

Square a binomial

$$1. (x+3)^2 = (x+3)(x+3) = x^2 + 6x + 9$$

$$2. (x-7)^2 = (x-7)(x-7) = x^2 - 14x + 49$$

$$3. (x+5)^2 = (x+5)(x+5) = x^2 + 10x + 25$$

★ Do you see a pattern or a shortcut?
Do 4-6 using the pattern/shortcut.

$$4. (x+4)^2 = x^2 + 8x + 16$$

$$5. (x-10)^2 = x^2 - 20x + 100$$

$$6. (y+2)^2 = y^2 + 4y + 4$$

Working backwards...factoring!

$$7. x^2 - 12x + 36 = (x-6)^2$$

$$8. x^2 + 8x + 16 = (x+4)^2$$

$$9. x^2 - 30x + 225 = (x-15)^2$$

★ What do you add to the expression to make it a perfect square?

$$x^2 + bx + \underbrace{\left(\frac{b}{2}\right)^2}_{\text{or } \frac{b^2}{4}} = \left(x + \frac{b}{2}\right)^2$$

Solve by completing the square.

$$1. x^2 + 8x = 40$$

$$x^2 + 8x + \underbrace{16}_{\left(\frac{8}{2}\right)^2} = 40 + \underbrace{16}$$

$$(x+4)^2 = 56$$

$$x+4 = \pm\sqrt{56} \leftarrow \text{simplify if possible}$$

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

$$x+4 = \pm 2\sqrt{14} \quad \text{solve for } x$$

$$\boxed{x = -4 \pm 2\sqrt{14}}$$

Solve by completing the square.

$$2. \quad x^2 + 10x - 24 = 0$$

$$x^2 + 10x + 25 = 24 + 25$$

add 25
to BOTH
sides.

$$\sqrt{\left(x + 5\right)^2} = \sqrt{49}$$

$$x + 5 = \pm 7$$

$$x = -5 \pm 7$$

$$\rightarrow -5 + 7 = 2$$

$$\rightarrow -5 - 7 = -12$$

Solve by completing the square.

$$3. \quad x^2 + 18x - 40 = 0$$

$$+40 \quad +40$$

$$x^2 + 18x + 81 = 40 + 81$$

$$\sqrt{\left(x + 9\right)^2} = \sqrt{121}$$

$$x + 9 = \pm 11$$

$$x = -9 \pm 11$$

$$\rightarrow -9 + 11 = 2$$

$$\rightarrow -9 - 11 = -20$$

Solve by completing the square.

4. $\frac{2x^2}{2} + \frac{6x}{2} = \frac{7}{2}$ make leading coefficient $\frac{1}{2}$.

$$x^2 + 3x + \frac{9}{4} = \frac{7 \cdot 2}{2 \cdot 2} + \frac{9}{4}$$

$$\left(x + \frac{3}{2}\right)^2 = \frac{14}{4} + \frac{9}{4}$$

$$\sqrt{\left(x + \frac{3}{2}\right)^2} = \sqrt{\frac{23}{4}}$$

$$x + \frac{3}{2} = \pm \frac{\sqrt{23}}{\sqrt{4}}$$

$$x + \frac{3}{2} = \pm \frac{\sqrt{23}}{2}$$

$$x = -\frac{3}{2} \pm \frac{\sqrt{23}}{2} = \frac{-3 \pm \sqrt{23}}{2}$$

Solve by completing the square.

5. $\frac{2x^2}{2} + \frac{10x}{2} = \frac{6}{2}$

$$x^2 + 5x + \frac{25}{4} = \frac{6 \cdot 4}{4} + \frac{25}{4}$$

$$\left(x + \frac{5}{2}\right)^2 = \frac{12}{4} + \frac{25}{4}$$

$$\left(x + \frac{5}{2}\right)^2 = \frac{37}{4}$$

$$x + \frac{5}{2} = \pm \sqrt{\frac{37}{4}}$$

$$x + \frac{5}{2} = \pm \frac{\sqrt{37}}{2}$$

$$x = -\frac{5}{2} \pm \frac{\sqrt{37}}{2}$$

$$x = \frac{-5 \pm \sqrt{37}}{2}$$