Essential Question: How can we write the equation of a transformed function?

Do Now:

A. Which equation will shift the graph of $y = x^2$ left 5 units and up 6 units?

$y = (x+5)^2 + 6$

a. $y = (x + 6)^2 - 5$
b. $y = (x + 5)^2 - 6$
c. $y = (x + 5)^2 + 6$
d. $y = (x - 5)^2 + 6$

B. The equation $y = (x + 3)^2 - 2$ moves the vertex of the parent function $y = x^2$ to:

moves left 3 units ↓ → move down 2 units.

(0, 0) → (-3, -2)

a. (3, 2)
b. (-3, -2)
c. (-2, 3)
d. (2, -3)

Transformation Rules for Functions

	Equation	How to obtain the graph
TRANSLATION	$y = f(x) + c$	Shift graph $y = f(x)$ up c units
	$y = f(x) - c$	Shift graph $y = f(x)$ down c units
	$y = f(x - c)$	Shift graph $y = f(x)$ right c units
	$y = f(x + c)$	Shift graph $y = f(x)$ left c units
REFLECTION	$y = -f(x)$ multiply by -1.	reflect graph $y = f(x)$ over x-axis "flip"
DILATION	$y = af(x)$ $(a > 1)$	Stretch graph $y = f(x)$ vertically by factor of a graph becomes more narrow
	$y = af(x)$ $(0 < a < 1)$ ↑ fraction	compress graph $y = f(x)$ vertically by factor of a graphs becomes wider.

Give the name of the parent function and describe the transformation represented.

1. $g(x) = x^2 - 1$

Name: quadratic function (x^2)

Transformation: Vertical shift 1 unit down

2. $f(x) = 2|x-1|$

Name: Absolute value function $y = |x|$

Transformation: horizontal shift 1 unit right
vertical stretch of factor of 2.

3. $h(x) = \sqrt{x-2}$

Name: square root function

Transformation: horizontal shift 2 units to the right.

4. $f(x) = |x+5| - 2$

Name: absolute value function.

Transformation: horizontal shift 5 units left
vertical shift 2 units down.

Given the parent function and a description of the transformation, write the equation of the transformed function, f(x).

5. Absolute value—vertical shift up 5, horizontal shift right 3. $f(x) = |x-3| + 5$

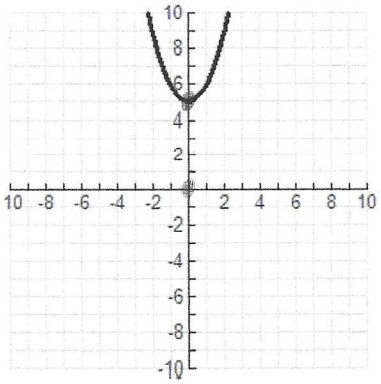
6. Square root — horizontal shift right 2, vertical shift down 1. $f(x) = \sqrt{x-2} - 1$

7. Cubic—reflected over the x axis and vertical shift down 2. $f(x) = -x^3 - 2$

8. Quadratic—vertical compression by 0.45, horizontal shift left 8. $f(x) = 0.45(x+8)^2$

Write the equation of the transformed function.

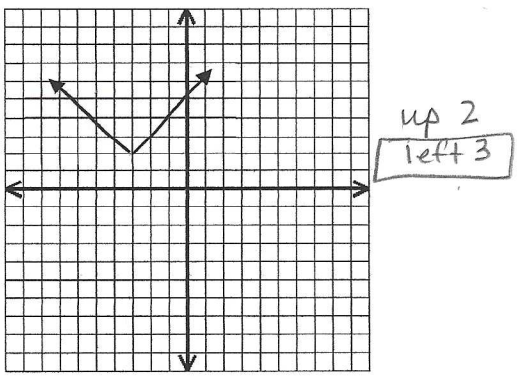
9.



Parent: $y = x^2$ (0,0) vertex moved up 5 units

$y = x^2 + 5$

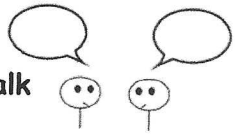
10.



Parent: $y = |x|$ (0,0) vertex

$y = |x+3| + 2$

Turn and Talk



1. If a quadratic function, $f(x)$, has a turning point at $(4,-5)$, and $g(x)=f(x-3)+2$, then where does $g(x)$ have a turning point?

move 2 units up.

+3 +2

move 3 units right

$(7,-3)$

(1) $(1,-3)$ (3) $(1,-7)$

(2) $(7,-3)$ (4) $(7,-7)$

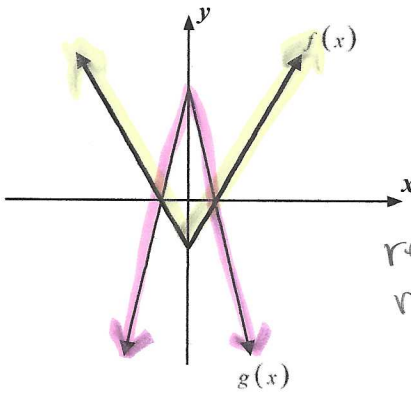
2. The graph of the function $f(x)$ is shown below in bold. Which of the following would give a possible formula for the function $g(x)$?

(1) $g(x)=3f(x)$

(2) $g(x)=\frac{1}{2}f(x)$

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

(4) $g(x)=-2f(x)$



reflected over x-axis (-1)
more narrow ($x>1$)

3. Given that $f(x)=x^3+1$, find $g(x)$ if $g(x)=2[f(x)]+5$.

$g(x)=2(x^3+1)+5$

$g(x)=2x^3+2+5$

$g(x)=2x^3+7$