Maryland Mathematics

Integrated Algebra 2

Number and Operation Sense NOS

A REASON WITH RATIONAL EXPONENTS. IA2.NOS.A

1 Apply the properties of exponents to generate equivalent numerical expressions involving radicals and rational exponents. IA2.NOS.A.1

B REASON ABOUT THE COMPLEX NUMBER SYSTEM. IA2.NOS.B

2 Use the knowledge that to write complex numbers in standard form, , and use them to represent solutions to quadratics that have no real solutions. IA2.NOS.B.2

Algebraic Thinking AT

A LOOK FOR AND MAKE USE OF STRUCTURE TO REWRITE EXPRESSIONS IN EQUIVALENT FORMS AND REASON ABOUT THEIR PROPERTIES. IA2.AT.A

1 Rewrite and interpret quadratic expressions to explain key properties of a relationship. IA2.AT.A.1

a Factor quadratic expressions to reveal the zeros of the function, and explain their significance in context. IA2.AT.A.1.A

b Complete the square to identify the maximum or minimum value of a relationship and interpret that value in context. IA2.AT.A.1.B

c Compare different forms of a quadratic expression (standard, factored, vertex) to determine which form is most useful for interpreting a given situation. IA2.AT.A.1.C

2 Given a polynomial of degree 3 or higher in factored form, use the Zero Product Property to identify its zeros and sketch a graph of the function. IA2.AT.A.2

3 Add, subtract, and multiply polynomials to rewrite expressions in equivalent forms for clarity, efficiency, or problem-solving applications. Use these operations to represent and analyze polynomial relationships in context. Multiplication of polynomials includes multiplying a binomial and a trinomial. IA2.AT.A.3

B MAKE SENSE OF AND SOLVE EQUATIONS AND SYSTEMS OF EQUATIONS. IA2.AT.B

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4 Create and solve quadratic equations in one variable. IA2.AT.B.4

a Create quadratic equations in one variable to represent relationships between quantities. IA2.AT.B.4.A

b Flexibly choose and apply methods to solve quadratic equations based on their initial form (i.e., solve equations by recognizing perfect squares (e.g.,), taking square roots, factoring when possible, completing the square, or applying the quadratic formula when necessary). Justify the selected method by reasoning about the structure of the equation and interpret the solution in context when applicable. IA2.AT.B.4.B

c Represent complex solutions as for real numbers a and b. IA2.AT.B.4.C

5 Solve radical equations in one variable that contain a single radical term. Explain why some solutions may be extraneous and justify whether a given solution is valid based on a given context. IA2.AT.B.5

6 Create, solve, and analyze systems consisting of a linear and a quadratic equation in two variables in context. IA2.AT.B.6

a Create systems consisting of a linear and a quadratic equation to represent relationships. IA2.AT.B.6.A

b Solve these systems exactly and approximately using algebraic methods (i.e., substitution), graphical methods, or tables. IA2.AT.B.6.B

c Interpret the meaning of the solution(s) in context. IA2.AT.B.6.C

7 Use technology to solve systems of equations that include a combination of linear, exponential, quadratic, and/or radical equations. Interpret the solution(s) within a given context. IA2.AT.B.7

C REASON ABOUT FUNCTIONS. IA2.AT.C

8 Calculate or estimate and interpret the average rate of change over a specified interval for exponential, quadratic, and radical functions presented graphically, symbolically or as a table. IA2.AT.C.8

9 Compare properties of two quadratic functions each represented in a different way (algebraically, graphically, numerically in tables, or by narrative descriptions), to analyze differences and similarities between the relationships the functions model. IA2.AT.C.9

10 Analyze and compare the behavior of functions across different families. IA2.AT.C.10

a Compare linear, quadratic, exponential, polynomial (degree of 3 or higher), and radical functions by analyzing differences in their patterns of change and key characteristics (e.g., symmetry, end behavior). Explain how these differences affect the modeling of various contexts. IA2.AT.C.10.A

b Analyze how the number and type of solutions to equations vary across function families and explain how those solutions are represented and interpreted in graphs and equations. IA2.AT.C.10.B

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ODEL WITH FUNCTIONS. IA2.AT.D

11 Write a quadratic function to model relationships between quantities given a narrative description, table of values, or graph. IA2.AT.D.11

12 Represent and interpret quadratic functions using tables and graphs and apply them in context. IA2.AT.D.12

- a Create tables and graphs to represent quadratic relationships and identify key features. Key features include: intercepts/zeros, symmetry, intervals of increase and decrease, relative extrema, end behavior, domain (if restricted in context), and range. IA2.AT.D.12.A
- b Relate key features in the table and graph to characteristics of a context. IA2.AT.D.12.B
- c Justify the appropriateness of a quadratic model by analyzing trends in the table or graph and explaining how the model's features support predictions or contextual interpretations. IA2.AT.D.12.C

13 Find and interpret the inverse of quadratic and exponential functions using algebraic and graphical representations. IA2.AT.D.13

- a Restrict the domain of a quadratic to make it one-to-one and express its inverse as a square root function. IA2.AT.D.13.A
- b Express the inverse of an exponential function as a logarithmic function and evaluate expressions involving logarithms. IA2.AT.D.13.B
- c Graph a function and its inverse and analyze features (e.g., domain and range, intercepts, points of intersection) and symmetry across the line y = x. IA2.AT.D.13.C
- d Interpret the meaning of inverse functions in context. IA2.AT.D.13.D

14 Represent and interpret higher degree polynomial (degree 3 or higher), and radical functions in context using tables and graphs. IA2.AT.D.14

- a Create tables and graphs to represent higher degree polynomial functions and identify key features. Key features include: intercepts/zeros, symmetry, intervals of increase and decrease, relative extrema, and end behavior. IA2.AT.D.14.A
- b Create tables and graphs to represent radical functions and identify key features. Key features include: domain restrictions, intercepts, intervals of increase and decrease, and end behavior. IA2.AT.D.14.B
- c Relate key features of higher-degree polynomial and radical functions to contexts. IA2.AT.D.14.C

15 Analyze how transformations affect the graph of a polynomial function given in vertex form and interpret their meaning in context. IA2.AT.D.15

- a Identify how the graph of a quadratic function changes when is replaced by , , and and determine the value of k from the graph. Describe the type of transformation. IA2.AT.D.15.A
- b Explain the meaning of each transformation by connecting the structure of the transformed function to the quantities it represents (e.g., how changes affect the vertex, direction of opening, and rate of change). IA2.AT.D.15.B

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Geometric Reasoning GR

A REASON ABOUT TRANSFORMATIONS AND SIMILARITY. IA2.GR.A

1. Describe the effect of dilations on two-dimensional figures using coordinates, including how scale factor and center of dilation impact side lengths and angle measures. IA2.GR.A.1
2. Use similarity transformations to determine and justify triangle similarity. IA2.GR.A.2
   - a. Determine whether two triangles are similar by identifying a sequence of similarity transformations (rotations, reflections, translations, and dilations) that relates one triangle onto another and aligns corresponding parts. IA2.GR.A.2.A
   - b. Justify triangle similarity by explaining how similarity transformations establish that corresponding angles are congruent and corresponding sides are proportional. IA2.GR.A.2.B
3. Apply properties of similar triangles to solve geometric problems in context. IA2.GR.A.3
4. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. IA2.GR.A.4

B REASON ABOUT RIGHT TRIANGLE RELATIONSHIPS. IA2.GR.B

5. Use similarity of right triangles to explain and define trigonometric ratios (sine, cosine, and tangent) for acute angles as properties of the angles, based on side ratios. IA2.GR.B.5
6. Justify the side length relationships in special right triangles (30°-60°-90° and 45°-45°-90°). IA2.GR.B.6
   - a. Use geometric reasoning (e.g., dissecting an equilateral triangle or square) to explain why the side length relationship in special right triangles hold. IA2.GR.B.6.A
   - b. Describe the consistent ratios of side lengths in these triangles (e.g., 1:1: and 1: :2), and explain how these ratios relate to the angle measures. IA2.GR.B.6.B
7. Use trigonometric ratios, the Pythagorean Theorem, and special right triangle relationships to solve right triangles in applied contexts. IA2.GR.B.7

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C MAKE SENSE OF CIRCLES AND THEIR PROPERTIES. IA2.GR.C

8 Apply similarity to develop and use formulas involving arc length, radian measure, and sector area. IA2.GR.C.8

a Explain and demonstrate, using similarity, that arc length is proportional to the radius of a circle. IA2.GR.C.8.A

b Calculate the radian measure of a central angle as the ratio of arc length to radius. IA2.GR.C.8.B

c Apply the formula for the area of a sector using radian measure. IA2.GR.C.8.C

9 Create the equation of a circle given the center and radius; identify the center and radius of a circle given the equation. IA2.GR.C.9

D MODEL WITH GEOMETRY. IA2.GR.D

10 Use geometric shapes, their measures, and their properties to represent real world objects, and solve related authentic modeling and design problems. IA2.GR.D.10

11 Rearrange geometric formulas to isolate and interpret a quantity of interest in context (e.g., solving for height in a volume formula), using reasoning aligned with solving equations and modeling with mathematics. IA2.GR.D.11

Reasoning with Data, Statistics, and Probability DS

A MAKE SENSE OF STATISTICAL INQUIRY. IA2.DS.A

1 Evaluate and refine statistical study designs and critically analyze data-based claims to improve the quality and validity of inferences. IA2.DS.A.1

a Assess the limitations of a sample or study design in terms of bias, randomness, and representativeness. IA2.DS.A.1.A

b Propose modifications to sampling methods or data collection strategies to enhance the validity and generalizability of conclusions. IA2.DS.A.1.B

c Identify potential sources of bias or misuse in data collection, representation, or modeling. IA2.DS.A.1.C

d Recognize when correlation is misused to imply causation. IA2.DS.A.1.D

B DESCRIBE, ANALYZE, AND COMPARE DATA USING VISUAL AND NUMERICAL REPRESENTATIONS TO MODEL SITUATIONS AND DRAW INFERENCES. IA2.DS.B

2 Represent data on two quantitative variables with a scatter plot, and describe how the variables are related. IA2.DS.B.2

a Fit a quadratic, higher degree polynomial, or radical function to data. Use functions fitted to data to solve problems in the context of the data. IA2.DS.B.2.A

b Informally assess the fit of a quadratic, higher degree polynomial, or radical function visually by analyzing the graph and analytically by evaluating the appropriateness of the chosen model in representing the data and context. IA2.DS.B.2.B

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3 Construct and interpret two-way frequency tables to analyze associations between two categorical variables. IA2.DS.B.3

a Use the tables to decide if events are independent IA2.DS.B.3.A

b Approximate conditional probabilities and explain their meaning in context, including the relationship between conditional probability and independence. IA2.DS.B.3.B