Unit 3 Test Study Guide
(Parent Functions & Transformations)

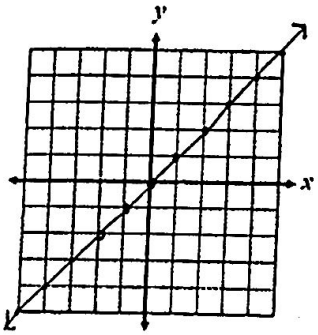
Name: Key

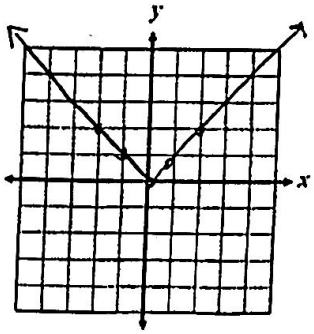
Date: _____ Block: _____

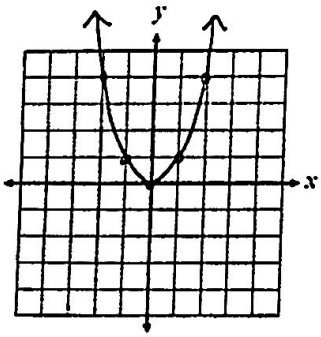
Topic 1: Introduction to Parent Functions - Linear, Absolute Value, and Quadratic

Identify each parent function, then graph:

Linear	Absolute Value	Quadratic
$f(x) = x$	$f(x) = \lvert x \rvert$	$f(x) = x^2$







Topic 2: Transformation on Functions

Describe each transformation rule:

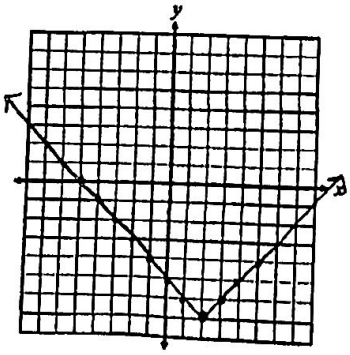
$f(x+h)$	left "h"	$f(x-h)$	right "h"
$f(x)+k$	up "k"	$f(x)-k$	down "k"
$a \cdot f(x)$ when $\lvert a \rvert > 1$	vertical stretch	$a \cdot f(x)$ when $\lvert a \rvert < 1$	vertical compression
$-f(x)$	reflection across x-axis		

Topic 3: Absolute Value Functions

Vertex Form of an Absolute Value Function: $f(x) = a\lvert x-h \rvert + k$

Give the vertex, then graph each function. State the domain and range.

1. $f(x) = \lvert x-2 \rvert - 7$

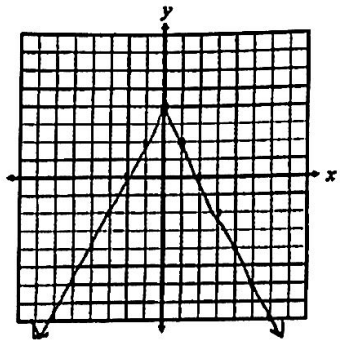


Vertex: (2, -7)

Domain: {ℝ}

Range: {y | y ≥ -7}

2. $f(x) = -2|x| + 4$



Vertex: (0,4)

Domain: {ℝ}

Range: {y | y ≤ 4}

The parent function of an absolute value equation is transfomed as described. Write the new equation in vertex form and identify the vertex.

3. Shifted five units left, then reflected about the x-axis.

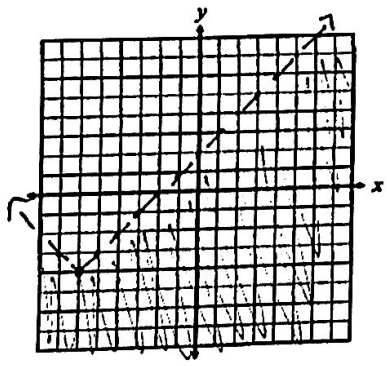
$f(x) = -|x+5|$

4. Shifted one unit up and two units right, then vertically compressed by a factor of one-third.

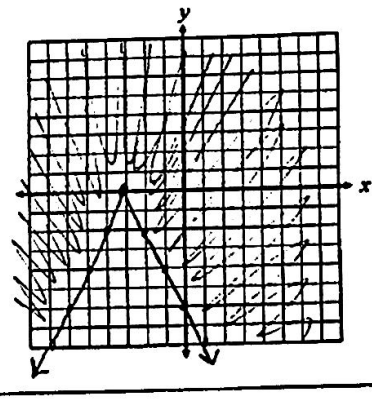
$f(x) = \frac{1}{3}|x-2| + 1$

Graph each inequality.

5. $f(x) < |x+6| - 4$



6. $f(x) \geq -2|x+3|$



Topic 4: Quadratic Functions

Standard Form of an Quadratic Function:

$f(x) = ax^2 + bx + c$

Vertex Form of an Quadratic Function:

$f(x) = a(x-h)^2 + k$

Give the vertex and axis of symmetry, then graph each function. State the domain and range.

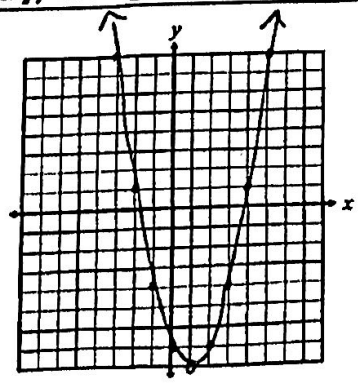
7. $f(x) = x^2 - 2x - 7$

$x = \frac{-(-2)}{2(1)}$ $\quad x = 1$

$y = (1)^2 - 2(1) - 7$

$y = 1 - 2 - 7$

$y = -8$



Axis of Symmetry: $x = 1$

Vertex: (1, -8)

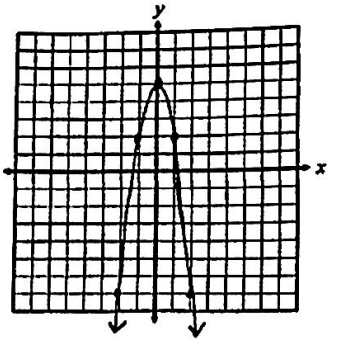
Domain: {ℝ}

Range: {y | y ≥ -8}

8. $f(x) = -3x^2 + 5$

$x = \frac{-(0)}{2(-3)}$ $x = 0$

$y = -3(0)^2 + 5$
$y = 5$



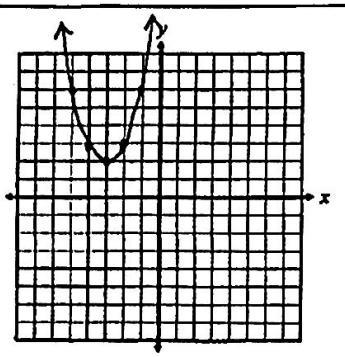
Axis of Symmetry: $x=0$

Vertex: $(0,5)$

Domain: $\{\mathbb{R}\}$

Range: $\{y \mid y \le 5\}$

9. $f(x) = (x+3)^2 + 2$



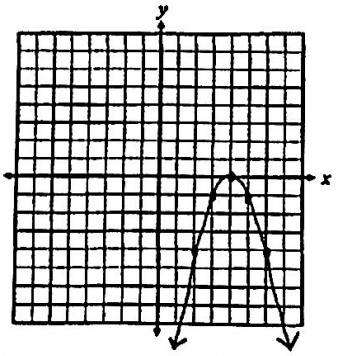
Axis of Symmetry: $x = -3$

Vertex: $(-3,2)$

Domain: $\{\mathbb{R}\}$

Range: $\{y \mid y \ge 2\}$

10. $f(x) = -(x-4)^2$



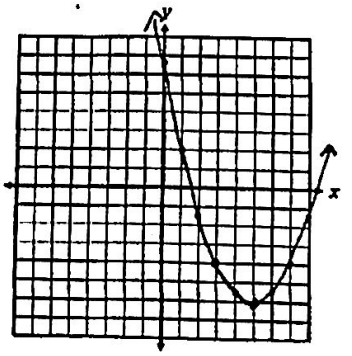
Axis of Symmetry: $x=4$

Vertex: $(4,0)$

Domain: $\{\mathbb{R}\}$

Range: $\{y \mid y \le 0\}$

11. $f(x) = \frac{1}{2}(x-5)^2 - 6$



Axis of Symmetry: $x=5$

Vertex: $(5,-6)$

Domain: $\{\mathbb{R}\}$

Range: $\{y \mid y \ge -6\}$

The parent function of a quadratic equation is transfomed as described. Write the new equation in vertex form and identify the vertex.

12. Shifted seven units right and vertically stretched by a factor of four.

$f(x) = 4(x-7)^2$

13. Shifted four units left, six units down, and reflected across the x-axis, and vertically compressed by a factor of one-half.

$f(x) = -\frac{1}{2}(x+4) - 6$

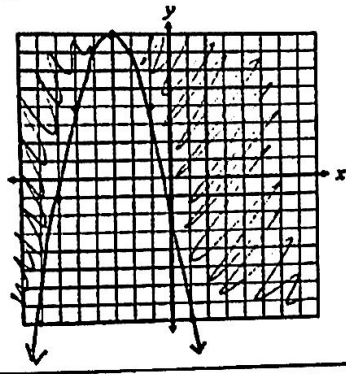
Graph each inequality.

14. $f(x) \geq -x^2 - 6x - 1$

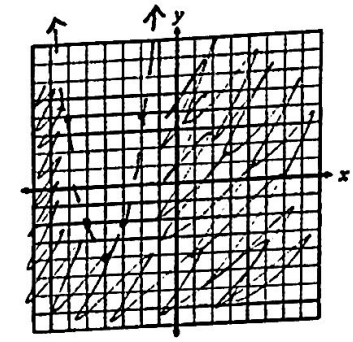
$x = \frac{-(-6)}{2(-1)}$ $x = -3$

$y = -(-3)^2 - 6(-3) - 1$

$y = -9 + 18 - 1$



15. $f(x) < 2(x+4) - 4$



Convert each equation to vertex form. Then state the vertex.

16. $f(x) = x^2 - 16x + 64$

$f(x) = (x^2 - 16x) + 64$

$\frac{-16}{2} = -8$ $(-8)^2 = 64$

$f(x) = (x^2 - 16x + 64) + 64 - 64$

$\boxed{f(x) = (x-8)^2}$ $\boxed{V: (8,0)}$

Omit

17. $f(x) = x^2 + 2x - 8$

$f(x) = (x^2 + 2x) - 8$

$\frac{2}{2} = 1$ $(1)^2 = 1$

$f(x) = (x^2 + 2x + 1) - 8 - 1$

$\boxed{f(x) = (x+1)^2 - 9}$ $\boxed{V: (-1,-9)}$

18. $f(x) = -x^2 + 10x - 23$

$f(x) = -(x^2 - 10x) - 23$

$\frac{-10}{2} = -5$ $(-5)^2 = 25$

$f(x) = -(x^2 - 10x + 25) - 23 + 25$

$\boxed{f(x) = -(x-5)^2 + 2}$ $\boxed{V: (5,2)}$

19. $f(x) = -2x^2 + 12x - 19$

$f(x) = -2(x^2 - 6x) - 19$

$\frac{-6}{2} = -3$ $(-3)^2 = 9$

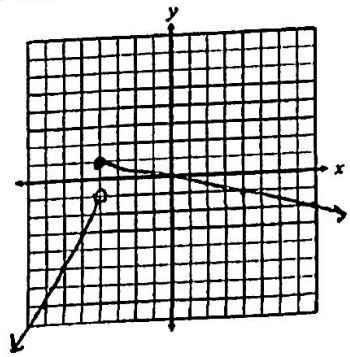
$f(x) = -2(x^2 - 6x + 9) - 19 + 18$

$\boxed{f(x) = -2(x-3)^2 - 1}$ $\boxed{V: (3,-1)}$

Topic 5: Piecewise Functions

Graph each function. State the domain and range.

20. $f(x) = \begin{cases} 2x+7 & \text{if } x < -4 \\ -\frac{1}{4}x & \text{if } x \geq -4 \end{cases}$



Domain: $\{\mathbb{R}\}$

Range: $\{y \mid y \leq 1\}$