

Quadratic Equations: R1, R5

Strategies:

1. Factoring
2. Square Root Principle
3. Completing the square
4. Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

***Note:** 2 real roots when $b^2 - 4ac > 0$
 1 real root when $b^2 - 4ac = 0$
 no real roots when $b^2 - 4ac < 0$

1. Factor: $3x^2 - 12x + 9$
 $3(x^2 - 4x + 3)$
 $3(x-3)(x-1)$

2. Factor: $18x^2 - 50y^2$
 $2(9x^2 - 25y^2)$
 $2(3x+5y)(3x-5y)$

3. Factor: $\frac{1}{4}x^2 + \frac{1}{2}x - 6$
 $\frac{1}{4}(x^2 + 2x - 24)$
 $\frac{1}{4}(x+6)(x-4)$

4. Factor: $2(x+2)^2 + 3(x+2) - 20$ let $x = x+2$

$$\begin{array}{l}
 p \ -40 \\
 s \ 3 \\
 F \ 8, -5 \\
 \begin{array}{|c|c|}
 \hline
 2 & 1 \\
 \hline
 4 & -5 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{aligned}
 & 2x^2 + 3x - 20 \\
 & (2x-5)(x+4) \\
 & (2(x+2)-5)(x+2+4) \\
 & (2x+4-5)(x+6) \\
 & (2x-1)(x+6)
 \end{aligned}$$

5. Solve: $(x-3)(3x-2) = 0$

$$x = 3 \quad x = \frac{2}{3}$$

6. Solve by Factoring: $5x^2 - 10x - 75 = 0$

$$5(x^2 - 2x - 15) = 0$$

$$5(x-5)(x+3) = 0$$

$$x = 5 \quad x = -3$$

7. Solve using the Square Root Principle: $3x^2 + 2 = 20$

$$3x^2 + 2 = 20$$

$$\frac{3x^2}{3} = \frac{18}{3}$$

$$\sqrt{x^2} = \sqrt{6}$$

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

8. Solve by Completing the Square: $(x^2 + 6x) - 5 = 0$

$$\begin{aligned} & \xrightarrow{\left(\frac{6}{2}\right)^2} \\ (x^2 + 6x + 9 - 9) - 5 &= 0 \\ (x^2 + 6x + 9) - 9 - 5 &= 0 \\ (x + 3)^2 - 14 &= 0 \\ \sqrt{(x + 3)^2} &= \sqrt{14} \\ x + 3 &= \pm \sqrt{14} \\ x &= -3 \pm \sqrt{14} \end{aligned}$$

9. Solve using the Quadratic Formula: $x^2 - 2x - 5 = 0$

$$\begin{aligned} x &= \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-5)}}{2(1)} \\ x &= \frac{2 \pm \sqrt{4 + 20}}{2} \\ x &= \frac{2 \pm \sqrt{24}}{2} \end{aligned}$$

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$$\begin{aligned} & \sqrt{24} \\ & \wedge \\ & \sqrt{4} \quad \sqrt{6} \\ & 2\sqrt{6} \end{aligned}$$

$$\begin{aligned} x &= \frac{2 \pm 2\sqrt{6}}{2} \Rightarrow x = \frac{\cancel{2}(1 \pm \sqrt{6})}{\cancel{2}} \quad x = 1 \pm \sqrt{6} \end{aligned}$$

10. How many roots? $3x^2 - 2x + 5 = 0$

$$\begin{aligned} b^2 - 4ac \\ (-2)^2 - 4(3)(5) \\ 4 - 60 \\ -56 \quad \therefore \text{no roots} \end{aligned}$$