Using Transformations to Graph Quadratic Functions

The Quadratic Parent Function $f(x) = x^2$

Domain:

All Real Numbers

$\mathbb{R}$

Range:

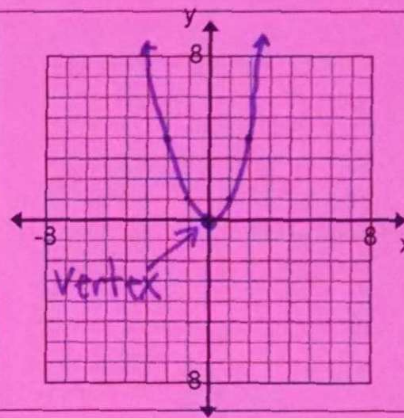
all values of y greater than or equal to 0

$\boxed{y \geq 0}$

Vertex:

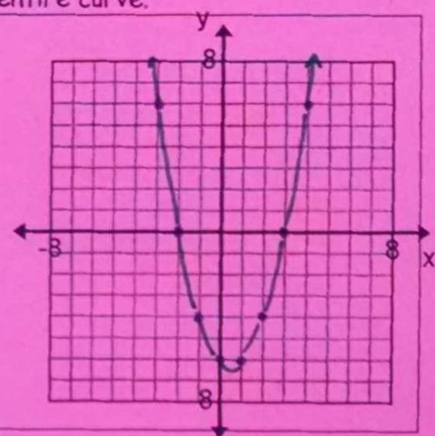
$(0, 0)$

x	$y = x^2$
–4	16
–2	4
0	0
2	4
4	16



Graph $f(x) = x^2 - x - 6$ by using a table. Plot enough points to see the entire curve.

x	$f(x) = x^2 - x - 6$	$(x, f(x))$
1	$(1)^2 - 1 - 6$	$(1, -6)$
2	$(2)^2 - 2 - 6$	$(2, -4)$
3	$(3)^2 - 3 - 6$	$(3, 0)$
4	$(4)^2 - 4 - 6$	$(4, 6)$
5	$(5)^2 - 5 - 6$	$(5, 14)$
6	$(6)^2 - 6 - 6$	$(6, 24)$



Identify how a quadratic function is transformed by changing a, h, and k

Vertical Stretch/Compression

$a > 1$ (Stretch) → narrower

$0 < a < 1$ (Compression) → wider

Horizontal Translation

$(x-h)^2$ → RIGHT

$(x+h)^2$ → LEFT

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

Opens Up/Down

$a > 0$ → opens up (has minimum)

$a < 0$ → opens down (has maximum)

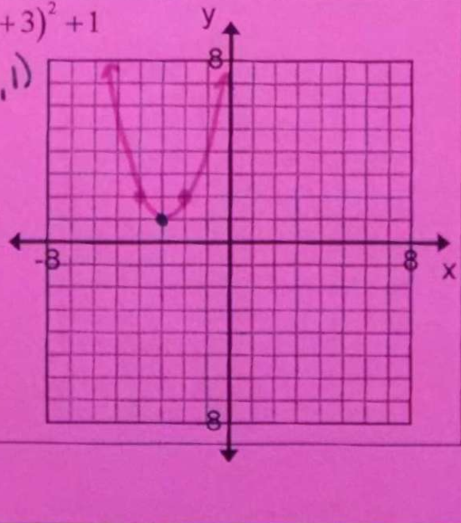
Vertical Translation $x^2 + h$ → up

$x^2 - h$ → Down

Without using a calculator, graph the transformation (use at least 3 points)

a. $g(x) = (x+3)^2 + 1$

Vertex: $(-3, 1)$



Domain:

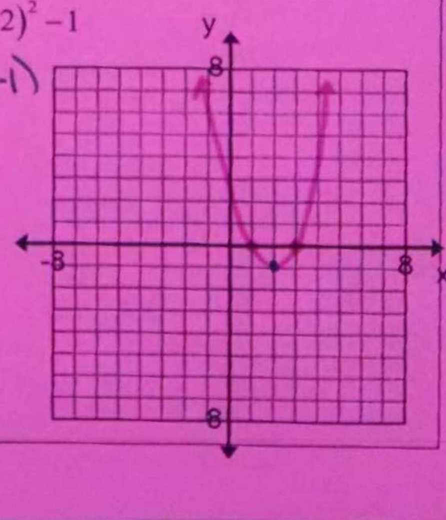
$\mathbb{R}$

Range:

$y \geq 1$

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

Vertex: $(2, -1)$



Domain:

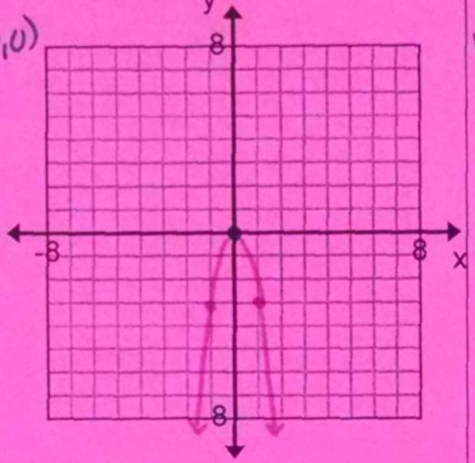
$\mathbb{R}$

Range:

$y \geq -1$

c. $g(x)=-3x^2$

Vertex: (0,0)



Domain:

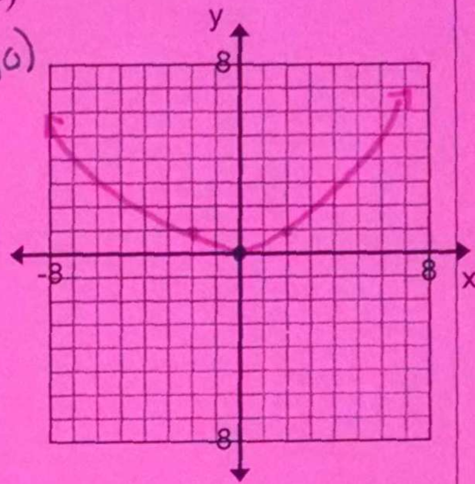
ℝ

Range:

$y \geq 0$

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

Vertex: (0,0)



Domain:

Range:

This lowest or highest point is the __Vertex__ of a parabola. (where it changes direction)

If a parabola opens upward, it has a __minimum__ point. (max or min?)

If a parabola opens downward, it has a __Maximum__ point. (max or min?)

The parent function $f(x)=x^2$ has its vertex at the __origin (0,0)__.

Because the vertex is translated h horizontal units and k vertical units from the __origin__, the vertex of the parabola is at __(h,k)__.

Use the description to write the quadratic function in vertex form. Check w/ calculator. ☺

a. The parent function $f(x)=x^2$ is reflected across the x-axis, vertically stretched by a factor of 6, and translated 3 units right to create g. $g(x)=-6(x-3)^2$	b. The parent function $f(x)=x^2$ is vertically compressed by a factor of $\frac{1}{3}$ and translated 2 units right and 4 units down to create g. $g(x)=\frac{1}{3}(x-2)^2-4$	c. The parent function $f(x)=x^2$ is reflected across the x-axis and translated 5 units left and 1 unit up to create g. $g(x)=-(x+5)^2+1$

GLUE