

4-5 Reteaching

Quadratic Equations

There are several ways to solve quadratic equations. If you can factor the quadratic expression in a quadratic equation written in standard form, you can use the Zero-Product Property.

If $ab = 0$ then $a = 0$ or $b = 0$.

Problem

What are the solutions of the quadratic equation $2x^2 + x = 15$?

$$2x^2 + x = 15 \quad \text{Write the equation.}$$

$$2x^2 + x - 15 = 0 \quad \text{Rewrite in standard form, } ax^2 + bx + c = 0.$$

$$(2x - 5)(x + 3) = 0 \quad \text{Factor the quadratic expression (the nonzero side).}$$

$$2x - 5 = 0 \quad \text{or} \quad x + 3 = 0 \quad \text{Use the Zero-Product Property.}$$

$$2x = 5 \quad \text{or} \quad x = -3 \quad \text{Solve for } x.$$

$$x = \frac{5}{2} \quad \text{or} \quad x = -3$$

Check the solutions:

$$x = \frac{5}{2}: 2\left(\frac{5}{2}\right)^2 + \left(\frac{5}{2}\right) \stackrel{?}{=} 15 \quad x = -3: 2(-3)^2 + (-3) \stackrel{?}{=} 15$$

$$\frac{25}{2} + \frac{5}{2} \stackrel{?}{=} 15 \quad 18 - 3 \stackrel{?}{=} 15$$

$$15 = 15 \quad 15 = 15$$

Both solutions check. The solutions are $x = \frac{5}{2}$ and $x = -3$.

Exercises

Solve each equation by factoring. Check your answers.

1. $x^2 - 10x + 16 = 0$ **2, 8**
2. $x^2 + 2x = 63$ **-9, 7**
3. $x^2 + 9x = 22$ **-11, 2**
4. $x^2 - 24x + 144 = 0$ **12**
5. $2x^2 = 7x + 4$ **$-\frac{1}{2}, 4$**
6. $2x^2 = -5x + 12$ **$-4, \frac{3}{2}$**
7. $x^2 - 7x = -12$ **3, 4**
8. $2x^2 + 10x = 0$ **-5, 0**
9. $x^2 + x = 2$ **-2, 1**
10. $3x^2 - 5x + 2 = 0$ **$\frac{2}{3}, 1$**
11. $x^2 = -5x - 6$ **-3, -2**
12. $x^2 + x = 20$ **-5, 4**

4-5 Reteaching (continued)

Quadratic Equations

Some quadratic equations are difficult or impossible to solve by factoring. You can use a graphing calculator to find the points where the graph of a function intersects the x -axis. At these points $f(x) = 0$, so x is a zero of the function.

The values r_1 and r_2 are the zeros of the function $y = (x - r_1)(x - r_2)$. The graph of the function intersects the x -axis at $x = r_1$, or $(r_1, 0)$, and $x = r_2$, or $(r_2, 0)$.

Problem

What are the solutions of the quadratic equation $3x^2 = 2x + 7$?

Step 1 Rewrite the equation in standard form, $ax^2 + bx + c = 0$.
 $3x^2 - 2x - 7 = 0$

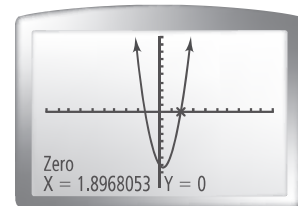
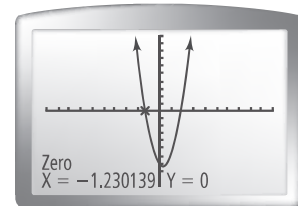
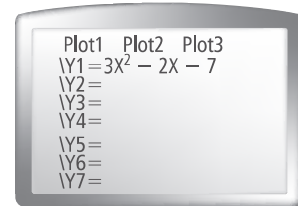
Step 2 Enter the equation as Y1 in your calculator.

Step 3 Graph Y1. Choose the standard window and see if the zeros of the function Y1 are visible on the screen. If they are not visible, zoom out and determine a better viewing window. In this case, the zeros are visible in the standard window.

Step 4 Use the ZERO option in the CALC feature. For the first zero, choose bounds of -2 and -1 and a guess of -1.5 . The screen display gives the first zero as $x = -1.230139$.

Similarly, the screen display gives the second zero as $x = 1.8968053$.

The solutions to two decimal places are $x = -1.23$ and $x = 1.90$.



Exercises

Solve the equation by graphing. Give each answer to at most two decimal places.

13. $x^2 = 5$ **-2.24, 2.24**

14. $x^2 = 5x + 1$ **-0.19, 5.19**

15. $x^2 + 7x = 3$ **-7.41, 0.41**

16. $x^2 + x = 5$ **-2.79, 1.79**

17. $x^2 + 3x + 1 = 0$ **-2.62, -0.38**

18. $x^2 = 2x + 4$ **-1.24, 3.24**

19. $3x^2 - 5x + 9 = 8$ **0.23, 1.43**

20. $4 = 2x^2 + 3x$ **-2.35, 0.85**

21. $x^2 - 6x = -7$ **1.59, 4.41**

22. $-x^2 = 8x + 8$ **-6.83, -1.17**