

## Completing the Square - PRACTICE

Solve each equation by completing the square.

1)  $v^2 - 4v - 93 = 3$

$$v^2 - 4v = 96$$

$$\left(\frac{-4}{2}\right)^2 = (-2)^2 = 4$$

$$v^2 - 4v + 4 = 96 + 4$$

$$(v-2)(v-2) = 100$$

$$(v-2)^2 = 100$$

$$(v-2) = \pm\sqrt{100}$$

$$v-2 = \pm 10$$

$$v-2 = 10$$

$$v = 12$$

$$v-2 = -10$$

$$v = -8$$

2)  $k^2 + 6k - 84 = 7$

$$k^2 + 6k = 91$$

$$\left(\frac{6}{2}\right)^2 = 3^2 = 9$$

$$k^2 + 6k + 9 = 91 + 9$$

$$(k+3)(k+3) = 100$$

$$(k+3)^2 = 100$$

$$k+3 = \pm\sqrt{100}$$

$$k+3 = \pm 10$$

$$k+3 = 10$$

$$k = 7$$

$$k+3 = -10$$

$$k = -13$$

3)  $x^2 - 16x + 7 = -8$

$$x^2 - 16x = -15$$

$$\left(\frac{-16}{2}\right)^2 = (-8)^2 = 64$$

$$x^2 - 16x + 64 = -15 + 64$$

$$(x-8)(x-8) = 49$$

$$(x-8)^2 = 49$$

$$x-8 = \pm\sqrt{49} = \pm 7$$

$$x-8 = 7$$

$$x = 15$$

$$x-8 = -7$$

$$x = 1$$

4)  $x^2 - 20x - 38 = -8$

$$x^2 - 20x = 30$$

$$\left(\frac{-20}{2}\right)^2 = (-10)^2 = 100$$

$$x^2 - 20x + 100 = 30 + 100$$

$$(x-10)(x-10) = 130$$

$$(x-10)^2 = 130$$

$$x-10 = \pm\sqrt{130}$$

$$x-10 = \sqrt{130}$$

$$x = 10 + \sqrt{130}$$

$$x-10 = -\sqrt{130}$$

$$x = 10 - \sqrt{130}$$

$$5) 7x^2 - 14x - 47 = 9$$

$$7x^2 - 14x = 56$$

$$7(x^2 - 2x) = 56 \quad \left(-\frac{a}{2}\right)^2 = \left(-1\right)^2 = 1$$

$$7(x^2 - 2x + 1) = 56 + 7(1)$$

$$7(x-1)^2 = 63$$

$$(x-1)^2 = 9$$

$$x-1 = \pm 3$$

$$\begin{aligned} \swarrow & \quad \searrow \\ x-1=3 & \quad x-1=-3 \\ \boxed{x=4} & \quad \boxed{x=-2} \end{aligned}$$

$$7) 9x^2 - 18x - 11 = 5$$

$$9x^2 - 18x = 16$$

$$9(x^2 - 2x) = 16 \quad \left(-\frac{a}{2}\right)^2 = \left(-1\right)^2 = 1$$

$$9(x^2 - 2x + 1) = 16 + 9(1)$$

$$9(x-1)^2 = 25$$

$$(x-1)^2 = \frac{25}{9}$$

$$x-1 = \pm \sqrt{\frac{25}{9}}$$

$$x-1 = \pm \frac{\sqrt{25}}{\sqrt{9}}$$

$$x-1 = \pm \frac{5}{3}$$

$$\begin{aligned} \swarrow & \quad \searrow \\ x-1 = \frac{5}{3} & \quad x-1 = -\frac{5}{3} \\ x = 1 + \frac{5}{3} & \quad x = 1 - \frac{5}{3} \\ x = \frac{3}{3} + \frac{5}{3} & \quad x = \frac{3}{3} - \frac{5}{3} \\ \boxed{x = \frac{8}{3}} & \quad \boxed{x = -\frac{2}{3}} \end{aligned}$$

$$6) 2p^2 - 20p - 14 = 8$$

$$2p^2 - 20p = 22$$

$$2(p^2 - 10p) = 22 \quad \left(-\frac{10}{2}\right)^2 = (-5)^2 = 25$$

$$2(p^2 - 10p + 25) = 22 + 2(25)$$

$$2(p-5)^2 = 72$$

$$(p-5)^2 = 36$$

$$p-5 = \pm \sqrt{36}$$

$$p-5 = \pm 6$$

$$\begin{aligned} \swarrow & \quad \searrow \\ p-5=6 & \quad p-5=-6 \\ \boxed{p=11} & \quad \boxed{p=-1} \end{aligned}$$

$$8) 2b^2 - 12b - 42 = -9$$

$$2b^2 - 12b = 33$$

$$2(b^2 - 6b) = 33$$

$$\left(-\frac{6}{2}\right)^2 = (-3)^2 = 9$$

$$2(b^2 - 6b + 9) = 33 + 2(9)$$

$$2(b-3)^2 = 51$$

$$(b-3)^2 = \frac{51}{2}$$

$$b-3 = \pm \sqrt{\frac{51}{2}}$$

$$b-3 = \pm \frac{\sqrt{51}}{\sqrt{2}}$$

$$b-3 = \pm \frac{\sqrt{51} \cdot \sqrt{2}}{2}$$

$$b-3 = \pm \frac{\sqrt{102}}{2}$$

$$\begin{aligned} \swarrow & \quad \searrow \\ b-3 = \frac{\sqrt{102}}{2} & \quad b-3 = -\frac{\sqrt{102}}{2} \\ \boxed{b = 3 + \frac{\sqrt{102}}{2}} & \quad \boxed{b = 3 - \frac{\sqrt{102}}{2}} \\ \text{or } b = \frac{6}{2} + \frac{\sqrt{102}}{2} & \quad \text{or } b = \frac{6}{2} - \frac{\sqrt{102}}{2} \\ \boxed{b = \frac{6 + \sqrt{102}}{2}} & \quad \boxed{b = \frac{6 - \sqrt{102}}{2}} \end{aligned}$$