Blueprint for *MathLinks 9 Adapted* Final Exam

Number **General Outcome**: Develop number sense.	
Specific Outcome: 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. [C, CN, PS, R]	
Demonstrate the differences between the exponent and the base by building models of a given power, such as 2^3 and 3^2.	MC #29, Conceptual MC #34, Conceptual
Explain, using repeated multiplication, the difference between two given powers in which the exponent and base are interchanged; e.g., 10^3 and 3^{10}.	
Express a given power as a repeated multiplication.	
Express a given repeated multiplication as a power.	MC #33, Procedural
Explain the role of parentheses in powers by evaluating a given set of powers; e.g., $(-2)^4$, (-2^4) and -2^4.	
Demonstrate, using patterns, that a^0 is equal to 1 for a given value of a ($a \neq 0$).	
Evaluate powers with integral bases (excluding base 0) and whole number exponents.	
Specific Outcome: Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents: • $(a^m)(a^n) = a^{m+n}$ • $a^m \div a^n = a^{m-n}$, $m > n$ • $(a^m)^n = a^{mn}$ • $(ab)^m = a^m b^m$ • $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$, $b \neq 0$ [C, CN, PS, R, T]	
Explain, using examples, the exponent laws of powers with integral bases (excluding base 0) and whole number exponents	
Evaluate a given expression by applying the exponent laws.	MC #30, Conceptual MC #33, Procedural
Determine the sum of two given powers, e.g., $5^2 + 5^3$, and record the process.	

Determine the difference of two given powers, e.g., $4^3 - 4^2$, and record the process.	WR #3d), Procedural
Identify the error(s) in a given simplification of an expression involving powers.	MC #28, Conceptual
Specific Outcome: Demonstrate an understanding of rational numbers by: • comparing and ordering rational numbers • solving problems that involve arithmetic operations on rational numbers. [C, CN, PS, R, T, V]	
Order a given set of rational numbers in fraction and decimal form by placing them on a number line; e.g., $\frac{3}{5}$, −0.666 …, 0.5, $-\frac{5}{8}$, $\frac{3}{2}$.	NR #32, Problem Solving
Identify a rational number that is between two given rational numbers.	MC #35, Procedural
Solve a given problem involving operations on rational numbers in fraction or decimal form.	WR #3a), Procedural
Specific Outcome: Explain and apply the order of operations, including exponents, with and without technology. [PS, T]	
Solve a given problem by applying the order of operations without the use of technology.	MC #4, Procedural WR #3a), Procedural
Solve a given problem by applying the order of operations with the use of technology.	MC #8, Procedural
Identify the error in applying the order of operations in a given incorrect solution.	MC #38, Procedural
Specific Outcome: Determine the square root of positive rational numbers that are perfect squares. [C, CN, PS, R, T]	
(Students should be aware of the existence of positive and negative square roots; however, at this grade, they should only work with the principal, positive square root.) Determine whether or not a given rational number is a square number, and explain the reasoning.	WR #1b), Procedural
Determine the square root of a given positive rational number that is a perfect square.	NR #14, Procedural NR #15, Procedural NR #16, Procedural MC #31, Conceptual
Identify the error made in a given calculation of a square root; e.g., is 3.2 the square root of 6.4?	
Determine a positive rational number, given the square root of that positive rational number.	

Specific Outcome: Determine an approximate square root of positive rational numbers that are non-perfect squares. [C, CN, PS, R, T]	
Estimate the square root of a given rational number that is not a perfect square, using the roots of perfect squares as benchmarks.	
Determine an approximate square root of a given rational number that is not a perfect square, using technology; e.g., a calculator, a computer.	
Explain why the square root of a given rational number as shown on a calculator may be an approximation.	
Identify a number with a square root that is between two given numbers.	

Patterns and Relations (Patterns) **General Outcome**: Use patterns to describe the world and solve problems.	

Specific Outcome: Generalize a pattern arising from a problem-solving context, using a linear equation, and verify by substitution. [C, CN, PS, R, V]	
Write an expression representing a given pictorial, oral or written pattern.	MC #7, Problem Solving MC #12, Problem Solving
Write a linear equation to represent a given context.	MC #9, Problem Solving
Describe a context for a given linear equation.	
Solve, using a linear equation, a given problem that involves pictorial, oral and written linear patterns.	NR #10, Procedural NR #11, Procedural MC #38, Procedural
Write a linear equation representing the pattern in a given table of values, and verify the equation by substituting values from the table.	

Specific Outcome: Graph a linear relation, analyze the graph, and interpolate or extrapolate to solve problems. [C, CN, PS, R, T, V]	
Describe the pattern found in a given graph.	
Graph a given linear relation, including horizontal and vertical lines.	
Match given equations of linear relations with their corresponding graphs.	MC #36, Problem Solving
Extend a given graph (extrapolate) to determine the value of an unknown element.	WR #2a) Conceptual
Interpolate the approximate value of one variable on a given graph, given the value of the other variable.	

Extrapolate the approximate value of one variable on a given graph, given the value of the other variable.	
Solve a given problem by graphing a linear relation and analyzing the graph.	WR #2b), c), d), Procedural

Patterns and Relations (Variables and Equations)
General Outcome: Represent algebraic expressions in multiple ways.

Specific Outcome: Model and solve problems, using linear equations of the form:
• $ax = b$
• $\dfrac{x}{a} = b, a \neq 0$
• $ax + b = c$
• $\dfrac{x}{a} = b = c, a \neq 0$
• $ax = b + cx$
• $a(x + b) = c$
• $ax + b = cx + d$
• $a(bx + c) = d(ex + f)$
• $\dfrac{a}{x} = b, x \neq 0$
where a, b, c, d, e, and f are rational numbers.
[C, CN, PS, V]

Model the solution of a given linear equation, using concrete or pictorial representations, and record the process.	
Verify by substitution whether a given rational number is a solution to a given linear equation.	MC #45, Procedural
Solve a given linear equation symbolically.	MC #44, Problem Solving NR #48, Procedural WR #3c), Procedural
Identify and correct an error in a given incorrect solution of a linear equation.	
Represent a given problem, using a linear equation.	MC #13, Conceptual
Solve a given problem, using a linear equation, and record the process.	WR #2e), f), Problem Solving

Specific Outcome: Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem solving context.
[C, CN, PS, R, V]

Translate a given problem into a single variable linear inequality, using the symbols ≥, >, < or ≤.	
Determine if a given rational number is a possible solution of a given linear inequality.	

Generalize and apply a rule for adding and subtracting a positive or negative number to determine the solution of a given inequality.	
Generalize and apply a rule for multiplying and dividing by a positive or negative number to determine the solution of a given inequality.	
Solve a given linear inequality algebraically, and explain the process orally or in written form.	WR #3b), Procedural
Compare and explain the process for solving a given linear equation to the process for solving a given linear inequality.	
Graph the solution of a given linear inequality on a number line.	WR #3b), Procedural
Compare and explain the solution of a given linear equation to the solution of a given linear inequality.	
Verify the solution of a given linear inequality, using substitution for multiple elements in the solution.	MC #45, Procedural
Solve a given problem involving a single variable linear inequality, and graph the solution.	MC #41, Procedural WR #3b), Procedural
Specific Outcome: Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2). [C, CN, R, V]	
Create a concrete model or a pictorial representation for a given polynomial expression.	
Write the expression for a given model of a polynomial.	MC #40, Procedural MC #44, Procedural
Identify the variables, degree, number of terms and coefficients, including the constant term, of a given simplified polynomial expression.	MC #42, Conceptual MC #43, Conceptual
Describe a situation for a given first degree polynomial expression.	
Match equivalent polynomial expressions given in simplified form; e.g., $4x - 3x^2 + 2$ is equivalent to $-3x^2 + 4x + 2$.	MC #39, Procedural
Specific Outcome: 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). [C, CN, PS, R, V]	
Model addition of two given polynomial expressions concretely or pictorially, and record the process symbolically.	MC #40, Procedural

Model subtraction of two given polynomial expressions concretely or pictorially, and record the process symbolically.	
Identify like terms in a given polynomial expression.	
Apply a personal strategy for addition or subtraction of two given polynomial expressions, and record the process symbolically.	MC #27, Procedural MC #39, Procedural
Refine personal strategies to increase their efficiency.	
Identify equivalent polynomial expressions from a given set of polynomial expressions, including pictorial and symbolic representations.	
Identify the error(s) in a given simplification of a given polynomial expression.	

Specific Outcome: 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.
[C, CN, R, V]

Model multiplication of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically.	WR #1a), Procedural
Model division of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically.	
Apply a personal strategy for multiplication and division of a given polynomial expression by a given monomial.	MC #37, Procedural MC #39, Procedural
Refine personal strategies to increase their efficiency.	
Provide examples of equivalent polynomial expressions.	
Identify the error(s) in a given simplification of a given polynomial expression.	

Shape and Space (Measurement)
General Outcome: Use direct or indirect measurement to solve problems.

Specific Outcome: 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.
[C, CN, PS, R, T, V]

Provide an example that illustrates: • 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.	
Solve a given problem involving application of one or more of the circle properties.	NR #17, Procedural NR #18, Procedural MC #19, Procedural NR #25, Procedural MC #26, Procedural
Determine the measure of a given angle inscribed in a semicircle, using the circle properties.	
Explain the relationship among the centre of a circle, a chord and the perpendicular bisector of the chord.	

Shape and Space (3-D Objects and 2-Shapes)
General Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

Specific Outcome: Determine the surface area of composite 3-D objects to solve problems.
[C, CN, PS, R, V]

Determine the area of overlap in a given composite 3-D object, and explain the effect on determining the surface area (limited to right cylinders, right rectangular prisms and right triangular prisms).	
Determine the surface area of a given composite 3-D object (limited to right cylinders, right rectangular prisms and right triangular prisms).	MC #5, Problem Solving MC #50, Procedural WR #1c), Problem Solving
Solve a given problem involving surface area.	MC #16, Problem Solving

Specific Outcome: Demonstrate an understanding of similarity of polygons.
[C, CN, PS, R, V]

Determine if polygons in a given pre-sorted set are similar, and explain the reasoning.	
Draw a polygon similar to a given polygon, and explain why the two are similar.	
Solve a given problem, using the properties of similar polygons.	NR #47, Problem Solving

Shape and Space (Transformations)
General Outcome: Describe and analyze position and motion of objects and shapes.

Specific Outcome: Draw and interpret scale diagrams of 2-D shapes.
[CN, R, T, V]

Identify an example of a scale diagram in print and electronic media, e.g., newspapers, the Internet, and interpret the scale factor.	
Draw a diagram to scale that represents an enlargement or a reduction of a given 2-D shape.	
Determine the scale factor for a given diagram drawn to scale.	MC #46, Conceptual MC #49, Problem Solving
Determine if a given diagram is proportional to the original 2-D shape, and, if it is, state the scale factor.	
Solve a given problem that involves the properties of similar triangles.	
Specific Outcome: Demonstrate an understanding of line and rotation symmetry. [C, CN, PS, V]	
Classify a given set of 2-D shapes or designs according to the number of lines of symmetry.	NR #3, Conceptual
Complete a 2-D shape or design, given one half of the shape or design and a line of symmetry.	
Determine if a given 2-D shape or design has rotation symmetry about the point at its centre, and, if it does, state the order and angle of rotation.	MC #1, Conceptual MC #2, Conceptual
Rotate a given 2-D shape about a vertex, and draw the resulting image.	
Identify a line of symmetry or the order and angle of rotation symmetry in a given tessellation.	
Identify the type of symmetry that arises from a given transformation on a Cartesian plane.	
Complete, concretely or pictorially, a given transformation of a 2-D shape on a Cartesian plane; record the coordinates; and describe the type of symmetry that results.	
Identify and describe the types of symmetry created in a given piece of artwork.	
Determine whether or not two given 2-D shapes on a Cartesian plane are related by either rotation or line symmetry.	
Draw, on a Cartesian plane, the translation image of a given shape, using a given translation rule such as R2, U3 or →→,↑↑↑; label each vertex and its corresponding ordered pair; and describe why the translation does not result in line or rotation symmetry.	

Create or provide a piece of artwork that demonstrates line and rotation symmetry, and identify the line(s) of symmetry and the order and angle of rotation.	

Statistics and Probability (Data Analysis)
General Outcome: Collect, display and analyze data to solve problems.

Specific Outcome: Describe the effect of:
• bias
• use of language
• ethics
• cost
• time and timing
• privacy
• cultural sensitivity
on the collection of data.
[C, CN, R, T]

Analyze a given case study of data collection; and identify potential problems related to bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity.	MC #21, Conceptual
Provide examples to illustrate how bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity may influence data.	

Specific Outcome: Select and defend the choice of using either a population or a sample of a population to answer a question.
[C, CN, PS, R]

Identify whether a given situation represents the use of a sample or a population.	MC #6, Conceptual
Provide an example of a situation in which a population may be used to answer a question, and justify the choice.	
Provide an example of a question where a limitation precludes the use of a population; and describe the limitation, e.g., too costly, not enough time, limited resources.	
Identify and critique a give example in which a generalization from a sample of a population may or may not be valid for the population.	MC #20, Problem Solving
Provide an example to demonstrate the significance of sample size in interpreting data.	

Specific Outcome: 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. [C, PS, R, T, V]	
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.	
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.	
Complete the project according to the plan, draw conclusions, and communicate findings to an audience.	
Self-assess the completed project by applying the rubric.	
Statistics and Probability (Chance and Uncertainty) **General Outcome**: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.	
Specific Outcome: Demonstrate an understanding of the role of probability in society. [C, CN, R, T]	
Provide an example from print and electronic media, e.g., newspapers, the Internet, where probability is used.	
Identify the assumptions associated with a given probability, and explain the limitations of each assumption.	
Explain how a single probability can be used to support opposing positions.	
Explain, using examples, how decisions may be based on a combination of theoretical probability, experimental probability and subjective judgement.	MC #23, Problem Solving MC #24, Procedural