Washington Mathematics

Integrated HS Math 2

Standards for Mathematical Practice

1 **Make sense of problems and persevere in solving them.** 1

2 **Reason abstractly and quantitatively.** 2

3 **Construct viable arguments and critique the reasoning of others.** 3

4 **Model with mathematics.** 4

5 **Use appropriate tools strategically.** 5

6 **Attend to precision.** 6

7 **Look for and make use of structure.** 7

8 **Look for and express regularity in repeated reasoning.** 8

Number & Quantity — **Number & Quantity**

The Real Number System

A **Extend the properties of exponents to rational exponents.**

1 Flexibly, efficiently, and accurately explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values using a variety of strategies, allowing for a notation for radicals in terms of rational exponents. N.RN.A.1

2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. Use properties of rational and irrational numbers. N.RN.A.2

B **Use properties of rational and irrational numbers.**

3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. N.RN.B.3

Complex Numbers

A **Perform arithmetic operations with complex numbers.**

1 Know there is a complex number i such that i2 = -1, and every complex number has the form a + bi with a and b real. N.CN.A.1

2 Use the relation i2 = -1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. N.CN.A.2

B Use complex numbers in polynomial identities and equations.

7 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. N.CN.A.7

Algebra	Algebra
Seeing Structure in Expressions	**A Interpret the structure of expressions.** 1a Interpret expressions that represent a quantity in terms of its context within linear, exponential, and quadratic functions. A.SSE.A.1A 2 Use the structure of an expression to identify ways to rewrite it within exponential and quadratic functions. A.SSE.A.2
	B Write expressions in equivalent forms to solve problems. 3a, c Flexibly, efficiently, and accurately create an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression including factoring quadratic expressions and using properties of exponents to create equivalent forms of exponential expressions to reveal properties of interest in the function. A.SSE.B.3A, C
Arithmetic with Polynomials and Rational Expressions	**A Perform arithmetic operations on polynomials.** 1 Flexibly, efficiently, and accurately demonstrate that polynomials form a system similar to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. A.APR.A.1
Creating Equations	**A Create equations that describe numbers or relationships.** 1 Flexibly, efficiently, and accurately create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions. A.CED.A.1 2 Flexibly, efficiently, and accurately create linear, quadratic, exponential equations to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A.CED.A.2 4 Flexibly, efficiently, and accurately rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations within linear, quadratic, and exponential equations. A.CED.A.4
Reason with Equations and Inequalities	**B Solve equations and inequalities in one variable.** 4b Solve quadratic equations in one variable by inspection, taking square roots, and factoring as appropriate to the initial form of the equation. A.REI.B.4B

C Solve systems of equations.

7 Flexibly, efficiently, and accurately solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. A.REI.C.7

Functions	Functions

Interpreting Functions

B Interpret functions that arise in applications in terms of the context.

4 For a function that models a relationship between two quantities in context, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries for functions including linear, exponential, and quadratic. F.IF.B.4

5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes in linear, exponential, or quadratic contexts. F.IF.B.5

6 Calculate and interpret the average rate of change of a function (represented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. F.IF.B.6

C Analyze functions using different representations.

7a, e Graph linear, exponential, and quadratic functions expressed symbolically and show key features of the graph, including intercepts, maximum, minimum, and interpreting end behavior for exponential functions by hand in simple cases and using technology for more complicated cases. F.IF.C.7A, E

8 Flexibly, efficiently, and accurately write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function including zeros and symmetry, using factoring for quadratic functions and integer constants for time with exponential growth and decay. F.IF.C.8

9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Functions could be linear, exponential, or quadratic. F.IF.C.9

A Build a function that models a relationship between two quantities.

1a, b Flexibly, efficiently, and accurately write a function that describes a relationship between two quantities, including linear and exponential arithmetic and geometric sequences in context. F.BF.A.1A, B

B Build new functions from existing functions.

3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Using a variety of strategies, experiment with cases and illustrate an explanation of the effects on the graph using technology. F.BF.B.3

Linear, Quadratic, and Exponential Models

A Construct and compare linear, quadratic, and exponential models and solve problems.

3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically. F.LE.A.3

Geometry **Geometry**

Congruence

C Solve real-world and mathematical problems involving area, surface area, and volume.

9 Flexibly, efficiently, and accurately prove theorems about lines and angles: vertical, transversals, alternate interior and exterior, perpendicular bisectors, etc. G.CO.C.9

10 Flexibly, efficiently, and accurately prove theorems about triangles: interior angles, base angles, segments joining midpoint of two sides, and medians of a triangle. G.CO.C.10

11 Flexibly, efficiently, and accurately prove theorems about parallelograms: congruence of opposite sides and opposite angles, properties of diagonals. G.CO.C.11

Similarity, Right Triangles, and Trigonometry

A Understand similarity in terms of similarity transformations.

1a, b Verify experimentally the properties of dilations given by a center and a scale factor by seeing what happens to lines affected by a center of dilation and how scale factor affects line segments. G.SRT.A.1A, B

2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. G.SRT.A.2

3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. G.SRT.A.3

B Prove theorems involving similarity

4 Flexibly, efficiently, and accurately prove theorems about triangles: proportionality, triangle similarity, and the Pythagorean Theorem. G.SRT.B.4

5 Flexibly, efficiently, and accurately use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. G.SRT.B.5

C Define trigonometric ratios and solve problems involving right triangles.

6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. G.SRT.C.6

7 Explain and use the relationship between the sine and cosine of complementary angles. G.SRT.C.7

8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. G.SRT.C.8

Circles

A Understand and apply theorems about circles.

1 Flexibly, efficiently, and accurately prove that all circles are similar. G.C.A.1

2 Identify and describe relationships among inscribed angles, radii, and chords, including how angles formed inside the circle, the circle's radius, and line segments within the circle are related. Understand special cases including angles formed by diameters and how the circle's edge interacts with its radius. G.C.A.2

3 Construct the inscribed and circumscribed circles of a triangle and flexibly, efficiently, and accurately prove properties of angles for a quadrilateral inscribed in a circle. G.C.A.3

B Find arc lengths and areas of sectors of circles.

5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. G.C.B.5

Expressing Geometric Properties with Equations

A Translate between the geometric description and the equation for a conic section.

1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem. G.GPE.A.1

B Use coordinates to prove simple geometric theorems algebraically.

4 Use coordinates to prove simple geometric theorems algebraically. G.GPE.B.4

Geometric Measurement and Dimension

A Explain volume formulas and use them to solve problems.

1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. G.GMD.A.1

3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. G.GMD.A.3

B Visualize relationships between two-dimensional and three-dimensional objects.

4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. G.GMD.B.4

Modeling with Geometry

A Apply geometric concepts in modeling situations.

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G.MG.A.1
2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G.MG.A.2
3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). G.MG.A.3

Statistics and Probability

Statistics and Probability

Conditional Probability and the Rules of Probability

A Understand independence and conditional probability and use them to interpret data.

1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). S.CP.A.1
2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. S.CP.A.2
3. Understand the conditional probability of AA given BB as $PP(AA\ aaaaaa\ BB)$, $PP(BB)$ and interpret independence of AA and BB as saying that the conditional probability of AA given BB is the same as the probability of AA, and the conditional probability of BB given AA is the same as the probability of BB. S.CP.A.3
4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. S.CP.A.4
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. S.CP.A.5

B Use the rules of probability to compute probabilities of compound events.

6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. S.CP.B.6
7. Apply the Addition Rule, $PP(AA\ oooo\ BB) = PP(AA) + PP(BB) - PP(AA\ aaaaaa\ BB)$, and interpret the answer in terms of the model. S.CP.B.7

Data Science

Formulate statistical investigative questions.

1. Formulate multivariable statistical investigative questions and determine how data can be collected and provide an answer, consider causality and prediction when posing the question. HS.DS.1

Collect and consider data.

2 Understand the issues of bias and confounding variables when collecting data and their impact on interpretation. Understand practices for collecting and handling data, including sensitive information and concerns for privacy and how that may affect data collection. HS.DS.2

Analyze the data.

3 Create and analyze data sets and data displays, including but not limited to scatter plots, regressions, histograms and boxplots using technology to sort or filter data, summarize, and describe relationships between quantitative variables. HS.DS.3

Interpret results.

4 Acknowledge the presence of missing data values and understand how missing values may add bias to analysis and interpretation. Examine and discuss competing explanations for data trends observed such as confounding variables. Respond to competing arguments or interpretations of the data of different community groups, paying careful attention to what conclusions the data supports, taking into account correlation versus causation. HS.DS.4