

Practice

Solving Equations: Solving Quadratics by Taking Square Roots and Completing the Square

Answer these problems, then check your answers using the key on the next page. If you missed something, look at the solutions after the answer key, and if you still don't understand, watch the review video again.

#1) Solve by taking square roots: $(x-2)^2 = 14$

#2) Solve by taking square roots: $(x-4)^2 - 9 = 5$

#3) Solve by taking square roots: $2(x-5)^2 = 30$

#4) Solve by taking square roots: $4(2a+3)^2 = 48$

#5) Solve by taking square roots: $45 = (7n + 2)^2$

#6) Solve by completing the square and taking square roots: $x^2 + 12x + 5 = 0$

#7) Solve by completing the square and taking square roots: $x^2 = 2x + 7$

#8) Solve by completing the square and taking square roots: $x^2 - 6x - 5 = 0$

#9) Solve by completing the square and taking square roots: $3x^2 - 12x + 5 = 0$

#10) Solve by completing the square and taking square roots and then solve again using Quadratic Formula to verify you get the same solution: $x^2 - 6x - 12 = 0$

Answers:

$$\#1) x = 2 + \sqrt{14}, \quad x = 2 - \sqrt{14}$$

$$\#2) x = 4 + \sqrt{14}, \quad x = 4 - \sqrt{14}$$

$$\#3) x = 5 + \sqrt{15}, \quad x = 5 - \sqrt{15}$$

$$\#4) a = -\frac{3}{2} + \sqrt{3}, \quad a = -\frac{3}{2} - \sqrt{3}$$

$$\#5) n = -\frac{2}{7} + \frac{3\sqrt{5}}{7}, \quad n = -\frac{2}{7} - \frac{3\sqrt{5}}{7}$$

$$\#6) x = -6 + \sqrt{31}, \quad x = -6 - \sqrt{31}$$

$$\#7) x = 1 + 2\sqrt{2}, \quad x = 1 - 2\sqrt{2}$$

$$\#8) x = 3 + \sqrt{14}, \quad x = 3 - \sqrt{14}$$

$$\#9) x = 2 + \frac{\sqrt{21}}{3}, \quad x = 2 - \frac{\sqrt{21}}{3}$$

$$\#10) x = 3 + \sqrt{21}, \quad x = 3 - \sqrt{21}$$

Solutions:

#1) Solve by taking square roots: $(x-2)^2 = 14$

$$\sqrt{(x-2)^2} = \pm\sqrt{14}$$

$$x-2 = \pm\sqrt{14}$$

$$\begin{array}{r} +2 \\ \hline x = 2 \pm \sqrt{14} \end{array}$$

$$\boxed{x = 2 + \sqrt{14}}$$

$$\boxed{x = 2 - \sqrt{14}}$$

#2) Solve by taking square roots: $(x-4)^2 - 9 = 5$

$$\begin{array}{r} +9 \quad +9 \\ \hline (x-4)^2 = 14 \end{array}$$

$$\sqrt{(x-4)^2} = \pm\sqrt{14}$$

$$x-4 = \pm\sqrt{14}$$

$$\begin{array}{r} +4 \quad +4 \\ \hline x = 4 \pm \sqrt{14} \end{array}$$

$$\boxed{x = 4 + \sqrt{14}}$$

$$\boxed{x = 4 - \sqrt{14}}$$

#3) Solve by taking square roots: $\frac{2(x-5)^2}{2} = \frac{30}{2}$

$$(x-5)^2 = 15$$

$$\sqrt{(x-5)^2} = \pm\sqrt{15}$$

$$x-5 = \pm\sqrt{15}$$

$$\begin{array}{r} +5 \quad +5 \\ \hline x = 5 \pm \sqrt{15} \end{array}$$

$$\boxed{x = 5 + \sqrt{15}}$$

$$\boxed{x = 5 - \sqrt{15}}$$

#4) Solve by taking square roots: $\frac{4(2a+3)^2}{4} = \frac{48}{4}$

$$(2a+3)^2 = 12$$

$$\sqrt{(2a+3)^2} = \pm\sqrt{12}$$

$$2a+3 = \pm\sqrt{12}$$

$$2a+3 = \pm\sqrt{4}\sqrt{3}$$

$$2a+3 = \pm 2\sqrt{3}$$

$$2a+3 = \pm 2\sqrt{3}$$

$$\begin{array}{r} -3 \quad -3 \\ \hline 2a = -3 \pm 2\sqrt{3} \end{array}$$

$$a = -\frac{3}{2} \pm \sqrt{3}$$

$$\boxed{a = -\frac{3}{2} + \sqrt{3}}$$

$$\boxed{a = -\frac{3}{2} - \sqrt{3}}$$

#5) Solve by taking square roots: $45 = (7n+2)^2$

$$\sqrt{(7n+2)^2} = \pm\sqrt{45}$$

$$7n+2 = \pm\sqrt{9}\sqrt{5}$$

$$7n+2 = \pm 3\sqrt{5}$$

$$\begin{array}{r} 7n+2 = \pm 3\sqrt{5} \\ -2 \quad -2 \\ \hline 7n = -2 \pm 3\sqrt{5} \end{array}$$

$$7n = -2 \pm 3\sqrt{5}$$

$$\frac{7n}{7} = \frac{-2 \pm 3\sqrt{5}}{7}$$

$$n = \frac{-2 \pm 3\sqrt{5}}{7}$$

$$\boxed{n = \frac{-2 + 3\sqrt{5}}{7}} \quad \boxed{n = \frac{-2 - 3\sqrt{5}}{7}}$$

#6) Solve by completing the square and taking square roots: $x^2 + 12x + 5 = 0$

$$x^2 + 12x + \underline{36} = -5 + \underline{36}$$

$$\begin{array}{r} \downarrow \\ (6)^2 \\ \hline 36 \end{array}$$

$$x^2 + 12x + 36 = 31$$

$$(x+6)^2 = 31$$

$$(x+6)^2 = 31$$

$$\sqrt{(x+6)^2} = \pm\sqrt{31}$$

$$\begin{array}{r} x+6 = \pm\sqrt{31} \\ -6 \quad -6 \end{array}$$

$$x = -6 \pm \sqrt{31}$$

$$\boxed{x = -6 + \sqrt{31}} \quad \boxed{x = -6 - \sqrt{31}}$$

#7) Solve by completing the square and taking square roots: $x^2 = 2x + 7$

$$x^2 - 2x + \underline{1} = 7 + \underline{1}$$

$$\begin{array}{r} \downarrow \\ (-1)^2 \\ \hline 1 \end{array}$$

$$(x-1)^2 = 8$$

$$\sqrt{(x-1)^2} = \pm\sqrt{8}$$

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

$$x-1 = \pm 2\sqrt{2}$$

$$\begin{array}{r} +1 \quad +1 \end{array}$$

$$x = 1 \pm 2\sqrt{2}$$

$$\boxed{x = 1 + 2\sqrt{2}} \quad \boxed{x = 1 - 2\sqrt{2}}$$

#8) Solve by completing the square and taking square roots: $x^2 - 6x - 5 = 0$

$$x^2 - 6x + \underline{9} = 5 + \underline{9}$$

$$\begin{array}{r} \downarrow \\ (-3)^2 \\ \hline 9 \end{array}$$

$$x^2 - 6x + 9 = 14$$

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

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

$$\sqrt{(x-3)^2} = \pm\sqrt{14}$$

$$x-3 = \pm\sqrt{14}$$

$$\begin{array}{r} +3 \quad +3 \end{array}$$

$$x = 3 \pm \sqrt{14}$$

$$\boxed{x = 3 + \sqrt{14}} \quad \boxed{x = 3 - \sqrt{14}}$$

#9) Solve by completing the square and taking square roots: $3x^2 - 12x + 5 = 0$

$$3x^2 - 12x + \frac{12}{3} = -5 + \frac{12}{3}$$

$$\left[\begin{array}{c} \downarrow +2 \\ (-6)^2 \\ 36 \end{array} \right]$$

would require $\sqrt{\quad}$
so instead \rightarrow
factor out
GCF:

$$3x^2 - 12x + 12 = 7$$

$$(\sqrt{3}x)^2$$

$$3(x^2 - 4x + 4) = 7$$

$$3(x^2 - 4x + (2)^2) = 7$$

$$3(x-2)^2 = 7$$

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

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

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

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

$$x = 2 \pm \sqrt{\frac{7}{3}} = 2 \pm \frac{\sqrt{7}\sqrt{3}}{\sqrt{3}\sqrt{3}} = 2 \pm \frac{\sqrt{21}}{3}$$

$$\boxed{x = 2 + \frac{\sqrt{21}}{3}} \quad \boxed{x = 2 - \frac{\sqrt{21}}{3}}$$

#10) Solve by completing the square and taking square roots and then solve again using Quadratic Formula to verify you get the same solution: $x^2 - 6x - 12 = 0$

$$x^2 - 6x - 12 = 0$$

$$x^2 - 6x + \frac{9}{1} = 12 + \frac{9}{1}$$

$$\left[\begin{array}{c} \downarrow +2 \\ (-3)^2 \\ 9 \end{array} \right]$$

$$x^2 - 6x + 9 = 21$$

$$(x-3)^2 = 21$$

$$\sqrt{(x-3)^2} = \pm \sqrt{21}$$

$$x-3 = \pm \sqrt{21}$$

$$+3 \quad +3$$

$$x = 3 \pm \sqrt{21}$$

$$\boxed{x = 3 + \sqrt{21}} \quad \boxed{x = 3 - \sqrt{21}}$$

$$x^2 - 6x - 12 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad a=1, b=-6, c=-12$$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-12)}}{2(1)}$$

$$x = \frac{6 \pm \sqrt{36 + 48}}{2}$$

$$x = \frac{6 \pm \sqrt{84}}{2}$$

$$x = \frac{6 \pm \sqrt{4} \sqrt{21}}{2}$$

$$x = \frac{6 \pm 2\sqrt{21}}{2}$$

$$x = \frac{6}{2} \pm \frac{2\sqrt{21}}{2}$$

$$x = 3 \pm \sqrt{21}$$

$$\boxed{x = 3 + \sqrt{21}} \quad \boxed{x = 3 - \sqrt{21}}$$