Objective: Graph Quadratic Functions From Standard Form Using Transformations

Concept

The Quadratic Function

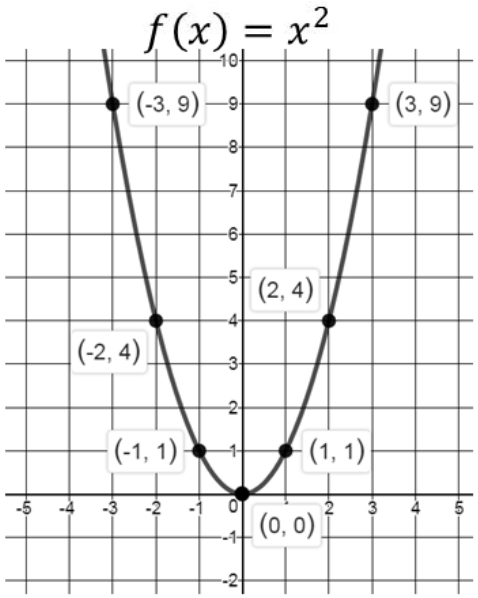
standard form

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

$$\text{vertex} = (h,k) = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$$

To graph a quadratic function (parabola) using transformations, you must know the graph of the parent function $f(x) = x^2$.

The point $(0,0)$ is only affected by translations. All other points are affected by all types of transformations.



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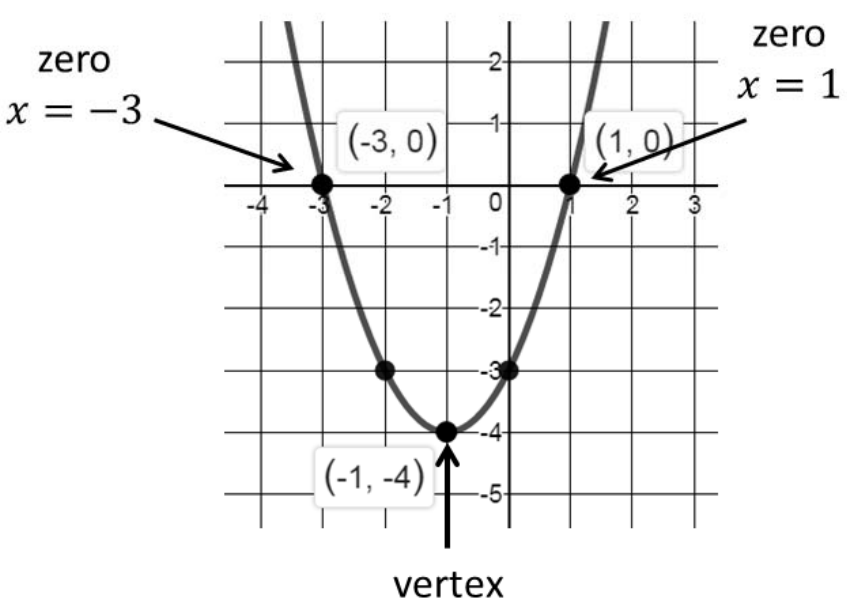
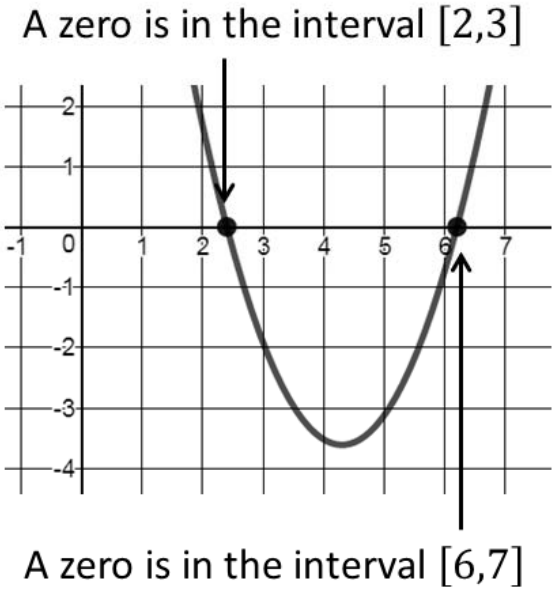
Concept

Zeros of a function are values of the independent variable, x, that make the value of the function (corresponding y value) equal to 0. **Zeros are found where the function intersects the x-axis.**





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Concept

One Procedure for Graphing a Parabola from Standard Form Using Transformations

1. Calculate the coordinates of the vertex. Graph the vertex.
2. Draw a dashed horizontal line through the vertex.
3. Perform any reflection, stretch, and/or compression on the other key points in the parent function using the line in step 2 as the reference line.
4. Draw in a smooth curve.

Objective: Graph Quadratic Functions From Standard Form Using Transformations

Ex) A) Graph each quadratic function using transformations. B) State the vertex and whether it's a maximum or minimum. C) State the zeros or the interval in which a zero is located.

$f(x) = 1x^2 - 6x + 5$

$a = 1 \quad b = -6$

no refl.
no stretch/comp

① find the vertex

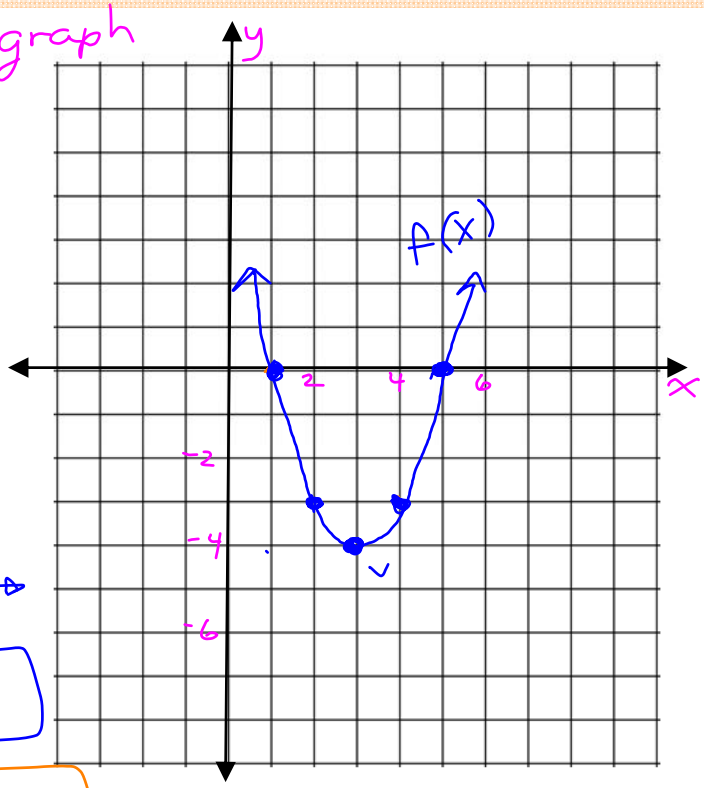
$h = \frac{-1b}{2a} = \frac{-1(-6)}{2(1)} = \frac{6}{2} = 3$

$k = f(3) = (3)^2 - 6(3) + 5$

$= 9 - 18 + 5$

$= -9 + 5 = -4$

② graph



(B) Vertex $(3, -4)$; minimum
(h, k)

(C) Zeros: $x = 1$ and $x = 5$

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Ex) A) Graph each quadratic function using transformations. B) State the vertex and whether it's a maximum or minimum. C) State the zeros or the interval in which a zero is located.

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

$a = -2$ $\quad b = 8$

x-axis refl. stretch

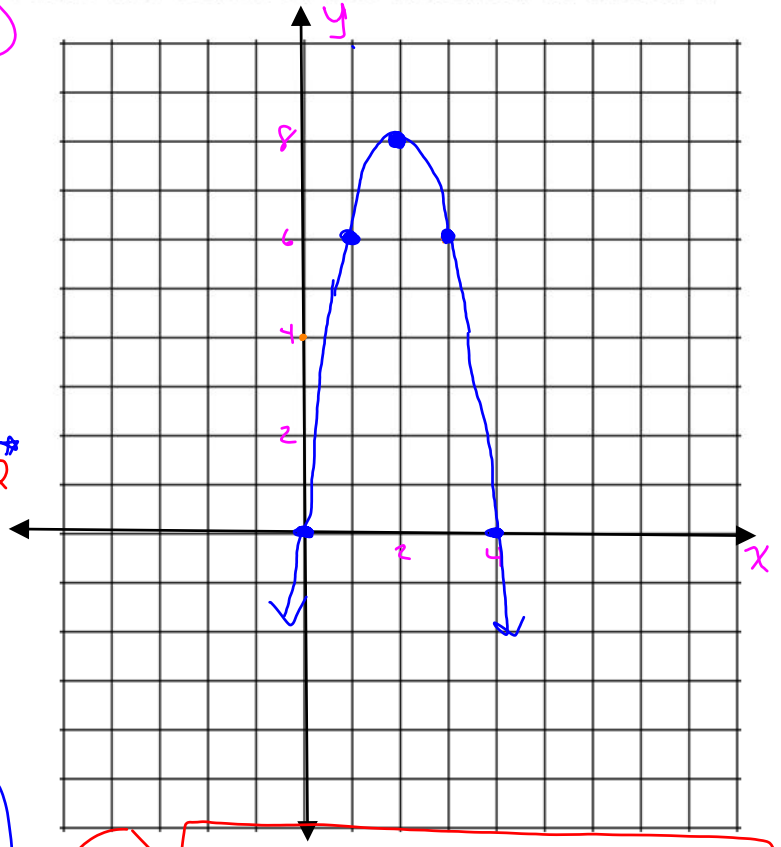
① find the vertex

$$h = \frac{-1b}{2a} = \frac{-1(8)}{2(-2)} = \frac{-8}{-4} = 2$$

$$k = c(2) = -2(2)^2 + 8(2)$$

$-2 \cdot 4$

$$= -8 + 16 = 8$$

② 

(B) vertex (2, 8); maximum (h, k)

(C) zeros: x = 0 and x = 4

Objective: Graph Quadratic Functions From Standard Form Using Transformations

Practice) A) Graph each quadratic function using transformations. B) State the vertex and whether it's a maximum or minimum. C) State the zeros or the interval in which a zero is located.

$$b(x) = -x^2 + 6x - 8$$

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

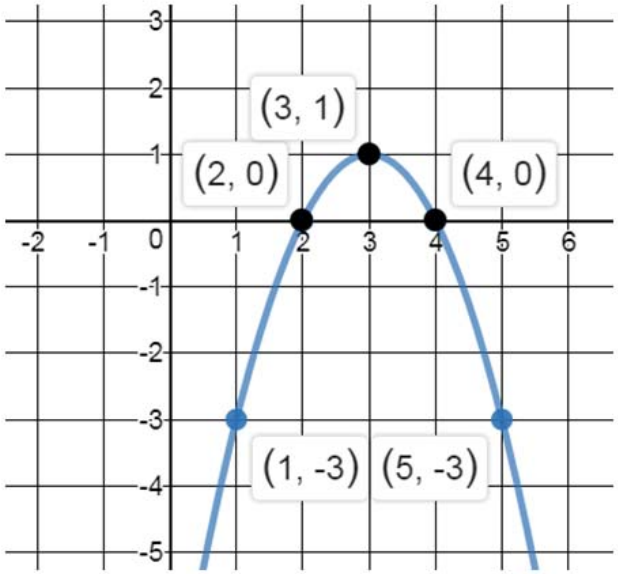
$$y = -1(3)^2 + 6(3) - 8$$

$$= -9 + 18 - 8$$

$$y = 1$$

B) vertex $(3,1)$, maximum

C) zeros $x = 2$ and $x = 4$.



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Ex) A) Graph each quadratic function using transformations. B) State the vertex and whether it's a maximum or minimum. C) State the zeros or the interval in which a zero is located.

$$p(x)=\frac{1}{2}x^2+4x+5$$

$a=\frac{1}{2}$ $b=4$

comp.

① find the vertex

$$h=\frac{-b}{2a}=\frac{-1(4)}{2\left(\frac{1}{2}\right)}=\frac{-4}{1}=-4$$

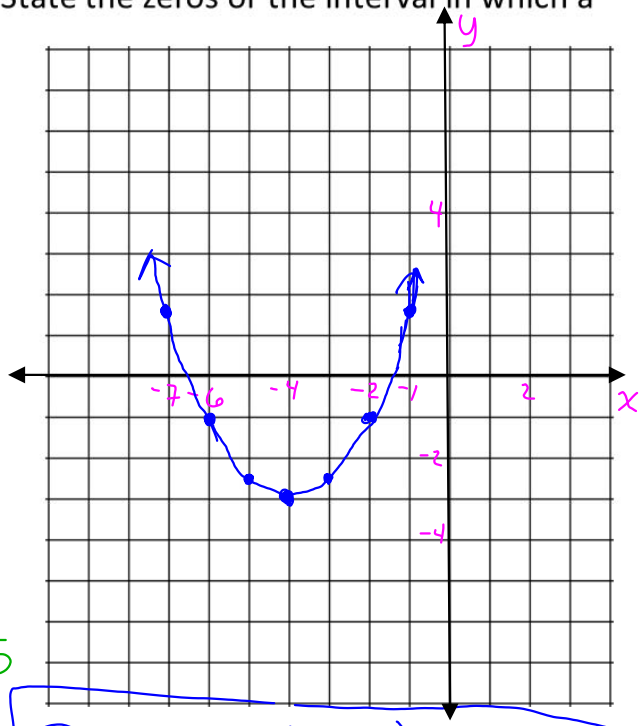
$\frac{2}{2}=1$

$$k=p(-4)=\frac{1}{2}(-4)^2+4(-4)+5$$

$\frac{1}{2}\cdot 16$

$$=8+-16+5$$

$$=-8+5=-3$$



(B) vertex $(-4,-3)$ minimum

(h,k)

(C) zeros are in $[-7,-6]$ and $[-2,-1]$

Objective: Graph Quadratic Functions From Standard Form Using Transformations

Practice) A) Graph each quadratic function using transformations. B) State the vertex and whether it's a maximum or minimum. C) State the zeros or the interval in which a zero is located.

$$n(x) = 2x^2 - 8x + 7$$

1. $x = \frac{-1b}{2a} = \frac{-1(-8)}{2(2)} = \frac{8}{4} = 2$

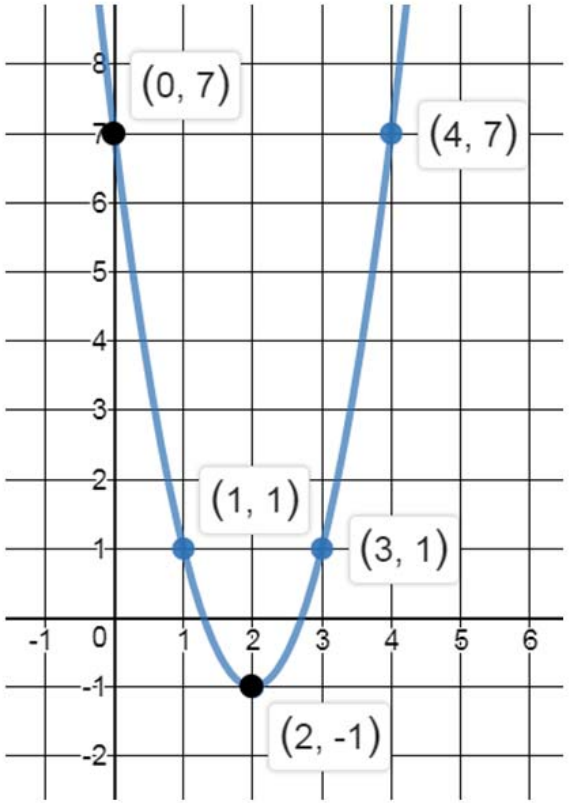
$y = 2(2)^2 - 8(2) + 7$

$= 8 - 16 + 7$

$y = -1$

B) vertex $(2, -1)$, minimum

C) The zeros are in the intervals $[1, 2]$ *and* $[2, 3]$.



Objective: Graph Quadratic Functions From Standard Form Using Transformations

Practice) A) Graph each quadratic function using transformations. B) State the vertex and whether it's a maximum or minimum. C) State the zeros or the interval in which a zero is located.

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

1. $x=\frac{-1b}{2a}=\frac{-1(-2)}{2\left(\frac{1}{2}\right)}=2$

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

$$=2-4-1$$

$$y=-3$$

B) vertex $(2,-3)$, minimum

C) The zeros are in the intervals $[-1,0]$ *and* $[4,5]$.