

Completing the Square

Solve each equation by completing the square.

1. $p^2 - 3p = 8$

2. $2q^2 + 8q = 3$

3. $\frac{1}{3}m^2 + 2m + 8 = 5$

4. $-4x^2 = 24x + 11$

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1. $p^2 - 3p = 8$

$$p^2 - 3p + \frac{9}{4} = 8 + \frac{9}{4}$$

$$\left(p - \frac{3}{2}\right)^2 = \frac{41}{4}$$

$$\left(p - \frac{3}{2}\right) = \pm \sqrt{\frac{41}{4}}$$

$$p = \frac{3}{2} \pm \frac{\sqrt{41}}{2}$$

2. $2q^2 + 8q = 3$

$$2(q^2 + 4q + 4) = 3 + 8$$

$$2(q + 2)^2 = 11$$

$$(q + 2)^2 = \frac{11}{2}$$

$$(q + 2) = \pm \sqrt{\frac{11}{2}}$$

$$q = -2 \pm \sqrt{\frac{11}{2}}$$

3. $\frac{1}{3}m^2 + 2m + 8 = 5$

$$\frac{1}{3}(m^2 + 6m) + 8 - 8 = 5 - 8$$

$$\frac{1}{3}(m^2 + 6m + 9) = -3 + 3$$

$$\frac{1}{3}(m + 3)^2 = 0$$

$$(m + 3)^2 = 0$$

$$m = -3$$

4. $-4x^2 = 24x + 11$

$$-4x^2 - 24x = 11$$

$$-4(x^2 + 6x + 9) = 11 - 36$$

$$-4(x + 3)^2 = -25$$

$$(x + 3)^2 = +\frac{25}{4}$$

$$x + 3 = \pm \frac{5}{2}$$

$$x = -3 \pm \frac{5}{2}$$

$$= -\frac{1}{2} \text{ or } -5\frac{1}{2}$$