

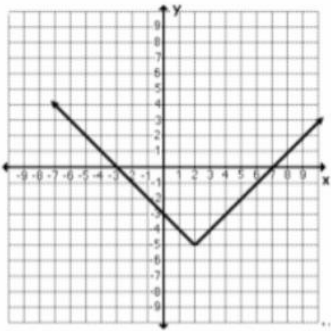
Unit 1 Transformations of Absolute Value and Quadratic Functions

Complete on a separate sheet of paper

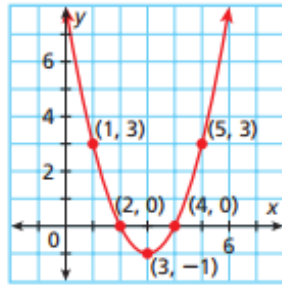
WS 1: Horizontal and Vertical Translations

For each graph, identify the parent function, describe the transformations, write an equation for the graph, identify the vertex, describe the domain and range using interval notation, and identify the equation for the axis of symmetry.

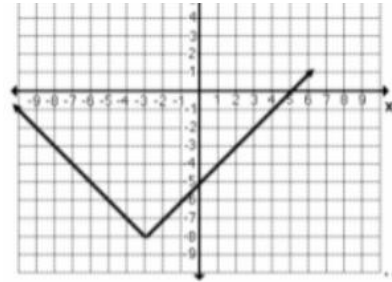
1.



2.



3.



<p>Parent function: absolute value</p> <p>Transformations: 2 units to the right, 5 units down</p> <p>Equation: $y = x - 2 - 5$</p> <p>Vertex: (2, -5)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-5, \infty)$</p> <p>AOS: $x = 2$</p>	<p>Parent function: quadratic</p> <p>Transformations: 3 units right, 1 unit down</p> <p>Equation: $y = (x - 3)^2 - 1$</p> <p>Vertex: (3, -1)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-1, \infty)$</p> <p>AOS: $x = 3$</p>	<p>Parent function: absolute value</p> <p>Transformations: 3 units left, 8 units down</p> <p>Equation: $y = x + 3 - 8$</p> <p>Vertex: (-3, -8)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-8, \infty)$</p> <p>AOS: $x = -3$</p>
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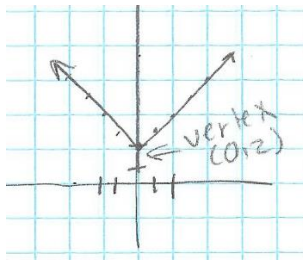
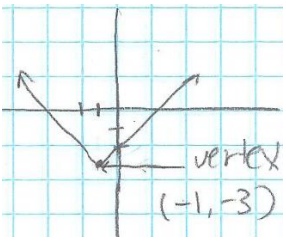
For each equation, identify the parent function, describe the transformations, graph the function, and describe the domain and range using interval notation.

4. $y = |x| + 2$

5. $y = |x - 6|$

6. $y = |x + 1| - 3$

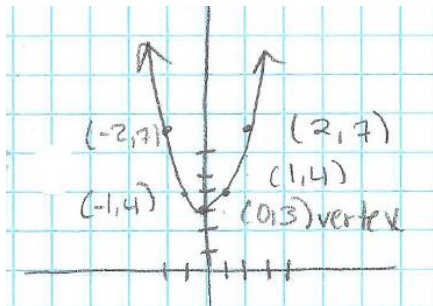
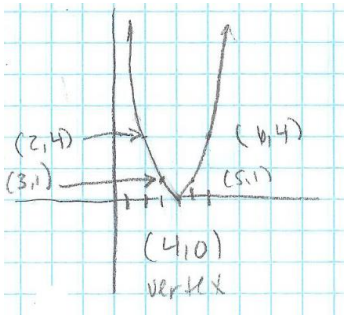
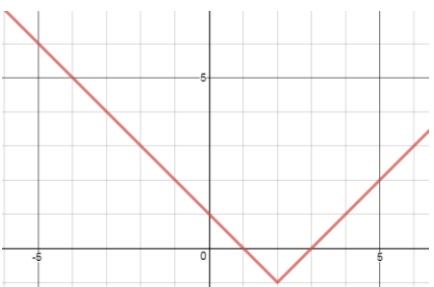
<p>Parent function: absolute value</p> <p>Transformations: 2 units up</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[2, \infty)$</p> <p>AOS: $x = 0$</p>	<p>Parent function: absolute value</p> <p>Transformations: 6 units right</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[0, \infty)$</p> <p>AOS: $x = 6$</p>	<p>Parent function: absolute value</p> <p>Transformations: 1 unit left, 3 units down</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-3, \infty)$</p>
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	<p>Use Desmos/graphing calc to check graph</p>	<p>AOS: $x = -1$</p> 
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7. $y = x^2 + 3$

8. $y = (x - 4)^2$

9. $y = (x - 2)^2 - 1$

<p>Parent function: quadratic</p> <p>Transformations: 3 units up</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[3, \infty)$</p> <p>AOS: $x = 0$</p> 	<p>Parent function: quadratic</p> <p>Transformations: 4 units right</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[0, \infty)$</p> <p>AOS: $x = 4$</p> 	<p>Parent function: quadratic</p> <p>Transformations: 2 unit right, 1 units down</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-1, \infty)$</p> <p>AOS: $x = 2$</p> 
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Given the parent graph and a list of transformations, write an equation, graph the function, and describe the domain and range using interval notation.

10. Quadratic function: translated 2 units up and 4 units to the right

$y = (x - 4)^2 + 2$; Domain: $(-\infty, \infty)$; Range: $[2, \infty)$; use Desmos/graphing calc to check graph

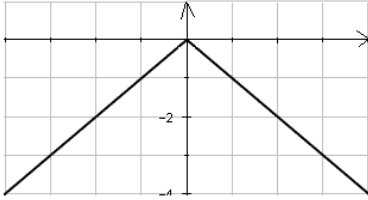
11. Absolute Value function: translated 1 unit down and 3 units to the right

$y = |x - 3| - 1$; Domain: $(-\infty, \infty)$; Range: $[-1, \infty)$; use Desmos/graphing calc to check graph

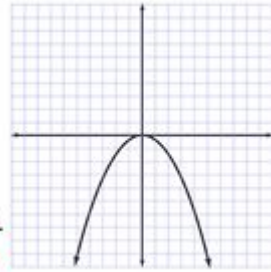
WS 2: Reflections

For each graph, identify the parent function, describe the transformations, write an equation for the graph, describe the domain and range using interval notation, and identify the equation for the axis of symmetry.

1.



2.



<p>Parent function: absolute value</p> <p>Transformations: reflection over the x-axis</p> <p>$y = - x$</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $(-\infty, 0]$</p> <p>AOS: $x = 0$</p>	<p>Parent function: quadratic</p> <p>Transformations: 4 units right</p> <p>Transformations: reflection over the x-axis</p> <p>$y = -x^2$</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $(-\infty, 0]$</p> <p>AOS: $x = 0$</p>
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For each equation, identify the parent function, describe the transformations, graph the function, and describe the domain and range using interval notation.

3. $y = -|x|$

4. $y = -x^2$

5. $y = (x - 1)^2 - 5$

6. $y = |x + 4| - 2$

<p>Parent function: absolute value</p> <p>Transformations: reflection over the x-axis</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $(-\infty, 0]$</p> <p>AOS: $x = 0$</p> <p>See previous question for graph</p>	<p>Parent function: quadratic</p> <p>Transformations: reflection over the x-axis</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $(-\infty, 0]$</p> <p>AOS: $x=0$</p> <p>See previous question for graph</p>	<p>Parent function: quadratic</p> <p>Transformations: 1 unit right, 5 units down</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-5, \infty)$</p> <p>AOS: $x = 1$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: absolute value</p> <p>Transformations: 4 units left, 2 units down</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-2, \infty)$</p> <p>AOS: $x = -4$</p> <p>Use Desmos/graphing calc to check graph</p>
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Given the parent graph and a list of transformations, write an equation graph the function, and describe the domain and range using interval notation.

7. Quadratic function: reflection over the x-axis (see question 2)

8. Absolute value function: vertical reflection (see question 1)

9. Quadratic function: vertical shift up two units and horizontal shift 3 units to the left

$y = (x + 3)^2 + 2$; Domain: $(-\infty, \infty)$; Range: $[2, \infty)$; use Desmos/graphing calc to check graph

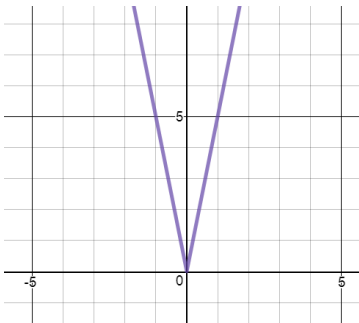
10. Absolute value function: vertical shift down 4 units and 5 units to the right

$y = |x + 5| - 4$; Domain: $(-\infty, \infty)$; Range: $[-4, \infty)$; use Desmos/graphing calc to check graph

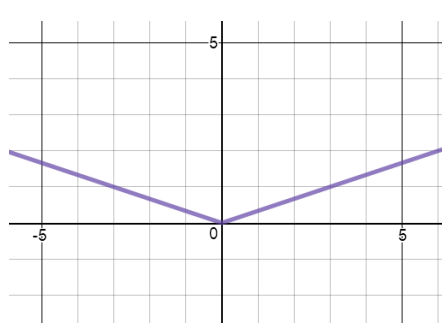
WS 3: Stretches and Shrinks

For each graph, identify the parent function, describe the transformations, write an equation for the graph, identify the vertex, describe the domain and range using interval notation, and identify the equation for the axis of symmetry.

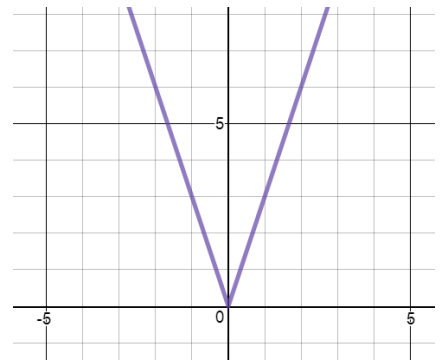
1.



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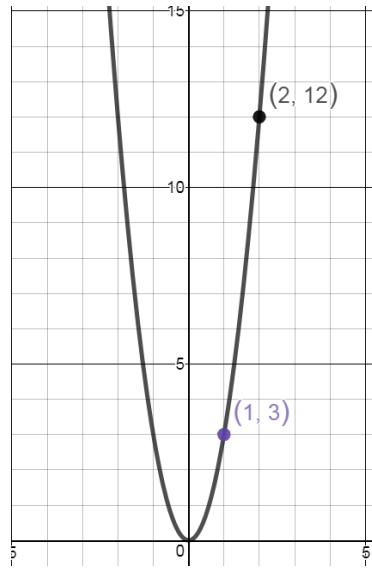
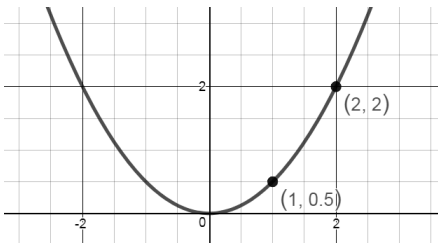
3.



<p>Parent function: absolute value</p> <p>Transformations: vertical stretch by a factor of 5 or horizontal shrink by a factor of 1/5</p> <p>Equation: $y = 5 x$ or $y = 5x$</p> <p>Vertex: (0,0)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[0, \infty)$</p> <p>AOS: $x = 0$</p>	<p>Parent function: absolute value</p> <p>Transformations: vertical compression by a factor of 1/3 or horizontal stretch by a factor of 3</p> <p>Equation: $y = \frac{1}{3} x$ or $y = \frac{1}{3}x$</p> <p>Vertex: (0,0)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[0, \infty)$</p> <p>AOS: $x = 0$</p>	<p>Parent function: absolute value</p> <p>Transformations: vertical stretch by a factor of 3 or a horizontal compression by a factor of 1/3</p> <p>Equation: $y = 3 x$ or $y = 3x$</p> <p>Vertex: (0, 0)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[0, \infty)$</p> <p>AOS: $x = 0$</p>
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4.

5.



Parent function: quadratic Transformations: vertical compression by a factor of 1/2 Equation: $y = \frac{1}{2}(x)^2$ Vertex: (0, 0) Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ AOS: $x = 0$	Parent function: quadratic Transformations: vertical stretch by a factor of 3 Equation: $y = 3(x)^2$ Vertex: (0, 0) Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ AOS: $x = 0$
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For each equation, identify the parent function, describe the transformations, graph the function, and describe the domain and range using interval notation.

6. $y = 3|x|$ 7. $y = 2x^2$ 8. $y = \frac{1}{5}|x|$ 9. $y = \frac{1}{3}x^2$

Parent function: absolute value Transformations: vertical stretch by a factor of 3 Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ AOS: $x = 0$ Use Desmos/graphing calc to check graph	Parent function: quadratic Transformations: vertical stretch by a factor of 2 Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ AOS: $x = 0$ Use Desmos/graphing calc to check graph	Parent function: absolute value Transformations: vertical compression by a factor of 1/5 Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ AOS: $x = 0$ Use Desmos/graphing calc to check graph	Parent function: quadratic Transformations: vertical compression by a factor of 1/3 Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ AOS: $x = 0$ Use Desmos/graphing calc to check graph
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10. $y = |3x|$

11. $y = (2x)^2$

12. $y = \left|\frac{1}{5}x\right|$

13. $y = \left(\frac{1}{3}x\right)^2$

<p>Parent function: absolute value</p> <p>Transformations: horizontal compression by a factor of 1/3</p> <p>Domain: $(-\infty, \infty)$ Range: $[0, \infty)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: quadratic</p> <p>Transformations: horizontal compression by a factor of 1/2</p> <p>Domain: $(-\infty, \infty)$ Range: $[0, \infty)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: absolute value</p> <p>Transformations: horizontal stretch by a factor of 5</p> <p>Domain: $(-\infty, \infty)$ Range: $[0, \infty)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: quadratic</p> <p>Transformations: horizontal stretch by a factor of 3</p> <p>Domain: $(-\infty, \infty)$ Range: $[0, \infty)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>
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Given the parent graph and a list of transformations, write an equation graph the function, and describe the domain and range using interval notation.

Quadratic function: vertical stretch by a factor of 4

$y = 4x^2$; Domain: $(-\infty, \infty)$; Range: $[0, \infty)$; use Desmos/graphing calc to check graph

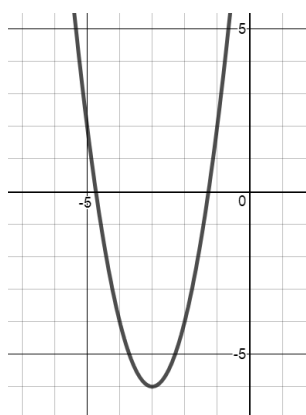
Absolute Value Function: horizontal shrink by a factor of 3

$y = |3x|$; Domain: $(-\infty, \infty)$; Range: $[0, \infty)$; use Desmos/graphing calc to check graph

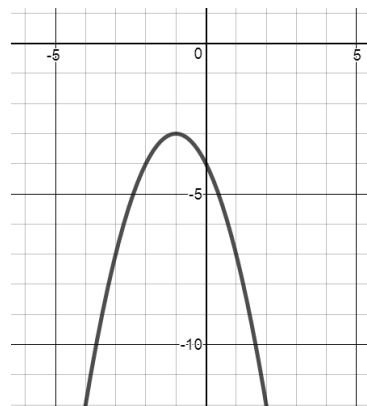
WS 4: Combinations of Transformations

For each graph, identify the parent function, describe the transformations, write an equation for the graph, describe the domain and range using interval notation, and identify the equation for the axis of symmetry.

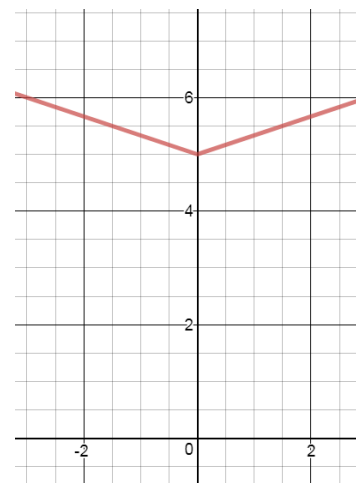
1.



2.



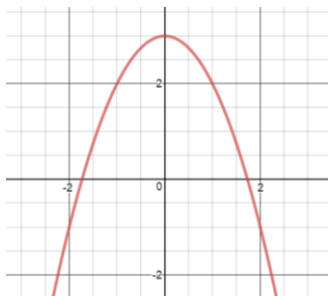
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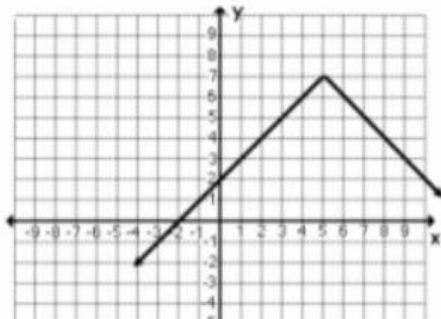
Parent function: quadratic	Parent function: quadratic	Parent function: absolute value
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<p>Transformations: translated 3 units left, 6 units down, vertical stretch by a factor of 2</p> <p>Equation: $y = 2(x + 3)^2 - 6$</p> <p>Vertex: (-3, -6)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-6, \infty)$</p> <p>AOS: $x = -3$</p>	<p>Transformations: 1 unit to the left, 3 units down, reflected over the x-axis</p> <p>Equation: $y = -(x + 1)^2 - 3$</p> <p>Vertex: (-1, -3)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-\infty, 7]$</p> <p>AOS: $x = -1$</p>	<p>Transformations: 5 units up, vertical compression by 1/3 (or horizontal stretch by a factor of 3)</p> <p>Equation: $y = \frac{1}{3} x + 5$ or $y = \left \frac{1}{2}x\right + 5$</p> <p>Vertex: (0, 5)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[5, \infty)$</p> <p>AOS: $x = 0$</p>
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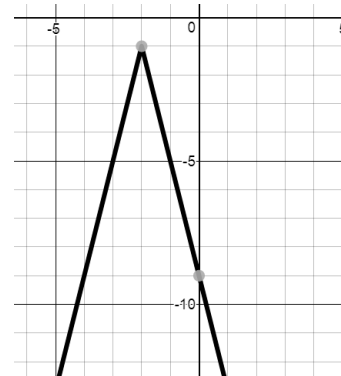
4.



5.



6.



<p>Parent function: quadratic</p> <p>Transformations: shifted 3 units up, vertical stretch by a factor of 2</p> <p>Equation $y = -(x)^2 + 3$</p> <p>Vertex: (0, 3)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-\infty, 3]$</p> <p>AOS: $x = 0$</p>	<p>Parent function: absolute value</p> <p>Transformations: 5 units to the right and 7 units up, reflected over x-axis</p> <p>Equation: $y = - x - 5 + 7$</p> <p>Vertex: (5, 7)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-\infty, 7]$</p> <p>AOS: $x = 5$</p>	<p>Parent function: absolute value</p> <p>Transformations: reflection over the x-axis, vertical stretch by a factor of 4, 2 units left, 1 unit down</p> <p>Equation: $y = -4 x + 2 - 1$</p> <p>Vertex: (-2, -1)</p> <p>Domain: $(-\infty, \infty)$</p> <p>Range: $[-\infty, 1]$</p> <p>AOS: $x = -2$</p>
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For each equation, identify the parent function, describe the transformations, graph the function, describe the domain and range using interval notation, and identify the equation for the axis of symmetry.

7. $y = -(x)^2 + 5$

8. $y = 2|x + 4|$

9. $y = (2x)^2 + 1$

<p>Parent function: quadratic</p> <p>Transformations: reflection over the x-axis, up 5 units</p> <p>Domain: $(-\infty, \infty)$ Range: $[-\infty, 5)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: absolute value</p> <p>Transformations: vertical stretch by a factor of 2, left 4 units</p> <p>Domain: $(-\infty, \infty)$ Range: $[0, \infty)$</p> <p>AOS: $x = -4$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: quadratic</p> <p>Transformations: horizontal compression by a factor of $\frac{1}{2}$, up 1 unit</p> <p>Domain: $(-\infty, \infty)$ Range: $[1, \infty)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>
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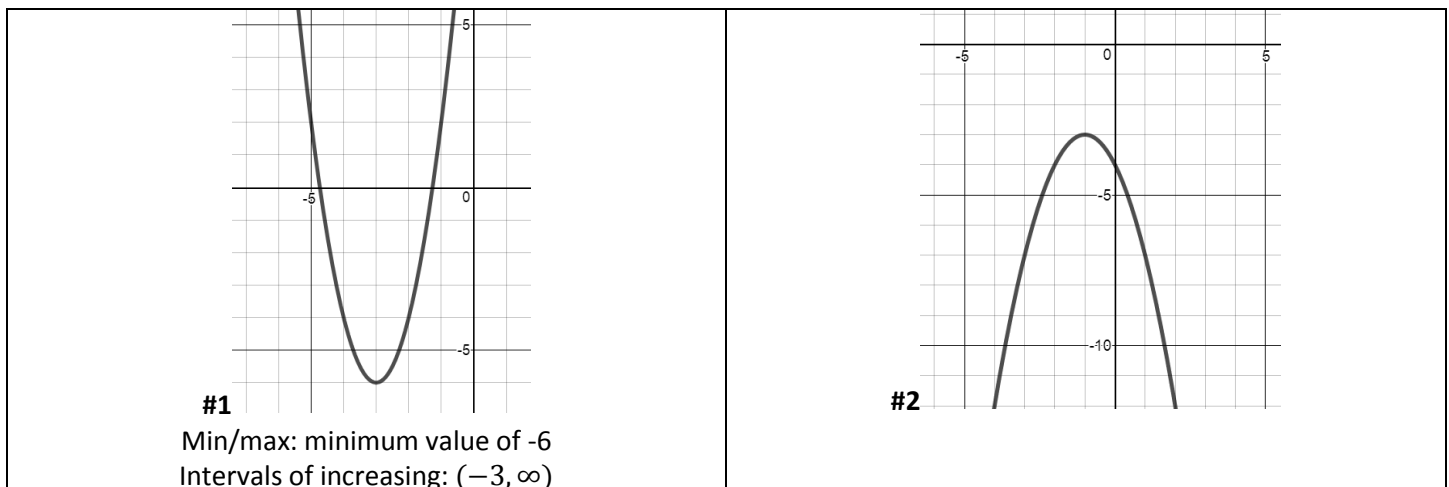
10. $y = -\left|\frac{1}{4}x\right|$

11. $y = -(2x)^2 - 1$

12. $y = -|3x| + 6$

<p>Parent function: absolute value</p> <p>Transformations: reflection over the x-axis, horizontal stretch by a factor of 4</p> <p>Domain: $(-\infty, \infty)$ Range: $[-\infty, 0)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: quadratic</p> <p>Transformations: horizontal compression by a factor of $\frac{1}{2}$, down 1 unit, reflection over x-axis</p> <p>Domain: $(-\infty, \infty)$ Range: $[-\infty, -1)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>	<p>Parent function: absolute value</p> <p>Transformations: horizontal compression by a factor of $\frac{1}{3}$, reflection over the x-axis, up 6 units</p> <p>Domain: $(-\infty, \infty)$ Range: $[\infty, -6)$</p> <p>AOS: $x = 0$</p> <p>Use Desmos/graphing calc to check graph</p>
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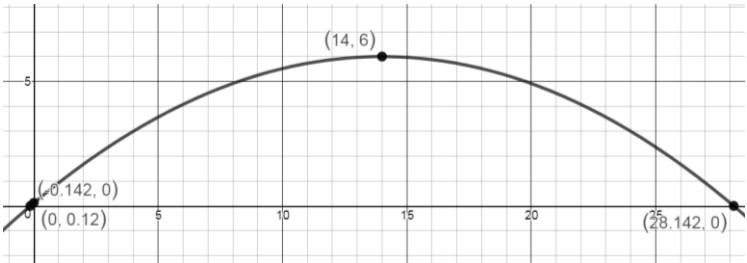
WS 5 Characteristics of Quadratic Functions



Intervals of decreasing: $(-\infty, -3)$ Intercepts (estimated): x-ints at $(-1.2, 0)$ and $(-4.7, 0)$; y-int: $(0, -3)$ End behavior:	
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1. The function $h(x) = -0.03(x - 14)^2 + 6$ models the jump of a red kangaroo, where x is the horizontal distance traveled in feet and $h(x)$ is the height in feet.

- a) Sketch a graph the equation (you can use a graphing calculator Desmos to help).
- b) Describe the domain and range and discuss what its significance in the context of the kangaroo jumping.

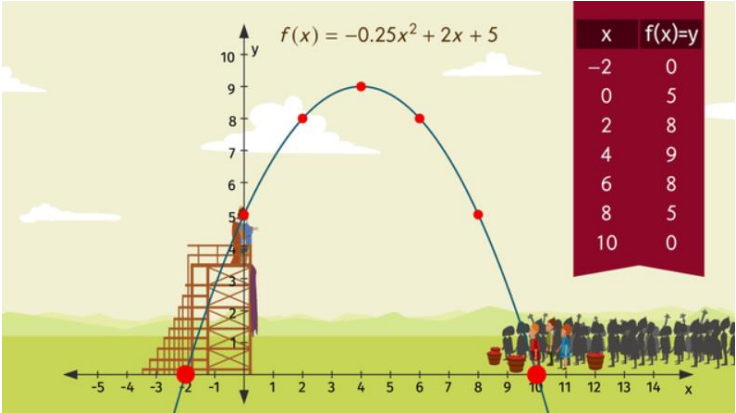


The domain is $[0, 28.142]$ and the range is $[0, 6]$. This means the kangaroo can jump a horizontal distance between 0 and 28.142 feet and a vertical distance between 0 and 6 feet.

- c) Identify the maximum and discuss its significance in the context of the kangaroo jumping.
A max of 6 means the kangaroo jumped up to 6 feet.
- d) Describe the intervals of increasing and decreasing and discuss their significance in the context of this picture.
Intervals of increasing: $(0, 14)$; intervals of decreasing: $(14, 28.142)$. This means that for the first 14 seconds, the kangaroo's height was increasing, and for the last 14 seconds it was decreasing.

2. For the picture below, answer the following questions:

- a) What is happening in this picture?
Answers may vary. Sample answer- a person is throwing a rock from a platform.
- b) What does the parabola represent?
The parabola represents the path of the rock, with the x-axis representing the distance from the platform and the y-axis representing the height of the rock in feet.
- c) Use your knowledge of transformations to write an equation for the parabola in vertex form.



$$y = -\frac{1}{4}(x - 4)^2 + 9$$

- d) Describe the domain and range and discuss what its significance in the context of this picture.
The domain would be $[0, 10]$ because that is the horizontal distance the rock travels. The range would be $[0, 9]$, indicating that the highest the rock traveled was 9 feet and it eventually hit the ground at 0 feet.
- e) Identify the vertex and discuss what its significance in the context of this picture.
The vertex is $(4, 9)$ meaning that at 4 feet horizontally it reached a max height of 9 feet.
- f) Describe the intervals of increasing and decreasing and discuss their significance in the context of this picture.
Intervals of increasing $(0, 4)$; intervals of decreasing: $(4, 10)$; This means that for the first 4 feet the rock was increasing in height, and for the last 6 feet it was decreasing in height.
- g) Do you think this is a realistic graph? Why or why not?

Answers will vary.

3. Use the Flight of Cindy's Rocket to the right to answer the following:

a) Identify the vertex and discuss what its significance in the context of this picture.

The vertex is (4.5, 21). At 4.5 seconds, Cindy's rocket reached a maximum height of 21 feet.

b) Describe the intervals of increasing and decreasing and discuss their significance in the context of this picture.

Intervals of increasing: (0, 4.5); intervals of decreasing: (4.5, 9); The rocket's height was increasing from 0 to 4.5 seconds and decreasing from 4.5 to 9 seconds.

