

Match That Function

A-E Strand(s): Algebra. Sample Courses: Middle School Course 2, Middle School Advanced One-Year Course, Integrated Course 2, Algebra I, and Algebra II.

Topic/Expectation

A.C.1 Elementary functions

- b. Graph and analyze exponential functions and identify their key characteristics.
- c. Analyze power functions and identify their key characteristics.
- e. Distinguish among the graphs of simple exponential and power functions by their key characteristics.
- f. Recognize and solve problems that can be modeled using exponential, power, and root functions; interpret the solution(s) in terms of the context of the problem.

Other Topic/Expectation(s)

A.A.3. Linear functions

- a. Analyze and identify linear functions of one variable.

A.B.1 Quadratic functions

- a. Identify quadratic functions expressed in multiple forms; identify the specific information each form clarifies.
- c. Recognize contexts in which quadratic models are appropriate; determine and interpret quadratic models that describe quadratic phenomena.

Core Algebra II EOC Content

EOC: P1. Quadratic functions

- d. Recognize, express, and solve problems that can be modeled using quadratic functions. Interpret their solutions in terms of the context.

EOC: P2. Polynomial functions

- a. Determine key characteristics of polynomial functions in the form $f(x) = ax^n$, $a \neq 0$, for positive integral values of n and their graphs

EOC: X1. Exponential functions

- a. Determine key characteristics of exponential functions and their graphs.

Rationale

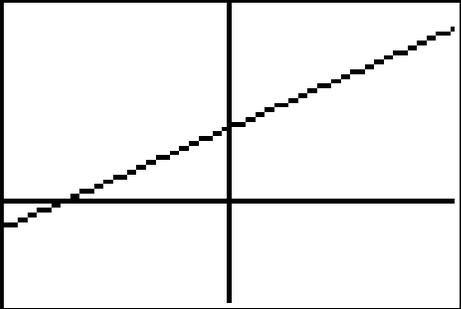
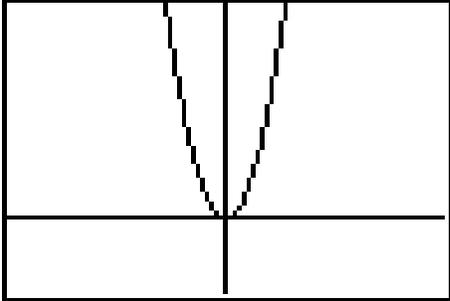
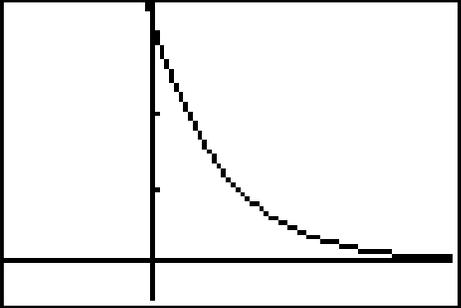
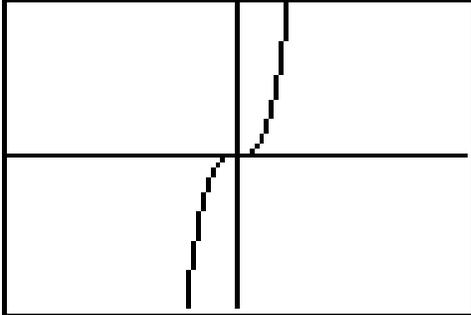
This task requires students to analyze a situation, describe the appropriate function for the situation using multiple representations, and make connections among the representations. The task provides an opportunity to compare various types of functions.

Instructional Task

For each verbal description of a situation, determine the type of function, a general graph to describe the function, a table of possible values, and a possible function rule that mathematically models the description. Record the letter that is in the upper left corner of each box in the appropriate row and column on the table that follows. For each matched set, explain your reasoning.

Set One:

<p>1</p> <p>At Sam's Pizza Parlor, the price of the pizza is a function of the number of toppings. Sam charges the same amount for each topping.</p>	<p>2</p> <p>A flag company makes rectangular flags with dimensions in a 2:1 ratio. The area of the flag in square inches is a function of the width of the flag.</p>
<p>3</p> <p>In a single-elimination athletic tournament, the number of teams remaining after each round is a function of the number of rounds that have been played.</p>	<p>4</p> <p>The volume of a sphere is a function of the radius of the sphere.</p>

<p>I</p> 	<p>P</p> 
<p>J</p> 	<p>O</p> 

Match That Function

<p>R</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>7.75</td> </tr> <tr> <td>2</td> <td>8.50</td> </tr> <tr> <td>3</td> <td>9.25</td> </tr> <tr> <td>4</td> <td>10</td> </tr> </tbody> </table>	x	f(x)	1	7.75	2	8.50	3	9.25	4	10	<p>S</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>2</td> </tr> <tr> <td>2</td> <td>8</td> </tr> <tr> <td>3</td> <td>18</td> </tr> <tr> <td>4</td> <td>32</td> </tr> </tbody> </table>	x	f(x)	0	0	1	2	2	8	3	18	4	32
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<p>A</p> $f(x) = 0.75x + 7$	<p>Y</p> $f(x) = 2x^2$																						
<p>Z</p> $f(x) = 64 \cdot \left(\frac{1}{2}\right)^x$	<p>B</p> $f(x) = \frac{4}{3}\pi x^3$																						

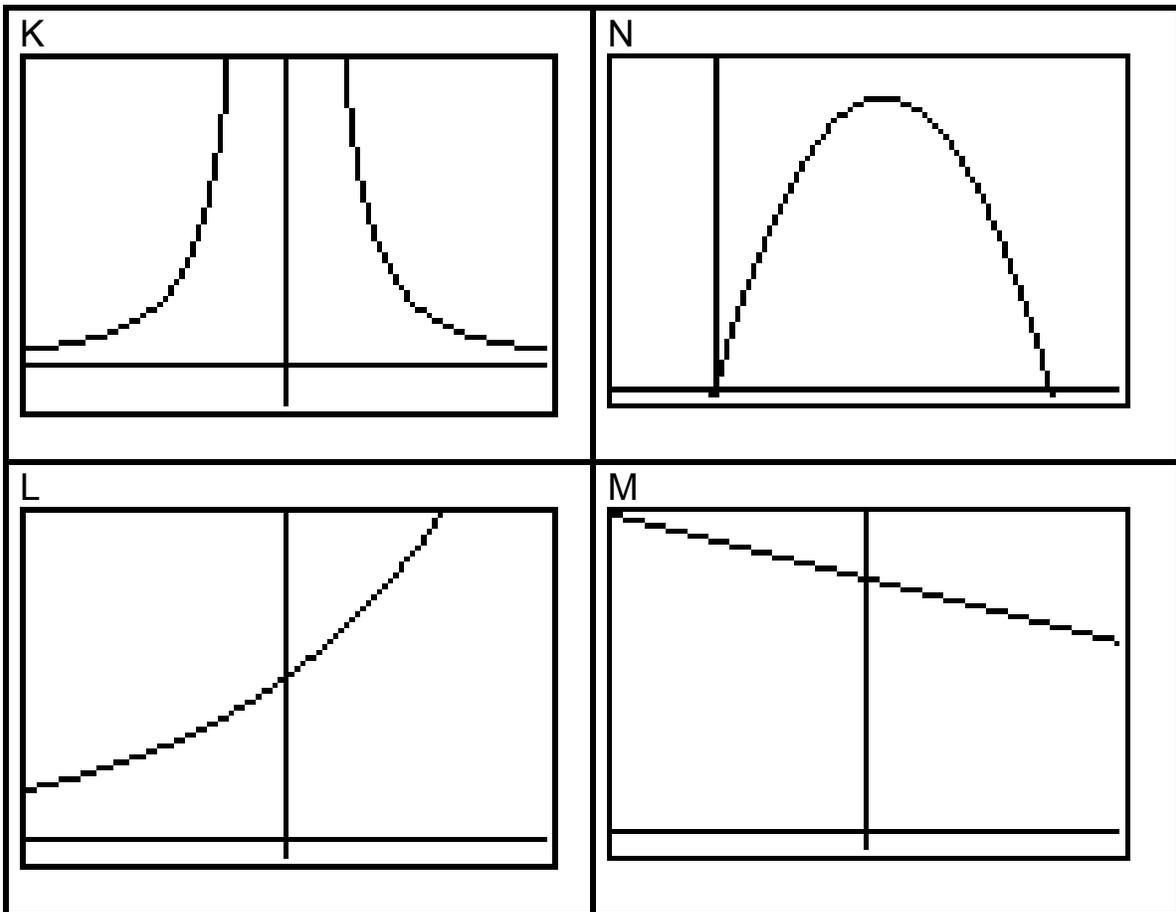
Match That Function

G Linear Function	BB Quadratic Function
AA Exponential Function	H Cubic Power Function

Set Two:

5 A hot air balloon appears to be descending at a steady rate. The height of the balloon is a function of time.	6 At a fireworks display, a fireworks rocket is launched upward from the ground with an initial velocity of 160 feet per second. The height of the rocket, in feet, is a function of time.
7 You receive a cash gift from your aunt. You decide to invest the money in a savings account in which the 6% interest rate is compounded annually. The amount in your savings account is a function of the number of years the money is invested in the account.	8 The intensity of light from a light source varies inversely with the square of the distance from the bulb.

Match That Function



Match That Function

<p>U</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr><td>1</td><td>100</td></tr> <tr><td>2</td><td>25</td></tr> <tr><td>3</td><td>11.1</td></tr> <tr><td>4</td><td>6.25</td></tr> <tr><td>5</td><td>4</td></tr> </tbody> </table>	x	f(x)	1	100	2	25	3	11.1	4	6.25	5	4	<p>V</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>1</td><td>144</td></tr> <tr><td>2</td><td>256</td></tr> <tr><td>3</td><td>336</td></tr> <tr><td>4</td><td>384</td></tr> </tbody> </table>	x	f(x)	0	0	1	144	2	256	3	336	4	384
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<p>F</p> $f(x) = 100x^{-2}$	<p>C</p> $f(x) = -16x^2 + 160x$																								
<p>E</p> $f(x) = 500(1.06)^x$	<p>D</p> $f(x) = 800 - 20x$																								

Match That Function

CC Inverse Power Function	BB Quadratic Function
AA Exponential Function	G Linear Function

Match That Function

Insert the letters of the representations that match.

Description	Type of Function (Explain how you know.)	Graph	Table	Function Rule
1				
2				
3				
4				
5				
6				
7				
8				

Discussion/Further Questions/Extensions

Note: This activity is divided into two parts. Teachers may want to give their students all eight examples or choose to limit the activity to either the first or second set of situations.

Teachers may guide student thinking by asking which of the verbal descriptions can be placed into more than one family of functions. Ask students to describe a process they could use to complete the activity and tell which column they might begin with. After they have completed the activity, ask students which of the graph, table, or function rule was the hardest to categorize. What made it hard?

The task may also be extended by asking students to create their own situations for elementary functions.

Extension Questions:

1. Create a verbal description that can be modeled by a power function. Create a graph, table, and function rule to represent the verbal description.
2. Create a verbal description that can be modeled by an exponential function. Create a graph, table, and function rule to represent the verbal description.

Sample Solutions

Insert the letters of the representations that match.

Description	Type of Function (Explain how you know.)	Graph	Table	Function Rule
1	G The Sam's Pizza Parlor situation is linear and increasing since there is a constant rate of increase in cost for each added topping.	I	R	A
2	BB The flag company situation is quadratic since 2-dimensional area depends on 1-dimensional width.	P	S	Y

Match That Function

Description	Type of Function (Explain how you know.)	Graph	Table	Function Rule
3	<p style="text-align: center;">AA</p> <p>In the tournament situation, the number of teams is cut in $\frac{1}{2}$ at the end of each round of play; therefore, the function is exponential and decreasing.</p>	J	Q	Z
4	<p style="text-align: center;">H</p> <p>3-dimensional volume depends on 1-dimensional radius, so this function is a power function (and is also cubic).</p>	O	T	B
5	<p style="text-align: center;">G</p> <p>The balloon's height is decreasing at a constant rate, so the function is linear and decreasing.</p>	M	X	D
6	<p style="text-align: center;">BB</p> <p>Height of the rocket depends on the gravity coefficient multiplied by the amount of time squared, which makes this quadratic.</p>	N	V	C
7	<p style="text-align: center;">AA</p> <p>The compounding interest formula is exponential since interest is figured each year on the increasing amount in the account.</p>	L	W	E
8	<p style="text-align: center;">CC</p> <p>The formula for light intensity is an inverse variation. There is a variable in the denominator.</p>	K	U	F