Diocese of Fresno

Office of Catholic Education

In Partnership with

CREATIVE LEADERSHIP SOLUTIONS

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Present

MATHEMATICS POWER STANDARDS 2021-2022

ALGEBRA

Introduction

In June 2021, a committee comprised of teachers and administrators led by Dr. Bill Sternberg from Creative Leadership Solutions worked over a period of three days to identify math Power Standards in Kindergarten through 8th Grade (and Algebra). This work, grounded in research from Doug Reeves, Larry Ainsworth, Dylan Wiliam and others offered the opportunity to collaboratively identify those standards that would be consistently focused upon throughout the year for maximum learning impact in math. The following three criteria were used in the identification of these standards:

***Leverage**: Does this indicator apply to other subjects?*

***Endurance**: Will this indicator be taught over multiple years of instruction?*

***Essentiality**: Is this indicator an essential skill students need to know and be able to do as soon as they enter their next level of instruction?*

Over the course of three days, our committee met in grade level teams to first identify those indicators that possessed leverage. From this list, grade level teams then identified indicators that also possessed endurance, effectively reducing the number of indicators from the original list. Lastly, grade level teams were paired with their vertical counterparts (e.g., Kindergarten was paired with First Grade) to identify indicators that possessed essentiality. Thus, from a list of 30 (or more) grade level math indicators, teams were able to identify 8-12 (depending upon grade level) indicators that would become Power Standards for their specific grade level.

As explained during this process, the intent is to focus consistently on these Power Standards through multiple units of instruction. In reviewing grade level math indicators, there are some that do not require an equal amount of focus as others: In other words, there are supporting standards that may only need to be taught for a smaller time period (e.g., 4-6 weeks) in order for a student to demonstrate mastery of that specific indicator. However, Power Standards identified in this process are those that will require a much more concerted focus throughout the academic year to better prepare students in their learning journey.

Under each Power Standard identified, you'll note graphic organizers that identify the C*oncepts* (nouns or noun phrases) of each Power Standard along with S*kills* (what we want students to know and be able to do). As well, there is a section labeled "*Topics*" which allows other content area teachers to identify units of instruction where these specific Power Standards can be inserted as a means of building cross-curricular connections. The "*Topics"* section is one that should continually be added to over time as there will undoubtedly be multiple opportunities for insertion of these Power Standards in other content areas.

The last piece you'll note under each identified Power Standard is a table listing "*Big Ideas"* and "*Essential Questions"*. The *"Big Ideas*" are those critical understandings of the purpose and meaning behind learning the Power Standard that we want students to possess in *their own words*. In essence, students should know the *why* of what they are learning, not just the *what*. The *"Essential Questions"* are those questions teachers use during instruction encompassing these Power Standards as a means to build interest and understanding from their students. We would expect student replies to these *"Essential Questions"* to resemble the *"Big Ideas"* within this table.

Contents

Power Standard #1:

Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define 5^1/3 to be the cube root of 5 because we want (5^1/3)^3= 5^(1/3)3 to hold, so (51/3)^3 must equal 5.

Concepts: Need to Know	*Skills: Be Able to Do*
● Rational numbers ● Rational Exponents ● Properties Integers ● Integer Exponent ● Notation ● Radicals ● Root	● Explain meaning of rational exponents ● Explain properties of exponent integers ● Explain relationship rational exponents and properties of exponent integers. ● Explain notation for radicals ● Explain radicals in terms of rational exponents
Topics ●	

Big Ideas	**Essential Questions**
● Any form of exponents impacts the base number	● Why do we need to understand exponents?

Bloom's Taxonomy Level: Understand
Depth of Knowledge Level: Level 1

Assessment Item:

Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT	TEACHER ASSESSMENT

Point Value Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT			TEACHER ASSESSMENT
	3	2	1	
	3	2	1	
	3	2	1	

*If using point values, create explicit expectations for student performance under each point value for each specific standard expectation.

EXPECTATION	3	2	1

Power Standard #2:

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays

Concepts	*Skills*
• Units • Solutions • Multi-step Problems • Word Problems • Formulas • Scale • Ratio • Origin in graphs • Properties of a graphs • data displays	• Use units to understand problem • Use units to guide solutions • Use unites to guide multi-step problems • Chose units consistently in formula • Interpret units consistently in formula • Chose the scale • Interpret the scale • Choose the origin in graphs • Interpret the origin in graphs • Chose the data display • Interpret the data display

Topics

- Science: Solving any science discovery lab.
- ELA: Breaking down piece of the writing process
- History: Interpreting historical events.
- Art: Art Perspective using scales and ratio

Big Ideas	**Essential Questions**
• Breaking down multi-step problems into simple units to find solution • Formulas help to solve specific problems • Graphs show a picture of the results	• Why do you break down multi-step problems? • What is the relationship between formulas and the expression? • Why do we have to graph information?

Bloom's Taxonomy Level: Understand

Depth of Knowledge Level: Level 3

Assessment Item:

Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT	TEACHER ASSESSMENT

Point Value Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT			TEACHER ASSESSMENT
	3	2	1	
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	3	2	1	

*If using point values, create explicit expectations for student performance under each point value for each specific standard expectation.

EXPECTATION	3	2	1

Power Standard #3:

Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Concepts	*Skills*
• Simple equations • steps of an equation • equality • assumptions • original equation • solution • viable arguments • justify • solution method	• Explain each step in solving simple problem • Explain steps from the equality of numbers for previous step • Construct a viable argument • Construct a viable argument to justify solution method
Topics •	

Big Ideas	**Essential Questions**
• Equations are solved by using a step-by-step process • Solutions must be able proven	• Why can't I solve the equation in one step? • How do I know my answer is right?

Bloom's Taxonomy Level: Evaluate
Depth of Knowledge Level: Level 3

Assessment Item:

Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT	TEACHER ASSESSMENT

Point Value Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT			TEACHER ASSESSMENT
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EXPECTATION	3	2	1

Power Standard #4:

Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Concepts	*Skills*
• Produce • Equivalent • Equivalent form • Expression • Properties • Properties of the expression • Quantity • Quantity of the expression	• Produce an equivalent form of an expression • Reveal properties of the quantity represent of the expression • Explain properties of the quantities of the expression • Choose an equivalent form of an expression
Topics •	

Big Ideas	**Essential Questions**
• Equations can be written in different ways and still have the same value.	• What is the purpose of writing equations in different ways?

Bloom's Taxonomy Level: Apply
Depth of Knowledge Level: Level 4

Assessment Item:

Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT	TEACHER ASSESSMENT

Point Value Three-Column Rubric

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	3	2	1	

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EXPECTATION	3	2	1

Power Standard #5:

Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials

Concepts	*Skills*
• Polynomials • System • Analogous • Integers • Closed • Operations of Addition, Subtraction, and Multiplication	• Understand a polynomial • Understand polynomial form a system of analogous (simpler monomials) • Understand that they are closed operations of addition • Understand that they are closed operations of subtraction • Understand that they are closed operations of multiplication
Topics •	

Big Ideas	**Essential Questions**
• Polynomial form a simpler system based on adding, subtracting, and multiplying	• How do you solve a polynomial?

Bloom's Taxonomy Level: Understand
Depth of Knowledge Level: Level 1

Assessment Item:

Three-Column Rubric

EXPECTATION	STUDENT SELF-ASSESSMENT	TEACHER ASSESSMENT

Point Value Three-Column Rubric

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EXPECTATION	3	2	1

Power Standard #6:

Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Concepts	*Skills*
• X-Coordinates • Points • Graph • Equation • Intersect • Solutions • Linear • Polynomials • Rational • Absolute Value • Exponential • Logarithmic Functions	• Explain x-coordinates of points • Explain where the graphs intersect • Explain that they are solutions to an equation • Find solutions for linear • Find solutions for polynomial • Find solutions for rational • Find solutions for absolute value • Find solutions for exponential • Find solutions for logarithmic functions • Find estimated solutions for linear • Find estimated solutions for polynomial • Find estimated solutions for rational • Find estimated solutions for absolute value • Find estimated solutions for exponential • Find estimated solutions for logarithmic functions

Topics

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Big Ideas	**Essential Questions**

● In an equation Y=a variable that variable equals itself. ● Graphing tables will show a picture of the result ● Technology is a tool that can support finding	● Why do we graph? ● Why do we use technology? ● How can y= two different functions?

Bloom's Taxonomy Level: Apply
Depth of Knowledge Level: Level 2

Assessment Item:

Three-Column Rubric

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EXPECTATION	3	2	1

Power Standard #7:

Distinguish between situations that can be modeled with linear functions and with exponential functions

Concepts	*Skills*
● Situation ● Linear Functions ● Exponential Functions	● Distinguish between situation ● Distinguish ways of modeling with linear functions ● Distinguish ways modeling with exponential function
Topics ●	

Big Ideas	**Essential Questions**
● Linear function increase at a slower rate than an exponential function ● Modeling linear and exponential function make a clearer picture of results	● What is the difference between linear function and exponential functions? ● What's the purpose of modeling a function?

Bloom's Taxonomy Level: Analyze
Depth of Knowledge Level: Level 2

Assessment Item:

Three-Column Rubric

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EXPECTATION	3	2	1

Power Standard #8:

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). Recognize possible associations and trends in the data.

• Categorical • Categorical Data • Frequency • Frequency table • two-frequency • Relative Frequency • Context of data • Joint frequencies • Marginal frequencies • conditional Relative frequencies • association data • data trends	• Summarize Categorical data • Summarize two-way frequency table • Interpret relative frequencies • Interpret joint frequencies • Interpret marginal frequencies • Interpret conditional relative frequencies • Recognize association data • recognize trends in data
Topics	

Big Ideas	**Essential Questions**
• Tables and graphs show a clear picture of the relationships of data	• What is the importance of data? • Why do we use the data to show trends?

Bloom's Taxonomy Level:Understand
Depth of Knowledge Level: Level 2

Assessment Item:

Three-Column Rubric

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EXPECTATION	3	2	1

Power Standard #9:

Represent data with plots on the real number line (dot plots, histograms, and box plots).

Concepts	*Skills*
• Data • Plots • Real Numbers • Dot Plots • Histograms • Box Plots	• Represent data with dot plots • represent data with histograms • represent data with box plots
Topics •	

Big Ideas	**Essential Questions**
• Information from tables and graphs can represent data in different form	• Does it matter which type of graph to use?

Bloom's Taxonomy Level: Analyze
Depth of Knowledge Level: Level 3

Assessment Item:

Three-Column Rubric

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Point Value Three-Column Rubric

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EXPECTATION	3	2	1

Power Standard #10:

Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Concepts	*Skills*
• System • Simple System • Linear equation • Quadratic equation • variables • two variables	• Solve simple system • Solve simple system using linear equation • Solve simple system using linear equation with two variables algebraically • Solve simple system using linear equations with two variables graphically • Solve simple system using quadratic equation • Solve simple system using quadratic equation with two variables algebraically • Solve simple system using quadratic equation with two variables graphically
Topics •	

Big Ideas	**Essential Questions**
• Linear equations have few steps than quadratic equations • Linear equation always graphs as a line • Quadratic equation always graphs as a parabola	• What's the difference between linear and quadratic equations? • What's difference in solving a linear versus a quadratic equation? • Why do linear and quadratic equations look different on a graph?

Bloom's Taxonomy Level: Apply
Depth of Knowledge Level: Level 1

Assessment Item:

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EXPECTATION	3	2	1