NAME

Module 13 Solving Quadratic Equations of One Variable

Lesson 2 Solving Quadratic Equations by Evaluating Square Roots

Solve by evaluating square roots.

1. $x^2 = 81$

{9, –9}

2. $x^2 = 169$

{13, –13}

3. $x^2 = 441$

{21, –21}

4. $x^2 = 49$

{7, –7}

5. $3x^2 = 75$

{5, –5}

6. $-4x^2 = 400$

∅

7. $-2x^2 = -72$

{6, –6}

8. $4x^2 = 60$

{$\sqrt{15}$, –$\sqrt{15}$}

9. $2x^2 - 4 = 28$

{4, –4}

10. $3x^2 + 2 = 149$

{7, –7}

11. $(x + 4)^2 = 81$

{5, –13}

12. $(x - 2)^2 = 100$

{12, –8}

13. $(x + 1)^2 = 49$

{6, –8}

14. $(x - 3)^2 = 196$

{17, –11}

15. $(x + 4)^2 = 11$

{–4 ± $\sqrt{11}$}

16. $(x + 7)^2 = 26$

{–7 ± $\sqrt{26}$}

17. $2(x - 3)^2 + 7 = 135$

{11, –5}

18. $3(x + 4)^2 + 12 = 12$

{–4}

19. $3(x - 6)^2 - 5 = 22$

{9, 3}

20. $5(x + 3)^2 - 8 = 172$

{3, –9}

21. $2(x + 3)^2 - 2 = 60$

{–3 ± $\sqrt{31}$}

22. $3(x + 1)^2 - 5 = 502$

{–14, 12}

Journal

1. Give one example each of quadratic equations which have zero, one, and two roots.
2. Sonya says that the solutions to $(x - 2)^2 = 16$ are 6 and –6. Maggie says the solutions are 6 and –2. Which girl is correct? Explain.
3. Describe how to solve $4(x - 2)^2 + 2 = 102$.
4. Lewis solved the equation $x^2 + 9 = 0$ and found the solutions 3 and –3. Where did he make a mistake?
5. Describe the general process used to solve a quadratic equation by evaluating square roots.

Cumulative Review

Simplify.

1. $2x^4(y^2z)^3 + (3x^2)^2y^6z^3$

   $11x^4y^6z^3$

2. $(3m - 2n + 5z) + (8m + 3n - 7z)$

   $11m + n - 2z$

3. $3p^2(4p^2 - 8p + 6)$

   $12p^4 - 24p^3 + 18p^2$

4. $(6a + 2b)(2a - 3b)$

   $12a^2 - 14ab - 6b^2$

Factor, if possible.

5. $4m^2 + 9n^2$

   This sum of squares cannot be factored

6. $a^2 - 2a - 99$

   $(a - 11)(a + 9)$

7. $12c^2 + 13c - 35$

   $(3c + 7)(4c - 5)$

8. $2m^2 - 10mn + 12n^2$

   $(2m - 4n)(m - 3n)$

Identify each polynomial equation as quadratic, linear, or neither.

9. $3^2x + 4x + 7 = 0$

   Linear

10. $3a + 2 = 5a^2$

    Quadratic

Possible Journal Answers

1. Answers may vary. An example of an equation with zero solutions (roots) is $x^2 = -4$. An example of an equation with one solution is $x^2 = 0$. An example of an equation with two solutions is $x^2 = 4$.
2. Maggie is correct. To solve the equation, first find the square root of both sides of the equation leaving $x - 2 = 4$ or $x - 2 = -4$. When two is added to both sides of the first equation, the answer is $x = 6$. When two is added to both sides of the second equation, the answer is $x = -2$
3. To solve $4(x - 2)^2 + 2 = 102$, first subtract two from both sides of the equation to get $4(x - 2)^2 = 100$. Then, divide both sides of the equation by four to get $(x - 2)^2 = 25$. Find the square root of both sides of the equation to get $x - 2 = 5$ or $x - 2 = -5$. Solve these equations to get $x = 7$ or $x = -3$.
4. The first step in solving the equation is to subtract nine from both sides of the equation. This leaves $x^2 = -9$. Negative nine does not have a square root. Therefore, there is no solution.
5. First, isolate the quantity that is squared. Next, determine what number or numbers the quantity is equal to by taking the square root of both sides of the equation. Then, solve the resulting equation(s) to find the solution(s).

Graphing Calculator Problem

Solve $3x^2 - 10 = 65$ by graphing its associated quadratic function on a graphing calculator.

1. Change the equation such that it is in the form $y = ax^2 + bx + c$, where $y = 0$. In this case, subtract 65 from both sides of the equation. The equation becomes $3x^2 - 75 = 0$. The associated quadratic function is $y = 3x^2 - 75$. To enter this into the calculator, press [Y=] and enter function $3x^2 - 75$ into $\mathbf{Y_1}$**=**. To enter x^2, press [X,T,θ,n] and [x^2]. To enter "–75," press [−], [7], and [5].
2. Press [GRAPH].
3. To solve the equation, find the *x*-intercepts of the graph. This is where the graph crosses the *x*-axis, and $y = 0$. When $y = 0$, we get the original equation with which we started. Use the CALC menu to find the *x*-intercept. Press [2nd] and then [CALC]. Use the down arrow to select **2:zero** and then, press [ENTER]. **Left Bound?** will appear in the lower left-hand corner of the screen. Use the arrow keys to move the cursor to the left of what appears to be the first *x*-intercept, just above the *x*-axis. Press [ENTER]. **Right Bound?** will appear in the lower left-hand corner of the screen. Use the arrow keys to move the cursor to the right of what appears to be the first x-intercept, just below the *x*-axis. Press [ENTER]. **Guess?** will appear in the lower left-hand corner of the screen. Press [ENTER]. The *x* and *y* values for the first root, or *x*-intercept, appear in the lower left-hand corner of the screen. The value of *x* in this case will be –5. Write this value on a piece of paper.
4. Repeat Step 3 to identify the value of the other root. Use the arrow keys to move the cursor just to the left and just to the right of the second *x*-intercept. The value of *x* in this case will be five.

The roots are {5, –5}.

Solve by graphing on a graphing calculator. If needed, round answers to the nearest hundredth.

1. $x^2 = 16$

   {4, –4}

2. $-2x^2 = 14$

   ∅

3. $2(x + 2)^2 + 25 = 25$

   {–2}

4. $3(x - 1)^2 - 1 = 38$

   {4.61, –2.61}