

Grade 9: A Comparison of WNCP Outcomes for 1995 and 2006

WNCP (1995)

Strand: Number

General Outcomes:

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

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

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

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.

Specific Outcomes:

1. 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]
2. Describe, orally and in writing, whether or not a number is rational. [C, R]
3. 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]
4. Illustrate power, base, coefficient and exponent, using rational numbers or variables as bases or coefficients. [R, V]

WNCP (2006)

Strand: Number

General Outcome:

Develop number sense.

Specific Outcomes:

1. 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]
2. Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents. [C, CN, PS, R, T]
3. 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]
4. Explain and apply the order of operations, including exponents with and without technology. [PS, T]
5. Determine the square root of positive rational numbers that are perfect squares. [C, CN, PS, R, T]
6. Determine an approximate square root of positive rational numbers that are non-perfect squares. [C, CN, PS, R, T]

WNCP (1995)

Strand: Number Concepts

Specific Outcomes (cont'd):

5. Explain and apply the exponent laws for powers with integral exponents.

$$x^m \cdot x^n = x^{m+n}$$

$$x^m + x^n = x^{m-n}$$

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

$$(xy)^m = x^m y^m$$

$$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}, y \neq 0$$

$$x^0 = 1, x \neq 0$$

$$x^{-n} = \frac{1}{x^n}, x \neq 0$$

[PS, R]

6. Determine the value of powers with integral exponents, using the exponent laws. [PS, R]
7. Document and explain the calculator keying sequences used to perform calculations involving rational numbers. [C, PS, T]
8. Solve problems, using rational numbers in meaningful contexts. [CN, PS]
9. Understand and use the exponent laws to simplify expressions with variable bases and evaluate expressions with numerical bases. [PS, R]
10. Use a calculator to perform calculations involving scientific notation and exponent laws. [PS, R, T]

WNCP (1995)

Strand: Patterns and Relations

General Outcomes:

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

Solve and verify linear equations and inequalities in one variable.

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

Specific Outcomes:

1. Use logic and divergent thinking to present mathematical arguments in solving problems. [C, PS, R]
2. Model situations that can be represented by first-degree expressions. [CN, PS]
3. Write equivalent forms of algebraic expressions, or equations, with rational coefficients. [C, CN, R]
4. Illustrate the solution process for a first-degree, single-variable equation, using concrete materials or diagrams. [PS, R, V]
5. 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]

WNCP (2006)

Strand: Patterns and Relations

General Outcomes:

Use patterns to describe the world and solve problems.

Represent algebraic expressions in multiple ways.

Specific Outcomes:

1. Generalize a pattern arising from a problem-solving context using linear equations and verify by substitution. [C, CN, PS, R, V]
2. Graph linear relations, analyze the graph and interpolate or extrapolate to solve problems. [C, CN, PS, R, T, V]
3. Model and solve problems using linear equations of the form:
 - $ax = b$
 - $\frac{x}{a} = b, a \neq 0$
 - $ax + b = c$
 - $\frac{x}{a} + b = c, a \neq 0$
 - $ax = b + cx$
 - $a(x + b) = c$
 - $ax + b = cx + d$
 - $a(bx + c) = d(ex + f)$
 - $\frac{a}{x} = b, x \neq 0$where a, b, c, d, e and f are rational numbers. [C, CN, PS, V]
4. Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context. [C, CN, PS, R, V]
5. Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2). [C, CN, R, V]

WNCP (1995)

Strand: Patterns and Relations

Specific Outcomes (cont'd):

6. Solve, algebraically, first-degree inequalities in one variable, display the solutions on a number line and test the solutions. [PS, R, V]
7. Identify constant terms, coefficients and variables in polynomial expressions. [C]
8. Evaluate polynomial expressions, given the value(s) of the variable(s). [E]
9. Represent and justify the addition and subtraction of polynomial expressions, using concrete materials and diagrams. [C, R, V]
10. Perform the operations of addition and subtraction on polynomial expressions. [R]
11. Represent multiplication, division and factoring of monomials, binomials, and trinomials of the form $x^2 + bx + c$, using concrete materials and diagrams. [R, V]
12. Find the product of two monomials, a monomial and a polynomial, and two binomials. [R]
13. Determine the equivalent forms of algebraic expressions by identifying common factors and factoring trinomials of the form $x^2 + bx + c$. [PS, R]
14. Find the quotient when a polynomial is divided by a monomial. [R]

WNCP (2006)

Strand: Patterns and Relations

Specific Outcomes (con't):

6. 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]
7. 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]

WNCP (1995)

Strand: Shape and Space

General Outcomes:

Use trigonometric ratios to solve problems involving a right triangle.

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.

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

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

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

Specific Outcomes:

1. Explain the meaning of sine, cosine and tangent ratios in right triangles. [C]
2. Demonstrate the use of trigonometric ratios (sine, cosine and tangent) in solving right triangles. [PS]
3. Calculate an unknown side or an unknown angle in a right triangle, using appropriate technology. [PS, T]
4. Model and then solve given problem situations involving only one right triangle. [PS, T, V]
5. Relate expressions for volumes of pyramids to volumes of prisms, and volumes of cones to volumes of cylinders. [CN, R]
6. Calculate and apply the rate of volume to surface area to solve design problems in three dimensions. [PS, T, V]

WNCP (2006)

Strand: Shape and Space

General Outcomes:

Use direct or indirect measurement to solve problems.

Describe the characteristics of 3-D objects and 2-D shapes and analyze the relationships among them.

Describe and analyze position and motion of objects and shapes.

Specific Outcomes:

1. 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[C, CN, PS, R, T, V]
2. Determine the surface area of composite 3-D objects to solve problems. [C, CN, PS, R, V]
3. Demonstrate an understanding of similarity of polygons. [C, CN, PS, R, V]
4. Draw and interpret scale diagrams of 2-D shapes. [C, CN, PS, R, V]
5. Demonstrate an understanding of line and rotation symmetry. [C, CN, PS, V]

WNCP (1995)

Strand: Shape and Space

Specific Outcomes (cont'd):

7. Calculate and apply the rate of area to perimeter to solve design problems in two dimensions. [PS, T, V]
8. Recognize when, and explain why, two triangles are similar, and use the properties of similar triangles to solve problems. [C, PS, R, T]
9. Recognize when, and explain why, two triangles are congruent, and use the properties of congruent triangles to solve problems. [C, CN, PS, R, T]
10. Relate congruence to similarity in the context of triangles. [CN, R]
11. Draw the plan and elevations of a 3-D object from sketches and models. [C, R, T, V]
12. Sketch or build a 3-D object, given its plan and elevation views. [C, PS, T, V]
13. Recognize and draw the locus of points in solving practical problems. [PS, T, V]
14. 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]
15. Identify the single transformation that connects a shape with its image. [R]
16. Demonstrate that a triangle and its dilatation image are similar. [R]
17. Demonstrate the congruence of a triangle with its:
 - translation image
 - rotation image
 - reflection image[R]

WNCP (1995)

Strand: Statistics and Probability

General Outcomes:

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

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

Specific Outcomes:

1. Design, conduct and report on an experiment to investigate a relationship between two variables. [C, CN, PS]
2. Create scatter plots for discrete and continuous variables. [C, V]
3. Interpret a scatter plot to determine if there is an apparent relationship. [E, R]
4. Determine the lines of best fit from a scatter plot for an apparent linear relationship by:
 - inspection
 - using technology (equations are not expected)[E, PS, T]
5. Draw and justify conclusions from the line of best fit. [C, R]
6. Assess the strengths, weaknesses and biases of samples and data collection methods. [C, R, T]
7. Critique ways in which statistical information and conclusions are presented by the media and other sources. [C, CN]
8. Recognize that decisions based on probability may be a combination of theoretical calculations, experimental results and subjective judgements. [PS, R]
9. Demonstrate an understanding of the role of probability and statistics in society. [C, CN]
10. Solve problems involving the probability of independent events. [PS, T]

WNCP (2006)

Strand: Statistics and Probability

General Outcomes:

Collect, display and analyze data to solve problems.

Use experimental and theoretical probabilities to represent and solve problems involving uncertainty.

Specific Outcomes:

1. Describe the effect of
 - bias
 - use of language
 - ethics
 - cost
 - time and timing
 - privacy
 - cultural sensitivityon the collection of data. [C, CN, R, T]
2. Select and defend the choice of using either a population or a sample of a population to answer a question. [C, CN, PS, R]
3. 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]
4. Demonstrate an understanding of the role of probability in society. [C, CN, R, T]

