

Berechne x mittels quadratischer Ergänzung

a) $x^2 + 4x - 12 = 0$

$$\Rightarrow x^2 + 4x + 4 - 4 - 12 = 0$$

$$\Rightarrow (x + 2)^2 = 16$$

$$\Rightarrow (x + 2) = 4 \quad \vee \quad (x + 2) = -4$$

$$\Rightarrow x = 2 \quad \vee \quad x = -6$$

b) $x^2 - 6x - 10 = 0$

$$\Rightarrow x^2 - 6x + 9 - 9 - 10 = 0$$

$$\Rightarrow (x - 3)^2 = 19$$

$$\Rightarrow (x - 3) = \sqrt{19} \quad \vee \quad (x - 3) = -\sqrt{19}$$

$$\Rightarrow x = 3 + \sqrt{19} \quad \vee \quad x = 3 - \sqrt{19}$$

c) $2x^2 + 4x - 16 = 0$

$$\Rightarrow x^2 + 2x - 8 = 0$$

$$\Rightarrow x^2 + 2x + 1 - 1 - 8 = 0$$

$$\Rightarrow (x + 1)^2 = 9$$

$$\Rightarrow (x + 1) = 3 \quad \vee \quad (x + 1) = -3$$

$$\Rightarrow x = 2 \quad \vee \quad x = -4$$

d) $3x^2 - 4x - 9 = 0$

$$\Rightarrow x^2 - \frac{4}{3}x - 3 = 0$$

$$\Rightarrow x^2 - \frac{4}{3}x + \frac{4}{9} - \frac{4}{9} - 3 = 0$$

$$\Rightarrow \left(x - \frac{2}{3}\right)^2 = \frac{31}{9}$$

$$\Rightarrow \left(x - \frac{2}{3}\right) = \frac{\sqrt{31}}{3} \quad \vee \quad \left(x - \frac{2}{3}\right) = -\frac{\sqrt{31}}{3}$$

$$\Rightarrow x = \frac{2 + \sqrt{31}}{3} \quad \vee \quad x = \frac{2 - \sqrt{31}}{3}$$

e) $x^2 + 4x + 3 = 0$

$$\Rightarrow x^2 + 4x + 4 - 4 + 3 = 0$$

$$\Rightarrow (x + 2)^2 = 1$$

$$\Rightarrow (x + 2) = 1 \vee (x + 2) = -1$$

$$\Rightarrow x = -1 \vee x = -3$$

f) $x^2 - 10x + 20 = 0$

$$\Rightarrow x^2 - 10x + 25 - 25 + 20 = 0$$

$$\Rightarrow (x - 5)^2 = 5$$

$$\Rightarrow (x - 5) = \sqrt{5} \vee (x - 5) = -\sqrt{5}$$

$$\Rightarrow x = 5 + \sqrt{5} \vee x = 5 - \sqrt{5}$$

g) $3x^2 + 12x - 9 = 0$

$$\Rightarrow x^2 + 4x - 3 = 0$$

$$\Rightarrow x^2 + 4x + 4 - 4 - 3 = 0$$

$$\Rightarrow (x + 2)^2 = 7$$

$$\Rightarrow (x + 2) = \sqrt{7} \vee (x + 2) = -\sqrt{7}$$

$$\Rightarrow x = -2 + \sqrt{7} \vee x = -2 - \sqrt{7}$$

h) $5x^2 - 10x - 20 = 0$

$$\Rightarrow x^2 - 2x - 4 = 0$$

$$\Rightarrow x^2 - 2x + 1 - 1 - 4 = 0$$

$$\Rightarrow (x - 1)^2 = 5$$

$$\Rightarrow (x - 1) = \sqrt{5} \vee (x - 1) = -\sqrt{5}$$

$$\Rightarrow x = 1 + \sqrt{5} \vee x = 1 - \sqrt{5}$$