

Use completing the square to solve for x.

$$\frac{a}{1} \cdot \frac{b^2}{4a^2}$$

$$ax^2 + bx + c = 0$$

$$\begin{aligned} & -\frac{c}{4a^2} + \frac{ab^2}{4a^2} \\ & -\frac{4ac}{4a^2} + \frac{ab^2}{4a^2} \end{aligned}$$

$$a(x^2 + \frac{b}{a}x + \frac{b^2}{4a^2}) = -c + \frac{ab^2}{4a^2}$$

$$\begin{aligned} \frac{1}{2}(\frac{b}{a}) &= \frac{b}{2a} \\ (\frac{b}{2a})^2 &= \frac{b^2}{4a^2} \end{aligned}$$

$$\frac{1}{a}(x + \frac{b}{2a})^2 = \frac{-4ac + b^2}{4a^2} \cdot \frac{1}{a}$$

$$\sqrt{(x + \frac{b}{2a})^2} = \sqrt{\frac{-4ac + b^2}{4a^2}}$$

$$\begin{aligned} x + \frac{b}{2a} &= \pm \sqrt{\frac{-4ac + b^2}{4a^2}} \\ -\frac{b}{2a} &= -\frac{b}{2a} \end{aligned}$$

$$x = \frac{-b \pm \sqrt{-4ac + b^2}}{2a}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



5.5 Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

To use the quadratic formula:

1. Equation must be in the form $ax^2 + bx + c = 0$.
2. Plug the values of a, b, and c into the formula.
3. Simplify the radical.
4. Simplify the answer.



Solve using the quadratic formula: $2x^2 - 3x - 2 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a=2 \quad b=-3 \quad c=-2$$

$$x = \frac{3 \pm \sqrt{(-3)^2 - 4(2)(-2)}}{2(2)}$$

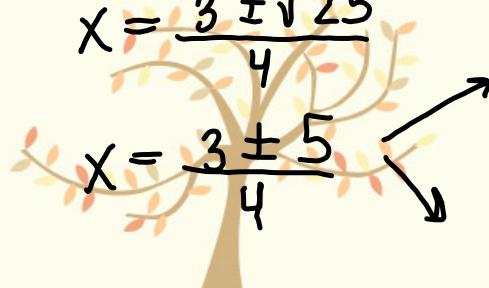
$$x = \frac{3 \pm \sqrt{9 + 16}}{4}$$

$$x = \frac{3 \pm \sqrt{25}}{4}$$

$$x = \frac{3 \pm 5}{4}$$

$$\frac{3+5}{4} = \frac{8}{4} = 2 = x$$

$$\frac{3-5}{4} = \frac{-2}{4} = -\frac{1}{2} = x$$



Solve using the quadratic formula: $4x^2 = 12x - 9$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-12 \pm \sqrt{(12)^2 - 4(-4)(-9)}}{2(-4)}$$

$$x = \frac{-12 \pm \sqrt{0}}{-8}$$

$$x = \frac{-12 \pm 0}{-8}$$

$$\frac{-4x^2 - 4x}{0 = -4x^2 + 12x - 9}$$

$$a = -4 \quad b = 12 \quad c = -9$$

$$\frac{-12 + 0}{-8} \rightarrow \frac{-12}{-8} = \frac{3}{2} = x$$

$$\frac{-12 - 0}{-8} \rightarrow \frac{-12}{-8} = \frac{3}{2} = x$$



Solve using the quadratic formula: $3x^2 + 2x = 3$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-2 \pm \sqrt{(2)^2 - 4(3)(-3)}}{2(3)}$$

$$x = \frac{-2 \pm \sqrt{40}}{6}$$

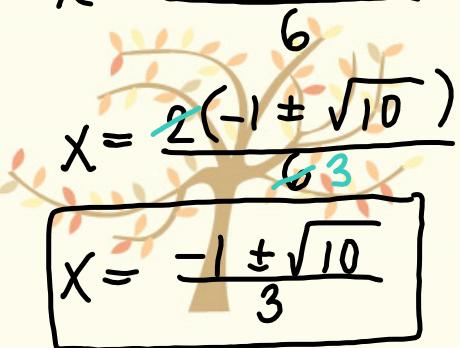
$$x = \frac{-2 \pm 2\sqrt{10}}{6}$$

$$x = \frac{2(-1 \pm \sqrt{10})}{6}$$

$$x = \frac{-1 \pm \sqrt{10}}{3}$$

$$\begin{array}{r} \frac{-3}{3x^2 + 2x - 3 = 0} \\ a=3 \quad b=2 \quad c=-3 \end{array}$$

$$\begin{array}{r} 2 | 40 \\ 2 | 20 \\ 2 | 10 \\ \hline & 5 \end{array}$$



Solve using the quadratic formula: $5x^2 + 1 = 7x$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{7 \pm \sqrt{(-7)^2 - 4(5)(1)}}{2(5)}$$

$$x = \frac{7 \pm \sqrt{29}}{10}$$

$$\begin{array}{r} \frac{-7x}{5x^2 - 7x + 1 = 0} \\ -7x \\ \hline \end{array}$$

$$a=5 \quad b=-7 \quad c=1$$

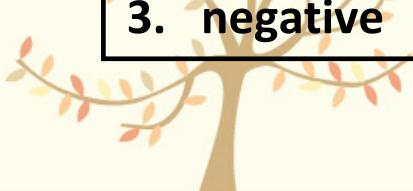


DISCRIMINANT: $b^2 - 4ac$

From the discriminant, we can determine:

1. the number of roots or solutions (how many? 1 or 2?)
2. the type of roots or solutions (real or imaginary?)

If the value of the discriminant is:	Then the roots or solutions are:
1. 0	1. one real
2. positive	2. two real
3. negative	3. two imaginary



Without solving, find the value of the discriminant and describe the roots (number and type).

1. $x^2 - 3x - 40 = 0$ $b^2 - 4ac = (-3)^2 - 4(1)(-40)$
2 real solutions $= 9 + 160$
 $= 169$

2. $3x^2 + 9x - 2 = 0$ $b^2 - 4ac = (9)^2 - 4(3)(-2)$
2 real solutions $= 81 + 24$
 $= 105$

3. $7x^2 + 6x + 2 = 0$ $b^2 - 4ac = (6)^2 - 4(7)(2)$
2 imaginary solutions $= 36 - 56$
 $= -20$

4. $x^2 - \frac{1}{2}x + \frac{1}{16} = 0$ $b^2 - 4ac = (-\frac{1}{2})^2 - 4(1)(\frac{1}{16})$
1 real solution $= \frac{1}{4} - \frac{1}{4}$
 $= 0$