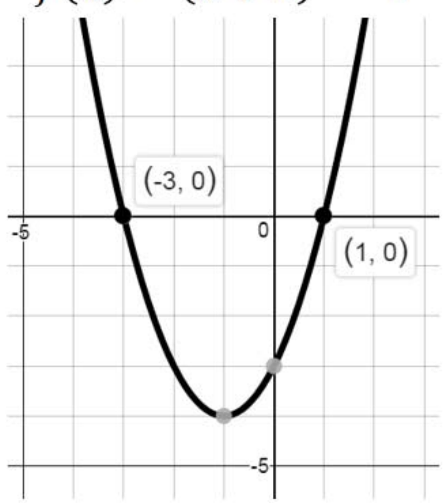
Objective: Use vertex form to find the zeros of a quadratic function.

Concept

How to Find the Zeros of a Function from Vertex Form Without Graphing

1. Set the function equal to 0 (i.e. let $f(x) = 0$). This is because the definition of a zero is a value of x that has a corresponding function value of 0.
2. Solve for x. These values will be the zeros of the function. This will use your algebra skills, including the square root property.
3. State the zeros of the function.

$f(x) = (x+1)^2 - 4$



Recall that zeros are values of x that create a function value (y value) of 0.

vertex form → $f(x) = (x+1)^2 - 4$

↓

$0 = (x+1)^2 - 4$

$4 = (x+1)^2$

Square root property $\pm\sqrt{4} = \sqrt{(x+1)^2}$

$-2\ ,\ 2 = x+1$

$-1\quad -1\quad -1$

zeros: $-3\ ,\ 1 = x$

Objective: Use vertex form to find the zeros of a quadratic function.

Ex) Find the zeros of the quadratic function without graphing. State whether the zeros are rational, irrational, or imaginary.

$$k(x) = -2x^2 + 64$$

★ concept:

zeros: $x = ?$

when $y = 0$

① $0 = -2x^2 + 64$

$-64 \qquad\qquad -64$

$\dfrac{-64}{-2} = \dfrac{-2x^2}{-2}$

$32 = x^2$

$\pm\sqrt{32} = \sqrt{x^2}$

$\sqrt{16}\cdot\sqrt{2}$

$\pm 4\sqrt{2} = x$

② The zeros of k(x) are $-4\sqrt{2}$ and $4\sqrt{2}$.

③ The zeros are irrational.

Objective: Use vertex form to find the zeros of a quadratic function.

Ex) Find the zeros of the quadratic function without graphing. State whether the zeros are rational, irrational, or imaginary.

$$d(x) = 6x^2 + 14$$

(1)

$$0 = 6x^2 + 14$$

$$-14 \qquad -14$$

reduce $\frac{-14}{6} = \frac{6x^2}{6}$

$$-\frac{7}{3} = x^2$$

$$\pm\sqrt{-\frac{7}{3}} = \sqrt{x^2}$$

$$x = \pm\frac{\sqrt{-7}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \pm\frac{\sqrt{-21}}{\sqrt{9}}$$

$\sqrt{21} \cdot \sqrt{-1}$

$$= \pm\frac{\sqrt{21}}{3}i$$

(2) The zeros of d(x) are $-\frac{\sqrt{21}}{3}i$ and $\frac{\sqrt{21}}{3}i$.

(3) The zeros are imaginary.

Objective: Use vertex form to find the zeros of a quadratic function.

Ex) Find the zeros of the quadratic function without graphing. State whether the zeros are rational, irrational, or imaginary.

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

①

$$0 = -(x-3)^2 + 4$$

$$-4 \qquad\qquad -4$$

$$\frac{-4}{-1} = \frac{-1 \cdot (x-3)^2}{-1}$$

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

$$\pm\sqrt{4} = \sqrt{(x-3)^2}$$

$$-2, 2 = x-3$$

$$+3, +3 \qquad +3$$

$$1, 5 = x$$

② The zeros of f(x) are 1 and 5.

③ The zeros are rational.

Objective: Use vertex form to find the zeros of a quadratic function.

Ex) Find the zeros of the quadratic function without graphing. State whether the zeros are rational, irrational, or imaginary.

$$g(x) = 3(x+4)^2 + 24$$

① $0 = 3(x+4)^2 + 24$

$-24 \qquad\qquad -24$

$\frac{-24}{3} = \frac{3(x+4)^2}{3}$

$-8 = (x+4)^2$

$\pm\sqrt{-8} = \sqrt{(x+4)^2}$

$\pm\sqrt{8}\cdot\sqrt{-1}$

$\pm\sqrt{4}\cdot\sqrt{2}\cdot\sqrt{-1} = x+4$

$\pm 2\sqrt{2}i = x+4$

$-4 \qquad\qquad -4$

$-4 \pm 2\sqrt{2}i = x$

② The zeros of g(x) are $-4-2\sqrt{2}i$ and $-4+2\sqrt{2}i$.

③ The zeros are imaginary.

Objective: Use vertex form to find the zeros of a quadratic function.

Ex) Find the zeros of the quadratic function without graphing. State whether the zeros are rational, irrational, or imaginary.

$$h(x)=2(x-2)^2-5$$

(1)

$$0=2(x-2)^2-5$$

$$+5 \qquad +5$$

$$\frac{5}{2}=\frac{2(x-2)^2}{2}$$

$$\frac{5}{2}=(x-2)^2$$

$$\pm\sqrt{\frac{5}{2}}=\sqrt{(x-2)^2}$$

$$x-2=\pm\frac{\sqrt{5}}{\sqrt{2}}\cdot\frac{\sqrt{2}}{\sqrt{2}}=\pm\frac{\sqrt{10}}{\sqrt{4}}$$

$$x-2=\pm\frac{\sqrt{10}}{2}$$

$$+2 \qquad +2$$

$$x=2\pm\frac{\sqrt{10}}{2}$$

(2) The zeros of h(x) are $2-\frac{\sqrt{10}}{2}$ and $2+\frac{\sqrt{10}}{2}$.

(3) The zeros are irrational.

Objective: Use vertex form to find the zeros of a quadratic function.

Ex) Find the zeros of the quadratic function without graphing. State whether the zeros are rational, irrational, or imaginary.

$$p(x) = -4(x+8)^2 - 27$$

① $0 = -4(x+8)^2 - 27$

$+27 \qquad +27$

$\frac{27}{-4} = \frac{-4(x+8)^2}{-4}$

$-\frac{27}{4} = (x+8)^2$

$\pm\sqrt{\frac{-27}{4}} = \sqrt{(x+8)^2}$

$x + 8 = \pm\frac{\sqrt{-27}}{\sqrt{4}} = \frac{\pm\sqrt{27}\cdot\sqrt{-1}}{2}$ ($\sqrt{9}\cdot\sqrt{3}\cdot\sqrt{-1}$)

$x + 8 = \pm\frac{3\sqrt{3}}{2}i$

$-8 \qquad -8$

$x = -8 \pm \frac{3\sqrt{3}}{2}i$

② The zeros of p(x) are $-8 - \frac{3\sqrt{3}}{2}i$ and $-8 + \frac{3\sqrt{3}}{2}i$.

③ The zeros are imaginary.