

Lösungen 1.1 Nullstellenberechnung quad. Fkt. / faktorisierte Form

a) $f(x) = x^4 - 3x^2 + 2$

b) $f(x) = 0,25x^3 + 0,25x^2 - 3x$

c) $f(x) = (0,5x - 3)(x + 2)$

d) $f(x) = (x + 3)^2 - 1$

a) $0 = x^4 - 3x^2 + 2$

| Substitution $x^2 = z$

$$0 = z^2 - 3z + 2$$

| pq-Formel

$$z_{1/2} = -\frac{-3}{2} \pm \sqrt{\left(\frac{-3}{2}\right)^2 - 2}$$

$$z_{1/2} = \frac{3}{2} \pm \frac{1}{2}$$

$$z_1 = 1$$

$$z_2 = 2$$

| Resubstitution $x_{1/2} = \sqrt{z}$

$$x_1 = 1$$

$$x_3 = \sqrt{2}$$

$$x_2 = -1$$

$$x_4 = -\sqrt{2}$$

$$\hookrightarrow f(x) = (x-1)(x+1)(x-\sqrt{2})(x+\sqrt{2})$$

b) $0 = 0,25x^3 + 0,25x^2 - 3x$

$$= x \cdot (0,25x^2 + 0,25x - 3)$$

$$\downarrow$$
$$x_1 = 0$$

\downarrow

$$0 = 0,25x^2 + 0,25x - 3$$

| : 0,25

$$= x^2 + x - 12$$

| pq-Formel

$$x_{2/3} = -\frac{1}{2} \pm \sqrt{\left(\frac{1}{2}\right)^2 + 12}$$

$$x_{2/3} = -0,5 \pm 3,5$$

$$x_2 = 3$$

$$\hookrightarrow f(x) = 0,25$$

c) $0 = (0,5x - 3)(x + 2)$

$$\downarrow$$
$$0 = 0,5x - 3$$

$$x_1 = 6$$

\downarrow

$$0 = x + 2$$

$$x_2 = -2$$

d) $0 = (x + 3)^2 - 1$

$$1 = (x + 3)^2$$

| $\sqrt{}$

$$1 = x + 3$$

$$-1 = x + 3$$

$$x_1 = -2$$

$$x_2 = -4$$

$$\hookrightarrow f(x) = (x + 2)(x + 4)$$

Lösung 1.2 allgemeine Form \leftrightarrow faktorisierte Form

a) $f(x) = (x - 1) \cdot (x + 2) \cdot (x - 3)$	Nullstellen:	$x_1 = \underline{1}$	$x_2 = \underline{-2}$	$x_3 = \underline{3}$
b) $f(x) = 0,7 \cdot (x - 6) \cdot (x + 2) \cdot (2x - 2)$	Nullstellen:	$x_1 = \underline{6}$	$x_2 = \underline{-2}$	$x_3 = \underline{1}$
c) $f(x) = (x + \underline{3}) \cdot (x + \underline{2}) \cdot (x + \underline{1})$	Nullstellen:	$x_1 = -3$	$x_2 = -2$	$x_3 = -1$
d) $f(x) = -4 \cdot (x + 1) \cdot (\underline{1} + x) \cdot (\underline{4} - x)$	Nullstellen:	$x_1 = -1$	$x_2 = 4$	
e) $f(x) = -0,1 \cdot (x^2 + 1) \cdot (\underline{2} - x) \cdot (\underline{4} + x)$	Nullstellen:	$x_1 = -4$	$x_2 = 2$	

$$\begin{aligned}
 a) \quad f(x) &= (x - 1)(x + 2)(x - 3) \\
 &= (x^2 + 2x - x - 2)(x - 3) \\
 &= (x^2 + x - 2)(x - 3) \\
 &= x^3 - 3x^2 + x^2 - 3x - 2x + 6 \\
 f(x) &= x^3 - 2x^2 - 5x + 6
 \end{aligned}$$

$$\begin{aligned}
 b) \quad f(x) &= 0,7 \cdot (x - 6) \cdot (x + 2) \cdot (2x - 2) \\
 &= 0,7 \cdot (x^2 + 2x - 6x - 12) \cdot (2x - 2) \\
 &= 0,7 \cdot (x^2 - 4x - 12) \cdot (2x - 2) \\
 &= 0,7 \cdot (2x^3 - 2x^2 - 8x^2 + 8x - 24x + 24) \\
 &= 0,7 \cdot (2x^3 - 10x^2 - 16x + 24) \\
 f(x) &= 1,4x^3 - 7x^2 - 11,2x + 16,8
 \end{aligned}$$