

## Station Activities: Choosing a Model

### Station 1

At this station, you will find three cards labeled with the following categories of functions: Linear, Exponential, and Quadratic. You will also find four sets of cards depicting functions:

- 3 Equation cards, numbered E1–E3
- 3 Table cards, lettered T1–T3
- 3 Graph cards, lettered G1–G3
- 3 Real-world Situation cards, lettered S1–S3

Using your knowledge of the key features of functions, work with your group to complete the problems that follow.

1. Spread out the three category cards. Identify each of the twelve function cards as a linear, exponential, or quadratic function. Arrange the function cards beneath the correct category card. Record the code for each card (e.g., S1) in the appropriate cell of the table that follows.

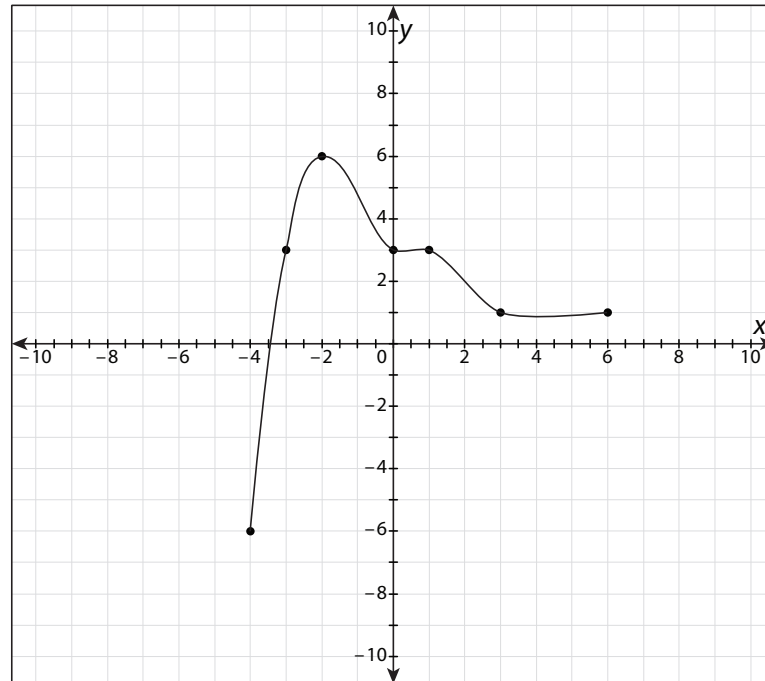
	Linear functions	Exponential functions	Quadratic functions
Equation			
Table			
Graph			
Situation			

2. Describe the key features of each type of function (linear, exponential, and quadratic), and explain how you used these features to sort the cards.

## Station 2

Work with your group to complete all parts of the problems involving the key features of the function described in each table or graph.

1.



- Identify the domain and range.
- Determine the  $x$ - and  $y$ -intercepts.
- Identify the maximum and minimum values.
- Determine the intervals where the function is increasing and/or decreasing.
- Describe the end behavior of the graph.

2.

$x$	-2	-1	0	1	2
$y$	5	2	1	2	5

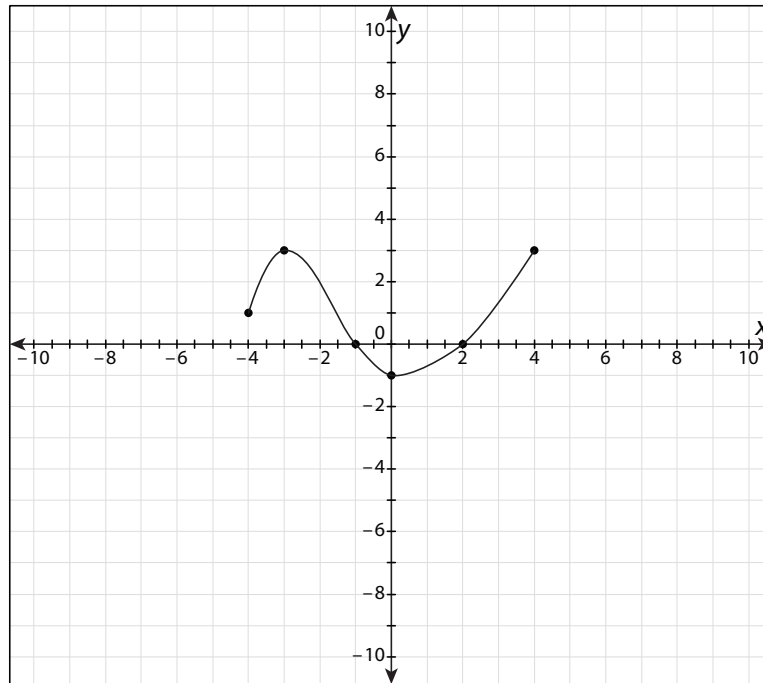
- Identify the domain and range.
- Determine the  $x$ - and  $y$ -intercepts.
- Identify the maximum and minimum values.
- Describe the end behavior of the graph.
- State whether the function is even or odd.

*continued*

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3.



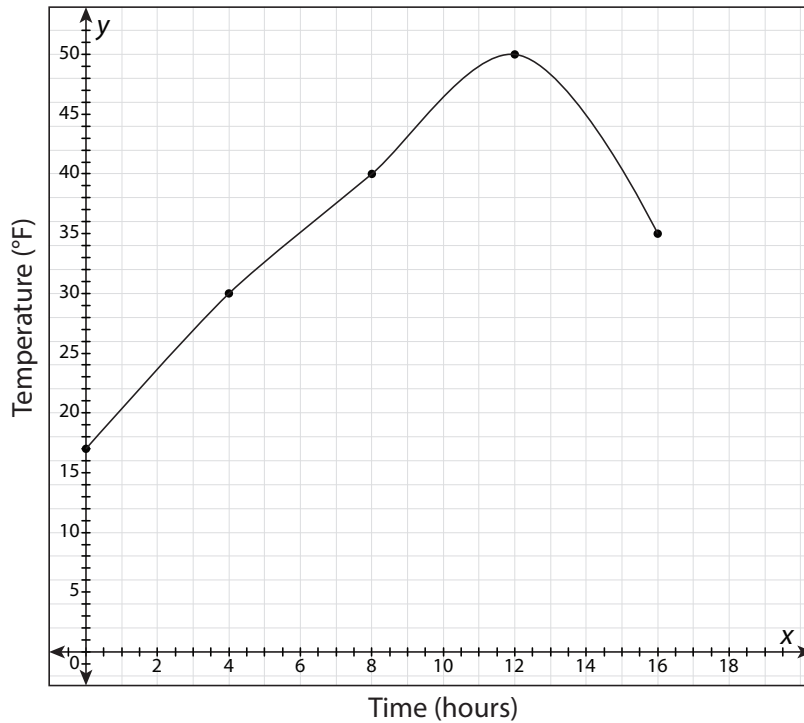
- Identify the domain and range.
- Determine the  $x$ - and  $y$ -intercepts.
- Identify the maximum and minimum values.
- Determine the intervals where the function is increasing and/or decreasing.
- State whether the function is even or odd.

*continued*

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4. The following graph shows the Temperature ( $T$ ) in degrees Fahrenheit over a 16-hour period in New York as a function of time ( $t$ ). Use the graph to complete all parts of the problem.



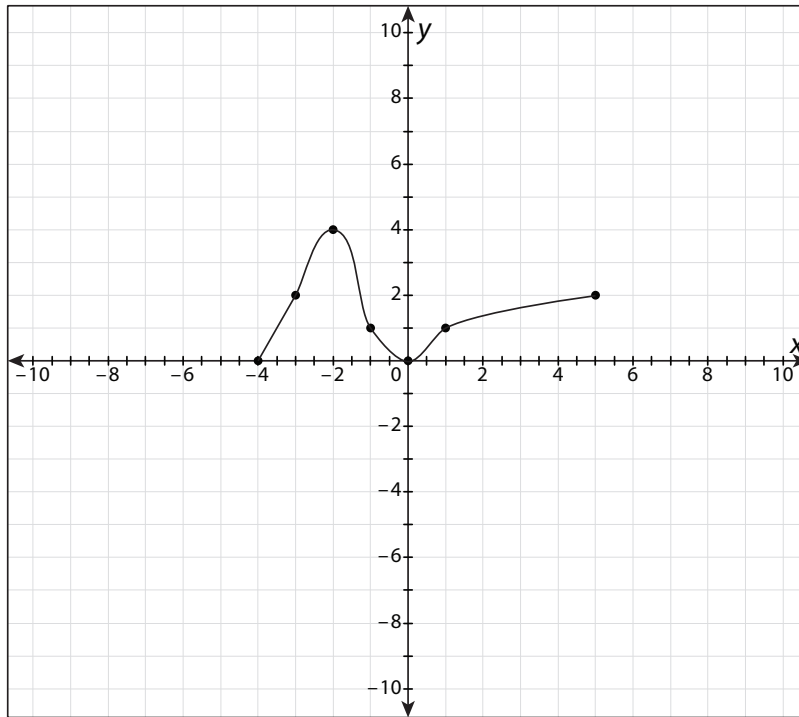
- Use the graph to estimate the value of  $T(8)$ .
- If  $T(0)$  corresponds to 6 A.M. and  $T(2)$  corresponds to 8 A.M., what time corresponds to  $T(12)$ ?
- Estimate the time or time frame when the temperature is the highest.
- Estimate the time or time frame when the temperature is decreasing.
- If you wanted to go for a walk and return before the temperature drops below freezing ( $32^{\circ}\text{F}$ ), when should you go?

**continued**

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5. Use the following graph to determine each of the values as indicated.



- a.  $f(0)$
- b.  $f(-2)$
- c.  $f(x) = 1$
- d.  $f(x) = 2$

**Station 3**

Work as a group to explore the given square root and cube root functions. Complete each table and graph each function using a graphing calculator. Then, use the table and graph to complete the problems.

1. Complete the table of values for the square root function  $f(x) = \sqrt{x}$ .

<b><math>x</math></b>	-5	-4	-3	-2	-1	0	1	2	3	4	5
<b><math>f(x)</math></b>											

- Determine the domain and range of the function.
  - What do you notice as you complete the table?
  - What do you notice about the graph on the calculator?
2. The square root function  $g(x) = \sqrt{x+1}$  is a transformation of the graph of  $f(x)$  from problem 1. Complete the table of values for  $g(x)$ .

<b><math>x</math></b>	-5	-4	-3	-2	-1	0	1	2	3	4	5
<b><math>g(x)</math></b>											

- Determine the domain and range of the function.
- Describe the transformation from the graph of  $f(x)$  to  $g(x)$ .
- What do you notice as you complete the table?
- What do you notice about the graph on the calculator?

**continued**

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3. The square root function  $h(x) = 2\sqrt{x} + 1$  is a transformation of the graph of  $f(x)$  from problem 1. Complete the table of values for  $h(x)$ .

<b><math>x</math></b>	-5	-4	-3	-2	-1	0	1	2	3	4	5
<b><math>h(x)</math></b>											

- Determine the domain and range of this function.
  - Describe the transformation from the graph of  $f(x)$  to  $h(x)$ .
  - What do you notice as you complete the table?
4. Based on your answers to problems 1–3, what can you conclude about the domain of a square root function?
5. Complete the table of values for the cube root function  $j(x) = \sqrt[3]{x}$ .

<b><math>x</math></b>	-5	-4	-3	-2	-1	0	1	2	3
<b><math>j(x)</math></b>									

- Determine the domain and range of this function.
  - What do you notice as you complete the table?
  - What do you notice about the graph on the calculator?
6. The cube root function  $k(x) = \sqrt[3]{x+2} + 1$  is a transformation of the graph of  $j(x)$  from problem 5. Complete the table of values for  $k(x)$ .

<b><math>x</math></b>	-5	-4	-3	-2	-1	0	1	2	3
<b><math>k(x)</math></b>									

- What do you notice as you complete the table?
- Describe the transformation from the graph of  $j(x)$  to  $k(x)$ .

**Station 4**

For each problem, the equation of a parent function is given. Work with your group to create a new equation that depicts the transformation(s) described. Use a graphing calculator to verify your equations.

1. Parent function:  $f(x) = \sqrt{x}$

Transformations: vertical stretch by a factor of 2 units; shift 3 units to the right and 1 unit up

2. Parent function:  $f(x) = \sqrt[3]{x}$

Transformation: shift 1 unit to the right

3. Parent function:  $f(x) = 2^x$

Transformations: shrink by a factor of  $\frac{1}{2}$ ; reflect over the  $x$ -axis; shift 2 units to the left

4. Parent function:  $f(x) = x^2$

Transformations: shift 1 unit to the right and 2 units up

5. Parent function:  $f(x) = |x|$

Transformations: shift 2 units to the left and 1 unit down

6. Parent function:  $f(x) = |x|$

Transformations: write as a piecewise function with a shift of 3 units to the left