

# Anleitung zur Nullstellenberechnung bei Funktionenscharen

3 Möglichkeiten:

1. lineare Gleichungen: ( $a \neq 0$ )

$$4x + 8 = 0 \quad / -8$$

$$\Leftrightarrow 4x = -8 \quad / :4$$

$$\Leftrightarrow x = -\frac{8}{4} = -2$$

$$ax + 8 = 0 \quad / -8$$

$$ax = -8 \quad / :a$$

$$x = -\frac{8}{a}$$

2. quadratische Gleichungen:

$$2x^2 - 10x + 12 = 0 \quad / :2$$

$$\Leftrightarrow x^2 - 5x + 6 = 0$$

$$\Leftrightarrow x_{1,2} = -\frac{-5}{2} \pm \sqrt{\left(\frac{-5}{2}\right)^2 - 6}$$

$$\Leftrightarrow x_{1,2} = 2,5 \pm \sqrt{\frac{25}{4} - \frac{24}{4}}$$

$$\Leftrightarrow x_{1,2} = 2,5 \pm \sqrt{\frac{1}{4}}$$

$$\Leftrightarrow x_{1,2} = 2,5 \pm 0,5$$

$$\Leftrightarrow x_1 = 3 \vee x_2 = 2$$

$$2x^2 - 10ax + 12a^2 = 0 \quad / :2$$

$$x^2 - 5ax + 6a^2 = 0$$

$$x_{1,2} = -\frac{-5a}{2} \pm \sqrt{\left(\frac{-5a}{2}\right)^2 - 6a^2}$$

$$x_{1,2} = 2,5a \pm \sqrt{\frac{25a^2}{4} - \frac{24}{4}a^2}$$

$$x_{1,2} = 2,5a \pm \sqrt{\frac{a^2}{4}}$$

$$x_{1,2} = 2,5a \pm 0,5a$$

$$x_1 = 3a \vee x_2 = 2a$$

### 3. Substitution

$$2x^4 - 14x^2 + 24 = 0 \quad /:2$$

$$\Leftrightarrow x^4 - 7x^2 + 12 = 0$$

$$\Leftrightarrow z^2 - 7z + 12 = 0$$

$$\Leftrightarrow z_{1,2} = -\frac{-7}{2} \pm \sqrt{\left(\frac{-7}{2}\right)^2 - 12}$$

$$\Leftrightarrow z_{1,2} = 3,5 \pm \sqrt{\frac{49}{4} - \frac{48}{4}}$$

$$\Leftrightarrow z_{1,2} = 3,5 \pm \sqrt{\frac{1}{4}}$$

$$\Leftrightarrow z_{1,2} = 3,5 \pm 0,5$$

$$\Leftrightarrow z_1 = 4 \vee z_2 = 3$$

$$\Leftrightarrow x = \pm 2 \vee x = \pm \sqrt{3}$$

$$2x^4 - 14ax^2 + 24a^2 = 0 \quad /:2$$

$$x^4 - 7ax^2 + 12a^2 = 0$$

$$z^2 - 7az + 12a^2 = 0$$

$$z_{1,2} = -\frac{-7a}{2} \pm \sqrt{\left(\frac{-7a}{2}\right)^2 - 12a^2}$$

$$z_{1,2} = 3,5a \pm \sqrt{\frac{49a^2}{4} - \frac{48}{4}a^2}$$

$$z_{1,2} = 3,5a \pm \sqrt{\frac{a^2}{4}}$$

$$z_{1,2} = 3,5a \pm 0,5a$$

$$z_1 = 4a \vee z_2 = 3a$$

$$x = \pm 2\sqrt{a} \vee x = \pm \sqrt{3a} \quad (\text{existiert nur, wenn } a \geq 0)$$