 125-126, Example #2a–c
1.8	Calculate the mean of a set of numbers after allowing the data to have different weightings (weighted mean).		✓ pp. 127-128, Example #3
1.9	Explain, using examples from print and other media, how measures of central tendency and outliers are used to provide different interpretations of data.	✓ Provide a partial explanation of how measures of central tendency and outliers are used to provide different interpretations.	✓ Provide a complete explanation of how measures of central tendency and outliers are used to provide different interpretations.
1.10	Solve a contextual problem that involves measures of central tendency.	✓ Solve contextual problems involving mean, median or mode. p. 119, #3	✓ Solve contextual problems involving weighted or trimmed mean. p. 132, #8

Statistics (continued)

Specific Outcome

It is expected that students will:

2. Analyze and describe percentiles.
   [C, CN, PS, R]

Notes

- Prior knowledge from previous courses includes the following:
  – converting fractions, decimals and percents
    (Mathematics 10-3 and Mathematics 20-3)
  – proportional reasoning (Mathematics 20-3).
- The emphasis is to be on the analysis and description of
  percentiles and not on the calculation of percentiles. Calculation
  of percentiles would be considered to reside at the standard of
  excellence.

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Achievement Indicators	Acceptable Standard	Standard of Excellence
2.1 Explain, using examples, percentile ranks in a context.	✓ p. 145, #8	
2.2 Explain decisions based on a given percentile rank.	✓ p. 140, #4	
2.3 Explain, using examples, the difference between percent and percentile rank.		✓ p. 139, Discuss the Ideas #1
2.4 Explain the relationship between median and percentile.		✓ p. 139, Discuss the Ideas #2

2.5 Solve a contextual problem that involves percentiles.		✓ p. 138, Example 2

Topic: Probability

General Outcome: Develop critical thinking skills related to uncertainty.

Specific Outcome

It is expected that students will:

1. Analyze and interpret problems that involve probability.
    [C, CN, PS, R]
Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

Notes

- Students have experience with probability through their work in Kindergarten to Grade 9 Mathematics.
- This outcome is intended to focus on single-event probability; therefore, discussions around independent, dependent and mutually inclusive events are beyond the scope of this outcome.

Achievement Indicators	Acceptable Standard	Standard of Excellence
1.1 Describe and explain the applications of probability; e.g., medication, warranties, insurance, lotteries, weather prediction, 100-year flood, failure of a design, failure of a product, vehicle recalls, approximation of area.	✓ pp. 150–151, Discuss the Ideas #1	
1.2 Calculate the probability of an event based on a data set; e.g., determine the probability of a randomly chosen light bulb being defective.	✓ p. 155, #7	
1.3 Express a given probability as a fraction, decimal and percent and in a statement.	✓ p. 154, #1	
1.4 Explain the difference between odds and probability.		✓ p. 170, Discuss the Ideas
1.5 Determine the probability of an event, given the odds for or against.	✓ p. 176, #7	
1.6 Explain, using examples, how decisions may be based on a combination of theoretical probability calculations, experimental results and subjective judgements.		✓ p. 163, #6
1.7 Solve a contextual problem that involves a given probability.	✓ p. 154, #5	

Appendix: Mathematics Directing Words

Discuss   The word *discuss* **will not** be used as a directing word on mathematics examinations because it is not used consistently to mean a single activity.

The following words are specific in meaning.

Algebraically   Use mathematical procedures that involve letters or symbols to represent numbers.

Analyze   Make a mathematical or methodical examination of parts to determine aspects of the whole; e.g., nature, proportion, function, interrelationship.

Compare   Examine the character or qualities of two things by providing characteristics of both that point out their mutual similarities and differences.

Conclude   State a logical end based on reasoning and/or evidence.

Contrast/Distinguish   Point out the differences between two things that have similar or comparable natures.

Criticize   Point out the merits and demerits of an item or issue.

Define   Provide the essential qualities or meaning of a word or concept; make distinct and clear by marking out the limits.

Describe   Give a written account or represent the characteristics of something, using a figure, model or picture.

Design/Plan   Construct a plan, i.e., a detailed sequence of actions, for a specific purpose.

Determine   Find a solution to a problem, to a specified degree of accuracy, by showing appropriate formulas, procedures and calculations.

Enumerate   Specify one-by-one or list in a concise form and according to some order.

Evaluate   Give the significance or worth of something by identifying the good and bad points or the advantages and disadvantages.

Explain   Make clear what is not immediately obvious or entirely known; give the cause of or reason for; make known in detail.

Graphically	Use a drawing that is produced electronically or by hand and that shows a relation between certain sets of numbers.
How	Show in what manner or way, with what meaning.
Hypothesize	Form a tentative proposition intended as a possible explanation for an observed phenomenon; i.e., a possible cause for a specific effect. The proposition should be testable logically and/or empirically.
Identify	Recognize and select as having the characteristics of something.
Illustrate	Make clear by providing an example. The form of the example must be specified in the question; i.e., word description, sketch or diagram.
Infer	Form a generalization from sample data; arrive at a conclusion by reasoning from evidence.
Interpret	State the meaning of something; present information in a new form that adds meaning to the original data.
Justify/Show How	Show reasons for or give facts that support a position.
Model	Find a model that does a good job of representing a situation. In mathematics, a model of a situation is a pattern that is supposed to represent or set a standard for a real situation.
Outline	Give, in an organized fashion, the essential parts of something. The form of the outline must be specified in the question; i.e., lists, flowcharts, concept maps.
Predict	State in advance on the basis of empirical evidence and/or logic.
Prove	Establish the truth or validity of a statement for the general case by providing factual evidence or a logical argument.
Relate	Show a logical or causal connection between things.
Sketch	Provide a drawing that represents the key features of an object or a graph.
Solve	Give a solution for a problem; i.e., explanation in words and/or numbers.
Summarize	Give a brief account of the main points.
Trace	Give a step-by-step description of the development.
Verify	Establish, by substitution for a particular case or by geometric comparison, the truth of a statement.
Why	Show the cause, reason or purpose.