12. Solving Quadratics

Solve the quadratic equations.

Example 1: \(4x^2 - 12x = 0\)

Solution: This type of problem is easily factored into \(4x(x - 3) = 0\).

Now you can get the solutions \(4x = 0\) or \(x - 3 = 0\), \(x = 0\) or \(x - 3 = 0\).

Example 2: \(x^2 - 2x + 13 = 0\)

Solution: This equation cannot be factored so you should use the Quadratic Formula.

\[
x = \frac{2 \pm \sqrt{48}}{2} = \frac{2 \pm 4i\sqrt{3}}{2} = 1 \pm 2i
\]

Example 3: \(\sqrt{x + 1} = \sqrt{x + 2}\)

Solution: When there are square roots in the problem you will need to square both sides.

\[
(\sqrt{x + 2})^2 = (\sqrt{x + 1})^2
\]

\[
x + 2 = x + 2\sqrt{x + 1}
\]

\[
\frac{1}{2} = \sqrt{x}
\]

Since there is still a square root, move all the other terms away from the root.

\[
\frac{1}{4} = x
\]

Now square both sides.

\[
\sqrt{0.25 + 2} = \sqrt{0.25 + 1}
\]

Make sure you plug the answer back into the original equation because sometimes extra solutions appear when you square equations.

\[
1.5 = 1.5
\]
Solve for the indicated variable.

1. \( 9x^2 - 12x = 0 \)
2. \( 2r + 1 = 15r^2 \)
3. \( 1 - \frac{1}{x} = \frac{12}{x^2} \)
4. \( x - \frac{4}{3x} = -\frac{1}{3} \)
5. \( (y + 6)(y - 2) = -7 \)
6. \( \sqrt{x + 2} = x - 4 \)
7. \( (y - 5)^2 = 9 \)
8. \( (y + 3)^2 = 18 \)
9. \( x^4 - x^2 = 20 \)
10. \( x^4 + 20 = 9x^2 \)
11. \( \sqrt{x + 5} = \sqrt{x + 1} \)
12. \( \sqrt{x + 4} = 2 - \sqrt{2x} \)
13. \( x^2 + 5x + 11 = 0 \)
14. \( x^2 + 1 = 0 \)
15. \( x^2 - x + 3 = 0 \)
16. \( x^2 = -(5 + x) \)