

Graphing Quadratics in Vertex Form

Learning Goals

- Graph a quadratic relation in the form $y = a(x - h)^2 + k$ by using transformations.

Big Ideas

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

- Order of Applying Transformations

1. Dilatations

- Vertical stretch if $|a| > 1$ or compression if $0 < |a| < 1$.

2. Reflections

- Vertical reflection if $a < 0$.

3. Translation

- Vertical shift up if $k > 0$ or shift down if $k < 0$.

- Horizontal shift right if $h > 0$ or shift left if $h < 0$.

$$y = a(x-h)^2 + k$$
$$y = a(x+3)^2 + k$$
$$y = a(x-3)^2 + k$$
$$(x-(+3))^2$$
$$h = 3$$

right 3

$$(x-(-3))^2$$
$$h = -3$$

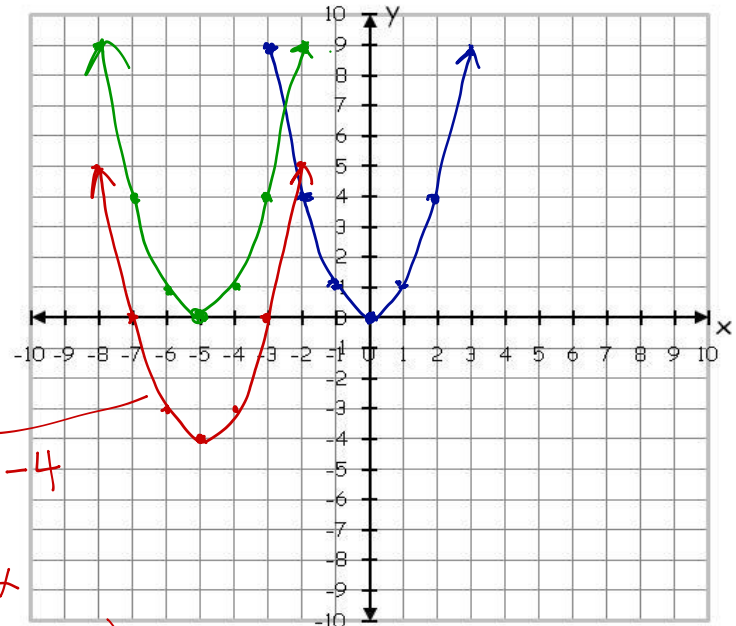
left 3

Example

- Sketch the graph of each quadratic relation using transformations.

- $y = (x + 5)^2 - 4$
- $y = -0.25x^2 + 8$
- $y = 2(x - 3)^2$
- $y = \frac{1}{2}(x - 4)^2 - 2$

start with $y = x^2$



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

Example

- Sketch the graph of each quadratic relation using transformations.

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

- $y = -0.25x^2 + 8$

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

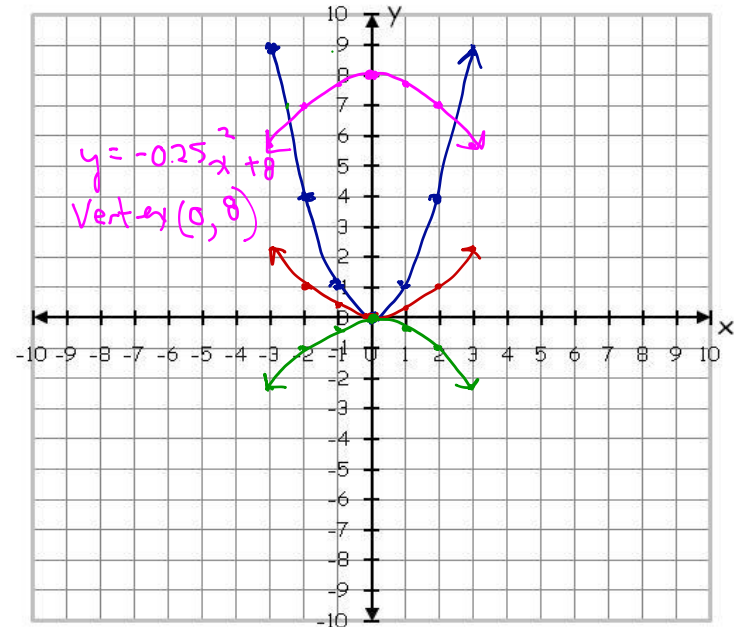
- $y = \frac{1}{2}(x - 4)^2 - 2$

Start with $y = x^2$

① multiply the y coordinate by 0.25

② Reflect in the axis

③ Translate 8 units up.



Example

- Sketch the graph of each quadratic relation using transformations.

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

- $y = -0.25x^2 + 8$

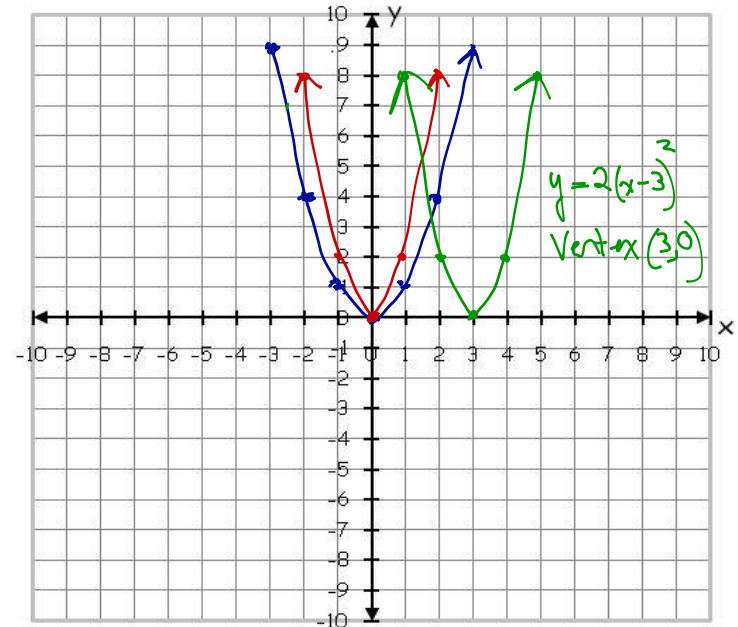
- $y = 2(x - 3)^2$

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

① Vertical stretch factor of 2
(multiply y coordinates by 2)

② Translate 3 units right.

Start with $y = x^2$



Example

- Sketch the graph of each quadratic relation using transformations.

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

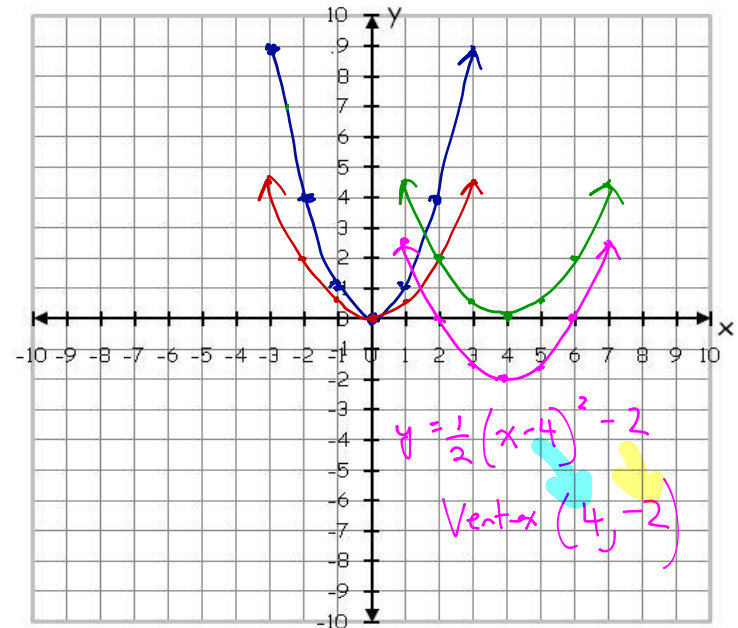
- $y = -0.25x^2 + 8$

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

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

- Vertical compression factor of $\frac{1}{2}$
(multiply y coordinates by $\frac{1}{2}$)
- Translate 4 units right
- Translate 2 units down

Start with $y = x^2$



Consolidation

- Let's summarize!

| Quadratic Relation | Stretch / Compression Factor | Reflection in the x-axis | Horizontal/ Vertical Translation | Vertex | Axis of Symmetry |
|--------------------|------------------------------|--------------------------|----------------------------------|----------|------------------|
| $y = 3(x-2)^2 - 5$ | 3 | No | Right 2 & Down 5 | (2, -5) | $x = 2$ |
| $y = 4(x+2)^2 - 3$ | 4 | No | Left 2, Down 3 | (-2, -3) | $x = -2$ |
| $y = -(x-1)^2 + 4$ | 1 | Yes | Right 1, Up 4 | (1, 4) | $x = 1$ |
| $y = 2x^2 - 5$ | 2 | No | Down 5 | (0, -5) | $x = 0$ |

Reinforcement

- Pages 270 – 272
 - #6, 7, 9, 14, 15