*Extending the Number System*

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| Secondary 2 | Secondary 1 | Intermediate 2 (8th) | Intermediate 1 (7th) |
| * Extend the properties of exponents to rational exponents
* Use properties of rational and irrational numbers
* Perform arithmetic operations with complex numbers
* Perform arithmetic operations on polynomials
 |  | * Know that there are numbers that are not rational (including square roots and cube roots), and approximate them by rational numbers
* Know and apply the properties of integer exponents to generate equivalent numerical expression
* Use square and cube root symbols to represent solutions to *x2 = p* and *x3 = p*, where *p* is a positive rational number
* Perform operations with numbers in scientific notation
 | * Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers
* Represent addition and subtraction on a horizontal or vertical number line
* Understand subtraction as adding the additive inverse
* Show distance between two rational numbers on the number line is the absolute value of their difference
* Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers
* Use properties of operations, particularly the distributive property and the rules for multiplying signed numbers
* Understand that integers can be divided, provided that the divisor is not zero, and the quotient is a rational number
* Convert a rational number to a decimal using division; know that the decimal form of a rational number terminates in zeros or eventually repeats
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*Quadratic Functions and Modeling*

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| Secondary 2 | Secondary 1 | Intermediate 2 (8th) | Intermediate 1 (7th) |
| * Interpret functions that arise in applications in terms of context (focus on quadratics)
* Analyze functions using different representations (algebraically, graphically, numerically in tables, or by verbal description)
* Compare and contrast absolute value, step and piecewise defined functions with linear, quadratic and exponential functions
* Build new functions from existing functions
* Find inverse functions
* Construct and compare linear, quadratic, and exponential models and solve problems
 | * Interpret functions that arise in applications in terms of context (focus on linear and exponential)
* Analyze functions using different representations (algebraically, graphically, numerically in tables, or by verbal description)
* Compare and contrast linear, exponential functions and non-examples
* Classify exponential functions as growth or decay
* Construct and compare linear and exponential models and solve problems
* Transformations of linear and exponential functions with regard the changes in their equations
* Understand the concept of function, use function notation, domain and range
 | * Understand the connections between proportional relationships, lines, and linear equations
* Graph proportional relationships, interpreting the unit rate as the slope of the graph
* Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation *y = mx* for a line through the origin and the equation *y = mx+b* for a line intercepting the vertical axis at *b*
* Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output
* Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
* Determine if functions are linear or nonlinear, increasing or decreasing
 | * Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin
* Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships
* Represent proportional relationships by equations.
* Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate
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*Expressions and Equations*

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| Secondary 2 | Secondary 1 | Intermediate 2 (8th) | Intermediate 1 (7th) |
| * Interpret the structure of expressions (terms, factors, coefficients)
* Write expressions in equivalent forms to solve problems
* Factor a quadratic expression to reveal the zeros of the function it defines, complete the square to reveal maximum and minimum values of a quadratic
* Use the properties of exponents to transform expressions for exponential functions
* Create equations and inequalities that describe numbers or relationships
* Solve Equations and inequalities in one variable (quadratic equations)
* Derive the quadratic formula from vertex form.
* Recognize when the quadratic formula gives complex solutions and write them in $a \pm bi$ for real numbers *a* and *b*
* Use complex number in polynomial identities and equations (limit to quadratics with real coefficients)
* Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials
* Solve systems of equations. Include systems consisting of one linear and one quadratic
 | * Interpret expressions that represent a quantity in terms of its context
* Interpret parts of an expression, such as terms, factors, and coefficients.
* Create equations and inequalities in one variable and use them to solve problems (limit to linear and exponential)
* Create equations in two or more variables to represent relationships between quantities, graph equations on coordinate axes with labels and scales
* Represent constraints by linear equations and inequalities
* Graph a system of linear equations or linear inequalities
* Solve systems of equations by substitution, linear combination (elimination), and graphing [Honors – row reduction matrices]
* Understand solving equations as a process of reasoning and explain the reasoning
* Solve equations and inequalities in one variable
 | * Solve linear equations in one variable, including rational number coefficients and whose solutions require expanding expressions using the distributive property and collecting like terms.
* Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solution.
* Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously
* Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations
 | * Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients
* Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.
* Use variables to represent quantities in a real-world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities.
* Solve word problem leading to equations of the form *px + q = r* or *p(x + q) = r*, where *p, q*, and *r* are specific rational numbers.
* Fluently solve equations of the form *px + q = r* or *p(x + q) = r*, where *p, q*, and *r* are specific rational numbers.
* Solve word problem leading to inequalities of the form *px + q > r* or *px + q < r*, where *p, q*, and *r* are specific rational numbers.
* Fluently solve equations of the form *px + q > r* or *px + q < r*, where *p, q*, and *r* are specific rational numbers.
* Graph the solution set of inequalities and interpret it in the context of a problem.
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*Applications of Probability*

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| Secondary 2 | Secondary 1 | Intermediate 2 (8th) | Intermediate 1 (7th) |
| * Understand independence and conditional probability and use them to interpret data
* Use the rules of probability to compute probabilities of compound events in a uniform probability model
* Apply the Addition Rule, Multiplication Rule, and use permutations and combinations to compute probabilities of compound events and solve problems
* Use probability to evaluate out comes of decisions (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game)
 | * Summarize, represent, and interpret data on a single count or measurement variable
* Represent data with plots on the real number line (dot plots, histograms, and box plots)
* Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
* Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers)
* Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies).
* Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
* Interpret the slope and the intercept of a linear model in the context of the data
* Compute (using technology) and interpret the correlation coefficient of a linear fit.
* Distinguish between correlation and causation
 | * Construct and interpret scatter plots for bivariate data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
* Know that straight lines are widely used to model relationships between two quantitative variables. Informally fit a straight line and informally assess the model fit by judging the closeness of the data points to the line.
* Understand that patterns of association can be seen by displaying frequencies and relative frequencies in a two-way table.
* Construct and interpret a two-way table summarizing data on two categorical variables from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
 | * Use random sampling to draw inferences about a population
* Draw informal comparative inferences about two populations (using measures of center and measures of variability)
* Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around one-half indicates and event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
* Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
* Develop probability model and use it to find probabilities of events (theoretical and experimental); if the agreement is not good, explain possible sources of the discrepancy.
* Find the probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
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*Similarity, Right Triangle Trigonometry, and Proof*

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| Secondary 2 | Secondary 1 | Intermediate 2 (8th) | Intermediate 1 (7th) |
| * Understand similarity in terms of similarity transformations (dilations)
* Prove geometric theorems. Encourage multiple ways of writing proofs, such as in narrative paragraphs, using flow diagrams, in two-column format, and using diagrams without words.
* Prove theorems about lines and Prove theorems about triangles Prove theorems about parallelograms
* Prove theorems involving similarity (a line parallel to ones side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using similarity.
* Use coordinates to prove simple geometric theorems algebraically
* Define trigonometric ratios using similarity and solve problems involving right triangles.
* Prove and apply trigonometric identities. Limit θ between 0 and 90 degrees. Connect to the Pythagorean theorem and the distance formula.
 | * Experiment with transformations (reflections, translations, rotations, and dilations) in the plane.
* Rotational and reflectional symmetry
* Describe transformations to map a figure onto another figure
* Understand congruence in terms of rigid motions (preserve distance and angle measure)
* Explain how the criteria for triangle congruency (ASA, SSS, SAS, etc) follow from the definition of congruence in terms of rigid motion.
* Make geometric constructions
 | * Understand congruence and similarity using physical models, transparencies, or software.
* Verify experimentally the properties of rotations, reflections and translations: line segments to line segments of the same length, angles are taken to angles of the same measure, etc.
* Understand that 2-d figures are congruent if one figure can be obtained by a sequence of rotations, reflections, and translations of the other figure
* Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
* Understand that 2-d figures are similar if one figure can be obtained by a sequence of rotations, reflections, translations, and dilations of the other figure
* Use information arguments to establish facts about angle sum and exterior angle of triangles, angles created when parallel lines are cut by a transversal, and the AA~ for triangles
* Explain a proof of the Pythagorean Theorem and its Converse
* Apply the Pythagorean Theorem to find missing sides and the distance between two points in a coordinate system.
 | * Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
* Use facts about supplementary, complementary, vertical and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure.
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*Circles With and Without Coordinates*

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| Secondary 2 | Secondary 1 | Intermediate 2 (8th) | Intermediate 1 (7th) |
| * Understand and apply theorems about circles. (all circles are similar; identify and describe relationships among inscribed angles, radii, and chords; etc.)
* Construct the inscribed and circumscribed circles of a triangle and prove properties of angles for a quadrilateral inscribed in a circle.
* Construct a tangent line from a point outside a given circle to the circle.
* Find arc lengths and areas of sectors of circles. (Derive using similarity, define radian, etc.)
* Translate between the geometric description and the equation for a conic section. (Derive the equation of a circle; derive the equation of a parabola given a focus and directrix.
* Use coordinates to prove simple geometric theorems algebraically. (Include proofs involving circles.
* Explain volume formulas and use them to solve problems. (Informal arguments for area and volume with similarity transformations; use dissection arguments, Cavalieri’s principle and informal limit arguments.
* Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
 | * Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
* Construct perpendicular bisector of a segment, perpendicular lines, and parallel lines.
 | * Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
 | * Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
* Know the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
* Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.
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