

Lesson Plan 1

Standards (Common Core) *Interpreting Functions F-IF*

Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Instructional Goals –

Students will need to know:

- what a function is *
- the types different functions*

Students will be able to:

- graph a function on graph paper *
- communicate to others what a function is and why*

Essential Questions – discussion questions

- * What are functions used for?
- Is a function an equation?
- What are the two most important components of a function?

Instructional Strategies and Activities - Frayer model [see appendix]

Instructional Materials – Computer, pencil, paper, graph paper, ruler, and graphing calculator

New Literacies – Game

Go to the website below, chose beginner mode of the function machine and play until you have correctly guessed three functions using the “chose your input” mode. Then chose the advanced mode and play the game until you have guessed one function correctly.

< <http://www.mathplayground.com/functionmachine.html> >

This new literacy will support student learning by focusing on self-regulation and the technology will extend and enhance the lesson by reinforcing the ideas about how to make a function.

Assessment – Authentic Assessment

Find functions in real life. Go to the local post office or go to the United States Post Service website <<http://usps.com>> and create and graph a step function for the cost of shipping an item. Find a profession that works by the hour. State what the cost just to hire them is and then what each additional hour would be. Create and graph a linear function showing their rate. Find a real world example of an exponential function. Graph the function and interpret.

Students will engage in self-assessment by finding real life examples of functions and examining whether or not their graphs correctly represent the information they found.

Lesson Plan 2

Standards (Common Core) *Interpreting Functions F-IF*

Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Instructional Goals –

Students will need to know:

- how to interpret a function*
- real life applications for functions*

Students will be able to:

- graph a function using a graphing calculator
- distinguish which points of a function are more important than others

Essential Questions – discussion questions

- What is the vertical line test?
- What is the effect of an asymptote on the graph of a function?

Instructional Strategies and Activities - *Graphic organizer <see appendix>*

Instructional Materials – Computer, pencil, paper, graph paper, ruler, and graphing calculator

New Literacies – Webquest

To begin your Webquest, search the term “math modeling” or “mathematical modeling” on <<http://www.wikipedia.com>> to give you a general idea of what the topic is. Next, browse two sites, other than Wikipedia, explaining the topic. Be sure to fact check any information you viewed on Wikipedia. Then in no less than four sentences, explain what math modeling is and how it pertains to functions we have been learning in class. Be sure to list the sites you used as references.

Next, go to <<http://www.mathworld.worlfram.com>> and search the Malthusian growth equation. In no less than four sentences, state what type of function this is, what it is used for, what the parameter “ r ” in the equation is, and how the parameter is found.

Finally, go to <<http://www.census.gov>> and find out the world’s population for the last 30 years, starting at 1980. Using the statistics provided from the census bureau, create a Malthusian growth parameter “ r ” and use both the parameter and the current world population in the Malthusian growth equation to predict what the world population will be in: one year, five years, and ten years. After making these calculations, explain why these calculations will be correct or incorrect.

This new literacy will support student learning because the information they are searching for in the webquest not only pertains to this lessons but other knowledge they needed or need from future lessons corresponding to the Common Core Standards. The technology will extend and enhance the lesson because the information that they are researching is not information that exists in the student’s textbooks and it allows them to explore a topic further at their own pace.

Assessment – Exit slip

Write in full sentences and state in your own words: what a function is, what are the noteworthy aspects of a function, and how would you use a function in real life

Students will engage in self-assessment by reflecting on everything they learned in the unit and then verifying that all of their information about the unit is correct before moving on.

Lesson Plan 3

Standards (Common Core) *Interpreting Functions F-IF*

Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Instructional Goals –

Students will need to know:

- critical points of a function
- which functions are related to another

Students will be able to:

- identify asymptotes
- distinguish which points of a function are more important than others

Essential Questions – Discussion questions

- How is the graph of a trigonometric function different from other functions?
- What allows something in real life to be described by a function?

Instructional Strategies and Activities – Jigsaw

After students have briefly studied all of the basic functions, each student (in a class of eighteen) will study two or three functions in depth, based on their ability level, and will be assigned to them. Students will then meet in groups of five and share their specialized knowledge about the three functions in their group.

Instructional Materials – Computer, pencil, paper, graph paper, ruler, and graphing calculator

New Literacies – Internet Research

Since you have studied functions in the Cartesian plane, briefly explore what functions are like in 3-space.

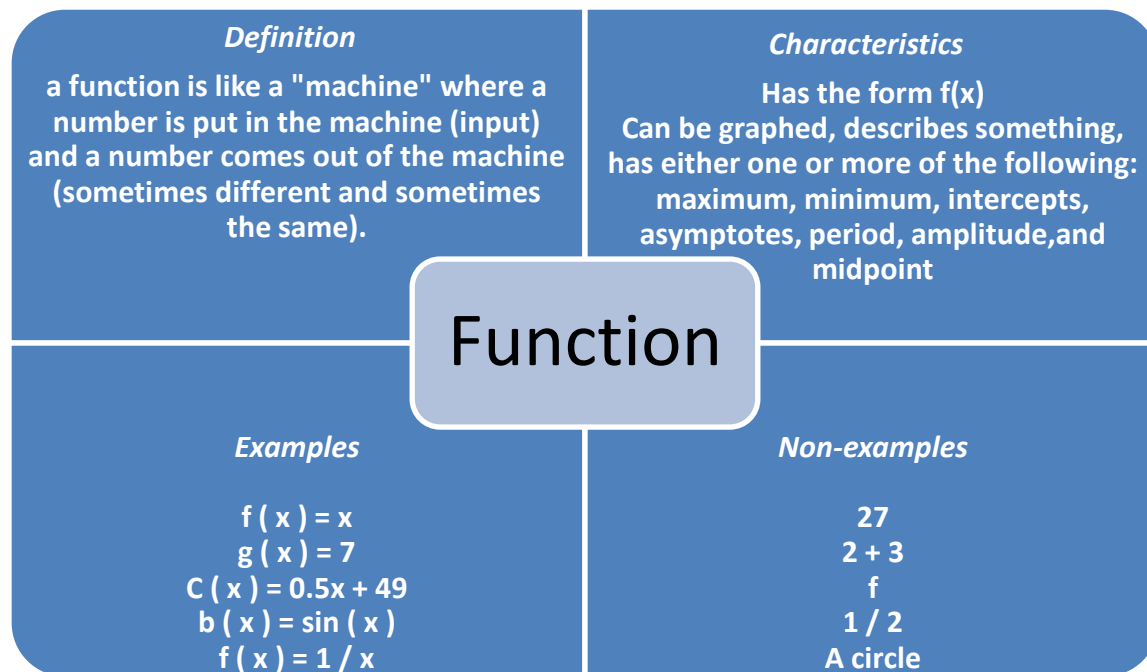
Using the Internet, explore the topic of vectors. Compare and contrast vectors and functions in three space to functions in the Cartesian plane.

This new literacy will support student learning by exploring the topic more in depth and raising awareness of other possibilities and the computer technology will extend and enhance the lesson by providing an enormous opportunity to obtain information in a short period of time.

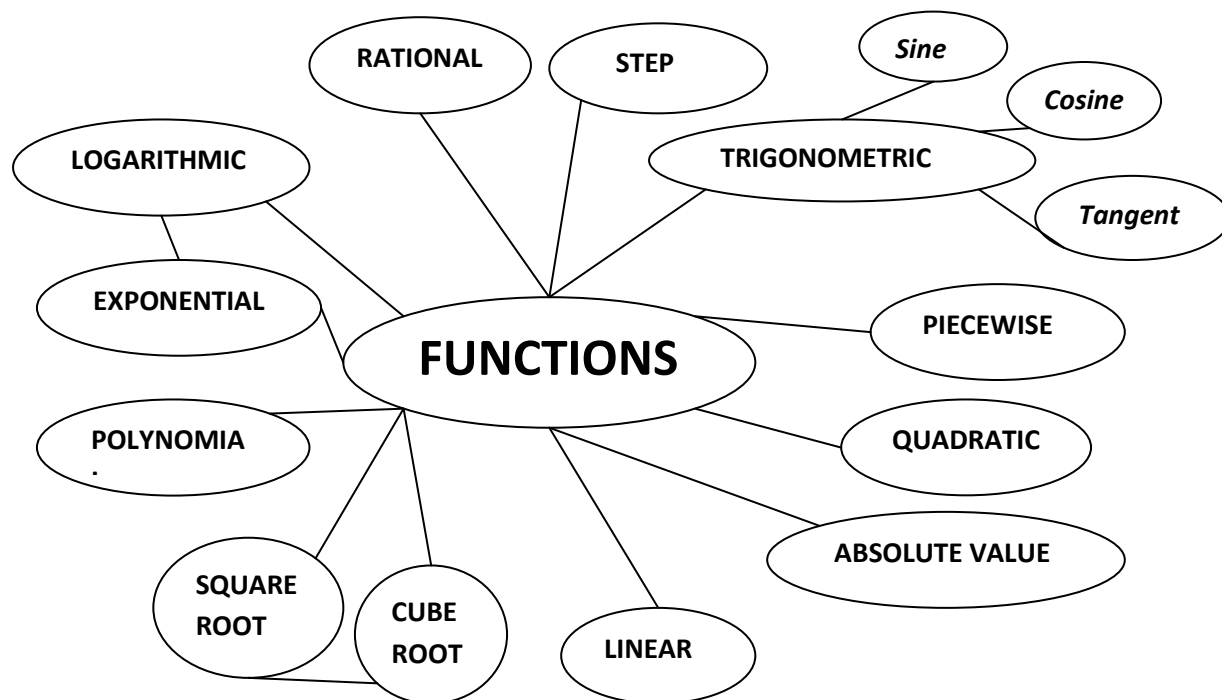
Assessment – Quiz <see appendix>

Students will engage in self-assessment by graphing a function by hand and then checking their work on the graphing calculator.

Frayer model



Graphic Organizer (WEB)



Name _____

Total quiz is worth 20 points.

Directions: Match a word from the left-hand column with a definition on the right-hand column. Words from the left hand column are not repeated. Each term matched correctly is worth one point.

1. Matching

- | | |
|--|------------------|
| a. The highest point reached in a function | _____ Maximum |
| b. A point of symmetry in a function | _____ Minimum |
| c. The point where a function begins to repeat | _____ Intercepts |
| d. Points where a function crosses an axis | _____ Period |
| e. The lowest point reached in a function | _____ Amplitude |
| f. A measure of height in a function | _____ Asymptotes |
| g. An invisible line in a function that is never crossed | _____ Midline |

On a separate sheet of graph paper provided, identify and graph each function. Each correct identification is worth one point and each correct graph is worth one point.

2. $f(x) = 2x - 7$

3. $g(x) = 1/x$

4. $P(x) = \sin(x)$

5. $q(x) = |2x|$

6. $t(x) = x^2 + 4x + 4$

7. $C(x) = x^3 - 1$

Worth one point. On graph paper provided, construct a piecewise function that has: a maximum at $y = 4$, a vertical asymptote at $x = 2$, and y-intercept at -1 .

Population	Algebra 2/Trig. class (11 th grade) 18 students (8 male and 10 female)				
Learning Content	Functions (identifying, graphing, and usage)				
Interval	3 weeks				
Evidence	1. Exit Slip 2. Authentic Assessment 3. Webquest 4. Quiz				
Baseline	1 student is proficient (received above a 95) 7 students are effective (received 85-94) 6 students are developing (received 75-84) 2 students are not proficient (received 65-74) 2 students are failing (received lower than 65)				
Target	Based on what I saw from the baseline, at the end of instruction, what I hope to happen is that ninety five percent of the class achieves proficiency in the unit.				
HEDI scoring	Proficient	Effective	Developing	Not Proficient	Failing
	Julia, Devyn, Harrison, Matt, Rowan, Caroline, Noah, Laura	Isabella, Allie, Shreya, Ryan	Daniel, Grace, Marcella	Nick, Christina	Danielle
Rationale	<p>When designing my unit, I incorporated SLO by not making each assessment and strategy too difficult for the students that struggle in school, and also made it challenging for the students that are gifted and already have high scores.</p> <p>I didn't expect that students in my class will learn everything in the unit after I teach them, although I did expect the students to learn the key ideas from the objectives in the Common Core Standards. Some of the things in the unit, like the internet research, were not entirely essential to remember for a Regents exam. It is, however, important for the research to give students a larger picture of the topic. The important things that the students learned are: the different types of functions, how to graph the functions, and the various vocabulary words associated with the functions. These three things were targeted explicitly and the majority of students did master them.</p>				

SLO

From the exit slips, I will grade them on a check, check plus and check minus scale where a check indicates a developing status and a check plus indicate proficiency of the concepts. A check minus indicates that a student is not proficient. Out of the 18 in the class, 15 will achieve proficiency.

On the Webquest, 14 students were effective (received a grade higher than 85). Three students were developing and one student failed. Although the student that failed was given a second attempt to complete the Webquest and achieved an effective grade

For the authentic assessment, 12 students are effective (received a grade higher than an 85). Three students are not proficient (received grades lower than a 65). Two students are not yet developing (received higher than a 65 but lower than a 75) and 1 student is proficient.

On the quiz, 13 students were effective on the first attempt (received higher than an 85). On the second attempt 4 more will be effective and on the third attempt, the last student (Danielle) will be effective.

Although not everyone in the class received a passing grade, there was progress made from both their scores from last year as well as scores from earlier in the year. Over seventy five percent of the class achieved proficiency from each assessment that was given and fifteen percent achieved proficiency soon after. Only ten percent of the class struggles to grasp the concepts being covered in the unit.