8.3 notes.

Transformations of Quadratic functions.

$y = x^2 + 1$ $\qquad a = 1 \quad b = 0 \quad c = 1$

$$x = \frac{-b}{2a} \quad \frac{-(0)}{2(1)} = \frac{0}{2} = 0 \quad x = 0$$

vertex $y = x^2 + 1$

$y = (0)^2 + 1$

$y = 0 + 1$

$y = 1$

vertex $(0, 1)$

x	$x^2 + 1$		y
-2	$(-2)^2 + 1$	$4 + 1$	5
-1	$(-1)^2 + 1$	$1 + 1$	2
0	$(0)^2 + 1$	$0 + 1$	1
1	$(1)^2 + 1$	$1 + 1$	2
2	$(2)^2 + 1$	$4 + 1$	5

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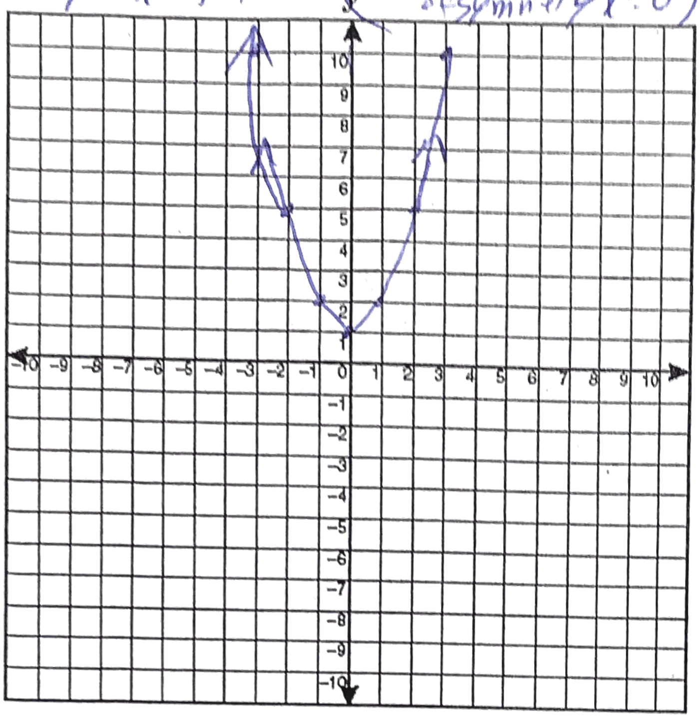
1) $y = x^2 + 1$

vertex $(0,1)$

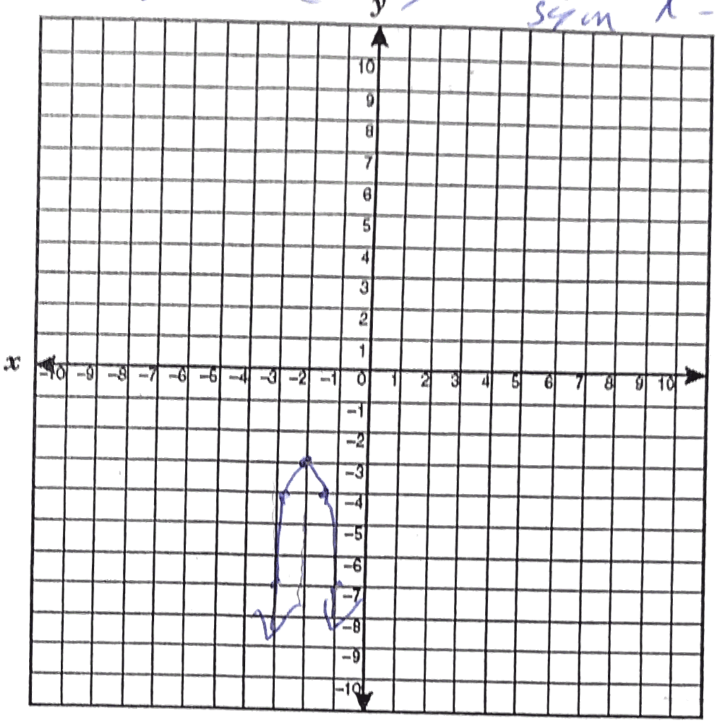
axis of symmetry $x = 0$



2) $y = -4(x+2)^2 - 3$

vertex $(-2, -3)$

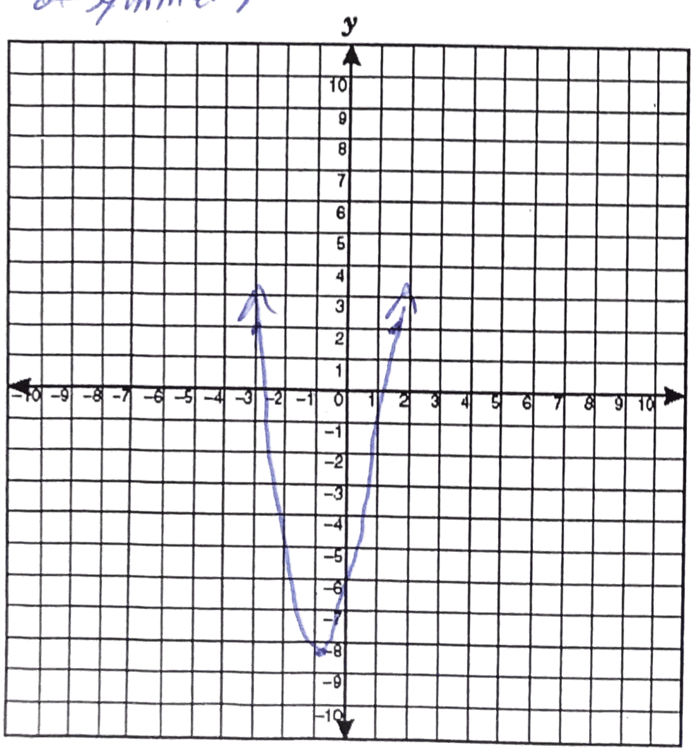
axis of sym $x = -2$



3) $y = 2x^2 + 3x - 7$

vertex $(-0.75, -8.13)$

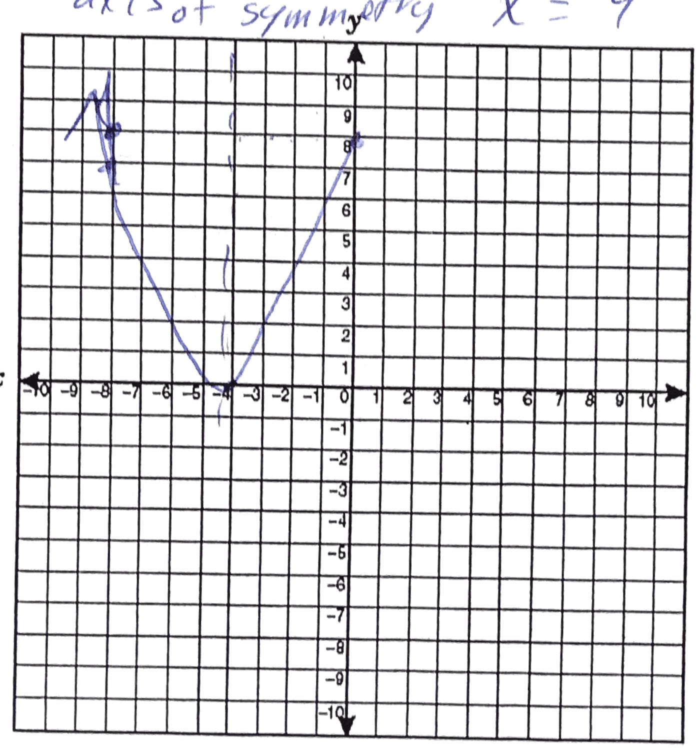
axis of symmetry $x = -0.75$



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

vertex $(-4, 0)$

axis of symmetry $x = -4$



5) $y = 2(x-1)^2 + 4$

6) $y = x^2 - 2x + 1$ axis of symmetry $x = 1$

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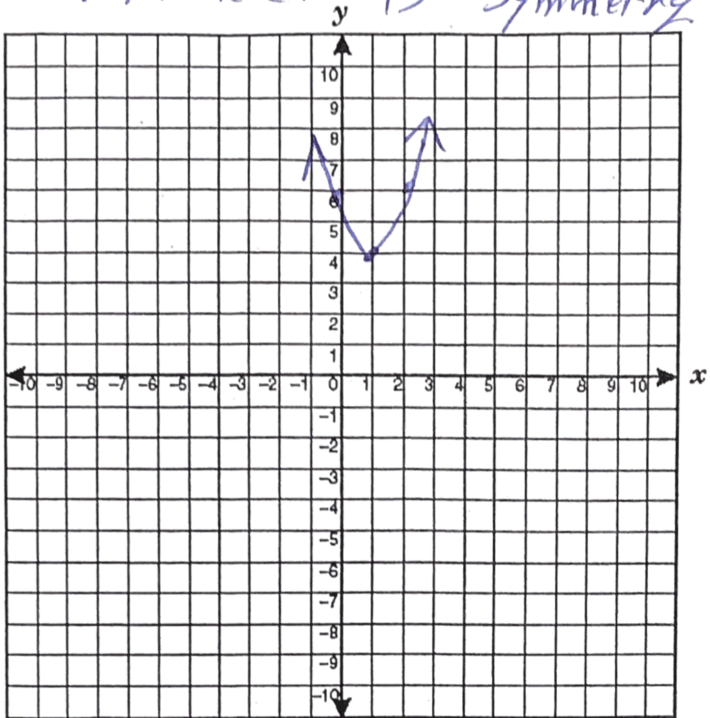
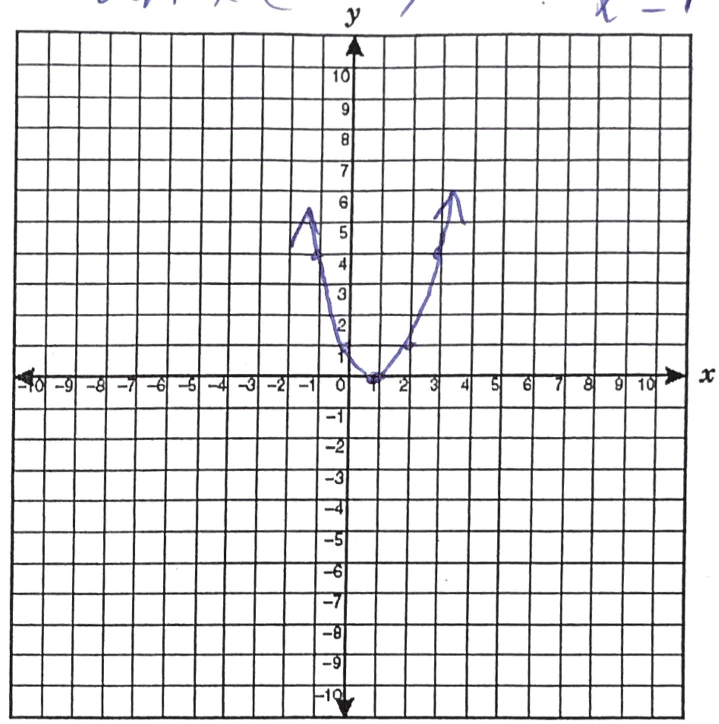
axis $x = 1$ symmetry

vertex $(1, 4)$

vertex $(1, 0)$





7) $f(x) = x^2$ parent function.

vertex $(0,0)$ $x = 0$

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

both have the same vertex and axis

vertical compression.

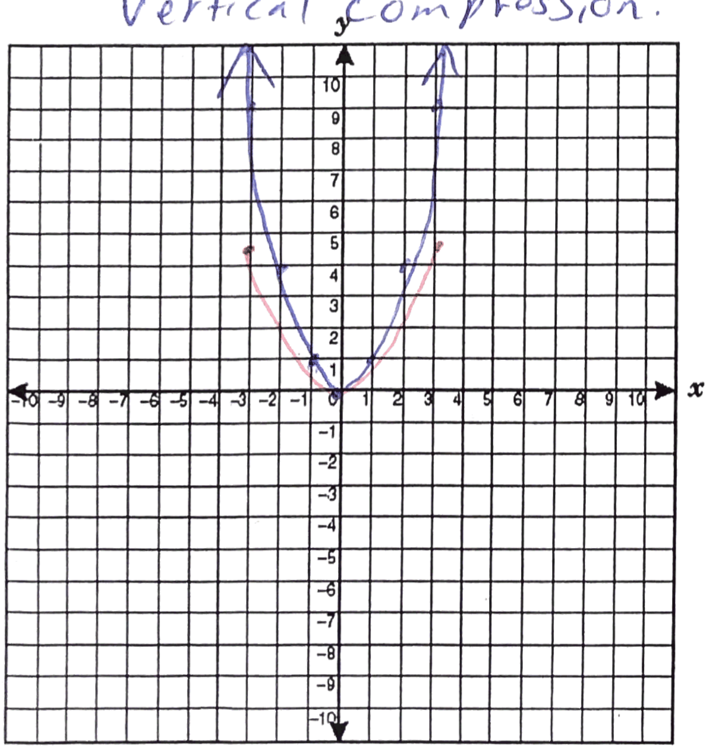
8) $f(x) = x^2$

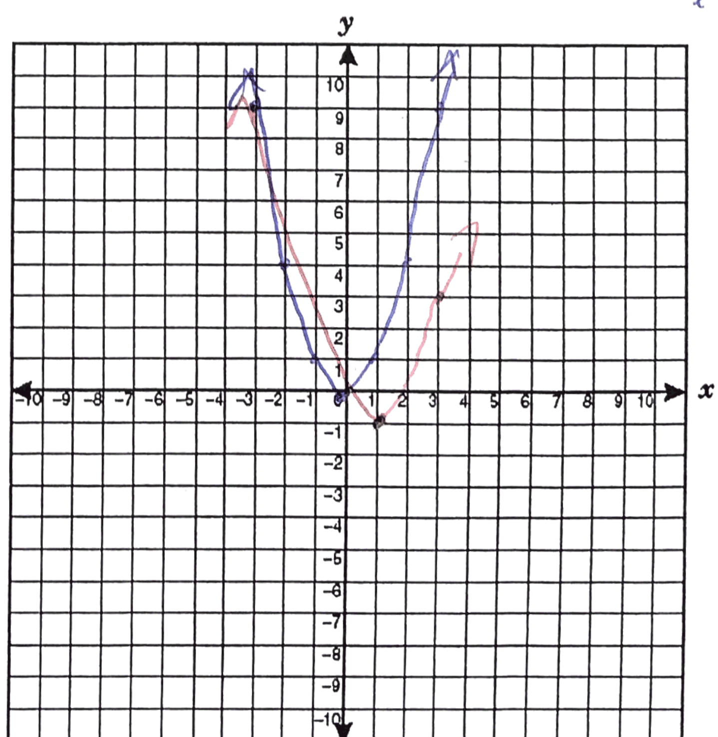
vertex $(0,0)$

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

vertex $(1,-1)$

$x = 1$





translation of 1 unit to the right and 1 unit down.

9) $f(x) = (x+1)^2$ vertex $(-1, 0)$ axis of symmetry $x = -1$

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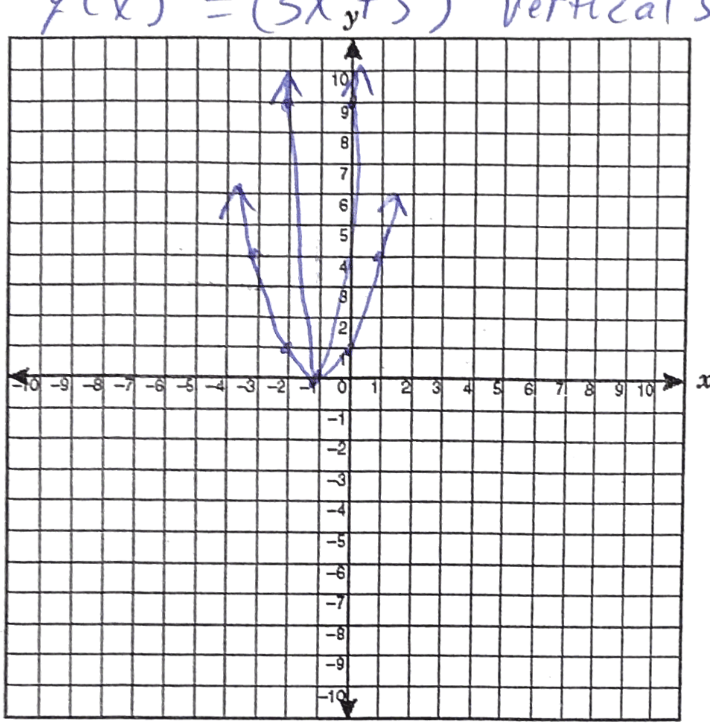
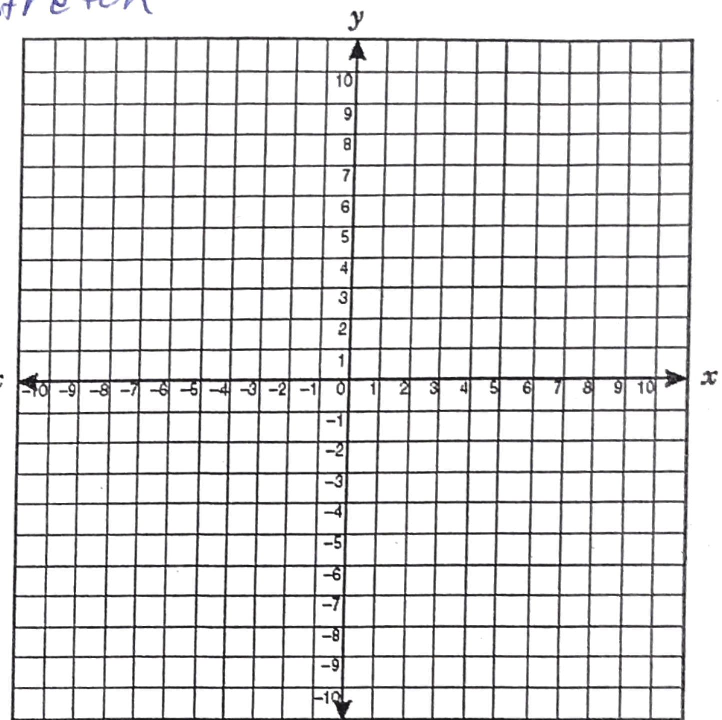
$g(x) = (3x+3)^2$ vertical stretch





10) $f(x) = (2x)^2+1$ vertex $(0, 1)$, $x = 0$ axis of symmetry

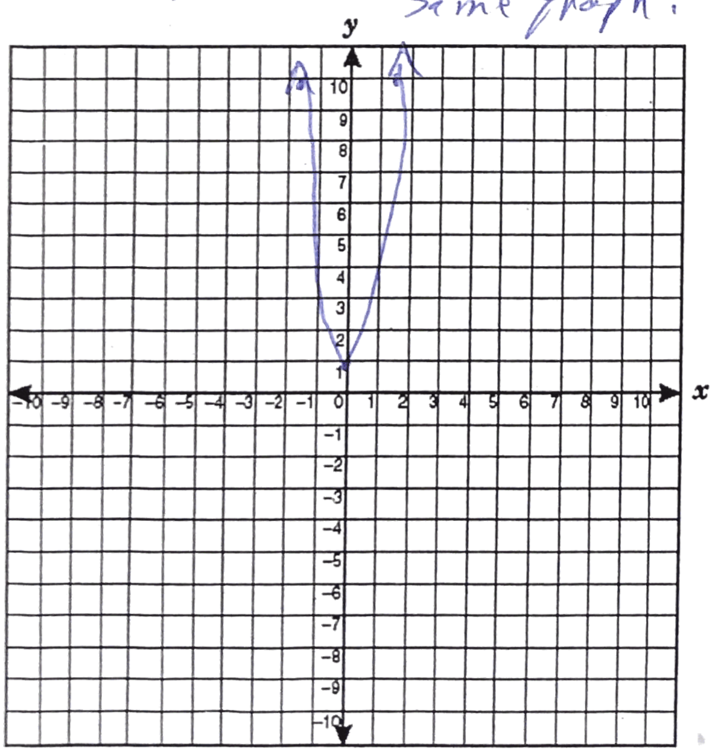
$g(x) = (-2x)^2+1$

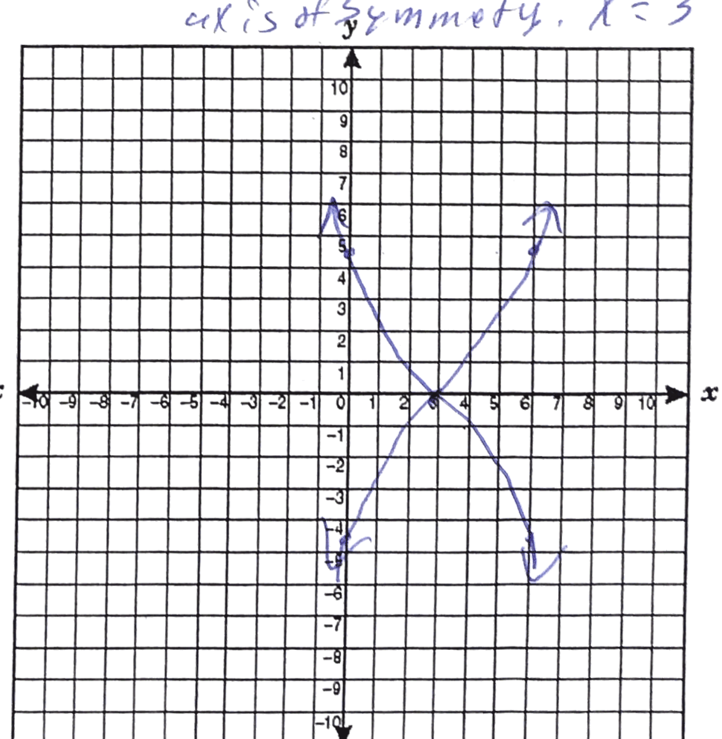
both have the same graph.

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

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

vertex $(3, 0)$ axis of symmetry. $x = 3$





reflection on the x axis.

Determine the effects on the graph of the parent function $f(x) = x^2$ when $f(x)$ is replaced.

12) $f(x)$ is replaced by $f(x) + d$ where $d = -2$

$f(x)$ is translated down by 2 units.

$f(x) = x^2$

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

13) $f(x)$ is replaced by $f(x-c)$ where $c = 4$

$f(x)$ is translated to the right 4 units.

14) $f(x) =$ is replaced by $a f(x)$ wher $a = 0.6$

vertical compression.

15) $f(x)$ is replaced by $f(bx)$ where $b = 2$

Horizontal compression

16) $g(x) = f(x) + d$ where $d = 6$

$f(x) = x^2$

$g(x) = f(x) + d$ translated

$g(x) = x^2 + 6$ 6 units up.

17) $g(x) = f(x-c)$ where $c = -4$

$f(x) = x^2$

$g(x) = f(x-c)$

$g(x) = f(x+4)^2$ translation 4 units to the left.

18.) $g(x) = af(x)$, where $a = -2$

$f(x) = 1x^2$

$g(x) = af(x)$

$g(x) = -2x^2$ vertical stretch by a factor of 2 reflection.

19) $g(x) = f(bx)$, where $b = 0.8$

$f(x) = x^2$

$g(x) = f(bx)$

$g(x) = (0.8x)^2$ Horizontal stretch.

20) $f(x)$ is replaced by $af(x)$ where $a = 0.01$

$f(x) = x^2$

$g(x) = af(x)$

$g(x) = 0.01x^2$

vertical compression.

21) f(x) is replaced by af(x), where a = -4

$f(x) = x^2$
$g(x) = af(x)$ vertical stretch by 4 units.
$g(x) = -4x^2$

22) f(x) is replaced by f(bx), where b = -0.75

$f(x) = x^2$
$g(x) = f(bx)$
$g(x) = (-0.75x)^2$
Horizontal stretch by a factor of -0.75.

24) f(x) is replaced by f(bx), where b = 5

$f(x) = x^2$
$g(x) = f(bx)$ Horizontal compression.
$g(x) = (5x)^2$

25) $f(x) = -\frac{1}{3}x^2$ $g(x) = \frac{1}{3}x^2 + 4$
reflection translated 4 units up.

26) $f(x) = x^2$ $g(x) = (x-2)^2 - 8$
move to the right
move down

It was translated 2 units to the right and 8 units down.

Transformation Rules

Function Notation	Type of Transformation	Movement of Graph	Change to Coordinate Point
f(x)+k	Vertical translation up k units	Shifts up k units	Add k to y (x,y+k)
f(x)-k	Vertical translation down k units	Shifts down k units	Subtract k from y (x,y-k)
f(x+h)	Horizontal translation left h units	Slides graph left h units	Subtract h from x (x-h,y)
f(x-h)	Horizontal translation right h units	Slides graph right h units	Add h to x (x+h,y)
-f(x)	Vertical reflection over x-axis	Flips graph over x-axis	Take the opposite value of y (x,-y)
f(-x)	Horizontal reflection over y-axis	Flips graph over y-axis	Take the opposite value of x (-x,y)
af(x)	Vertical **stretch** for $\|a\| > 0$	Pulls y values away from x-axis	Multiply y by a (x,ay)
af(x)	Vertical **compression** for $0 < \|a\| < 1$	Pushes y values toward x-axis	Multiply y by a (x,ay)
f(bx)	Horizontal **compression** for $\|b\| > 0$	Pulls x-values away from y-axis	Divide x by b $(\frac{x}{b}, y)$
f(bx)	Horizontal **stretch** for $0 < \|b\| < 1$	Pushes x values towards x-axis	Divide x by b $(\frac{x}{b}, y)$