Mathematics 8

NUMBER

A1 demonstrate an understanding of perfect square and square root, concretely, pictorially, and symbolically (limited to whole numbers)

A2 determine the approximate square root of numbers that are not perfect squares (limited to whole numbers)

A3 demonstrate an understanding of percents greater than or equal to 0%

A4 demonstrate an understanding of ratio and rate

A5 solve problems that involve rates, ratios, and proportional reasoning

A6 demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially, and symbolically

A7 demonstrate an understanding of multiplication and division of integers, concretely, pictorially, and symbolically

SHAPE AND SPACE

C1 develop and apply the Pythagorean theorem to solve problems

C2 draw and construct nets for 3-D objects

C3 determine the surface area of
- right rectangular prisms
- right triangular prisms
- right cylinders

to solve problems

C4 develop and apply formulas for determining the volume of right prisms and right cylinders

C5 draw and interpret top, front, and side views of 3-D objects composed of right rectangular prisms

C6 demonstrate an understanding of tessellation by
- explaining the properties of shapes that make tessellating possible
- creating tessellations
- identifying tessellations in the environment

PATTERNS AND RELATIONS

B1 graph and analyze two-variable linear relations

B2 model and solve problems using linear equations of the form
- $ax = b$
- $x/a = b,\ a \neq 0$
- $ax + b = c$
- $x/a + b = c,\ a \neq 0$
- $a(x + b) = c$

concretely, pictorially, and symbolically, where a, b, and c are integers

STATISTICS AND PROBABILITY

D1 critique ways in which data is presented

D2 solve problems involving the probability of independent events

Mathematics 9

NUMBER

A1 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
- solving problems involving powers

A2 demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents

A3 demonstrate an understanding of rational numbers by
- comparing and ordering rational numbers
- solving problems that involve arithmetic operations on rational numbers

A4 explain and apply the order of operations, including exponents, with and without technology

A5 determine the square root of positive rational numbers that are perfect squares

A6 determine an approximate square root of positive rational numbers that are non-perfect squares

PATTERNS AND RELATIONS

B1 generalize a pattern arising from a problem-solving context using linear equations and verify by substitution

B2 graph linear relations, analyse the graph, and interpolate or extrapolate to solve problems

B3 model and solve problems using linear equations of the form
- $ax = b$
- $x/a = b$, $a \neq 0$
- $ax + b = c$
- $x/a + b = c$, $a \neq 0$
- $ax = b + cx$
- $a(x + b) = c$
- $ax + b = cx + d$
- $a(bx + c) = d(ex + f)$
- $a/x = b$, $x \neq 0$

where a, b, c, d, e, and f are rational numbers

B4 explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context

B5 demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2)

B6 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)

B7 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

SHAPE AND SPACE

C1 solve problems and justify the solution strategy using circle properties, including
- 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

C2 determine the surface area of composite 3-D objects to solve problems

C3 demonstrate an understanding of similarity of polygons

C4 draw and interpret scale diagrams of 2-D shapes

C5 demonstrate an understanding of line and rotation symmetry

STATISTICS AND PROBABILITY

D1 describe the effect of
- bias
- use of language
- ethics
- cost
- time and timing
- privacy
- cultural sensitivity on the collection of data

D2 select and defend the choice of using either a population or a sample of a population to answer a question

D3 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

D4 demonstrate an understanding of the role of probability in society

FOUNDATIONS OF MATHEMATICS AND PRE-CALCULUS GRADE 10

Measurement

1. Solve problems related to:
- perimeter
- area
- the Pythagorean theorem
- primary trigonometric ratios
- income.

2. Apply proportional reasoning to problems that involve conversions between SI and imperial units of measure.

3. Solve problems, using SI and imperial units, that involve the surface area and volume of 3-D objects, including:
- right cones
- right cylinders
- right prisms
- right pyramids
- spheres.

4. Develop and apply the primary trigonometric ratios (sine, cosine, tangent) to solve problems that involve right triangles.

Algebra and Number

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

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

3. Demonstrate an understanding of powers with integral and rational exponents.

4. Demonstrate an understanding of the multiplication of polynomial expressions (limited to monomials, binomials and trinomials), concretely, pictorially and symbolically.

5. Demonstrate an understanding of common factors and trinomial factoring, concretely, pictorially and symbolically.

Relations and Functions

1. Interpret and explain the relationships among data, graphs and situations.

2. Demonstrate an understanding of relations and functions.

3. Demonstrate an understanding of slope with respect to:
- rise and run
- line segments and lines
- rate of change
- parallel lines
- perpendicular lines.

4. Describe and represent linear relations, using:
- words
- ordered pairs
- tables of values
- graphs
- equations.

5. Determine the characteristics of the graphs of linear relations, including the:
- intercepts
- slope
- domain
- range.

6. Relate linear relations expressed in:
- slope–intercept form ($y = mx + b$)
- general form ($Ax + By + C = 0$)
- slope–point form ($y - y_1 = m(x - x_1)$) to their graphs.

7. Determine the equation of a linear relation, given:
- a graph
- a point and the slope
- two points
- a point and the equation of a parallel or perpendicular line to solve problems.

8. Represent a linear function, using function notation.

9. Solve problems that involve systems of linear equations in two variables, graphically and algebraically.

FOUNDATIONS OF MATHEMATICS GRADE 11

Measurement 1. Solve problems that involve the application of rates. 2. Solve problems that involve scale diagrams, using proportional reasoning. 3. Demonstrate an understanding of the relationships among scale factors, areas, surface areas and volumes of similar 2-D shapes and 3-D objects.	Geometry 1. Derive proofs that involve the properties of angles and triangles. 2. Solve problems that involve the properties of angles and triangles. 3. Solve problems that involve the cosine law and the sine law, including the ambiguous case.
Logical Reasoning 1. Analyze and prove conjectures, using inductive and deductive reasoning, to solve problems. 2. Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies.	Statistics 1. Demonstrate an understanding of normal distribution, including: • standard deviation • z -scores. 2. Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies.
Relations and Functions 1. Model and solve problems that involve systems of linear inequalities in two variables. 2. Demonstrate an understanding of the characteristics of quadratic functions, including: • vertex • intercepts • domain and range • axis of symmetry.	Mathematics Research Project 1. Research and give a presentation on a historical event or an area of interest that involves mathematics.

PRECALCULUS GRADE 11

Algebra and Number

1. Demonstrate an understanding of the absolute value of real numbers.

2. Solve problems that involve operations on radicals and radical expressions with numerical and variable radicands.

3. Solve problems that involve radical equations (limited to square roots).

4. Determine equivalent forms of rational expressions (limited to numerators and denominators that are monomials, binomials or trinomials).

5. Perform operations on rational expressions (limited to numerators and denominators that are monomials, binomials or trinomials).

6. Solve problems that involve rational equations (limited to numerators and denominators that are monomials, binomials or trinomials).

Trigonometry

1. Demonstrate an understanding of angles in standard position [0° to 360°].

2. Solve problems, using the three primary trigonometric ratios for angles from 0° to 360° in standard position.

3. Solve problems, using the cosine law and sine law, including the ambiguous case.

Relations and Functions

1. Factor polynomial expressions of the form:
- $ax^2 + bx + c, a \neq 0$
- $a^2x^2 - b^2y^2, a \neq 0, b \neq 0$
- $a(f(x))^2 + b(f(x)) + c, a \neq 0$
- $a(f(x))^2 - b(g(y))^2, a \neq 0, b \neq 0$

where a , b and c are rational numbers.

2. Graph and analyze absolute value functions (limited to linear and quadratic functions) to solve problems.

3. Analyze quadratic functions of the form $y=a(x-p)^2+q$ and determine the:
- vertex
- domain and range
- direction of opening
- axis of symmetry
- x - and y -intercepts.

4. Analyze quadratic functions of the form $y=ax^2+bx+c$ to identify characteristics of the corresponding graph, including:
- vertex
- domain and range
- direction of opening
- axis of symmetry
- x- and y-intercepts

and to solve problems.

5. Solve problems that involve quadratic equations.

6. Solve, algebraically and graphically, problems that involve systems of linear-quadratic and quadratic-quadratic equations in two variables.

7. Solve problems that involve linear and quadratic inequalities in two variables.

8. Solve problems that involve quadratic inequalities in one variable.

9. Analyze arithmetic sequences and series to solve problems.

10. Analyze geometric sequences and series to solve problems.

11. Graph and analyze reciprocal functions (limited to the reciprocal of linear and quadratic functions).

FOUNDATIONS OF MATHEMATICS 12

Financial Mathematics 1. Solve problems that involve compound interest in financial decision making. 2. Analyze costs and benefits of renting, leasing and buying. 3. Analyze an investment portfolio in terms of: • interest rate • rate of return • total return.	**Logical Reasoning** 1. Analyze puzzles and games that involve numerical and logical reasoning, using problem-solving strategies. 2. Solve problems that involve the application of set theory. 3. Solve problems that involve conditional statements.
Probability 1. Interpret and assess the validity of odds and probability statements. 2. Solve problems that involve the probability of mutually exclusive and non–mutually exclusive events. 3. Solve problems that involve the probability of two events. 4. Solve problems that involve the fundamental counting principle. 5. Solve problems that involve permutations. 6. Solve problems that involve combinations.	**Relations and Functions** 1. Represent data, using polynomial functions (of degree $\leq$ 3), to solve problems. 2. Represent data, using exponential and logarithmic functions, to solve problems. 3. Represent data, using sinusoidal functions, to solve problems.
Mathematics Research Project 1. Research and give a presentation on a current event or an area of interest that involves mathematics.	

PRE-CALCULUS GRADE 12

Trigonometry

1. Demonstrate an understanding of angles in standard position, expressed in degrees and radians.

2. Develop and apply the equation of the unit circle.

3. Solve problems, using the six trigonometric ratios for angles expressed in radians and degrees.

4. Graph and analyze the trigonometric functions sine, cosine and tangent to solve problems.

5. Solve, algebraically and graphically, first and second degree trigonometric equations with the domain expressed in degrees and radians.

6. Prove trigonometric identities, using:
- reciprocal identities
- quotient identities
- Pythagorean identities
- sum or difference identities (restricted to sine, cosine and tangent)
- double-angle identities (restricted to sine, cosine and tangent).

Relations and Functions

1. Demonstrate an understanding of operations on, and compositions of, functions.

2. Demonstrate an understanding of the effects of horizontal and vertical translations on the graphs of functions and their related equations.

3. Demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations.

4. Apply translations and stretches to the graphs and equations of functions.

5. Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including reflections through the:
- x -axis
- y -axis
- line $y = x$.

6. Demonstrate an understanding of inverses of relations.

7. Demonstrate an understanding of logarithms.

8. Demonstrate an understanding of the product, quotient and power laws of logarithms.

9. Graph and analyze exponential and logarithmic functions.

10. Solve problems that involve exponential and logarithmic equations.

11. Demonstrate an understanding of factoring polynomials of degree greater than 2 (limited to polynomials of degree $\leq$ 5 with integral coefficients).

12. Graph and analyze polynomial functions (limited to polynomial functions of degree $\leq$ 5).

13. Graph and analyze radical functions (limited to functions involving one radical).

14. Graph and analyze rational functions (limited to numerators and denominators that are monomials, binomials or trinomials).

Permutations, Combinations and Binomial Theorem

1. Apply the fundamental counting principle to solve problems.

2. Determine the number of permutations of n elements taken r at a time to solve problems.

3. Determine the number of combinations of n different elements taken r at a time to solve problems.

4. Expand powers of a binomial in a variety of ways, including using the binomial theorem (restricted to exponents that are natural numbers).

APPRENTICESHIP AND WORKPLACE MATHEMATICS GRADE 10

Measurement

1. Demonstrate an understanding of the System International (SI) by:
- describing the relationships of the units for length, area, volume, capacity, mass and temperature
- applying strategies to convert SI units to imperial units.

2. Demonstrate an understanding of the imperial system by:
- describing the relationships of the units for length, area, volume, capacity, mass and temperature
- comparing the American and British imperial units for capacity
- applying strategies to convert imperial units to SI units.

3. Solve and verify problems
that involve SI and imperial linear measurements, including decimal and fractional measurements.

4. Solve problems that involve SI and imperial area measurements of regular, composite and irregular 2-D shapes and 3-D objects, including decimal and fractional measurements, and verify the solutions.

Geometry

1. Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies.

2. Demonstrate an understanding of the Pythagorean theorem by:
- identifying situations that involve right triangles
- verifying the formula
- applying the formula
- solving problems.

3. Demonstrate an understanding of similarity of convex polygons, including regular and irregular polygons.

4. Demonstrate an understanding of primary trigonometric ratios (sine, cosine, tangent) by:
- applying similarity to right triangles
- generalizing patterns from similar right triangles
- applying the primary trigonometric ratios
- solving problems.

5. Solve problems that involve parallel, perpendicular and transversal lines, and pairs of angles formed between them.

6. Demonstrate an understanding of angles,including acute, right, obtuse, straight and reflex,by:
- drawing
- replicating and constructing
- bisecting
- solving problems.

Number

1. Solve problems that involve unit pricing and currency exchange, using proportional reasoning.

2. Demonstrate an understanding of income, including:
- wages
- salary
- contracts
- commissions
- piecework to calculate gross pay and net pay.

Algebra

1. Solve problems that require the manipulation and application of formulas related to:
- perimeter
- area
- the Pythagorean theorem
- primary trigonometric ratios
- income.

APPRENTICESHIP AND WORKPLACE MATHEMATICS GRADE 11

Measurement

1. Solve problems that involve SI and imperial units in surface area measurements and verify the solutions.

2. Solve problems that involve SI and imperial units in volume and capacity measurements.

Algebra

1. Solve problems that require the manipulation and application of formulas related to:
   - volume and capacity
   - surface area
   - slope and rate of change
   - simple interest
   - finance charges.

2. Demonstrate an understanding of slope:
   - as rise over run
   - as rate of change
   - by solving problems.

3. Solve problems by applying proportional reasoning and unit analysis.

Geometry

1. Solve problems that involve two and three right triangles.
2. Solve problems that involve scale.
3. Model and draw 3-D objects and their views.

4. Draw and describe exploded views, component parts and scale diagrams of simple 3-D objects.

Statistics

1. Solve problems that involve creating and interpreting graphs, including:
   - bar graphs
   - histograms
   - line graphs
   - circle graphs.

Number

1. Analyze puzzles and games that involve numerical reasoning, using problem-solving strategies.

2. Solve problems that involve personal budgets.

3. Demonstrate an understanding of compound interest.

4. Demonstrate an understanding of financial institution services used to access and manage finances.

5. Demonstrate an understanding of credit options, including credit cards and loans.

APPRENTICESHIP AND WORKPLACE MATHEMATICS GRADE 12

Measurement

1. Demonstrate an understanding of the limitations of measuring instruments, including:

Algebra

1. Demonstrate an understanding of linear relations by:

- recognizing patterns and trends
- graphing
- creating tables of values
- writing equations
- interpolating and extrapolating
- solving problems.

Geometry

1. Solve problems by using the sine law and cosine law, excluding the ambiguous case.

2. Solve problems that involve:
- triangles
- quadrilaterals
- regular polygons.

3. Demonstrate an understanding of transformations on a 2-D shape or a 3-D object, including:
- translations
- rotations
- reflections
- dilations.

Statistics

1. Solve problems that involve measures of central tendency, including:
- mean
- median
- mode
- weighted mean
- trimmed mean.

2. Analyze and describe percentiles.

Number

1. Analyze puzzles and games that involve logical reasoning, using problem-solving strategies.

2. Solve problems that involve the acquisition of a vehicle by:
- buying
- leasing
- leasing to buy.

3. Critique the viability of small business options by considering:
- expenses
- sales
- profit or loss.

Probability

1. Analyze and interpret problems that involve probability.