Arizona Mathematic Standards

Mathematics Curriculum Map

Mathematics Year 4

ARIZONA DEPARTMENT OF EDUCATION
HIGH ACADEMIC STANDARDS

Chandler Unified School District Standards

Math Year 4 – At a Glance

NOTE: Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.

Math 4 Curriculum Map

Semester 1				Semester 2			Flex	
Unit 1 Linear Equations And Inequalities	**Unit 2 Functions**	**Unit 3 Exponentials /Quadratics**	**Unit 4 Trigonometry**	**Unit 5 Geometry**	**Unit 6 Probability**	**Unit 7 Statistics**	**Flex Unit 1 Set Theory**	**Flex Unit 2 Consumer Math**
A2.A-CED.A.1 **A1.A-CED.A.2** **A2.A-REI.B.4** **A2.F-BF.A.1** **Optional:** **A2.A-REI.A.2** **A2.A-APR.D.6**	**A1.F-IF.A.1** **A1.F-IF.A.2** **A2.F-BF.A.1** **A2.F- IF.B.6** **Optional:** **A2.F-BF.B.3** **A2.F-BF.B.4**	**A2.A-SSE.A.2** **A2.A-APR.B.3** **A2.F-BF.B.3** **A2.F-BF.A.1** **A2.F-LE.B.5** **Optional:** **A2.F-IF.B.4** **A2.F-IF.B.6** **A2.N-CN.A.1** **A2.N-CN.A.7** **A2.F-LE.A.4**	**A2.F-TF.A.1** **A2.F-TF.A.2** **P-F-TF.A.3** **G.G-SRT.C.8** **Optional** **A2.F-TF.C.8** **A2.F-TF.B.5**	**MCCD OCC 15** **MCCD OCC 16** **MCCD OCC 17** **MCCD OCC 18** **MCCD OCC 19**	**MCCD OCC 3** **MCCD OCC 4** **MCCD OCC 5** **MCCD OCC 6** **MCCD OCC 18** **MCCD OCC 19**	**MCCD OCC 7** **MCCD OCC 8** **MCCD OCC 9** **MCCD OCC 10** **MCCD OCC 18** **MCCD OCC 19**	**MCCD OCC 1** **MCCD OCC 2** **MCCD OCC 3** **MCCD OCC 18** **MCCD OCC 19**	**MCCD OCC 11** **MCCD OCC 12** **MCCD OCC 13** **MCCD OCC 14** **MCCD OCC 18** **MCCD OCC 19**

Semester 2 Standards are Based on the MCCCD Official Course Competencies

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

All units will include the Mathematical Practices

MCCCD Official Course Competencies

1. Distinguish between a subset and a proper subset.
2. Use Venn diagrams to solve applied problems involving the union, intersection, and complement of sets.
3. Distinguish between experimental and theoretical probability, and use each to solve applied problems.
4. Use conditional probability to solve applied problems involving dependent events.
5. Use probabilities to calculate odds, either in favor of or against a particular event, and vice versa.
6. Solve probability problems involving combinations and permutations.
7. Organize, analyze, and display data using multiple representations.
8. Calculate and interpret measures of central tendency and dispersion.
9. Calculate and interpret measures of location (percentiles and quartiles).
10. Solve applications using the normal distribution.
11. Solve applications involving loans and amortizations.
12. Solve applications involving annuities.
13. Calculate the annual interest rate given the annual yield and vice versa.
14. Solve real-life problems using exponential growth.
15. Use appropriate formulas and units of measure for composite geometric shapes and figures from real life problems.
16. Apply unit analysis skills to solve applied problems.
17. Use dimensional analysis to convert units of measurement between different systems.
18. Use written and verbal communication to describe process and results.
19. Model and solve real-world problems.

Standards for Mathematical Practices (MP)

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Semester 1

Unit 1 Linear Equations and Inequalities

Essential Question(s):

- **How do I solve a linear equation?**
- **How do I classify an equation?**
- **How do I solve a literal equation?**
- **How do I solve rational and radical equations?**
- **How do I solve equations with rational exponents?**
- **How do I solve linear, quadratic, and rational inequalities?**

Topic	Arizona Mathematics Standard	Mathematical Practices	Resources
Optional Review: Basic Algebraic Concepts 1. Exponent Rules 2. Simplify Radicals 3. Simplify Rational Exponents 4. Simplifying Rational Expressions	A2.A-APR.D.6 : Rewrite 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.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Blitzer P2,P3,P6
Linear Equations Applications Optional: 1. Solving Radical Equations 2. Solving Absolute Value Equations and Inequalities	A2.A-CED.A.1: Create equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context. A1.A-CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A2.A-REI.A.2: Solve rational and radical equations in one variable, and give examples showing how extraneous solutions may arise A2.A-REI.B.4: Fluently solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.		Blitzer 1.2,1.3 Thinking Mathematically 1.2, 1.3, 7.2 Optional Content: Blitzer 2.6,2.7

Optional Continued: 1. Solving Radical Equations 2. Solving Absolute Value Equations and Inequalities	A2.F-BF.A.1: Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine function types using arithmetic operations and function composition.		Optional Content: Blitzer 2.6,2.7
Linear Inequalities Optional – Interval Notation (Blitzer Book) Optional – Solving Compound Inequality	A2.A-CED.A.1: Create equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context.	MP 1 MP 2 MP 3 MP 5 MP 6	Blitzer 1.7 Thinking Mathematically 7.4

Semester 1

Unit 2 Functions

Essential Question(s):

- **How can you determine the domain, range, and end behavior of a function?**
- **What are some of the attributes of a function, and how are they related to the function's graph?**
- **How can you analyze functions to solve real-world problems?**
- **How do the equations of transformed graphs compare to the parent function?**

Topic	Arizona Mathematics Standard	Mathematical Practices	Resources
Introduction to Functions Optional: 1. Composite Functions 2. Inverse Functions	A1.F-IF.A.1: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). A1.F-IF.A.2: Evaluate a function for inputs in the domain, and interpret statements that use function notation in terms of a context. Optional: A2.F-BF.B.3: Identify the effect on the graph of replacing *f(x)* by *f(x)* + *k*, *kf(x)*, *f(kx)*, and *f(x+k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. A2.F-BF.B.4: Find inverse functions. a. Understand that an inverse function can be obtained by expressing the dependent variable of one function as the independent variable of another, recognizing that functions *f* and g are inverse functions if and only if *f(x)* = *y* and *g(y)* = *x* for all values of *x* in the domain of *f* and all values of *y* in the domain of *g*. b. Understand that if a function contains a point (*a,b*), then the graph of the inverse relation of the function contains the point (b,*a*). c. Interpret the meaning of and relationship between a function and its inverse utilizing real-world context.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6	Blitzer 2.1 Thinking Mathematically 7.1 Optional Content: Blitzer 2.6,2.7

Linear Functions, Slope, and Equations of Lines	A2.F – IF.B.6: Calculate and interpret the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. A2.F-BF.A.1: Write a function that describes a relationship between two quantities. Include problem-solving opportunities utilizing real-world context. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine function types using arithmetic operations and function composition.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Blitzer 2.3 Thinking Mathematically 7.2

Semester 1

Unit 3 – Quadratics and Exponentials

Essential Question(s):

- **How can you use the graph of a quadratic equation to determine the number of real solutions of the equation?**
- **What are the subsets of the set of complex numbers?**
- **How can you complete the square for a quadratic expression?**
- **How can you derive a general formula for solving a quadratic equation?**
- **How can you use exponential and logarithmic functions to solve real-world problems?**
- **How can modeling with exponential and other functions help you to solve real-world problems?**

Topic	Arizona Mathematics Standard	Mathematical Practices	Resources
Factoring Optional – Sum and Difference of Cubes Optional - Finding Zeros of Polynomials	A2.A-SSE.A.2: Use structure to identify ways to rewrite polynomial and rational expressions. Focus on polynomial operations and factoring patterns. A2.A-APR.B.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.	MP 1 MP 4 MP 5 MP 7	Blitzer P5 Optional Blitzer 3.1.-3.4
Modeling Quadratics Graphing Quadratics – standard form but could include vertex and factored form	A1.F-BF.A.1: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from real-world context.	MP 1 MP 2 MP 4 MP 5	Blitzer Book 3.1 Thinking Mathematically 7.6

Solving Quadratics Optional: 1. Zeros of Polynomials 2. Complex Numbers	A2.F-BF.B.3: Identify the effect on the graph of replacing *f(x)* by *f(x)* + *k*, *kf(x)*, *f(kx)*, and *f(x+k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Optional: A2.F-IF.B.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. Include problem-solving opportunities utilizing a real-world context. A2.F-IF.B.6: Calculate and interpret the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. A2.N-CN.A.1: Apply the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. Write complex numbers in the form ($a+bi$) with *a* and *b* real. A2.N-CN.C.7: Solve quadratic equations with real coefficients that have complex solutions.	MP 1 MP 2 MP 4	Blitzer 1.5 Thinking Mathematically 6.5 Optional Content: Blitzer 1.4/3.2-3.4
Exponential Functions	A1.F-BF.A.1: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from real-world context. A2.F-BF.B.3: Identify the effect on the graph of replacing *f(x)* by *f(x)* + *k*, *kf(x)*, *f(kx)*, and *f(x+k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. A2.F-LE.B.5: Interpret the parameters in an exponential function with rational exponents utilizing real-world context.	MP 1 MP 2 MP 4 MP 5 MP 6	Blitzer 4.1 Thinking Mathematically 7.6

Optional as follows: 1. Introduction to Logarithmic Functions 2. Properties of Logarithmic Functions 3. Solving Exponential and Logarithmic Functions	A1.F-BF.A.1: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from real-world context. A2.F-BF.B.3: Identify the effect on the graph of replacing *f(x)* by *f(x)* + *k*, *kf(x)*, *f(kx)*, and *f(x+k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. A2.F-LE.A.4: For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithms that are not readily found by hand or observation using technology.	MP 1 MP 2 MP 4 MP 5 MP 6	Blitzer 4.2-4.4 Thinking Mathematically 7.6

Semester 1

Unit 4 – Trigonometry
Essential Question(s):

- **How do we relate angular measure to periodic behavior?**
- **How can we use trigonometric functions to model the world around us?**

Topic	Arizona Mathematics Standard	Mathematical Practices	Resources
Right Triangle Trigonometry	G.SRT.C.8: Use trigonometric ratios (including inverse trigonometric ratios) and the Pythagorean Theorem to find unknown measurements in right triangles utilizing real-world context.	MP 1	Blitzer Book 5.2
Optional 1. Trigonometry Identities 2. Graphing Basic Sine and Cosine Functions	A2.F-TF.B.5: Create and interpret sine, cosine and tangent functions that model periodic phenomena with specified amplitude, frequency, and midline. A2.F-TF.C.8: Use the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and the quadrant of the angle θ to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$ or $\cos(\theta)$.	MP 1 MP 2 MP 4 MP 5	Blitzer 5.3, 5.5, 6.1 Thinking Mathematically 10.6
Angels and Radians Optional: Unit Circle	F-TF.A.1: Understand radian measure of an angle as the length of the arc on any circle subtended by the angle, measured in units of the circle's radius. F-TF.A.2: Explain how the unit circle in the coordinate plane enables the extension of sine and cosine functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. P.F-TF.A.3: Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.	MP 1 MP 2 MP 3 MP 4	Blitzer 5.1 Thinking Mathematically 10.6

Semester 2

Unit 5 - Geometry
Essential Question(s):

- **How can geometry help us model and solve real-world problems?**

Topic	MCCCD Official Course Competencies	Mathematical Practices	Resources
Dimensional Analysis	16. Apply unit analysis skills to solve applied problems. 17. Use dimensional analysis to convert units of measurement between different systems. 18. Use written and verbal communication to describe process and results. (I-VI) 19. Model and solve real-world problems.	MP 1 MP 2 MP 3 MP 4	Thinking Mathematically 9.1 – 9.3
Geometry	15. Use appropriate formulas and units of measure for composite geometric shapes and figures from real life problems. 17. Use dimensional analysis to convert units of measurement between different systems. 18. Use written and verbal communication to describe process and results. 19. Model and solve real-world problems.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Thinking Mathematically 10.3 - 10.5

Semester 2

Unit 6 - Probability

Essential Question(s):

- **How can you use probability to model real-world problems?**
- **What is conditional probability?**
- **How can you list the possible outcomes in the sample space of an experiment?**
- **How can you determine whether two events are independent or dependent?**
- **How can you construct and interpret a two-way table?**
- **How can you find probabilities of disjoint and overlapping events?**
- **How can a tree diagram help you visualize the number of ways in which two or more events can occur?**
- **How can you determine the frequency of each outcome of an event?**

Topic	MCCCD Official Course Competencies	Mathematical Practices	Resources
Probability	3. Distinguish between experimental and theoretical probability, and use each to solve applied problems. 4. Use conditional probability to solve applied problems involving dependent events. 6. Solve probability problems involving combinations and permutations. 17. Use dimensional analysis to convert units of measurement between different systems. 18. Use written and verbal communication to describe process and results. 19. Model and solve real-world problems.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Thinking Mathematically 11.1 – 11.7

Semester 2

Unit 7 - Statistics

Essential Question(s):

- **Under what circumstances should a sample statistic be uses as an estimator of a population?**
- **Which measures of center and spread are appropriate for a normal distribution, and which are appropriate for a skewed distribution?**
- **What is a probability distribution for a discrete random variables, and how can it be displayed?**
- **How can you find percent's of data an probabilities of events associate with normal distributions?**
- **How is the mean of a sampling distribution related to the corresponding population mean or population proportion?**
- **How can you calculate a confidence interval and a margin of error for a population proportion or population mean?**
- **What kinds of statistical research are there, and which ones can establish cause-and-effect relationship between variables?**
- **How can you calculate a confidence interval and margin of error for a population proportion or population mean?**

Topic	MCCCD Official Course Competencies	Mathematical Practices	Resources
Statistics	7. Organize, analyze, and display data using multiple representations. 8. Calculate and interpret measures of central tendency and dispersion. 9. Calculate and interpret measures of location (percentiles and quartiles). 10. Solve applications using the normal distribution. 18. Use written and verbal communication to describe process and results. 19. Model and solve real-world problems.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Thinking Mathematically 12.1 – 12.6

Flex

Flex Unit 1 - Set Theory
Essential Question(s):

- **How is the study of set theory related to other disciplines?**
- **How does set theory help to identify relationships and solve problems?**

Topic	MCCCD Official Course Competencies	Mathematical Practices	Resources
Set Theory	1. Distinguish between a subset and a proper subset. 2. Use Venn diagrams to solve applied problems involving the union, intersection, and complement of sets. 3. Distinguish between experimental and theoretical probability, and use each to solve applied problems. 18. Use written and verbal communication to describe process and results. 19. Model and solve real-world problems.	MP 1 MP 2 MP 3 MP 4	Thinking Mathematically 2.1-2.5

Flex

Flex Unit 2 - Finance

Essential Question(s):

- **How will a financial plan contribute to lifelong goal achievement?**
- **Which statistical graph is the best representation for a particular financial situation?**
- **How can compound interest change my rate of return?**
- **In what ways can Algebra be used to better understand finance?**

Topic	MCCCD Official Course Competencies	Mathematical Practices	Resources
Consumer Mathematics and Financial Management	8. Calculate and interpret measures of central tendency and dispersion. 9. Calculate and interpret measures of location (percentiles and quartiles). 10. Solve applications using the normal distribution. 11. Solve applications involving loans and amortizations. 12. Solve applications involving annuities. 13. Calculate the annual interest rate given the annual yield and vice versa. 18. Use written and verbal communication to describe process and results. 19. Model and solve real-world problems.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Thinking Mathematically 8.1 – 8.5

The Mathematical Practices: Narratives and Questions

Mathematics Practices		Narratives	Related Questions
Overarching habits of mind of a productive math thinker	**A1.MP.1 Make sense of problems and persevere in solving them**	Mathematically proficient students explain to themselves the meaning of a problem, look for entry points to begin work on the problem, and plan and choose a solution pathway. While engaging in productive struggle to solve a problem, they continually ask themselves, "Does this make sense?" to monitor and evaluate their progress and change course if necessary. Once they have a solution, they look back at the problem to determine if the solution is reasonable and accurate. Mathematically proficient students check their solutions to problems using different methods, approaches, or representations. They also compare and understand different representations of problems and different solution pathways, both their own and those of others.	• How would you describe the problem in your own words? • How would you describe what you are trying to find? • What do you notice about...? • What information is given in the problem? • Describe the relationship between the quantities. • Describe what you have already tried. What might you change? • Talk me through the steps you've used to this point. • What steps in the process are you most confident about? • What are some other strategies you might try? • What are some other problems that are similar to this one? • How might you use one of your previous problems to help you begin? • How else might you organize...represent... show...?
	A1.MP.6 Attend to precision	Mathematically proficient students clearly communicate to others using appropriate mathematical terminology, and craft explanations that convey their reasoning. When making mathematical arguments about a solution, strategy, or conjecture, they describe mathematical relationships and connect their words clearly to their representations. Mathematically proficient students understand meanings of symbols used in mathematics, calculate accurately and efficiently, label quantities appropriately, and record their work clearly and concisely.	• What mathematical terms apply in this situation? • How did you know your solution was reasonable? • Explain how you might show that your solution answers the problem. • What would be a more efficient strategy? • How are you showing the meaning of the quantities? • What symbols or mathematical notations are important in this problem? • What mathematical language...,definitions..., properties can you use to explain...? • How could you test your solution to see if it answers the problem?

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Most questions from all Grades Common Core State Standards Flip Book

The Mathematical Practices: Narratives and Questions

Mathematics Practices		Narratives	Related Questions
Reasoning and Explaining	**A1.MP.2 Reason abstractly and quantitatively**	Mathematically proficient students make sense of quantities and their relationships in problem situations. Students can contextualize and decontextualize problems involving quantitative relationships. They contextualize quantities, operations, and expressions by describing a corresponding situation. They decontextualize a situation by representing it symbolically. As they manipulate the symbols, they can pause as needed to access the meaning of the numbers, the units, and the operations that the symbols represent. Mathematically proficient students know and flexibly use different properties of operations, numbers, and geometric objects and when appropriate they interpret their solution in terms of the context.	• What do the numbers used in the problem represent? • What is the relationship of the quantities? • How is _____ related to _____? • What is the relationship between _____and _____? • What does_____mean to you? (e.g. symbol, quantity, diagram) • What properties might we use to find a solution? • How did you decide in this task that you needed to use...? • Could we have used another operation or property to solve this task? Why or why not?
	A1.MP.3 Construct viable arguments and critique the reasoning of others	Mathematically proficient students construct mathematical arguments (explain the reasoning underlying a strategy, solution, or conjecture) using concrete, pictorial, or symbolic referents. Arguments may also rely on definitions, assumptions, previously established results, properties, or structures. Mathematically proficient students make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. Mathematically proficient students present their arguments in the form of representations, actions on those representations, and explanations in words (oral or written). Students critique others by affirming or questioning the reasoning of others. They can listen to or read the reasoning of others, decide whether it makes sense, ask questions to clarify or improve the reasoning, and validate or build on it. Mathematically proficient students can communicate their arguments, compare them to others, and reconsider their own arguments in response to the critiques of others.	• What mathematical evidence would support your solution? • How can we be sure that...? / How could you prove that...? • Will it still work if...? • What were you considering when...? • How did you decide to try that strategy? • How did you test whether your approach worked? • How did you decide what the problem was asking you to find? • Did you try a method that did not work? Why didn't it work? Could it work? • What is the same and what is different about...? • How could you demonstrate a counter-example?

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The Mathematical Practices: Narratives and Questions

Mathematics Practices		Narratives	Related Questions
Modeling and Using Tools	**A1.MP.4 Model with mathematics**	Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. When given a problem in a contextual situation, they identify the mathematical elements of a situation and create a mathematical model that represents those mathematical elements and the relationships among them. Mathematically proficient students use their model to analyze the relationships and draw conclusions. They interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.	• What number model could you construct to represent the problem? • What are some ways to represent the quantities? • What is an equation or expression that matches the diagram, number line, chart, table, and your actions with the manipulatives? • Where did you see one of the quantities in the task in your equation or expression? What does each number in the equation mean? • How would it help to create a diagram, graph, table...? • What are some ways to visually represent...? • What formula might apply in this situation?
	A1.MP.5 Use appropriate tools strategically	Mathematically proficient students consider available tools when solving a mathematical problem. They choose tools that are relevant and useful to the problem at hand. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful; recognizing both the insight to be gained and their limitations. Students deepen their understanding of mathematical concepts when using tools to visualize, explore, compare, communicate, make and test predictions, and understand the thinking of others.	• What mathematical tools can we use to visualize and represent the situation? • Which tool is more efficient? Why do you think so? • What information do you have? • What do you know that is not stated in the problem? • What approach are you considering trying first? • What estimate did you make for the solution? • In this situation would it be helpful to use...a graph..., number line..., ruler..., diagram..., calculator..., manipulative? • Why was it helpful to use...? • What can using a _____ show us that _____may not? • In what situations might it be more informative or helpful to use...?

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The Mathematical Practices: Narratives and Questions

Mathematics Practices		Narratives	Related Questions
Seeing structure and generalizing	**A1.MP.7 Look for and make use of structure**	Mathematically proficient students use structure and patterns to assist in making connections among mathematical ideas or concepts when making sense of mathematics. Students recognize and apply general mathematical rules to complex situations. They are able to compose and decompose mathematical ideas and notations into familiar relationships. Mathematically proficient students manage their own progress, stepping back for an overview and shifting perspective when needed.	• What observations do you make about...? • What do you notice when...? • What parts of the problem might you eliminate..., simplify...? • What patterns do you find in...? • How do you know if something is a pattern? • What ideas that we have learned before were useful in solving this problem? • What are some other problems that are similar to this one? • How does this relate to...? • In what ways does this problem connect to other mathematical concepts?
	A1.MP.8 Look for and express regularity in repeated reasoning	Mathematically proficient students look for and describe regularities as they solve multiple related problems. They formulate conjectures about what they notice and communicate observations with precision. While solving problems, students maintain oversight of the process and continually evaluate the reasonableness of their results. This informs and strengthens their understanding of the structure of mathematics which leads to fluency.	• Explain how this strategy works in other situations? • Is this always true, sometimes true or never true? • How would we prove that...? • What do you notice about...? • What is happening in this situation? • What would happen if...? • Is there a mathematical rule for...? • What predictions or generalizations can this pattern support? • What mathematical consistencies do you notice?

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