Washington Mathematics

Integrated Math 3

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

Algebra

Algebra

Seeing Structure in Expressions

A Interpret the structure of expressions.

- 1a Interpret expressions that represent a quantity in terms of its context. A.SSE.A.1A, B
- 2 Use the structure of an expression to identify ways to rewrite it. A.SSE.A.2

B Write expressions in equivalent forms to solve problems.

- 3a, b, 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, completing the square in a quadratic expression to reveal maximums or minimums, and using properties of exponents to create equivalent forms of exponential expressions to reveal properties of interest in the function. A.SSE.B.3A, B, C
- 4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. A.SSE.B.4

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

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2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x - a is p(a), so p(a) = 0 if and only if (x - a) is a factor of p(x). A.APR.B.2

3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. A.APR.B.3

4 Prove polynomial identities and use them to describe numerical relationships. A.APR.C.4

6 Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system. A.APR.D.6

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. A.CED.A.1

2 Flexibly, efficiently, and accurately create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A.CED.A.2

3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. A.CED.A.3

4 Flexibly, efficiently, and accurately rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. A.CED.A.4

Reason with Equations and Inequalities

A Understand solving equations as a process of reasoning and explain the reasoning.

2 Solve rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. A.REI.A.2

B Solve equations and inequalities in one variable.

4a, b Solve quadratic equations in one variable by inspection, factoring, completing the square and derive the quadratic formula from this form. Recognize when the quadratic formula give complex solutions and write them as a ± bi for real numbers a and b. A.REI.B.4A, B

D Represent and solve equations and inequalities graphically.

11 Using a variety of strategies explain why the x-coordinates of the points where the graphs of the equations $yy = ff(xx)$ and $yy = gg(xx)$ intersect are the solutions of the equation $ff(xx) = gg(xx)$ find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $ff(xx)$ and/or $gg(xx)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. A.REI.D.11

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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, 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. Functions can include: polynomial, radical, rational, logarithms, absolute value, piecewise, and trigonometric. Linear, exponential, and quadratic relationships in increased complexity. F.IF.B.4

5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes in context. Functions can include: polynomial, radical, rational, logarithms, absolute value, piecewise, and trigonometric. Linear, exponential, and quadratic relationships in increased complexity. F.IF.B.5

6 Calculate and interpret the average rate of change of a function (presented 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.

7b, c, e Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases including linear, quadratic, exponential, square root, cube root, and piecewise-defined functions, including step functions and absolute value functions, polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior, and exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. F.IF.C.7B, C, E

8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function, including factoring and completing the square to reveal zeros, symmetry, and extreme values of a quadratic functions and non-integer constants for time with exponential growth and decay in context. 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 can include: polynomial, radical, rational, logarithms, absolute value, piecewise, and trigonometric. Linear, exponential, and quadratic relationships in increased complexity. F.IF.C.9

Building Functions

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

1a, b Write a function that describes a relationship between two quantities including determining an explicit expression, recursive process, or steps for calculation from a context, and combining standard function types using arithmetic operations. F.BF.A.1A, B

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2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. F.BF.A.2

B Build new functions from existing functions.

3 Identify the effect on the graph of replacing $ff(xx)$ $bbbb\,ff(xx) + kk$, $kk\,ff(xx)$, $ff(kkkk)$, $aaaaaa\,ff(xx + kk)$ for specific values of kk (both positive and negative); find the value of kk given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. F.BF.B.3

4 Find inverse functions through focus on relationships between inputs and outputs. F.BF.B.4A

Linear, Quadratic, and Exponential Models

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

4 For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. F.LE.A.4

Trigonometric Functions

A Extend the domain of trigonometric functions using the unit circle.

1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. F.TF.A.1

2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. F.TF.A.2

B Interpret expressions for functions in terms of the situation they model.

5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. F.TF.B.5

C Prove and apply trigonometric identities.

8 Prove the Pythagorean identity sin2(θ) + cos2(θ) = 1 and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle. F.TF.C.8

Geometry

Geometry

Geometric Measurement and Dimension

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

Statistics and Pr

Statistics and Probability

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Interpreting Categorical and Quantitative Data

A Summarize, represent, and interpret data on a single count or measurement variable.

4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. S.ID.A.4

Making Inferences and Justifying Conclusions.

A Understand and evaluate random processes underlying statistical experiments.

1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. S.IC.A.1

2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. S.IC.A.2

B Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. S.IC.B.3

4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. S.IC.B.4

5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. S.IC.B.5

6 Evaluate reports based on data. S.IC.B.6

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.

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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