

## Core Content

**Cluster Title: Interpret functions that arise in applications in terms of a context.**

**Standard:** F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★

### Concepts and Skills to Master

- Given a graph, identify key features such as x- and y-intercepts; intervals where the function is increasing, decreasing, positive, or negative.
- Given a table of values, identify key features such as x- and y-intercepts; intervals where the function is increasing, decreasing, positive, or negative
- Find key features of a function and use them to graph the function.
- Use interval notation and symbols of inequality to communicate key features of graphs.

## Supports for Teachers

### Critical Background Knowledge

- Ability to graph a linear or exponential function from a table or equation.

### Academic Vocabulary

- Increasing, decreasing, positive, negative, intervals, intercepts, interval notation

### Suggested Instructional Strategies

- Use graphing technology to explore and identify key features of a function.
- Use key features of a function to graph functions by hand.

### Resources

Online Graphing Calculator  
<http://rentcalculators.org/stheli.html>

### Sample Formative Assessment Tasks

#### Skill-based Task

Identify the intervals where the function is increasing and decreasing.

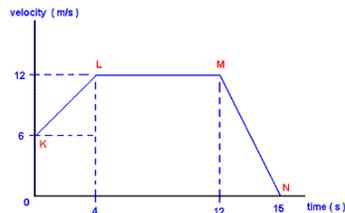


Fig. 3.9

#### Problem Task

- Create a story that would generate a linear or exponential function and describe the meaning of key features of the graph as they relate to the story.

★Modeling

## Core Content

<b>Cluster Title: Interpret functions that arise in applications in terms of a context.</b>
<b>Standard:</b> F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function.</i> ★
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>Identify domains of functions given a graph.</li> <li>Graph a function, given a restricted domain.</li> <li>Identify reasonability of a domain in a particular context.</li> </ul>

## Supports for Teachers

<b>Critical Background Knowledge</b>	
<ul style="list-style-type: none"> <li>Familiarity with function notation and domain.</li> <li>Knowledge of independent and dependent variables</li> </ul>	
<b>Academic Vocabulary</b>	
<ul style="list-style-type: none"> <li>Domain, function, integers, independent variable, dependent variable</li> </ul>	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>
<ul style="list-style-type: none"> <li>Discuss contexts where the domain of a function should be limited to a subset of integers, positive or negative values, or some other restriction to the real numbers.</li> <li>Find examples of functions with limited domains from other curricular areas (science, physical education, social studies, consumer science)</li> </ul>	<p><a href="http://www.illustrations.NCTM.org">www.illustrations.NCTM.org</a></p> <ul style="list-style-type: none"> <li>Domain Representations</li> </ul>
<b>Sample Formative Assessment Tasks</b>	
<p><b>Skill-based Task</b></p> <p>You are hoping to make a profit on the school play and have determined the function describing the profit to be <math>f(t) = 8t - 2654</math> where <math>t</math> is the number of tickets sold. What is a reasonable domain for this function? Explain.</p>	<p><b>Problem Task</b></p> <p>Create a function in context where the domain would be</p> <ul style="list-style-type: none"> <li>All real numbers</li> <li>Integers</li> <li>Negative integers</li> <li>Rational Numbers</li> <li><math>[10, 40)</math></li> </ul>

★Modeling

## Core Content

<b>Cluster Title: Interpret functions that arise in applications in terms of a context.</b>
<b>Standard:</b> F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>• Calculate rate of change given a linear function, from the equation or a table.</li> <li>• Calculate rate of change over a given interval in an exponential function from an equation or a table where the domain is a subset of the integers.</li> <li>• Use a graph to estimate the rate of change over an interval in a linear or exponential function.</li> </ul>

## Supports for Teachers

<b>Critical Background Knowledge</b>																																																	
<ul style="list-style-type: none"> <li>• Definition of slope.</li> </ul>																																																	
<b>Academic Vocabulary</b>																																																	
<ul style="list-style-type: none"> <li>• Increasing, decreasing, rate of change, average, function, interval</li> </ul>																																																	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>																																																
<ul style="list-style-type: none"> <li>• Use graphical data from birth rates, BMI in growing children, electricity rates, population growth or other linear or exponential data to explore and discuss the meaning of rate of change.</li> </ul>	<a href="http://www.illustrations.NCTM.org">www.illustrations.NCTM.org</a> : <ul style="list-style-type: none"> <li>• Drug Filtering</li> <li>• Illustrations: Growth Rate</li> </ul>																																																
<b>Sample Formative Assessment Tasks</b>																																																	
<p><b>Skill-based Task</b> Find the average rate of change on the interval <math>[-3,1]</math></p> <p>Table 1</p> <table border="1"> <tr><td>X</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr> <tr><td>Y</td><td>8</td><td>3</td><td>-2</td><td>-7</td><td>-12</td><td>-17</td><td>-22</td></tr> </table> <p>Table 2</p> <table border="1"> <tr><td>X</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr> <tr><td>Y</td><td>6</td><td>12</td><td>24</td><td>48</td><td>96</td><td>192</td><td>384</td></tr> </table> <p>Table 3</p> <table border="1"> <tr><td>X</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr> <tr><td>Y</td><td>7</td><td>2</td><td>-1</td><td>0</td><td>2</td><td>4</td><td>6</td></tr> </table>	X	-3	-2	-1	0	1	2	3	Y	8	3	-2	-7	-12	-17	-22	X	-3	-2	-1	0	1	2	3	Y	6	12	24	48	96	192	384	X	-3	-2	-1	0	1	2	3	Y	7	2	-1	0	2	4	6	<p><b>Problem Task</b> The graph models the speed of a car. Tell a story using the graph to describe what is happening in various intervals.</p>
X	-3	-2	-1	0	1	2	3																																										
Y	8	3	-2	-7	-12	-17	-22																																										
X	-3	-2	-1	0	1	2	3																																										
Y	6	12	24	48	96	192	384																																										
X	-3	-2	-1	0	1	2	3																																										
Y	7	2	-1	0	2	4	6																																										

★Modeling