Decide whether you should use factoring or Completing the Square to solve:

1) $x^2 + 12x - 17 = 0$

2) $x^2 - 2x - 15 = 0$

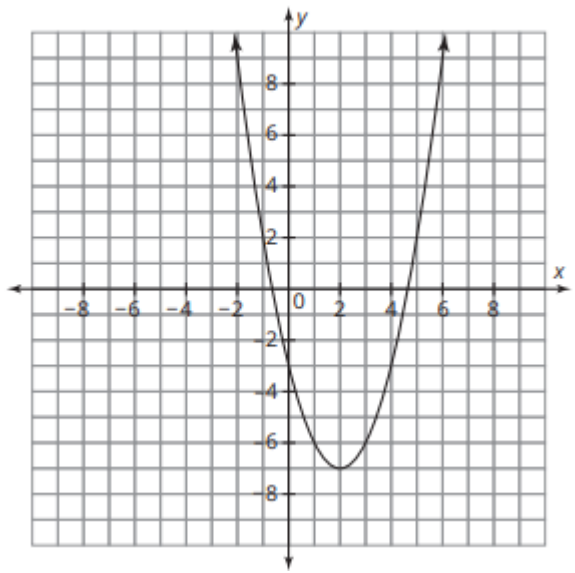
1. Match each equation to its corresponding graph.

a. $(x - 2)^2 - 7 = 0$

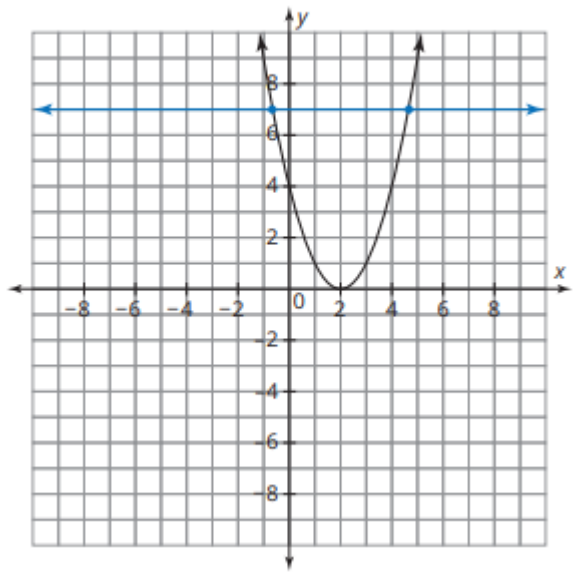
b. $y = (x - 2)^2 - 7$

c. $(x - 2)^2 = 7$

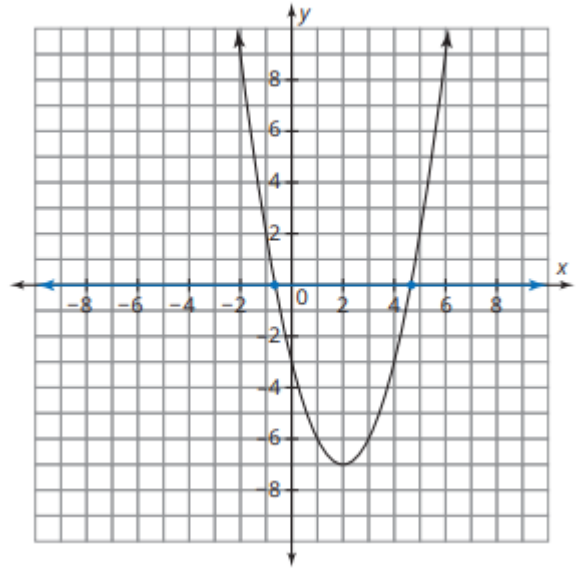
Graph A



Graph B



Graph C



Worked Example

Write the equation in general form with $y = 0$.	$ax^2 + bx + c = 0$
Complete the square.	$ax^2 + bx = -c$ $x^2 + \frac{b}{a}x = -\frac{c}{a}$ $x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$ $\left(x + \frac{b}{2a}\right)^2 = \left(\frac{b}{2a}\right)^2 - \frac{c}{a}$

Rewrite the right side of the equation.	$\left(x+\frac{b}{2a}\right)^2=\frac{b^2}{4a^2}-\frac{c}{a}$ $\left(x+\frac{b}{2a}\right)^2=\frac{b^2}{4a^2}-\frac{4ac}{4a^2}$ $\left(x+\frac{b}{2a}\right)^2=\frac{b^2-4ac}{4a^2}$
Now that equation is written in the form $(x-c)^2=q$, the square root can be taken on each side. Extract the square roots. Solve for x. These are the roots for the quadratic equation in the general form, $ax^2+bx+c=0$.	$x+\frac{b}{2a}=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$ $x=-\frac{b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a}$ $x=\frac{-b}{2a}+\frac{\sqrt{b^2-4ac}}{2a}$ $\quad x=\frac{-b}{2a}-\frac{\sqrt{b^2-4ac}}{2a}$

This equation is known as the *Quadratic Formula*. The **Quadratic Formula**, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, can be used to calculate the solutions to any quadratic equation of the form $ax^2 + bx + c = 0$, where a, b, and c represent real numbers and $a \neq 0$.

You can use the Quadratic Formula to determine the zeros of the function $f(x) = -4x^2 - 40x - 99$.

Worked Example

Rewrite the function as an equation to be solved for x when $y = 0$.	$-4x^2 - 40x - 99 = 0$
Determine the values of a, b, and c.	$a = -4, b = -40, c = -99$
Substitute the values into the Quadratic Formula.	$x = \frac{-(-40) \pm \sqrt{(-40)^2 - 4(-4)(-99)}}{2(-4)}$
Perform operations to rewrite the expression.	$x = \frac{40 \pm \sqrt{1600 - 1584}}{-8}$ $x = \frac{40 \pm \sqrt{16}}{-8}$ $x = \frac{40 \pm 4}{-8}$ $x = \frac{40 + 4}{-8}$ and $x = \frac{40 - 4}{-8}$ $x = \frac{44}{-8}$ and $x = \frac{36}{-8}$ $x = -5.5$ and $x = -4.5$

The Perris Pandas baseball team has a new promotional activity to encourage fans to attend games: launching free T-shirts! They can launch a T-shirt in the air with an initial velocity of 91 feet per second from $5\frac{1}{2}$ feet off the ground (the height of the team mascot).

A T-shirt's height can be modeled with the quadratic function $h(t) = -16t^2 + 91t + 5.5$, where t is the time in seconds and $h(t)$ is the height of the launched T-shirt in feet. They want to know how long it will take for a T-shirt to land back on the ground after being launched (if no fans grab it before then!)

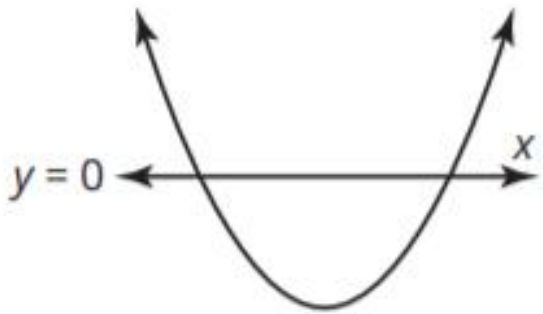
1. **Why does it make sense to use the Quadratic Formula to solve this problem?**

2. **Use the Quadratic Formula to determine how long it will take for a T-shirt to land back on the ground after being launched.**

3. **Classify your solutions as rational or irrational.**

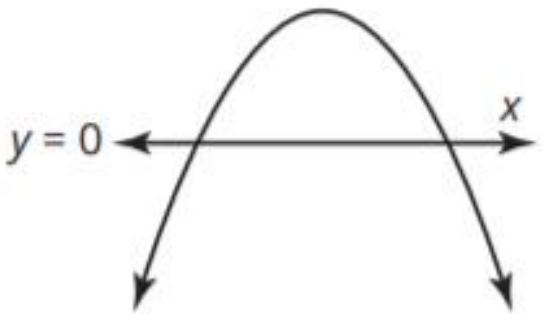
Quadratic Equations

With Two Real Roots



$y = ax^2 + bx + c$

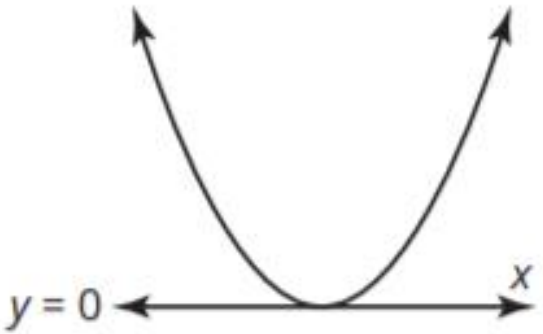
$a > 0$



$y = ax^2 + bx + c$

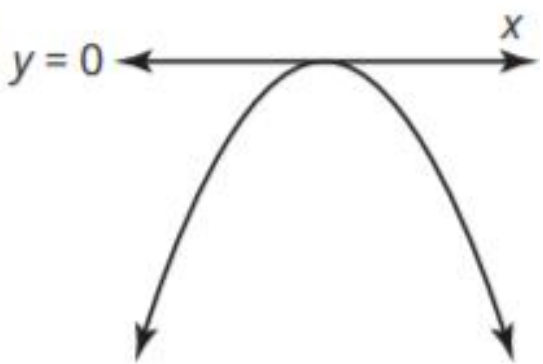
$a < 0$

With Double Real Roots



$y = ax^2 + bx + c$

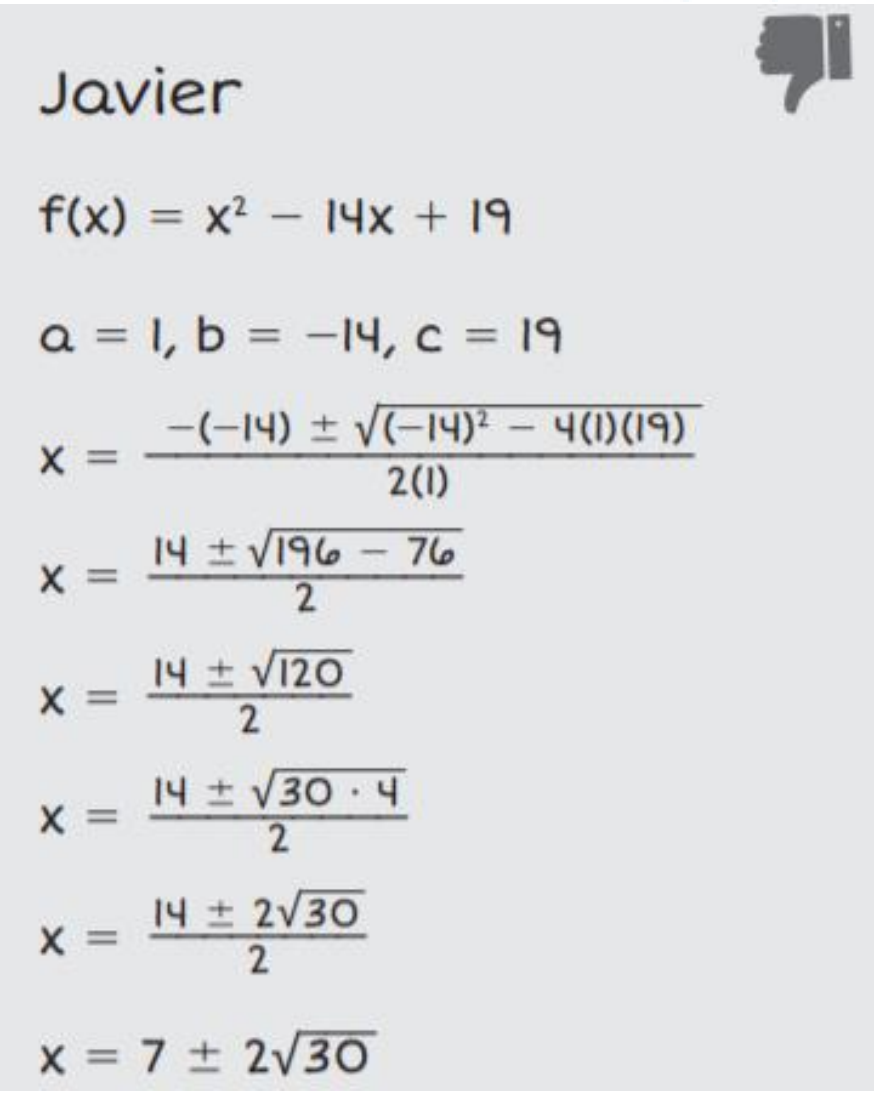
$a > 0$



$y = ax^2 + bx + c$

$a < 0$

1. **Javier is determining the exact zeros for $f(x) = x^2 - 14x + 19$. His work is shown.**



a. **Identify the error Javier made when determining the zeros.**

b. **Determine the correct zeros of the function.**

"Leave the solutions in exact form" means not to estimate any radical values with rounded decimals.

2. Use the Quadratic Formula to determine the zeros for each function given. Leave the solutions in exact form and classify them as rational or irrational.

a. $f(x) = -2x^2 - 3x + 7$

b. $r(x) = -3x^2 + 19x - 7$