MATHEMATICS INDICATORS

GRADES 7–8–9

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Alberta
LEARNING

INTRODUCTION

"To begin with the end in mind means to start with a clear understanding of your destination." Stephen R. Covey, *The Seven Habits of Highly Effective People*

Mathematics Indicators have been developed to assist grades 7, 8 and 9 teachers of mathematics in interpreting curriculum outcomes and in planning mathematical lessons that will ultimately improve student learning and performance in mathematics classrooms.

The first step in designing effective lessons that develop student understanding is establishing a clear idea of what it is teachers want students to understand and be able to do. Mathematics Indicators, which were written by grades 7, 8 and 9 teachers of mathematics, are intended to assist teachers in doing this.

Mathematics Indicators are statements of what students should know and be able to do if they have obtained an acceptable understanding of a given outcome. The list of indicators contained in this document is not intended to be exhaustive but rather to provide teachers with examples of evidence of understanding that may be used in determining whether or not students understand a given outcome. Teachers may use any number of these indicators, or they may choose to use other indicators as evidence that the desired learning has been achieved. Mathematics Indicators should also help teachers form a clear picture of the intent and scope of each mathematics outcome.

The Mathematics Indicators are written for each specific outcome in the Alberta Mathematics Grades 7–8–9 Program of Studies. Each specific outcome has been identified with a code. The first number in the code indicates the grade from which the specific outcome is taken; the last number indicates the specific outcome number. The letter refers to the strand in the program of studies. The following letters have been used to identify the strands in the program of studies:

N – Number
PR – Patterns and Relations
SS – Shape and Space
SP – Statistics and Probability

So, 8N12 indicates that the specific outcome is from Grade 8, the Number strand, and is Specific Outcome 12.

Where appropriate, links to other related specific outcomes have been identified in parentheses, after the relevant indicator. In the example below, the suggested indicator for 8N12 (Grade 8, Number strand, Specific Outcome 12) is linked to two other specific outcomes: 8N5 (Grade 8, Number strand, Specific Outcome 5) and 8N6 (Grade 8, Number strand, Specific Outcome 6).

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
8N12	Use concepts of rate, ratio, proportion and percent to solve problems in meaningful contexts. [E, PS, T]	❑ Determine whether rate, ratio, proportion or percent could be used in solving a given problem. (8N5, 8N6)

Mathematics Indicators: Grades 7–8–9 is a draft document, and stakeholder input is welcome. Please forward any comments regarding the Mathematics Indicators to:

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GRADE 7

INDICATORS

NUMBER (NUMBER CONCEPTS)

General Outcome
Demonstrate a number sense for decimals and integers, including whole numbers.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7N1	Define and use power, base and exponent to represent repeated multiplication. [C, T, V]	❑ Explain that a power is an expression composed of a base and an exponent. ❑ Identify the base and the exponent for a given power. Example: For 2^3, the base is 2 and the exponent is 3. ❑ Explain the meaning of the base and the exponent for a given power. (7PR1) ❑ Express a power as a repeated multiplication. Example: $2^3 = 2 \times 2 \times 2$ ❑ Express a repeated multiplication of numbers as a power. Example: $4 \times 4 \times 4 \times 4 \times 4 = 4^5$
7N2	Write a whole number as: • an expanded numeral, using powers of 10 • scientific notation, and vice versa. [C, CN, V]	❑ Express a whole number as an expanded number, using powers of 10 written in exponential form. Example: $4526 = (4 \times 10^3) + (5 \times 10^2) + (2 \times 10^1) + (6 \times 10^0)$ ❑ Convert a number from expanded form to standard form. Example: $(4 \times 10^3) + (5 \times 10^2) + (2 \times 10^1) + (6 \times 10^0) = 4526$ ❑ Express a whole number in scientific notation. ❑ Convert a number from scientific notation to standard form. ❑ Provide real-world examples of whole numbers written in scientific notation. Example: Express China's population for 2004 as a whole number and in scientific notation.
7N3	Use divisibility rules to determine if a number is divisible by 2, 3, 4, 5, 6, 9, 10. [CN, R]	❑ Explain the divisibility rule for 2, 3, 4, 5, 6, 9 and 10. ❑ Determine if a given number is divisible by 2, 3, 4, 5, 6, 9 and/or 10; and justify their answer. (7N20)

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
7N4	Read and write numbers to any number of decimal places. [C, CN, V]	❑ Orally read a decimal number. ❑ Write a decimal number symbolically and in words. ❑ Read and write decimal numbers that are used in real-world situations, including those found in other subject areas.
7N5	Demonstrate and describe equivalent mixed numbers and improper fractions concretely, pictorially and symbolically. [C, R, V]	❑ Represent improper fractions and mixed numbers using manipulatives or pictures. ❑ Represent, symbolically, the concrete or pictorial presentation of mixed numbers and improper fractions. ❑ Explain the relationship between a mixed number and an improper fraction using manipulatives and/or pictures. (Use the terminology: numerator and denominator.) ❑ Write a mixed number as an improper fraction. (7N6) ❑ Write an improper fraction as a mixed number. (7N6) ❑ Write improper fractions and mixed numbers in simplest form.
7N6	Compare and/or order improper fractions, mixed numbers and decimals to thousandths. [R, T, V]	❑ Place improper fractions, mixed numbers and decimals (to the thousandths) in ascending or descending order and justify their placements. Example: Use a number line with benchmarks, such as halves, thirds and quarters. ❑ Compare fractions and/or decimals (to the thousandths), using the symbols <, >, and =. (7N5)
7N7	Recognize and illustrate that all fractions and mixed numbers can be represented in decimal form (include terminating and repeating decimals). [R, V]	❑ Convert a fraction or mixed number to its decimal form and explain the process. ❑ Explain the difference between repeating and terminating decimals and provide examples (including decimals such as 0.3 and $0.\dot{3}$). ❑ Describe real-world situations where fractional representations are preferable over decimal representations and vice versa.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
7N8	Convert from terminating decimals to fractions. [R]	❑ Write a given terminating decimal as a fraction, using a denominator that is a power of 10. (7N7, 7N9) Example: $0.625 = \frac{625}{1000}$ ❑ Write a given terminating decimal as a fraction in simplest (reduced) form.
7N9	Convert from single-digit repeater ($0.\dot{3}$) decimal numbers to fractions, using patterns. [CN, R, V]	❑ Given a pattern such as: $\frac{1}{9} = 0.11111\ldots$ $\frac{2}{9} = 0.22222\ldots$ $\frac{3}{9} = 0.33333\ldots$ predict the decimal or fractional equivalent of subsequent elements within this pattern and explain the pattern in words. ❑ Express commonly used fractions in decimal form. Example: $\frac{1}{3} = 0.33333\ldots$ $\frac{2}{3} = 0.66666\ldots$ $\frac{1}{6} = 0.16666\ldots$
7N10	Demonstrate, concretely and pictorially, that the sum of opposite integers is zero. [R, V]	❑ Use a number line to explain that a move in one direction followed by an equivalent move in the opposite direction results in no change in position. (7N16) ❑ Use concrete materials, such as tiles and coloured chips, to explain that the sum of opposite integers is zero. (7N16) ❑ Draw diagrams to illustrate that the sum of opposite integers is zero. (7N16) ❑ Use real-world examples, such as elevators, thermometers, golf, football and money, to explain the zero principle. (7N16)

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
7N11	Represent integers in a variety of concrete, pictorial and symbolic ways. [R, V]	❑ Draw and label a number line that includes both positive and negative integers. ❑ Use concrete materials, such as the unit tiles from an algebra tile set and coloured chips, as well as diagrams to represent positive and negative integers. ❑ Write positive and negative integers with appropriate symbols. ❑ Provide examples to illustrate where integers are used in the real world. Example: thermometers, golf, football, money
7N12	Compare and order integers. [R, V]	❑ Correctly place given integers on a number line and justify their placement. ❑ Compare two integers and represent their relationship using the symbols <, >, and =. ❑ Arrange given integers in ascending or descending order. ❑ Compare integers in real-world situations. (7N11) Example: golf, temperature, money

INDICATORS

NUMBER (NUMBER OPERATIONS)

General Outcome
Apply arithmetic operations on decimals and integers, and illustrate their use in solving problems.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7N13	Use patterns, manipulatives and diagrams to demonstrate the concepts of multiplication and division by a decimal. [CN, PS, R, V]	❑ Demonstrate multiplication and division by a decimal using the area model. ❑ Show that multiplying a number by 0.1, 0.01, 0.001 and so on results in a product smaller than the original number. ❑ Show that dividing a number by 0.1, 0.01, 0.001 and so on results in a quotient larger than the original number. ❑ Continue and explain patterns such as: $2 \times 3 = 6$ $0.2 \times 3 = 0.6$ $0.02 \times 3 = 0.06$ to generalize a rule for multiplying with decimals. (7N15) ❑ Continue and explain patterns such as: $6 \div 2 = 3$ $6 \div 0.2 = 30$ $6 \div 0.02 = 300$ to generalize a rule for dividing with decimals. (7N15)
7N14	Use estimation strategies to justify or assess the reasonableness of calculations. [E, PS]	❑ Demonstrate and explain a variety of estimation strategies. Example: rounding, benchmarking, front end, compensation, using compatible numbers ❑ Apply estimation strategies to check the reasonableness of calculations when solving problems.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
7N15	Add, subtract, multiply and divide decimals (for more than 2-digit divisors or multipliers, the use of technology is expected). [E, PS, T]	❑ Use paper and pencil to add and subtract positive decimals and justify the process. ❑ Use paper and pencil to multiply and divide positive decimals for 1-digit and 2-digit divisors or multipliers. Example: 2.4×0.3 $7.2 \div 2$ ❑ Estimate the sum, difference, product or quotient of positive decimals to verify solutions. ❑ Use technology to multiply and divide positive decimals for divisors or multipliers with more than 2 digits. Example: 2.4×0.32 $7.2 \div 2.65$ ❑ Identify and apply the correct mathematical operation, given a problem involving positive decimals.
7N16	Add, subtract, multiply and divide integers concretely, pictorially and symbolically. [PS, V]	❑ Add and subtract integers, using manipulatives such as bingo chips or integer tiles, and/or diagrams. (7N10) ❑ Multiply and divide integers using manipulatives and/or diagrams. ❑ Add and subtract integers without a calculator. (7N10) ❑ Multiply and divide integers without a calculator. ❑ Solve problems involving operations on integers.
7N17	Illustrate and explain the order of operations, using paper and pencil or a calculator. [PS, T, V]	❑ Explain the need to have a universally accepted order of operations. ❑ Give examples where the order of operations does not require working in order from left to right. ❑ Perform calculations involving order of operations (with and without technology) and justify the process. ❑ Perform calculations on expressions containing brackets and parentheses. ❑ Use the order of operations to solve problems.

INDICATORS

General Outcome
Illustrate the use of rates, ratios, percentages and decimals in solving problems.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7N18	Estimate and calculate percentages. [E, PS]	❑ Describe a situation when the percentage is more than 100%. ❑ Describe a situation when the percentage is less than 1%. ❑ Convert fractions, decimals or their concrete representations to a percent. ❑ Calculate a given percentage of a number. ❑ Estimate percents using fraction benchmarks. Example: 57% is a little more than $\frac{1}{2}$. ❑ Use estimation strategies to verify the reasonableness of answers. ❑ Calculate percentage in a variety of problem-solving situations. Example: percent increase/decrease, tax, interest, statistics, discount, markup, commission
7N19	Distinguish between rate and ratio, and use them to solve problems. [PS]	❑ Provide examples of ratios where the two measures being compared are expressed in the same unit. Example: $\frac{\text{ginger ale}}{\text{juice}} = \frac{1\,\text{L}}{3\,\text{L}}$ $\frac{\text{rice}}{\text{water}} = \frac{250\,\text{mL}}{500\,\text{mL}}$ ❑ Provide examples of ratios where the two measures being compared are expressed in different units (rate). Example: $\frac{\text{kilometres}}{\text{hour}}, \frac{\text{words}}{\text{minute}}$ ❑ Write equivalent ratios. (7N20) ❑ Solve problems involving rate and ratio. (7N20)

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
		❑ Explain how fractions and ratios are different. (Ratios cannot be added or subtracted like fractions because the denominator of a ratio may not indicate how the whole is divided.) ❑ Explain how fractions and ratios are alike. (Ratios can be simplified like fractions are, as both compare two quantities.) ❑ Provide the other two forms, given one of the following ratio forms: $\frac{a}{b}$, $a : b$, a to b.
7N20	Explain, demonstrate and use proportion in solving problems. [C, PS, V]	❑ Explain the meaning of proportion and give examples. ❑ Write an equivalent proportion given two or more ratios. ❑ Determine the missing value in a proportion and justify the process. (7N3) ❑ Solve real-world problems using proportions.
7N21	Convert, mentally, among fractions, decimals and percents to facilitate the solution of problems. [E, PS]	❑ Convert between commonly used fractions, such as halves, quarters, thirds, fifths and tenths, decimals and percents. (7N18) Example: $\frac{1}{4} = 0.25 = 25\%$ ❑ Solve problems using fractions, decimals and percents.

INDICATORS

PATTERNS AND RELATIONS (PATTERNS)

General Outcome
Express patterns, including those used in business and industry, in terms of variables, and use expressions containing variables to make predictions.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7PR1	Predict and justify possible *n*th values of a number pattern. [C, CN, R]	❑ Determine the next three numbers in a number pattern, given several elements of the pattern. (7N1) Example: sequence, chart or drawing ❑ Predict the n^{th} term of a given number pattern. ❑ Justify the n^{th} term in a number pattern, by identifying the rule used to create the pattern.
7PR2	Interpolate and extrapolate number values from a given graph. [E, PS, V]	❑ Describe the patterns found in a given graph. ❑ Estimate (interpolate) the coordinates for a value that is between the plotted points of a graph. (7N14) ❑ Answer real-world questions, given a graph. ❑ Extend a graph to predict unknown values (extrapolate). (7N14) ❑ Summarize the relationship displayed in a graph and use it to solve problems. (7PR3)
7PR3	Graph relations, analyze the result and draw a conclusion from a pattern. [R, V]	❑ Identify the independent (manipulated) variable and dependent (responding) variable in a graph. ❑ Analyze relations graphically to determine how changes to one quantity may affect the other. (7PR2) ❑ Graph a given relation and describe the patterns found in the graph. (7PR6)
7PR4	Use patterns and relations to represent simple oral and written expressions as mathematical symbols, and vice versa. [CN, PS, R]	❑ Explain what a variable is and how it is used in a given mathematical expression. ❑ Explain the difference between a mathematical expression and an equation. ❑ Express real-world situations in mathematical symbols. Example: \$5 per person can be shown a 5*x*. ❑ Provide a real-world context for a given expression.

INDICATORS

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome
Use variables and equations to express, summarize and apply relationships as problem-solving tools in a restricted range of contexts.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7PR5	Write mathematical expressions that arise from problem-solving contexts. [C, CN, PS]	❑ Identify the relationship between an expression and its corresponding real-world problem. Example: Cell phone charges are 25¢ a minute, which can be represented by the expression $25x$.
7PR6	Evaluate expressions with and without concrete models. [R, V]	❑ Use algebra tiles to represent a given expression. ❑ Substitute values for the variable in an expression and determine its numerical value. (7N16)
7PR7	Illustrate the solution process for a one-step, single-variable, first-degree equation, using concrete materials or diagrams. [CN, PS, V]	❑ Verify, using examples, that performing the same operation on each side of an equation maintains the equality of the relationship. ❑ Use concrete models to represent and solve a given mathematical equation. Example: two-pan balance, algebra tiles ❑ Draw a visual representation of the steps required to solve a given mathematical equation. Example: two-pan balance, algebra tiles
7PR8	Solve and verify one-step linear equations, using a variety of techniques. [PS, R]	❑ Solve a given equation. (7N16, 7PR7) ❑ Substitute the solution for the variable into the original equation to verify the equality. (7N16)
7PR9	Explain how to solve simple problems, using informal algebraic methods. [C, PS, R]	❑ Solve real-world mathematical problems and justify the process. (7PR7)

INDICATORS

SHAPE AND SPACE (MEASUREMENT)

General Outcome
Solve problems involving the properties of circles and their connections with angles and time zones.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7SS1	Measure the diameters, radii and circumferences of circles, and establish the relationships among them. [CN, R]	❑ Identify the diameter, radius and circumference of a circle in a given diagram or concrete model. ❑ Determine the measure of the diameter, radius and circumference of a circle in a given diagram or concrete model. ❑ Explain the relationship between diameter and radius. ❑ Explain the relationship between diameter and circumference. ❑ Explain that the ratio of the circumference to the diameter is always the same. This ratio is called π. ❑ Provide an approximate value for π, such as 3.14.
7SS2	Solve problems involving the radii, diameters and circumferences of circles. [PS, T]	❑ Find the diameter of a circle, given the radius. ❑ Find the radius of a circle, given the diameter. ❑ Find the circumference of a circle, given the radius or diameter. (7N14, 7N15) ❑ Find the radius or diameter of a circle, given the circumference. (7N14, 7N15) ❑ Solve for unknown dimensions (r, d or C) in a given problem. (7N14)
7SS3	Explain how time zones are determined. [C, PS]	❑ Explain the relationship between a complete rotation of the earth (in 24 hours) and the 24 time zones. ❑ Explain variations in the 24 time zones. Example: why time zones do not run through cities, why certain areas do not change time biannually
7SS4	Research and report how measurement instruments are used in the community. [C, CN]	❑ Provide examples of measurement instruments that are used within the community and explain their use. Example: trundle wheel, micrometer

INDICATORS

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

General Outcome
Link angle measures to the properties of parallel lines.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7SS5	Measure and classify pairs of angles as complementary or supplementary angles. [E]	❑ Measure given angles, regardless of their orientation. ❑ Explain the meaning of complementary and supplementary angles, and provide examples. ❑ Identify the complementary and supplementary pairs, given a set of angles. (8SS1, 8SS2, 9SS2) ❑ Draw the complementary or supplementary angle of a given angle.
7SS6	Investigate, identify and name pairs of angles pertaining to parallel lines and transversals, including: • corresponding • vertically opposite • interior on the same side of the transversal • exterior on the same side of the transversal • alternate angles. [C, V]	❑ Explain the meaning of parallel lines and transversals, and provide real-world examples. ❑ Identify and name pairs of angles, given parallel lines and a transversal, that are: • corresponding • vertically opposite • interior on the same side of the transversal • exterior on the same side of the transversal • alternate angles. (7SS12)
7SS7	Describe the relationships between the pairs of angles pertaining to parallel lines and transversals. [C, R, T]	❑ Prove, given parallel lines and a transversal, and using tracing paper, a protractor, cutting, folding and/or repositioning, that: • alternate angles have equal angle measurements • corresponding angles have equal angle measurements • vertically opposite angles have equal angle measurements • interior angles on the same side of the transversal have a sum of 180˚ • exterior angles on the same side of the transversal have a sum of 180˚. (7SS12)

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
7SS8	Explain, in more than one way, why the sum of the measures of the angles of a triangle is 180º. [C, R, T]	❑ Demonstrate that the sum of the interior angles in a variety of triangles is always 180º, using multiple methods such as measuring the angles, cutting out the angles to form a line and using Geometer's Sketchpad. (8SS1, 8SS2, 9SS2)
7SS9	Use mathematical reasoning to determine the measures of angles in a diagram. [R, V]	❑ Determine the measures of the unknown angles in a labelled diagram by applying any one or a combination of the following relationships: • interior of angles in a triangle • vertically opposite angles • complementary angles • supplementary angles • angle pairs in parallel lines with transversals. (7SS5, 7SS6, 7SS7, 7SS8, 7PR8, 7PR9) ❑ Solve problems where one angle is given and the second angle is unknown but can be determined using the properties of parallel lines and transversals.
7SS10	Construct angle bisectors and perpendicular bisectors. [R, T, V]	❑ Define a bisector, as it relates to angles and lines, using words and diagrams. ❑ Construct the bisector of a given angle using a compass, and verify using a protractor. ❑ Construct the perpendicular bisector of a line segment using a compass, and verify using a protractor.

INDICATORS

SHAPE AND SPACE (TRANSFORMATIONS)

General Outcome
Create and analyze patterns and designs, using congruence, symmetry, translation, rotation and reflection.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7SS11	Create, analyze and describe designs, using translations (slides), rotations (turns) and reflections (flips). [C, T, V]	❑ Define translations, rotations and reflections using words and pictures, and provide real-world examples. ❑ Explain a transformation process (translation, rotation and/or reflection) that could have created an image from its original shape. ❑ Identify the line of reflection, given a shape and its reflected image. ❑ Create a design using rotations. ❑ Create a design using a combination of two or more translations, rotations and reflections.
7SS12	Use informal concepts of congruence to describe images after translations, rotations and reflections. [C, T]	❑ Demonstrate, using examples, that a figure does not change its shape or size as a result of a translation, rotation and/or reflection. (7SS6, 7SS7)
7SS13	Draw designs, using ordered pairs, in all four quadrants of the coordinate grid, together with translation and reflection images. [PS, V]	❑ Draw and label the four quadrants of a Cartesian plane. (7N11, 7N12) ❑ Identify the coordinates of a point in all four quadrants. (7N11, 7N12) ❑ Plot points given coordinates in all four quadrants. (7N11, 7N12) ❑ Draw a design in all four quadrants, using ordered pairs. ❑ Draw a design in one or more quadrants, using ordered pairs, and draw its image using a translation. (7N11, 7N12) ❑ Draw a design in all four quadrants, using ordered pairs, and draw its image using a reflection. (7N11, 7N12)
7SS14	Relate reflections to lines and planes of symmetry. [CN, V]	❑ Identify the line(s) of symmetry, given a drawing. ❑ Explain, using an example, that the line of symmetry can be obtained by folding a figure so that it has two parts that match exactly.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
		❑ Find a line of reflection between an original object and its image. ❑ Explain that a line of reflection is a straight line and that this line acts as a line of symmetry between the original object and its image. ❑ Identify the planes of symmetry, given a 3-D object.

INDICATORS

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome
Develop and implement a plan for the collection, display and analysis of data, using measures of variability and central tendency.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7SP1	Formulate questions for investigation, from a real-world context. [C, CN, R]	❑ Write a question that will facilitate the collection of data, when provided with a real-world situation.
7SP2	Select, defend and use appropriate methods of collecting data: • designing and using questionnaires • interviews • experiments • research. [C, PS, T]	❑ Use a selected data collection method, analyze the results and evaluate the suitability of the data collection method. ❑ Identify two or more data collection methods to answer a question, and provide a justification for choosing one method over another. (7SP1) Example: Choosing a survey over interviews because of the time available. ❑ Choose a data collection method and provide suggestions on how to improve the data collection procedure. Example: survey more parents, clarify wording
7SP3	Describe issues to be considered when collecting data; e.g., appropriate language, ethics, cost, privacy, cultural sensitivity. [C, CN, R]	❑ Analyze a case study of data collection and identify potential problems related to appropriate language, ethics, cost, privacy or cultural sensitivity. (7SP2)
7SP4	Display data by hand or by computer in a variety of ways, including circle graphs. [C, T, V]	❑ Select an appropriate graphing method for displaying a particular set of data, such as: • stem and leaf plot • line plot • pictograph • bar graph • broken-line graph • double bar graph • double broken-line graph • histogram and produce the graph with or without the use of technology. (7PR2, 7PR3) ❑ Create a circle graph to display a given set of data. (7N18)

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
7SP5	Read and interpret graphs. [C, E, PS, R]	❑ Analyze the information provided in a graph to answer questions. (7PR2, 7PR3) ❑ Explain how the format of a graph, such as the size of intervals, the width of bars and the visual presentation, may lead to the misinterpretation of data. ❑ Write questions that can be answered by data displayed on a given graph.
7SP6	Determine measures of central tendency for a set of data: • mode • median • mean. [PS]	❑ Define mode, median and mean. ❑ Calculate the measures of central tendency (mean, median and mode) for a given set of data and explain why these values may be the same or different. ❑ Solve problems involving the measures of central tendency.
7SP7	Determine measures of the distribution of a set of data: • range • extremes, gaps and clusters • quartiles. [PS]	❑ Calculate the range and extremes for a set of data. ❑ Identify gaps and clusters in a set of data. ❑ Determine the upper and lower quartiles for a set of data. ❑ Solve problems involving the measures of the distribution of a set of data.
7SP8	Interpolate from data to make predictions. [E, PS, R]	❑ Organize a set of given data in order to make and justify predictions. (7PR3)

INDICATORS

STATISTICS AND PROBABILITY (CHANCE AND UNCERTAINTY)

General Outcome
Create and solve problems, using probability.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
7SP9	Use a table to identify all possible outcomes of two independent events. [PS, R]	❑ Provide an example of an independent event and explain why it is independent. ❑ List all possible outcomes for each of two independent events.
7SP10	Create and solve problems, using the numerical definition of probability as favourable outcomes divided by possible outcomes. [PS, R]	❑ Explain the meaning of favourable outcomes. ❑ Explain that probability of an event is the number of favourable outcomes divided by the number of possible outcomes. ❑ Determine the probability of an event. ❑ Express a probability as a fraction, decimal and/or percent. (7N14, 7N18) ❑ Solve probability problems. ❑ Explain that a probability of zero means that the event cannot happen and the probability of one means that the event will certainly happen.
7SP11	Use the Monte Carlo simulation method to solve probability problems. [CN, E, PS, T]	❑ Solve a probability problem using the Monte Carlo simulation method.

GRADE 8

INDICATORS

NUMBER (NUMBER CONCEPTS)

General Outcome
Demonstrate a number sense for rational numbers, including common fractions, integers and whole numbers.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8N1	Demonstrate and explain the meaning of a negative exponent, using patterns (limit to base 10). [C, CN, R, V]	❑ Analyze the pattern in the following table to determine that: • A number to the zero power is equal to one Example: $10^0 = 1$ • Whole numbers with negative exponents can be expressed as fractions. • As you decrease the exponent by 1 for a given power, the value is $\frac{1}{10}$ as large. 10^2 | 100 10^1 | 10 10^0 | 1 10^{-1} | $\frac{1}{10}$ 10^{-2} | $\frac{1}{100}$ 10^{-3} | $\frac{1}{1000}$ ÷10 ❑ Indicate the exponential fraction form for a given power with a base of 10 and a negative exponent. Example: $10^{-2} = \frac{1}{10^2}$ ❑ Indicate the standard fractional form for a given power with a base of 10 and a negative exponent. Example: $10^{-2} = \frac{1}{100}$

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
		❑ Indicate the standard decimal form for a given power with a base of 10 and a negative exponent. Example: $10^{-2} = 0.01$
8N2	Represent any number in scientific notation. [R]	❑ Express large or small numbers in scientific notation. (8N1) Example: $4\,032\,396 = 4.032\,396 \times 10^{6}$ $0.000\,054 = 5.4 \times 10^{-5}$ ❑ Provide real-world examples for the use of scientific notation for large and small numbers.
8N3	Define, compare and order any rational numbers. [R, T, V]	❑ Define a rational number as a number that can be written as a fraction where the denominator is not zero. ❑ Determine whether or not numbers in a given set are rational. ❑ Determine whether one rational number is greater than, less than or equal to another, and provide a justification. ❑ Arrange a set of given rational numbers in ascending or descending order. Example: 7, -12, 0.43, $\frac{1}{3}$
8N4	Demonstrate concretely, pictorially and symbolically that the product of reciprocals is equal to 1. [R, V]	❑ State that a number must be expressed as a fraction before its reciprocal can be determined. ❑ Explain why the number zero cannot have a reciprocal. ❑ Explain why the product of a number and its reciprocal is equal to 1. (8PR5) ❑ Write the reciprocal of a given number.
8N5	Express 3-term ratios in equivalent forms. [CN]	❑ Explain the relationship between a given pair of equivalent 2-term ratios. ❑ Write an equivalent ratio, given a 2-term ratio. ❑ Determine the missing term in a pair of equivalent 3-term ratios. (8N12) ❑ Generate equivalent ratios, given a 3-term ratio, and explain how they know they are equal. Example: 1 : 2 : 3 = 3 : 6 : 9

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
8N6	Represent and apply fractional percents, and percents greater than 100, in fraction or decimal form, and vice versa. [CN, R]	❑ Express the shaded part of a given ten thousandths grid as a fraction percent, and/or a decimal. Example: $\frac{25}{10\,000} = \frac{1}{4}\%$ ❑ Represent given percents (including less than 1 and greater than 100) by shading grids. ❑ Convert percents greater than and less than 1 to a fraction or a decimal in simplest form and vice versa. ❑ Solve problems involving fractional percents and percents greater than 100.
8N7	Represent square roots concretely, pictorially and symbolically. [R, V]	❑ Define a perfect square as the product of a whole number multiplied by itself. Example: $36 = 6 \times 6$, so 36 is a perfect square. ❑ Use manipulatives or diagrams to represent a perfect square and determine its square root. Example: grid paper, base 10 blocks ❑ Use manipulatives or diagrams to show that not all square numbers are perfect squares. Example: $4.41 = 2.1 \times 2.1$, so 4.41 is a square number but not a perfect square. ❑ Determine whether or not a given number is a square number, and justify their reasoning. ❑ Define a square number as the product of a number multiplied by itself. (8N11)
8N8	Distinguish between a square root and its decimal approximation as it appears on a calculator. [T]	❑ Calculate the square root of a number, using technology, and state whether or not the square root shown is an exact value or an approximation. (8N11) Example: $\sqrt{16} = 4$ ($\sqrt{16}$ is an exact value.) $\sqrt{4.41} = 2.1$ ($\sqrt{4.41}$ is an exact value.) $\sqrt{17} = 4.123\,105\ldots$ ($\sqrt{17}$ is an approximation.)

NUMBER (NUMBER OPERATIONS)

General Outcome
Apply arithmetic operations on rational numbers to solve problems.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8N9	Add, subtract, multiply and divide fractions concretely, pictorially and symbolically. [E, PS, V]	❑ Add and subtract fractions without the use of technology: • demonstrate the process for adding and/or subtracting fractions with common denominators using manipulatives Example: fraction blocks, fraction strips, paper folding, Cuisenaire rods • add or subtract two fractions with common denominators • add or subtract two fractions with unlike denominators, by rewriting them as fractions with common denominators then adding or subtracting them • add or subtract two or more fractions with either common or unlike denominators, and express the sum/difference in simplest form. ❑ Multiply and divide fractions without the use of technology: • multiply a fraction by a fraction, a fraction by a mixed number or a fraction by a whole number, and provide a real-world context for each • demonstrate, using diagrams or manipulatives, that the product of a whole number multiplied by a fraction less than 1 is **less than** the whole number • demonstrate, using diagrams or manipulatives, that the product of two positive fractions that are less than 1 is **less than** either factor

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
		• model the division of a fraction by a whole number, using manipulatives or diagrams • divide a whole number by a fraction, a fraction by a whole number, and a fraction by a fraction • model division of a whole number by a fraction, using manipulatives or diagrams • divide a mixed number by a fraction, a mixed number by a whole number, and a mixed number by another mixed number. ❑ Solve real-world problems involving fractions.
8N10	Estimate, compute and verify the sum, difference, product and quotient of rational numbers, using only decimal representations of negative rationals. [E, PS, T]	❑ Add and subtract positive and negative decimals without using a calculator. ❑ Add and subtract positive and negative decimals using a calculator. ❑ Estimate the sum and difference of positive and negative decimals to verify solutions. ❑ Multiply and divide positive and negative decimals without using a calculator. ❑ Multiply and divide positive and negative decimals using a calculator. ❑ Estimate the product and quotient of positive and negative decimals to verify solutions. ❑ Solve real-world problems involving rational numbers.
8N11	Estimate, compute (using a calculator) and verify approximate square roots of whole numbers and of decimals. [E, PS, T]	❑ Determine the square root of a given square number. ❑ Estimate the square roots of whole numbers and decimals, and explain their response using known roots of perfect squares. ❑ Verify their estimates using technology. (8N8)

INDICATORS

General Outcome
Apply the concepts of rate, ratio, percentage and proportion to solve problems in meaningful contexts.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8N12	Use concepts of rate, ratio, proportion and percent to solve problems in meaningful contexts. [E, PS, T]	❑ Determine whether rate, ratio, proportion or percent could be used in solving a given problem. (8N5, 8N6) ❑ Calculate the rate, ratio, proportion or percent of given numbers. (8N13, 8N14, 8N15) ❑ Solve problems involving rate, ratio, proportion and percent.
8N13	Calculate combined percentages in a variety of meaningful contexts. [CN, E, PS, T]	❑ Explain the meaning of combined percentages using a real-world example. ❑ Demonstrate that a percent increase followed by an equal percent decrease does not produce the original number, and vice versa. Example: A 50% increase to 100 is equal to 150. A 50% decrease to 150 is equal to 75, which is less than the original 100. ❑ Solve problems involving combined percentages. (8N12) Example: What is the new value of a $75 item that is marked up 20% and then marked down 20%?
8N14	Derive and apply unit rates. [PS, R]	❑ Explain the meaning of unit rates, using an example. ❑ Determine the unit rate for a given rate. (8N12) Example: Twelve oranges cost $3. The unit cost is 25¢/orange. ❑ Convert a given rate into a unit rate to determine reasonableness. Example: You plan to travel 950 km in 6 hours by car. Is this reasonable?
8N15	Express rates and ratios in equivalent forms. [PS, R]	❑ Determine the missing term in a set of equivalent rates or ratios. (8N12) ❑ Solve real-world problems using equivalent rates or ratios.

PATTERNS AND RELATIONS (PATTERNS)

General Outcome
Use patterns, variables and expressions, together with their graphs, to solve problems.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8PR1	Generalize a pattern arising from a problem-solving context, using mathematical expressions and equations, and verify by substitution. [C, CN, PS, R]	❑ Represent a real-world situation with an algebraic expression. ❑ Evaluate a given algebraic expression by substituting values for the unknowns. ❑ Describe the pattern of change occurring in an arithmetic or geometric sequence, and translate this description into an algebraic expression. ❑ Create a table of values for a given algebraic expression. (8PR2) ❑ Write an equation representing the pattern in a given table of values, and verify the equation by substituting values from the table. (8PR2)
8PR2	Substitute numbers for variables in expressions, and graph and analyze the relation. [C, PS, R, V]	❑ Determine the missing value in an ordered pair, given an equation. ❑ Create a table of values by substituting into a 2-variable equation. (8PR1) ❑ Graph the table of values for a given equation to solve problems. ❑ Analyze the relationship between the x and y variables for a given graph.
8PR3	Translate between an oral or written expression and an equivalent algebraic expression. [C, CN]	❑ Translate a word statement into an algebraic expression. ❑ Describe, in words, the relation in a given algebraic expression.

INDICATORS

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome
Solve and verify one-step and two-step linear equations with rational number solutions.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8PR4	Illustrate the solution process for a two-step, single-variable, first-degree equation, using concrete materials or diagrams. [CN, PS, V]	❑ Demonstrate, using diagrams or concrete materials such as algebra tiles and counters, that performing the same operation on each side of an equation maintains the equality of the relationship. ❑ Use concrete materials or diagrams to represent the steps for solving a two-step, single-variable, first-degree equation. Example: two-pan balances, algebra tiles ❑ Explain that the goal of solving an equation is to isolate the variable and reduce its coefficient to 1.
8PR5	Solve and verify one- and two-step, first-degree equations of the form: • $x + a = b$ • $ax = b$ • $\frac{x}{a} = b$ • $ax + b = c$ • $\frac{x}{a} + b = c$ where a, b and c are integers. [PS, V]	❑ Solve one-step equations of the form • $x + a = b$ • $ax = b$ • $\frac{x}{a} = b$ and show their process. (8N4, 8PR4) ❑ Solve two-step equations of the form • $ax + b = c$ • $\frac{x}{a} + b = c$ and show their process. (7N10, 8PR4) ❑ Verify a solution by substituting into the equation. (8PR2)
8PR6	Create and solve problems, using first-degree equations. [PS]	❑ Represent a real-world situation as a first-degree equation and solve it. (8PR5) Example: Cell phone charges are 25¢ a minute. What is the cost of using the phone for 2 hours?

INDICATORS

SHAPE AND SPACE (MEASUREMENT)

General Outcome
Apply indirect measurement procedures to solve problems.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8SS1	Use concrete materials and diagrams to develop the Pythagorean relationship. [CN, R]	❑ Identify the hypotenuse in a right triangle regardless of the orientation of the triangle. ❑ Prove the Pythagorean theorem, using manipulatives or diagrams.
8SS2	Use the Pythagorean relationship to calculate the measure of the third side, of a right triangle, given the other two sides in 2-D applications. [PS]	❑ Determine the length of the third side of a right triangle, given the length of two sides. (8N11) ❑ Draw a diagram to represent a given problem which includes a right triangle, and solve the problem using the Pythagorean theorem.

General Outcome
Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
8SS3	Describe patterns, and generalize the relationships by determining the areas and perimeters of quadrilaterals and the areas and circumferences of circles. [C, CN, PS, T]	❑ Determine the perimeter of triangles and quadrilaterals. ❑ Develop, verify and use formulas for determining the area of a triangle. Example: Generalize the relationship between the area of a rectangle and the area of a triangle. ❑ Develop, verify and use rules for determining the area of quadrilaterals such as parallelograms, rhombi and trapezoids. ❑ Calculate the circumference of circles. (8PR1) ❑ Use the formula $A = \pi r^2$ to determine the area of a circle. ❑ Determine the area of a circle given its circumference. (8PR2) ❑ Determine the effect on the area and perimeter of changing one or more dimensions of a figure.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
8SS4	Estimate, measure and calculate the surface area and volume of any right prism or cylinder. [E, PS, T]	❑ Differentiate between linear, square and cubic units of measure. ❑ Sketch, draw or build a net for a right prism and a cylinder. ❑ Name right prisms or cylinders from sketches, models or nets. ❑ Calculate the surface area of a right prism or cylinder. (8PR1) ❑ Estimate the surface area of a right prism or cylinder from its dimensions. (8SS3, 8PR2) ❑ Use a known referent, such as a juice box or pop can, to estimate the volume of a given right prism or cylinder. ❑ Calculate the volume of a given right prism or cylinder. (8PR2) ❑ Estimate the dimensions of a right prism or cylinder to estimate its volume or surface area. ❑ Solve problems involving surface area and volume.
8SS5	Estimate and calculate the area of composite figures. [E, PS, R]	❑ Identify a set of shapes, such as quadrilaterals, triangles and/or circles, that make up a given composite 2-D figure. ❑ Estimate and calculate the area of a composite figure using the areas of its component shapes. (8SS3, 8PR2) ❑ Solve problems involving composite figures. (8SS3, 8PR2)
8SS6	Estimate, measure and calculate the surface area of composite 3-D objects. [E, PS, R]	❑ Identify and draw a set of shapes, such as quadrilaterals, triangles and/or circles, that can be combined to make the net of a given composite solid, and label the dimensions. ❑ Estimate the surface area of a composite 3-D object, and explain the process. (8SS4, 8PR2) ❑ Calculate the surface area of the 3-D object, determining the area of each of its shapes. (8SS4, 8PR2) ❑ Solve problems involving the surface area of a 3-D object.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
8SS7	Estimate, measure and calculate the volume of composite 3-D objects. [E, PS, R]	❑ Identify a set of right prisms and/or cylinders that can be combined to make a given composite solid. ❑ Estimate the volume of each simple solid to estimate the volume of a composite 3-D solid. (8SS4, 8PR2) ❑ Calculate the volume of each simple solid to determine the volume of a composite 3-D solid. (8SS4, 8PR2) ❑ Solve problems involving the volume of composite 3-D objects.

INDICATORS

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

General Outcome
Link angle measures and the properties of parallel lines to the classification and properties of quadrilaterals.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8SS8	Identify, investigate and classify quadrilaterals, regular polygons and circles, according to their properties. [PS, R, T]	❑ List properties that are used in classifying quadrilaterals and regular polygons, such as the number of angles, number of sides, number of equal sides, number of parallel sides and number of right angles. ❑ List properties, such as size, colour and orientation, that are not used in identifying quadrilaterals and regular polygons. ❑ Sort a given set of figures according to their properties, and communicate and justify the groupings.
8SS9	Build 3-D objects from a variety of representations (nets, skeletons). [PS, V]	❑ Create nets or skeletons for a given 3-D object. ❑ Construct 3-D objects from their nets.

INDICATORS

SHAPE AND SPACE (TRANSFORMATIONS)

General Outcome
Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8SS10	Represent, analyze and describe enlargements and reductions. [CN, R]	❑ Determine the scale factor for the enlargement or reduction of an original to its image. (8N12) ❑ Create an enlargement or reduction of the original, using a given scale factor. (8N12) ❑ Identify enlargements and reductions in real-world contexts.
8SS11	Draw and interpret scale diagrams. [PS, T]	❑ Calculate actual measurements from scale diagrams, such as maps. (8N12) ❑ Provide a rationale for using scale diagrams in real-world situations. ❑ Recognize that a scale is a ratio of the dimensions of the drawing to the dimensions of the real object. ❑ Draw a scale diagram from actual measurements, using an appropriate scale factor.
8SS12	Represent, analyze and describe regions and colouring problems. [C, PS, V]	❑ Colour a 2-dimensional diagram with many regions using as few colours as possible and ensuring that no adjacent regions have the same colour. ❑ Interpret diagrams where colour is used to represent regions.
8SS13	Describe, analyze and solve network problems; e.g., bus routes, a telephone exchange. [C, E, PS]	❑ Answer questions using a given network diagram. ❑ Create a diagram to represent a given network. Example: airplane routes

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome
Develop and implement a plan for the collection, display and analysis of data, using technology, as required.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8SP1	Formulate questions for investigation, using existing data. [C, CN, R]	❑ Write questions for further investigation arising from a given set of data.
8SP2	Select, defend and use appropriate methods of collecting data: • designing and using surveys • research, using electronic media. [C, PS, T]	❑ Identify different methods of data collection, such as questionnaires, interviews, surveys, experiments and research, including the use of electronic media. ❑ Select and use the most appropriate method of collecting data for a given question. ❑ Identify an appropriate population and sample size to gather their data, and justify their choice. ❑ Use technology to collect the appropriate data in determining the answer to a given question.
8SP3	Display data by hand or by computer in a variety of ways, including box and whisker plots. [C, T, V]	❑ Choose an appropriate graphing method to display a particular set of data, and defend the method selected. ❑ Display data appropriately, by hand or computer, using graphs or charts such as pictographs, pie charts, line graphs, bar graphs, histograms, stem and leaf plots, vertical line plots or box and whisker plots. ❑ Create a box and whisker plot to display a given set of data.

INDICATORS

General Outcome

Evaluate and use measures of central tendency and variability.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8SP4	Determine and use the most appropriate measure of central tendency in a given context. [CN, PS, T]	❑ Calculate mean, median and mode for any given set of data. ❑ Identify mean as an appropriate description of central tendency for sets of data with no outliers. ❑ Identify median as an appropriate description of central tendency for sets of data with several outliers. ❑ Identify mode as an appropriate description of central tendency for sets of data with many identical data points. ❑ Select the appropriate measure of central tendency to describe a given set of data, and justify their choice.
8SP5	Describe the variability of data sets, using such techniques as range, and box and whisker plots. [C, PS, T]	❑ Determine the range, extremes, outliers, gaps clusters and quartiles in a given set of data. ❑ Determine the quartiles and extremes to make a box and whisker plot.
8SP6	Construct sets of data given measures of central tendency and variability. [PS, R]	❑ Create a possible set of data when given a value for mean. ❑ Create a possible set of data when given a value for median. ❑ Create a possible set of data when given a value for mode.
8SP7	Determine the effect on the mean, median and/or mode when: • a constant is added or subtracted from each value • each value is multiplied or divided by the same constant • a significantly different value is included. [E, PS, R]	❑ Add or subtract a constant to each value in a set of data; recalculate the mean, median and/or mode; and analyze the effect. ❑ Multiply or divide each value in a set of data by a constant; recalculate the mean, median and/or mode; and analyze the effect. ❑ Add an outlier to a set of data; recalculate the mean, median and/or mode; and analyze the effect.

STATISTICS AND PROBABILITY (CHANCE AND UNCERTAINTY)

General Outcome
Compare theoretical and experimental probability of independent events.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
8SP8	Use computer or other simulations to solve probability and data collection problems. [E, PS, T]	❑ Choose a simulation method, such as a coin toss, rolling dice, a spinner, cards or a computer, to represent the possible outcomes for a given problem. Example: coin toss to represent gender ❑ Use a simulation method to determine the experimental probability of an event. (8N12)
8SP9	Recognize that if n events are equally likely the probability of any one of them occurring is $\frac{1}{n}$. [R]	❑ Explain what "equally likely" means, and provide examples. ❑ Determine the probability of an event occurring if each outcome is equally likely to occur. (8N12)
8SP10	Determine the probability of two independent events where the combined sample space has 52 or fewer elements. [PS, R, V]	❑ Provide examples of dependent and independent events. ❑ Identify all possible outcomes of two combined independent events, using tree diagrams, tables or other diagrams, to determine the probability of a favourable outcome.
8SP11	Predict population characteristics from sample data. [C, CN]	❑ Predict, using a sample space, the approximate occurrence of a characteristic within the population. Example: If 1 out of a sample space of 5 has green eyes, then 20% of the population would have green eyes.

GRADE 9

INDICATORS

NUMBER (NUMBER CONCEPTS)

General Outcome
Explain and illustrate the structure and the interrelationship of the sets of numbers within the rational number system.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9N1	Give examples of numbers that satisfy the conditions of natural, whole, integral and rational numbers, and show that these numbers comprise the rational number system. [C, CN, PS, R]	❑ Sort and classify a given set of numbers into their number systems. (9N2) ❑ Place numbers from the natural (N), whole (W), integral (I), rational (Q) and irrational ($\overline{Q}$) number systems onto a number line. (9PR6) ❑ Provide real-world examples that illustrate each number system. ❑ Explain and illustrate the similarities and differences between each number system. (9PR6) Example: Create a Venn diagram. ❑ Use the correct symbols (N, W, I, Q, $\overline{Q}$) to identify the number systems. (9PR5, 9PR6)
9N2	Describe, orally and in writing, whether or not a number is rational. [C, R]	❑ Show that a given number is rational by expressing it in the form $\frac{a}{b}$ where both a and b are integers and $b \neq 0$. ❑ Provide examples of irrational numbers (that cannot be written in $\frac{a}{b}$ form).
9N3	Give examples of situations where answers would involve the positive (principal) square root, or both positive and negative square roots of a number. [C, CN, PS, R]	❑ Provide the positive (principal) and negative square root for a given square. Example: $\sqrt{25} = 5$; $\sqrt{5^2} = \pm 5$ ❑ Explain why only principal square roots are used in measurement. (9SS7)

INDICATORS

General Outcome
Develop a number sense of powers with integral exponents and rational bases.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9N4	Illustrate power, base, coefficient and exponent, using rational numbers or variables as bases or coefficients. [R, V]	❑ Explain, using an example, that a power is an expression made up of a coefficient, a base and an exponent. (9PR5, 9PR7, 9PR11, 9PR12, 9PR14) ❑ Identify the coefficient, base and exponent of a given a power. (9PR7) Example: $2x^3$ 2 – coefficient x – base 3 – exponent ❑ Write a given power in expanded form. (9N5) Example: $(4a^2)^3 = (4a^2)(4a^2)(4a^2)$
9N5	Explain and apply the exponent laws for powers with integral exponents: $(x^m)(x^n) = x^{m+n}$ $x^m \div x^n = x^{m-n}$ $(x^m)^n = x^{mn}$ $(xy)^m = x^m y^m$ $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}, y \neq 0$ $x^0 = 1, x \neq 0$ $x^{-n} = \frac{1}{x^n}, x \neq 0$ [PS, R]	❑ Simplify expressions by applying the exponent laws. ❑ Substitute integral values for the base and exponent, and solve to verify a law. Example: $(x^m)(x^n) = x^{m+n}$ $(3^2)(3^3)$ $= (3 \times 3)(3 \times 3 \times 3)$ $= 3^{2+3}$ $= 3^5$ $(y^m)^n = y^{mn}$ $(y^2)^3$ $= (y^2)(y^2)(y^2)$ $= y^{(2\times3)}$ $= y^6$ ❑ Show that any base (except 0) with an exponent of 0 is equal to 1, using a pattern or the quotient law for exponents. Example: $x^n \div x^n = x^{n-n}$ $\frac{x^n}{x^n} = x^0$ $1 = x^0$ ❑ Show that $x^{-n} = \frac{1}{x^n}$, where $x \neq 0$, using a pattern.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
9N6	Determine the value of powers with integral exponents, using the exponent laws. [PS, R]	❑ Simplify and evaluate expressions with powers, using the exponent laws. (9PR8) ❑ Demonstrate that $-x^2 \neq (-x)^2$, using examples.

INDICATORS

NUMBER (NUMBER OPERATIONS)

General Outcome
Use a scientific calculator or a computer to solve problems involving rational numbers.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9N7	Document and explain the calculator keying sequences used to perform calculations involving rational numbers. [C, PS, T]	❑ Determine the answer to a problem, using the correct calculator keying sequence, and explain their keying sequence.
9N8	Solve problems, using rational numbers in meaningful contexts. [CN, PS]	❑ Solve real-world problems involving the use of rational numbers.

General Outcome
Explain how exponents can be used to bring meaning to large and small numbers, and use calculators or computers to perform calculations involving these numbers.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
9N9	Understand and use the exponent laws to simplify expressions with variable bases and evaluate expressions with numerical bases. [PS, R]	❑ Apply one or more exponent laws to simplify an expression. (9N5, 9N6, 9PR12) ❑ Evaluate expressions with numerical bases, using the exponent laws. ❑ Write an equivalent expression, using positive exponents for a given expression with negative exponents. (9N5)
9N10	Use a calculator to perform calculations involving scientific notation and exponent laws. [PS, R, T]	❑ Solve real-world problems involving numbers written in scientific notation with the aid of a calculator. (9N7) ❑ Apply the exponent laws to simplify problems involving scientific notation.

PATTERNS AND RELATIONS (PATTERNS)

General Outcome
Generalize, design and justify mathematical procedures, using appropriate patterns, models and technology.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9PR1	Use logic and divergent thinking to present mathematical arguments in solving problems. [C, PS, R]	❑ Solve problems using mathematical reasoning, and explain their thinking.
9PR2	Model situations that can be represented by first-degree expressions. [CN, PS]	❑ Use concrete models or pictures to illustrate first-degree expressions. (9PR3) ❑ Write a first-degree expression to represent a real-world situation. (9PR1, 9PR5) Example: cell phone costs
9PR3	Write equivalent forms of algebraic expressions, or equations, with rational coefficients. [C, CN, R]	❑ Identify equivalent forms of a given algebraic expression or equation, and provide justification. ❑ Simplify a given algebraic expression or equation. ❑ Manipulate formulas with a rational coefficient to isolate an identified variable. Example: $\frac{C}{2\pi} = r$ $C = 2\pi r$

PATTERNS AND RELATIONS (VARIABLES AND EQUATIONS)

General Outcome
Solve and verify linear equations and inequalities in one variable.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9PR4	Illustrate the solution process for a first-degree, single-variable equation, using concrete materials or diagrams. [PS, R, V]	❑ Illustrate an equation using concrete materials such as algebra tiles. (9PR5) ❑ Illustrate the process for solving an equation, using diagrams or concrete materials.
9PR5	Solve and verify first-degree, single-variable equations of forms, such as: • $ax = b + cx$ • $a(x + b) = c$ • $ax + b = cx + d$ • $a(bx + c) = d(ex + f)$ • $\frac{a}{x} = b$ where a, b, c, d, e and f are all rational numbers (with a focus on integers), and use equations of this type to model and solve problem situations. [C, PS, V]	❑ Apply the distributive property to solve an equation. Example: $2(x + 3) = 2x + 6$ ❑ Apply the associative property to solve an equation. Example: $2 + (6 + 8) = (2 + 6) + 8$ ❑ Combine like terms to simplify an expression or equation. (9PR10) ❑ Solve an equation, and verify the solution by substituting into the equation. (9N4, 9PR10, 9PR12) ❑ Use equations to solve real-world problems.
9PR6	Solve, algebraically, first-degree inequalities in one variable, display the solutions on a number line and test the solutions. [PS, R, V]	❑ Provide examples of inequalities, using the symbols $<$, $>$, $\leq$ and $\geq$. ❑ List similarities and differences between solving an equation and solving an inequality. (9PR5) ❑ Solve inequalities that involve multiplication or division by a negative number. ❑ Differentiate between $\geq$ and $>$, and between $<$ and $\leq$ by providing examples. ❑ Describe the solution of an inequality, which may include infinity. ❑ Illustrate the solution of an inequality on a number line, in a list and/or on a graph. ❑ Verify the solution of an inequality using substitution. (Ensure that multiple values within the range of the solution are used to validate the correct inequality symbol.) ❑ Solve inequalities algebraically, showing all steps in the solution.

INDICATORS

General Outcome
Generalize arithmetic operations from the set of rational numbers to the set of polynomials.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9PR7	Identify constant terms, coefficients and variables in polynomial expressions. [C]	❑ Identify the coefficients, variables and constant (if present), given a polynomial. (9N4) ❑ Simplify a given expression by combining like terms. ❑ Identify monomials, binomials and trinomials from a given list of polynomials.
9PR8	Evaluate polynomial expressions, given the value(s) of the variable(s). [E]	❑ Determine the value of an expression by substituting a given value(s). (9N7) ❑ Simplify an expression by applying the rules for the order of operations.
9PR9	Represent and justify the addition and subtraction of polynomial expressions, using concrete materials and diagrams. [C, R, V]	❑ Represent a given expression using diagrams and concrete materials such as algebra tiles. (9PR4) ❑ Demonstrate the addition and subtraction of polynomials using diagrams and concrete materials. ❑ Explain the meaning of additive inverse for a polynomial, using concrete materials to represent the polynomial. Example: Flip the tiles representing a polynomial to determine its additive inverse. ❑ Explain and illustrate the zero principle. Example: □ + ■ = 0, □ – □ = 0,■ – ■ = 0
9PR10	Perform the operations of addition and subtraction on polynomial expressions. [R]	❑ Identify like terms in a polynomial expression. (9PR5) ❑ Simplify an expression by combining like terms. (9PR5) ❑ Add and subtract polynomial expressions algebraically.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
9PR11	Represent multiplication, division and factoring of monomials, binomials, and trinomials of the form $x^2 + bx + c$, using concrete materials and diagrams. [R, V]	❑ Write a polynomial expression represented by a given rectangle built with algebra tiles. ❑ Write the factors of a polynomial expression from the dimensions of a given rectangle made with algebra tiles. ❑ Illustrate, with concrete materials or drawings, the multiplication of polynomial expressions. (9SS7) ❑ Model the process of factoring a given polynomial expression by using algebra tiles to form a rectangle. ❑ Demonstrate the process of dividing a polynomial expression, given one of its factors, using algebra tiles to form a rectangle.
9PR12	Find the product of two monomials, a monomial and a polynomial, and two binomials. [R]	❑ Explain the distributive property for multiplying polynomials, using an example. Example: $2(x + 2)$ $= 2x + 4$ ❑ Apply the distributive property when multiplying polynomials. (9PR5) ❑ Determine the product of two monomials, and explain their process. ❑ Determine the product of two binomials, and explain their process. ❑ Multiply a monomial by a polynomial with three or fewer terms.
9PR13	Determine equivalent forms of algebraic expressions by identifying common factors and factoring trinomials of the form $x^2 + bx + c$. [PS, R]	❑ List all the possible factors for each term in a given polynomial. ❑ Identify the greatest common factor (GCF) for the terms in a given polynomial, and rewrite the polynomial as a product of factors, one being the GCF. ❑ Identify and factor polynomials that can be factored using the difference of squares. (9N3) ❑ Identify and factor a given perfect square trinomial. Example : $x^2 + 8x + 16$ $= (x + 4)^2$ ❑ Factor a given trinomial with two real roots. (9PR12)
9PR14	Find the quotient when a polynomial is divided by a monomial. [R]	❑ Divide a given polynomial by a monomial. (9N5, 9PR11)

INDICATORS

SHAPE AND SPACE (MEASUREMENT)

General Outcome
Use trigonometric ratios to solve problems involving a right triangle.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9SS1	Explain the meaning of sine, cosine and tangent ratios in right triangles. [C]	❑ Identify the hypotenuse, opposite and adjacent sides according to the angle of reference in right triangles. ❑ Identify the ratio for sine, cosine and tangent, given a right triangle in a variety of orientations.
9SS2	Demonstrate the use of trigonometric ratios (sine, cosine and tangent) in solving right triangles. [PS]	❑ Identify the trigonometric ratio needed to solve a given problem. Example: sine, cosine, tangent ❑ Draw a diagram to illustrate a real-world problem using trigonometric ratios, and determine the solution. (9SS4)
9SS3	Calculate an unknown side or an unknown angle in a right triangle, using appropriate technology. [PS, T]	❑ Solve for an unknown side in a given right triangle, using the appropriate trigonometric ratio. ❑ Solve for an unknown angle in a given right triangle, using the appropriate trigonometric ratio. ❑ Apply a correct calculator keying sequence to solve for an unknown side or angle, given a right triangle. (9N7) Example: [Tan] [5] [1] or [5] [1] [Tan] ❑ Explain the relationship between a trigonometric ratio and its inverse. Example: [Tan] and [Tan^{-1}]
9SS4	Model and then solve given problem situations involving only one right triangle. [PS, T, V]	❑ Create and label a right triangle diagram for a given word problem. (9SS2) ❑ Solve for the unknown length or angle in a right triangle, using an appropriate method such as trigonometric ratios, similarity, congruency or the Pythagorean theorem.

INDICATORS

General Outcome
Describe the effects of dimension changes in related 2-D shapes and 3-D objects in solving problems involving area, perimeter, surface area and volume.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9SS5	Relate expressions for volumes of pyramids to volumes of prisms, and volumes of cones to volumes of cylinders. [CN, R]	❑ Determine the volume of a cone given the volume of a cylinder with the same radius and height. ❑ Determine the volume of a pyramid given the volume of a prism with the same base and height. ❑ Determine the volume of a cone, and explain their process. ❑ Determine the volume of a pyramid, and explain their process. ❑ Manipulate the formula for the volume of a cone or pyramid to determine a missing measure.
9SS6	Calculate and apply the rate of volume to surface area to solve design problems in three dimensions. [PS, T, V]	❑ Determine the result of changing the dimensions of a given solid on its surface area and volume. Example: doubling, adding units to or subtracting units from each dimension ❑ Determine the volume and the surface area of various solids, and explain their process. ❑ Build or draw a solid with a given volume that has the greatest/least possible surface area. ❑ Build or draw a solid with a given surface area that has the greatest/least volume.
9SS7	Calculate and apply the rate of area to perimeter to solve design problems in two dimensions. [PS, T, V]	❑ Determine the area and perimeter of various 2-D shapes. ❑ Draw or build a 2-D shape with a given area that has the greatest/least possible perimeter. ❑ Draw or build a 2-D shape with a given perimeter that has the greatest/least possible area. ❑ Determine the result of changing the dimensions of a given 2-D shape on its area and perimeter. Example: doubling, adding units to or subtracting units from each dimension

SHAPE AND SPACE (3-D OBJECTS AND 2-D SHAPES)

General Outcome
Specify conditions under which triangles may be similar or congruent, and use these conditions to solve problems.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9SS8	Recognize when, and explain why, two triangles are similar, and use the properties of similar triangles to solve problems. [C, PS, R, T]	❑ Apply appropriate symbols associated with similarity. Example: Δ ABC ~ ΔDEF ❑ Name the corresponding angles and sides of a given pair/set of similar triangles. ❑ Determine if two triangles are similar, and explain their reasoning using corresponding angles and sides. ❑ Write appropriate proportions to solve unknown sides of similar triangles. ❑ Solve real-world problems involving similar triangles. ❑ Draw a diagram to represent and solve real-world problems involving similar triangles.
9SS9	Recognize when, and explain why, two triangles are congruent, and use the properties of congruent triangles to solve problems. [C, CN, PS, R, T]	❑ Apply appropriate symbols associated with congruency. Example: Δ ABC $\cong$ ΔDEF ❑ Identify the corresponding angles and sides of a given pair of congruent triangles. ❑ Explain, using examples, the axioms SSS, SAS and AAS for proving congruency. ❑ Determine whether or not triangles in a given set are congruent, and explain their reasoning. (9SS17) ❑ Solve real-world problems using the congruency axioms.
9SS10	Relate congruence to similarity in the context of triangles. [CN, R]	❑ Draw a diagram to represent and solve real-world problems involving congruent and similar triangles. ❑ Identify whether given triangles are similar, congruent or neither. ❑ Show, using examples, that two triangles can be both similar and congruent. ❑ Show, using examples, that two triangles can be similar but not congruent.

INDICATORS

General Outcome
Use spatial problem solving in building, describing and analyzing geometric shapes.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9SS11	Draw the plan and elevations of a 3-D object from sketches and models. [C, R, T, V]	❑ Define elevation as it relates to 3-D objects. ❑ Draw the plan (top/bottom views) of a given 3-D object. ❑ Draw the elevations (front/back, right/left views) of a given 3-D object.
9SS12	Sketch or build a 3-D object, given its plan and elevation views. [C, PS, T, V]	❑ Match given plan and elevation views to the 3-D object or its corresponding sketch. ❑ Create a model of a 3-D object from a 2-D plan, including front/back, top/bottom and right/left views. ❑ Draw the sketch of a 3-D object from a 2-D plan, including front/back, top/bottom and right/left views.
9SS13	Recognize and draw the locus of points in solving practical problems. [PS, T, V]	❑ Explain what is meant by the term "locus of points." ❑ Draw a diagram to show possible solutions to a given problem.

INDICATORS

SHAPE AND SPACE (TRANSFORMATIONS)

General Outcome
Apply coordinate geometry and pattern recognition to predict the effects of translations, rotations, reflections and dilatations on 1-D lines and 2-D shapes.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9SS14	Draw the image of a 2-D shape as a result of: • a single transformation • a dilatation • combinations of translations and/or reflections. [PS, T, V]	❑ Draw the translation image of a 2-D shape as a result of a single transformation. ❑ Determine the scale factor in a dilatation transformation. ❑ Draw the dilatation image of a given 2-D shape, using scale factors. ❑ Draw an original 2-D shape from its dilatation image, given the scale factor. ❑ Draw the translation image of a 2-D shape after a combination of translations and reflections. ❑ Determine the original from its transformation image, given a series of translations and/or reflections.
9SS15	Identify the single transformation that connects a shape with its image. [R]	❑ Identify the transformation from a diagram of the original and its image.
9SS16	Demonstrate that a triangle and its dilatation image are similar. [R]	❑ Justify the statement that a triangle and its dilatation image form a pair of similar triangles. (9SS8)
9SS17	Demonstrate the congruence of a triangle with its: • translation image • rotation image • reflection image. [R]	❑ Justify the statement that a triangle and its transformation image are congruent. (9SS9)

STATISTICS AND PROBABILITY (DATA ANALYSIS)

General Outcome
Collect and analyze experimental results expressed in two variables, using technology, as required.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9SP1	Design, conduct and report on an experiment to investigate a relationship between two variables. [C, CN, PS]	❑ Identify an issue that can be investigated using the correlation between two variables: • design an experiment to investigate the relationship between the two sets of data • conduct the experiment to collect data • organize the data in a table or chart.
9SP2	Create scatterplots for discrete and continuous variables. [C, V]	❑ Describe the difference between discrete and continuous variables. ❑ Create a scatterplot from a given set of continuous data. (9SP1) ❑ Create a scatterplot from a given set of discrete data. (9SP1)
9SP3	Interpret a scatterplot to determine if there is an apparent relationship. [E, R]	❑ Describe the pattern of data points created on a scatterplot. (9SP1) ❑ Discuss why some data points lie outside the pattern. ❑ State an apparent relationship shown by a trend in a scatterplot. ❑ Discuss whether or not the trend will continue.
9SP4	Determine the lines of best fit from a scatterplot for an apparent linear relationship, by: • inspection • using technology (equations are not expected). [E, PS, T]	❑ Draw a line of best fit by inspection for a given scatterplot. (9SP1) ❑ Use a spreadsheet program to enter data into a table, generate a scatterplot and draw the line of best fit. (9SP1)
9SP5	Draw and justify conclusions from the line of best fit. [C, R]	❑ Use the line of best fit to identify trends and make predictions. (9SP1)
9SP6	Assess the strengths, weaknesses and biases of samples and data collection methods. [C, R, T]	❑ Describe the strengths and weaknesses of various methods of data collection. ❑ Identify sources of bias for data collection methods, such as surveys, interviews, electronic media and experiments.

INDICATORS

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
		❑ Provide reasons why data collected by a sample may differ from data collected from the entire population. ❑ Provide reasons why using sample data may be necessary. ❑ Discuss ways in which a sample can be biased.
9SP7	Critique ways in which statistical information and conclusions are presented by the media and other sources. [C, CN]	❑ Identify bias in given graphs and data tables. ❑ Present possible reasons for using biased graphs and tables. ❑ Display the data from a biased graph in an unbiased manner, and compare the two. ❑ Find examples of biased and unbiased graphs and tables in the media.

INDICATORS

STATISTICS AND PROBABILITY (CHANCE AND UNCERTAINTY)

General Outcome
Explain the use of probability and statistics in the solution of complex problems.

CODE	SPECIFIC OUTCOME	SUGGESTED INDICATORS
	Students will:	*The following set of indicators may be used to determine whether students have met the corresponding specific outcome.* *Students should be able to:*
9SP8	Recognize that decisions based on probability may be a combination of theoretical calculations, experimental results and subjective judgements. [PS, R]	❑ Provide examples where decisions may be based on a combination of theoretical probability, experience and subjective judgement. Example: choosing to travel by airplane, choosing to buy a raffle ticket
9SP9	Demonstrate an understanding of the role of probability and statistics in society. [C, CN]	❑ Identify real-world situations where probability influences decisions. ❑ Identify examples where probability and statistics are used in the media. ❑ Discuss how advertisers can sway public opinion through the use of probability and statistics.
9SP10	Solve problems involving the probability of independent events. [PS, T]	❑ Identify independent and dependent events. ❑ Determine the probability of two given independent events occurring, by multiplying the probability of the first event by the probability of the second event. ❑ Determine the probability of *n* events occurring, by multiplying the probabilities of each event. ❑ Solve a given word problem involving probability of independent events.