

Mathematics 9

Foundational Outcomes

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Outcomes Framework Grade 9 (2020-21)

In September 2020, teachers will be working hard to create a space that is safe and welcoming for all learners no matter the location of their “classroom”. The first weeks will still be a time to establish a sense of community, engage learners in rich interactive experiences to promote critical thinking and create opportunities for collaboration and discussion. This is an opportune time to develop a culture and a climate for mathematics learning, conducive to collaboration, risk taking and inquiry.

The **Foundational Outcomes** identified in this document represent outcomes determined to be relevant for future learning in mathematics. Decisions about foundational outcomes were made in consultation with teachers, provincial mathematics team, Board and Regional Centre staff. The foundational outcomes are meant to guide teachers in making decisions about creating learning experiences that will prepare and engage their learners in a responsive way. However, a teacher’s professional judgment remains the most important guide to effectively responding to the needs of their learners.

Colour coding has been used to identify outcomes and indicators as foundational (**green**), optional (**orange**) or non-foundational (**red**) for the 2020-2021 school year.

N01 Students will be expected to demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by representing repeated multiplication using powers, using patterns to show that a power with an exponent of zero is equal to one, and solving problems involving powers.

Performance Indicators: all indicators

N02 Students will be expected to demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents.

$$(a^m)(a^n) = a^{m+n}$$

$$a^m \div a^n = a^{m-n}, m > n$$

$$(a^m)^n = a^{mn}$$

$$(ab)^m = a^m b^m$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0.$$

Performance Indicators: all indicators

N03 Students will be expected to demonstrate an understanding of rational numbers by comparing and ordering rational numbers and solving problems that involve arithmetic operations on rational numbers.

Performance Indicators: all indicators

N04 Students will be expected to explain and apply the order of operations, including exponents, with and without technology.

Performance Indicators: all indicators

N05 Students will be expected to determine the exact square root of positive rational numbers.

Performance Indicators: all indicators

N06 Students will be expected to determine an approximate square root of positive rational numbers.

Performance Indicators: all indicators

PR01 Students will be expected to generalize a pattern arising from a problem-solving context using a linear equation and verify by substitution.

Performance Indicators: all indicators

PR02 Students will be expected to graph a linear relation, analyze the graph, and interpolate or extrapolate to solve problems.

Performance Indicators:

PR02.01 Describe the pattern found in a given graph.

PR02.02 Graph a given linear relation, including horizontal and vertical lines.

PR02.03 Match given equations of linear relations with their corresponding graphs.

PR02.04 Extend a given graph (extrapolate) to determine the value of an unknown element.

PR02.05 Interpolate the approximate value of one variable on a given graph, given the value of the other variable.

PR02.06 Extrapolate the approximate value of one variable from a given graph, given the value of the other variable.

PR02.07 Solve a given problem by graphing a linear relation and analyzing the graph.

PR03 Students will be expected to model and solve problems, where a , b , c , d , e , and f are rational numbers, using linear equations of the form.

$$ax = b$$

$$\frac{x}{a} = b, a \neq 0$$

$$ax + b = c$$

$$\frac{x}{a} + b = c, a \neq 0$$

$$ax = b + cx$$

$$a(x + b) = c$$

$$ax + b = cx + d$$

$$a(bx + c) = d(ex + f)$$

$$\frac{a}{x} = b, x \neq 0$$

Performance Indicators: all indicators

PR04 Students will be expected to explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context.

Performance Indicators: all indicators

PR05 Students will be expected to demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2).

Performance Indicators: all indicators

PR06 Students will be expected to model, record, and explain the operations of addition and subtraction of polynomial expressions, concretely, pictorially, and symbolically (limited to polynomials of degree less than or equal to 2).

Performance Indicators: all indicators

PR07 Students will be expected to model, record, and explain the operations of multiplication and division of polynomial expressions (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially, and symbolically.

Performance Indicators: all indicators

M01 Students will be expected to solve problems and justify the solution strategy, using the following circle properties:

- The perpendicular from the centre of a circle to a chord bisects the chord.
- The measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc.
- The inscribed angles subtended by the same arc are congruent.
- A tangent to a circle is perpendicular to the radius at the point of tangency.

Performance Indicators: all indicators

G01 Students will be expected to determine the surface area of composite 3-D objects to solve problems.

Performance Indicators: all indicators

G02 Students will be expected to demonstrate an understanding of similarity of polygons.

Performance Indicators: all indicators

G03 Students will be expected to draw and interpret scale diagrams of 2-D shapes.

Performance Indicators: all indicators

G04 Students will be expected to demonstrate an understanding of line and rotation symmetry.

Performance Indicators: all indicators

SP01 Students will be expected to describe the effect on the collection of data of bias, use of language, ethics, cost, time and timing, privacy, and cultural sensitivity.

Performance Indicators: all indicators

SP02 Students will be expected to select and defend the choice of using either a population or a sample of a population to answer a question.

Performance Indicators: all indicators

SP03 Students will be expected to develop and implement a project plan for the collection, display, and analysis of data by:

- formulating a question for investigation
- choosing a data collection method that includes social considerations
- selecting a population or a sample
- collecting the data
- displaying the collected data in an appropriate manner
- drawing conclusions to answer the question

Performance Indicators:

SP03.01 Create a rubric to assess a project that includes the assessment of

- a question for investigation
- the choice of a data collection method that includes social considerations
- the selection of a population or a sample and the justification for the selection
- the display of collected data
- the conclusions to answer the question

SP03.02 Develop a project plan that describes

- a question for investigation
- the method of data collection that includes social considerations
- the method for selecting a population or a sample
- the methods for display and analysis of data

SP03.03 Complete the project according to the plan, draw conclusions, and communicate findings to an audience.

SP03.04 Self-assess the completed project by applying the rubric.

SP04 Students will be expected to demonstrate an understanding of the role of probability in society.

Performance Indicators: all indicators