MATHEMATICS COMMON CORE CURRICULUM UNIT # 5 Algebra 2
North Smithfield School Department

TITLE OF UNIT: Unit 5 Modeling with Functions________________ **COURSE:** Algebra 2

DATE PRESENTED: _____________ **DATE DUE:** _________________ **LENGTH OF TIME:** Several weeks, quarter, semester

OVERVIEW OF UNIT:

Unit 5 standards will focus on using functions to model relationships. Students will create equations that describe numbers or relationships, interpret functions that arise in applications in terms of the context, build functions that model relationships between two quantities, build new functions from existing functions, and construct and compare linear, quadratic, and exponential models and solve problems.

ESSENTIAL QUESTION, PROMPT, PROBLEM/UNIT

STANDARDS: Common Core Math Standards – Grade level Categories 9-12

Number and Quantity	Algebra	Functions	Modeling	Geometry	Statistics and Probability
☐ The Real Number System N-RN	☐ Seeing Structure in Expressions A-SSE	☐ Interpreting Function F-If	☐	☐ Congruence G-CO	☐ Interpreting Categorical and Quantitative Data S-ID
☐ Quantities N-Q	☐ Arithmetic with Polynomials and Rational Expressions A-APR	☐ Building Functions F-BF	☐	☐ Similarity, Right Triangles, and Trigonometry G-SRT	☐ Making Inferences and Justifying Conclusions S-IC
☐ The Complex Number System N-CN	☐ Creating Equations A-CED	☐ Linear, Quadratic, and Exponential Models F-LE		☐ Circles G-c	
☐ Vector and Matrix Quantities N-VM	☐ Reasoning with Equations and Inequalities A-REI	☐ Trigonometric Functions F-TF		☐ Expressing Geometric Properties with Equations G-GPE	
☐	☐	☐		☐ Geometric Measurement and Dimensions G-GMD	
☐	☐	☐		☐ Modeling with Geometry G-MG	

STANDARDS: Mathematical Practices grades K-12

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

FOCUS MATHEMATICS STANDARDS:

- Create equations that describe numbers or relationships. A.CED.1,2,3,4
- Interpret functions that arise in applications in terms of a context. F.IF.4,5,6
- Analyze functions using different representations. F.IF.7, 7c, 7e, 8, 9
-
- Build a function that models a relationship between two quantities. F.BF.1b
- Build new functions from existing functions. F.BF.3,4a
- Construct and compare linear, quadratic, and exponential models and solve problems. F.LE.4bolically or as a table) over a specified interval. F.IF.6

Applied Learning Standards:

problem solving communication critical thinking research reflection/ evaluation

Expectations for Student Learning (High School only):

Problem Solving, Communication, Body of Knowledge, Responsibility

ENDURING UNDERSTANDING:

At the end of this unit, students will be proficient in the following:

- Translate real-world situations into equations or inequalities.
- Analyze and compare graphs of equations and inequalities.
- Determine whether a point is a viable solution to a system of equations or inequalities, graphically and algebraically.
- Solve a formula for a particular variable.
- Relate the shape of a graph to the relationship it represents.
- Determine the appropriate domain for a function describing a real-world situation.
- Understand the relationship between the parts of a graph and the situation it represents.
- Determine which type of model best models a given situation.
- Rewrite functions in different forms to identify key features.
- Represent and solve equations and inequalities graphically.
- Use data to model a given situation.
- Understand and describe the transformation(s) done to a parent function to create a new function.
- Determine whether a function has an inverse, find the inverse if it exists, and determine whether the inverse is also a function.

*Referenced templates from *Common Core Curriculum Maps, English Language Arts* and *The Understanding By Design Guide to Creating High Quality Units*

PRIOR KNOWLEDGE:

Algebra 1

STUDENT OBJECTIVES, SKILLS and/or NEW KNOWLEDGE:

- Equations and inequalities can be created to represent and solve real-world and mathematical problems.
- Relationships between two quantities can be represented through the creation of equations in two variables and graphed on coordinate axes with labels and scales.
- Solutions are viable or not in different situations depending upon the constraints of the given context.
- Formulas can be rearranged and solved for a given variable using the same reasoning as in solving an equation.
- Key features of a graph or table may include intercepts; intervals in which the function is increasing, decreasing or constant; intervals in which the function is positive, negative or zero; symmetry; maxima; minima; and end behavior.
- Given a verbal description of a relationship that can be modeled by a function, a table or graph can be constructed and used to interpret key features of that function.
- Graphs can be described in terms of their relative maxima and minima; symmetries; end behavior; and periodicity.
- The intervals over which a function is increasing, decreasing or constant, positive, negative or zero are subsets of the function's domain.
- Determine the appropriate domain for a function describing a real-world situation.
- The average rate of change of a function *y = f(x)* over an interval [a, b] is

$$\frac{\Delta y}{\Delta x}=\frac{f(b)-f(a)}{b-a}$$

- Key features of a graph or table may include intercepts; intervals in which the function is increasing, decreasing or constant; intervals in which the function is positive, negative or zero; symmetry; maxima; minima; end behavior; asymptotes; domain; range and periodicity.
- The graph of a trigonometric function shows period, amplitude, midline and asymptotes.
- The graph of a polynomial function shows zeros and end behavior.
- For a function of the form $f(t) = ab^t$, if b > 1 the function represents exponential growth; if b < 1 the function represents exponential decay.
- A function can be represented algebraically, graphically, numerically in tables, or by verbal descriptions.
- A function is a relationship between two quantities.
- The function representing a given situation may be a combination of more than one standard function.
- Standard functions may be combined through arithmetic operations.
- *f(x) + k* will translate the graph of the function f(x) up or down by k units.
- *k•f(x)* will expand or contract the graph of the *function f(x)* vertically by a factor of k. If *k* < 0 the graph will reflect across the x-axis.
- *f(kx)* will expand or contract the graph of the function f(x) horizontally by a factor of *k*. If *k* < 0 the graph will reflect across the y-axis.
- *f(x + k*) will translate the graph of the function f(x) left or right by k units.
- If *f(–x) = f(x)* then the function is even, therefore its graph is symmetrical across the y-axis.
- If *f(–x) = –f(x)* then the function is odd, therefore its graph is symmetrical across the origin.
- Two functions f and g are inverses of one another if for all values of x in the domain of f, *f(x)=y* and *g(y)=x.*
- Not all functions have an inverse.
- The solution to an exponential function can be found using logarithms.

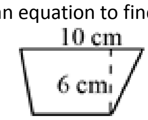
SUGGESTED PROBLEMS:

Teaching Examples A.CED.1

- For A-CED.1, use all available types of functions to create such equations, including root functions, but constrain to simple cases.
- Equations can represent real-world and mathematical problems. Include equations and inequalities that arise when comparing the values of two different functions, such as one describing linear growth and one describing exponential growth.

Examples:

- Given that the following trapezoid has area 54 cm2, set up an equation to find the length of the unknown base, and solve the equation.



- Lava coming from the eruption of a volcano follows a parabolic path. The height h in feet of a piece of lava t seconds after it is ejected from the volcano is given by $h(t) = -16t^2 + 64t + 936$. After how many seconds does the lava reach its maximum height of 1000 feet? (TUSD)

Teaching Examples A.CED.2

- While functions used in A-CED.2, 3, and 4 will often be linear, exponential, or quadratic, the types of problems should draw from more complex situations than those addressed in Algebra 1. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line.

Examples:

- Find a formula for the volume of a single-scoop ice cream cone in terms of the radius and height of the cone. Rewrite your formula to express the height in terms of the radius and volume. Graph the height as a function of radius when the volume is held constant.
- Find the distance from the point (-2, 5) to the line y = 3x + 1. (TUSD)

Teaching Examples A.CED.3

Example:

- A club is selling hats and jackets as a fundraiser. Their budget is $1500 and they want to order at least 250 items. They must buy at least as many hats as they buy jackets. Each hat costs $5 and each jacket costs $8.
  - Write a system of inequalities to represent the situation.
  - Graph the inequalities.
  - If the club buys 150 hats and 100 jackets, will the conditions be satisfied?
  - What is the maximum number of jackets they can buy and still meet the conditions? (TUSD)

Teaching Examples A.CED.4

Examples:

- The Pythagorean theorem expresses the relation between the legs a and b of a right triangle and its hypotenuse c with the equation $a^2 + b^2 = c^2$.
- Why might the theorem need to be solved for c?
- Solve the equation for c and write a problem situation where this form of the equation might be useful.
- Solve $V = \frac{4}{3}\pi r^3$ for radius r.
- Motion can be described by the formula below, where t = time elapsed, u = initial velocity, a = acceleration, and s = distance traveled:
- $s = ut + \frac{1}{2}at^2$
- Why might the equation need to be rewritten in terms of a?
- Rewrite the equation in terms of *a*. (TUSD)

Teaching Examples F-IF.4

- Students may be given graphs to interpret or produce graphs given an expression or table for the function, by hand or using technology.

Examples:

- A rocket is launched from 180 feet above the ground at time t = 0. The function that models this situation is given by $h = -16t^2 + 96t + 180$, where t is measured in seconds and *h* is height above the ground measured in feet.
  1. What is a reasonable domain restriction for t in this context?
  2. Determine the height of the rocket two seconds after it was launched.
  3. Determine the maximum height obtained by the rocket.
  4. Determine the time when the rocket is 100 feet above the ground.
  5. Determine the time at which the rocket hits the ground.
  6. How would you refine your answer to the first question based on your response to the second and fifth questions?
  7. Compare the graphs of $y = 3x^2$ and $y = 3x^3$.
  8. Let $R(x) = \frac{2}{\sqrt{x-2}}$. Find the domain of *R(x).* Also find the range, zeros, and asymptotes of *R(x).*
  9. Let $f(x) = 5x^3 - x^2 - 5x + 1$. Graph the function and identify end behavior and any intervals of constancy, increase, and decrease.
  10. It started raining lightly at 5 a.m., then the rainfall became heavier at 7a.m. By 10 a.m. the storm was over, with a total rainfall of 3 inches. It didn't rain for the rest of the day. Sketch a possible graph for the number of inches of rain as a function of time, from midnight to midday. (TUSD)

Teaching Examples F.IF.5

- Students may explain orally, or in written format, the existing relationships.

Examples:

- If the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

- A hotel has 10 stories above ground and 2 levels in its parking garage below ground. What is an appropriate domain for a function *T(n)* that gives the average number of times an elevator in the hotel stops at the n[th] floor each day?

Teaching Examples F.IF.6

- The average rate of change of a function *y = f(x)* over an interval [*a, b]* is

$$\frac{\Delta y}{\Delta x} = \frac{f(b) - f(a)}{b - a}$$

In addition to finding average rates of change from functions given symbolically, graphically, or in a table, students may collect data from experiments or simulations (such as a falling ball, velocity of a car, etc.) and find average rates of change for the function modeling the situation.

Examples:

- Use the following table to find the average rate of change of g over the intervals [–2, –1] and [0, 2]:

x	*g(x)*
-2	2
-1	-1
0	-4
2	-10

- The table below shows the elapsed time when two different cars pass a 10, 20, 30, 40 and 50 meter mark on a test track.
  - For car 1, what is the average velocity (change in distance divided by change in time) between the 0 and 10 meter mark? Between the 0 and 50 meter mark? Between the 20 and 30 meter mark? Analyze the data to describe the motion of car 1.
  - How does the velocity of car 1 compare to that of car 2?

	Car 1	*Car 2*
d	t_1	t_2
10	4.472	1.742
20	6.325	2.899
30	7.746	3.831
40	8.944	4.633
50	10	5.348

(TUSD)

Teaching Examples F.IF.7,7c,7e

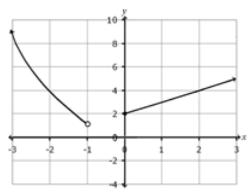
- In Algebra I, students looked at F-IF.7c as the relationship between zeros of quadratic functions and their factored forms.
- F-IF.7e links to F-TF.2 and 5 regarding the extension of trig functions.
- Logarithmic functions do not need to be addressed in Algebra II in terms of graphing.
- Key characteristics include but are not limited to maxima, minima, intercepts, symmetry, end behavior, and asymptotes. Students may use graphing calculators, graphing programs, spreadsheets, or computer algebra systems to graph functions.

Examples:

- Describe key characteristics of the graph of f(x) = |x – 3| + 5.
- Sketch the graph and identify the key characteristics of the function described below.

$$F(x) = \begin{cases} x + 2 & \text{for} \quad x \geq 0 \\ -x^2 & \text{for} \quad x < -1 \end{cases}$$

Solution:



- Graph the function *f(x) = 2x* by creating a table of values. Identify the key characteristics of the graph.
- Graph *f(x) = 2 tan x – 1*. Describe its domain, range, intercepts, and asymptotes.

Draw the graph of *f(x) = sin x* and *f(x) = cos x.* What are the similarities and differences between the two graphs? (TUSD)

Teaching Examples F.IF.8

- In Algebra I, students focused on this standard with linear, exponential and quadratic functions.

Example:

- Write the following function in a different form and explain what each form tells you about the function:

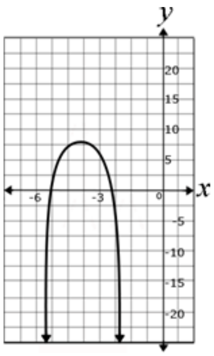
$f(x) = x^3 - 6x^2 + 3x + 10$ (TUSD)

Teaching F.IF.9

Example:

- Examine the functions below. Which function has the larger maximum? How do you know?

$$f(x) = -2x^2 - 8x + 20$$



(TUSD)

Teaching Examples F.BF.1

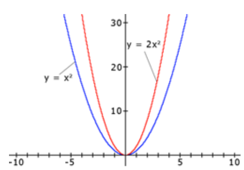
Examples:

- You buy a \$10,000 car with an annual interest rate of 6 percent compounded annually and make monthly payments of \$250. Express the amount remaining to be paid off as a function of the number of months, using a recursion equation.
- A cup of coffee is initially at a temperature of 93º F. The difference between its temperature and the room temperature of 68º F decreases by 9% each minute. Write a function describing the temperature of the coffee as a function of time.
- You are making an open box out of a rectangular piece of cardboard with dimensions 40 cm by 30 cm by cutting equal squares out of the four corners and then folding up the sides. How big should the squares be to maximize the volume of the box? Draw a diagram to represent the problem and write an appropriate equation to solve.
- Build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. (TUSD)

Teaching Examples F.BF.3

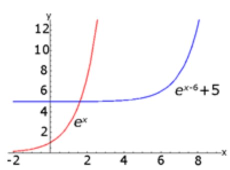
Examples:

- Explore the functions $f(x) = 3x$, $g(x) = 5x$, and $h(x) = \frac{1}{2}x$ with a calculator to develop a relationship between the coefficient on x and the slope of a line.
- Compare the graphs of $f(x) = 3x$ with those of $g(x) = 3x + 2$ and $h(x) = 3x – 1$ to see that parallel lines have the same slope AND to explore the effect of the transformations of the function $f(x) = 3x$, such that $g(x) = f(x)+2$ and $h(x) = f(x) – 1$.
- Is $f(x) = x^3 - 3x^2 + 2x + 1$ even, odd, or neither? Explain your answer orally or in written format.
- Compare the shape and position of the graphs of $f(x) = x^2$ and $g(x) = 2x^2$, and explain the differences in terms of the algebraic expressions for the functions.

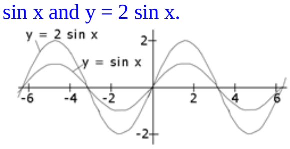
- 

- Describe the effect of varying the parameters a, h, and k on the shape and position of the graph of $f(x) = a(x-h)^2 + k$.

- Compare the shape and position of the graphs of $f(x) = e^x$ and $g(x) = e^{x-6} + 5$, and explain the differences, orally or in written format, in terms of the algebraic expressions for the functions.



- Describe the effect of varying the parameters a, h, and k on the shape and position of the graph $f(x) = ab^{(x-h)} + k$, orally or in written format. What effect do values between 0 and 1 have? What effect do negative values have?
- Compare the shape and position of the graphs of y = sin x and y = 2 sin x.



(TUSD)

<u>Teaching Examples</u> F.BF.4

Examples:

- For the function $h(x) = (x – 2)^3$, defined on the domain of all real numbers, find the inverse function if it exists or explain why it doesn't exist. Graph *h(x)* and $h^{-1}(x)$ and explain how they relate to each other graphically.
- Find a domain for $f(x) = 3x^2 +12x-8$ on which it has an inverse. Explain why it is necessary to restrict the domain of the function.
- Find the inverse of the function $f(x) = \frac{3x+2}{2x-1}$, if it exists, or explain why the inverse doesn't exist. Describe the domain and range of *f(x)* and its inverse (if it exists). (TUSD)

<u>Teaching Examples</u> F.LE.4

- Solve $200 e^{0.04t} = 450$ for *t*.

Solution:

- We first isolate the exponential part by dividing both sides of the equation by 200.
  - $e^{0.04t} = 2.25$
- Now we take the natural logarithm of both sides.
  - $\ln (e^{0.04t})= \ln 2.25$
- The left hand side simplifies to 0.04*t*.
  - $0.04t = \ln 2.25$
- Lastly, divide both sides by 0.04.
  - $t = \ln (2.25) / 0.04$
  - $t \approx 20.3$ (TUSD)

<u>Assessment Problems</u>

A-CED.A.1 Basic

- http://www.illustrativemathematics.org/illustrations/702 (Basketball)
- http://www.algebralab.org/lessons/lesson.aspx?file=Algebra_OneVariableWritingEquations.xml (linear)
- http://www.illustrativemathematics.org/illustrations/582 (linear)
- http://www.illustrativemathematics.org/illustrations/580 ((quadratic)
- http://www.illustrativemathematics.org/illustrations/437
- http://www.illustrativemathematics.org/illustrations/702

A-CED.A.1 Advanced

- http://www.illustrativemathematics.org/illustrations/83 (linear)

A-CED.A.2 Basic

- http://www.illustrativemathematics.org/illustrations/1010 (linear)

A-CED.A.3 Basic

- http://www.illustrativemathematics.org/illustrations/1010 (linear)
- http://www.illustrativemathematics.org/illustrations/220F.IF.4 Basic
- http://www.illustrativemathematics.org/illustrations/387 (rational)
- http://www.illustrativemathematics.org/illustrations/649 (interpreting graphs)
- http://www.illustrativemathematics.org/illustrations/637 (interpreting graphs)
- http://www.illustrativemathematics.org/illustrations/1279 (quadratic)
- http://www.illustrativemathematics.org/illustrations/650 (interpreting graphs)
- http://www.illustrativemathematics.org/illustrations/639 (interpreting graphs)
- http://www.illustrativemathematics.org/illustrations/595 (trig function)

F.IF.4 Advanced

- http://www.ccsstoolbox.com/parcc/PARCCPrototype_main.html
- http://www.illustrativemathematics.org/illustrations/386 (rational)

- http://www.illustrativemathematics.org/illustrations/394 (alternate version of previous problem)
- http://www.illustrativemathematics.org/illustrations/804 (logistic growth)
- http://www.illustrativemathematics.org/illustrations/800 (logistic growth)

F.IF.5 Basic
- http://www.illustrativemathematics.org/illustrations/387 (rational)
- http://www.illustrativemathematics.org/illustrations/631 (linear)

F.IF.5 Advanced
- http://www.illustrativemathematics.org/illustrations/386 (tabular; rational function)
- http://www.illustrativemathematics.org/illustrations/595 (trig function)

F.IF.6 Basic
- http://www.illustrativemathematics.org/illustrations/577

F.IF.7 Basic
- http://www.illustrativemathematics.org/illustrations/388 A-SSE.B.3, F-IF.C.7 (Graphs of Quadratic Functions)
- http://www.illustrativemathematics.org/illustrations/803 (Identifying graphs of functions)
- http://www.illustrativemathematics.org/illustrations/627 **F-IF.C.7.c** (Graphs of power functions)
- http://www.illustrativemathematics.org/illustrations/803 (7e) (exponential/logistic growth)

F.IF.7 Advanced
- http://www.illustrativemathematics.org/illustrations/388 (7c) (quadratic)

F.IF.8 Basic
- http://www.illustrativemathematics.org/illustrations/640 F-IF.C.8.a (Which Function?)
- http://www.illustrativemathematics.org/illustrations/375 F-IF.C.8.a, A-REI.B.4.b (Springboard Dive)
- http://www.illustrativemathematics.org/illustrations/640 (8a) (quadratic)
- http://www.illustrativemathematics.org/illustrations/375 (also A-REI.4b)

F.IF.9 Basic
- http://www.illustrativemathematics.org/illustrations/1279 F-IF.B.4, F-IF.C.9 (Throwing Baseballs)
- http://www.parcconline.org/samples/mathematics/high-school-functions
- http://www.illustrativemathematics.org/illustrations/1279 (quadratic)

F.BF.1 Basic
- http://www.illustrativemathematics.org/illustrations/230
- http://www.illustrativemathematics.org/illustrations/241 (linear)
- http://www.illustrativemathematics.org/illustrations/533 (exponential)
- http://www.illustrativemathematics.org/illustrations/386 (rational)

F.BF.1 Advanced
- http://www.illustrativemathematics.org/illustrations/75 (quadratic)
- http://www.illustrativemathematics.org/illustrations/72 (rational)
- http://www.ccsstoolbox.com/parcc/PARCCPrototype_main.html

F.BF.3 Basic
- http://www.illustrativemathematics.org/illustrations/232
- http://www.illustrativemathematics.org/illustrations/741
- http://www.illustrativemathematics.org/illustrations/742
- http://www.ccsstoolbox.com/parcc/PARCCPrototype_main.html

F.BF.3 Advanced
- http://www.illustrativemathematics.org/illustrations/695 (quadratic)
- http://www.illustrativemathematics.org/illustrations/505 (quadratic)

F.BF.4 Basic
- http://www.illustrativemathematics.org/illustrations/501 (linear)

F.LE.4 Basic
- http://www.illustrativemathematics.org/illustrations/370
- http://www.illustrativemathematics.org/illustrations/570
- http://www.illustrativemathematics.org/illustrations/369
- http://www.illustrativemathematics.org/illustrations/760
- http://www.illustrativemathematics.org/illustrations/214
- http://www.illustrativemathematics.org/illustrations/382

F.LE.4 Advanced
- http://www.illustrativemathematics.org/illustrations/638
- http://www.illustrativemathematics.org/illustrations/784

ACTIVITIES, PRODUCTS, PERFORMANCE, and ASSESSMENTS: see curriculum introduction

1. Application to real world problems
2. Creating charts/collecting data
3. Collaboration - interpersonal
4. Conferencing
5. Exhibits
6. Graphic organizers
7. Graphing
8. Interviews
9. Journals
10. KWL charts
11. Mathematical Practices
12. Modeling ★
13. Oral presentations
14. Problem/Performance based/common tasks
15. Real-life applications involving graphing
16. Represent numbers
17. Rubrics/checklists (mathematical practice, modeling)
18. Technology
19. Summarizing and note-taking
20. Tests and quizzes
21. Writing genres Arguments/ opinion Informative

- Warm ups
- Unit assessments
- Semester/End of course exams

HIGHER ORDER THINKING SKILLS: Web's Depth of Knowledge 2 – 4 or Bloom's Taxonomy

Web's Depth of Knowledge

- skill/conceptual understanding
- strategic reasoning
- extended reasoning

Bloom's Taxonomy

- apply
- analyze
- synthesize/create
- evaluate

ADDITIONAL RESOURCES: see curriculum for specifics

Textbook
- *Algebra 2, McDougal Littell 2004*
- *Explorations, Holt McDougal*

Technology
- Computer lab
- Computer software that generate graphs of functions
- Computers
- Document camera
- Graphing calculator
- Graphing software
- Interactive boards
- LCD projectors
- Overhead graphing scientific

Websites
- http://curriculum.northsmithfieldschools.com
- http://www.achieve.org/http://my.hrw.com
- http://www.illustrativemathematics.org/standards/practice
- http://www.ixl.com/standards/common-core/math/grade-8
- http://www.ixl.com/standards/common-core/math/high-school
- http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEDefaultPage.aspx?page=1
- http://www.ode.state.or.us/search/page/?id=3747
- http://www.parcconline.org/sites/parcc/files/PARCC%20Math%20S
- http://www.schools.utah.gov/CURR/mathsec/Core.aspx
- http://www.tusd1.org/contents/distinfo/curriculum/index.asp
- www.commoncore.org/maps
- www.corestandards.org
- www.khanacademy.com
- www.ride.ri.gov

*Referenced templates from *Common Core Curriculum Maps, English Language Arts* and *The Understanding By Design Guide to Creating High Quality Units*

Materials
- Tables, graphs and equations of real-world applications that apply quadratic and exponential functions

VOCABULARY

Academic vocabulary

- Axes
- Constraints
- Dependent
- Equations
- Exponential
- Independent
- Inequalities
- Labels
- Linear
- Origin
- Quadratic
- Scales
- Viable solutions

Academic vocabulary

- Amplitude
- Asymptote
- Delta
- Dependent variable
- Domain
- Domain restriction
- End behavior
- Exponential decay
- Exponential growth
- Independent variable
- Interval
- Maxima
- Minima
- Period
- Periodic function
- Range
- Rate of change
- Subset
- Symmetry
- Zeros

Academic vocabulary

- Contract
- Expand
- Inverse function
- Inverse operation
- Odd/even function
- Parameters
- Reflection
- Shrink
- Standard function
- Stretch
- Symmetrical
- Transformation
- Translation/Shift

Academic vocabulary

- Base
- Common logarithm
- Exponential function
- Logarithm
- Natural Logarithm

LESSON PLAN for UNIT ________________

LESSONS

- **Lesson # 1 Summary:**

- **Lesson #2 Summary:**

- **Lesson #3 Summary:**

OBJECTIVES for LESSON # ________________

- **Materials/Resources:**

- **Procedures:**
  - **Lead –in**

  - **Step by step**

  - **Closure**

- **Instructional strategies:** see curriculum introduction

- **Assessments:** see curriculum introduction
  - **Formative**

  - **Summative**

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