

S123

$$1) \frac{1}{4} \log(256x^8) - 2 \cdot \log \frac{\sqrt{9}}{x^2} - 0,5 \cdot \log \frac{x^4}{9} = 1,5 \log(9x^4) + 3 \log \frac{1}{2x^3} + 4 \cdot \log \sqrt{27x}$$

$$\log(256x^8)^{1/4} - \log(3/2)^2 - \log(x^4/9)^{1/2} = \log(9x^4)^{3/2} + \log(1/2x^3)^3 + \log(\sqrt{27x})^4$$

$$\log \frac{4x^2}{3^{1/4} x^4 y^{2/3}} = \log 3^3 x^6 \cdot \frac{1}{2^3 x^9} \cdot 3^6 \cdot x^2 \quad | \uparrow^{10x}$$

$$\frac{4}{3} x^4 = 3^{9/2} \cdot \frac{1}{x} \quad | \cdot x \quad | \cdot 3/4$$

$$x^5 = 3^{10/2} \quad | \sqrt[5]{\quad}$$

$$x = 3^{2/2} = 9/2 \quad \mathbb{D} = \mathbb{R}^+ \quad \mathbb{L} = \{9/2\}$$

$$2) \quad 6 \cdot \ln \sqrt[3]{3} - 4 \cdot \left(\ln \sqrt{\frac{2}{x}} + \frac{1}{2} \cdot \ln \frac{9}{x} \right) = 2 \cdot \ln \frac{\sqrt{x^3}}{3} - 0,25 \cdot \ln (16x^9) + 3 \ln \frac{8}{x^2}$$

$$\ln (3^{1/3})^6 - \ln \left(\frac{2^{1/2}}{x^{1/2}} \right)^4 - \ln \left(\frac{9}{x} \right)^2 = \ln \left(\frac{x^{3/2}}{3} \right)^2 - \ln (16x^9)^{1/4} + \ln \left(\frac{8}{x^2} \right)^3$$

$$\ln \frac{3^{1/2}}{2^{1/2} \cdot 3^{4/2}} = \ln \frac{x^{3/2} \cdot 2^{2/4} \cdot 3^3}{2x^4 \cdot x} \quad | \uparrow \text{ex}$$


$$\frac{1}{2 \cdot 3^2} \cdot x^4 = \frac{2^8}{3^2} \cdot \frac{1}{x^5} \quad | \cdot x^5 \cdot 3^2 \cdot 2$$

$$x^9 = 2^9 \quad | \sqrt[9]{\quad}$$

$$x = 2$$

$$D = \mathbb{R}^+$$

$$L = \{2\}$$

$$3) f(x) = -\frac{1}{13} \cdot \ln(x^2 - 6x - 40) = -\frac{1}{13} \cdot \ln[(x-10)(x+4)]$$


$$\mathbb{D} = \{x \in \mathbb{R} \mid x > 10 \vee x < -4\}$$

$$\lim_{x \rightarrow 10^+} f(x) = \lim_{x \rightarrow -4^-} f(x) = \left[-\frac{1}{13} \ln(0^+) \right] = -\frac{1}{13} \cdot (-\infty) = \infty$$

$$\lim_{x \rightarrow \pm\infty} f(x) = \left[-\frac{1}{13} \cdot \ln \infty \right] = -\frac{1}{13} \cdot \infty = -\infty \quad \text{Kv} = y \in \mathbb{R}$$

$$4) f(x) = \log\left(\sqrt{2x+4} - 8\right) - 12$$

$x \geq -2$

$$\sqrt{2x+4} - 8 = 0 \quad | +8$$

$$\sqrt{2x+4} = 8 \quad | \uparrow^2$$

$$2x+4 = 64 \quad | -4$$


$$2x = 60 \quad | :2$$

$$x = 30$$

$$\lim_{x \rightarrow \infty} f(x) = \left[\log(\infty - 8) - 12 \right] = \infty$$

$$\lim_{x \rightarrow 30^+} f(x) = \left[\log(\sqrt{64} - 8) - 12 \right] = -\infty$$

$$\text{Kv} = y \in \mathbb{R}$$



$$\mathbb{D} = x \in \mathbb{R}^{>30}$$

$$5) \quad h(x) = \frac{3x}{\underbrace{\ln(15-3x)}} \quad 15-3x=0 \quad x=5$$

$$\ln(1) = 0 \Rightarrow 15-3x = 1 \quad | +3x - 1$$

$$14 = 3x \quad | :3$$

$$x = 14/3 = 4 \frac{2}{3}$$



$$D = x \in \mathbb{R}^{<5} \setminus \{4 \frac{2}{3}\}$$

$$\lim_{x \rightarrow -\infty} h(x) = \left[\frac{-\infty}{\infty} \right] = -\infty$$

$$(3x)' = 3$$

$$(\ln(15-3x))' = \frac{1}{15-3x} \cdot (-3) = -\frac{1}{x-5}$$

$$\lim_{x \rightarrow 5^-} h(x) = \left[\frac{15}{\ln(0)} \right] = 0^-$$

$$\lim_{x \rightarrow 4 \frac{2}{3}} h(x) = \left[\frac{14}{\ln(1)} \right] = \infty$$

$$\Rightarrow W = y \in \mathbb{R}$$

$$f(x) = x^2 - 6x - 16$$

\downarrow \downarrow
 $a^2 + 2ab + b^2$
 \downarrow \downarrow
 1 $\cdot (-1/2)$

$$(x-3)^2 - 3^2 - 16$$

$$(x^2 - 6x + 9)$$

$$f(x) = (x+a)^2 + b$$

$$S(-a \quad | \quad b)$$

$$f(x) = (x-3)^2 - 25$$

$$S(3 \quad | \quad -25)$$

Quadratische
Ergänzung

$$x^2 + a \cdot x + b$$

\downarrow \downarrow
 1 $\cdot (1/2)$

$$(x + \frac{a}{2})^2 - (\frac{a}{2})^2 + b$$

\uparrow
 a^2

$$f(x) = x^2 - 5x - 6$$

$$(x - \frac{5}{2})^2 - (\frac{5}{2})^2 - 6 = (x - \frac{5}{2})^2 - \frac{49}{4}$$

$$f(x) = x^2 + 5x + 6$$

$$(x + 5/2)^2 - (5/2)^2 + 6$$

$$(x + 5/2)^2 - 1/4 \quad \rightarrow \quad S(-5/2 | -1/4) \hat{=} TP$$

$$S_y(0 | f(0)) = (0 | 6)$$

x-Achse:

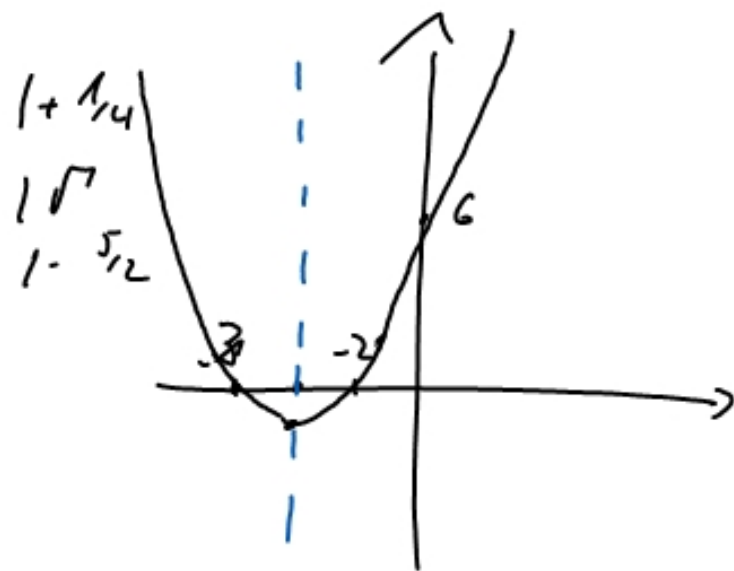
$$f(x) = 0 = (x + 5/2)^2 - 1/4$$

$$1/4 = (x + 5/2)^2$$

$$\pm 1/2 = x + 5/2$$

$$x = \pm 1/2 - 5/2$$

$$x_1 = -2 \quad \vee \quad x_2 = -3$$



Achsensymmetrie zu $x = -2,5$

$$f(x) = x^2 - 7x + 6 = (x - 7/2)^2 - (7/2)^2 + 6$$

$$= (x - 7/2)^2 - 25/4 \quad S(7/2 | -25/4)$$

\uparrow
TIP

$$S_y(0 | 6) \quad S_{x_{1/2}}: 0 = (x - 7/2)^2 - 25/4 \quad | \cdot 25/4$$

$$25/4 = (x - 7/2)^2 \quad | \sqrt{\quad}$$

$$\pm 5/2 = (x - 7/2) \quad | + 7/2$$

$$S_{x_1}(1 | 0)$$

$$7/2 \pm 5/2 = x$$

$$S_{x_2}(6 | 0)$$

$$x_1 = 6 \quad \vee \quad x_2 = 1$$

$$U = \{1; 6\}$$

$$f(x) = x^2 - 7x + 6 = (x - 6)(x - 1)$$

$$S_{x_1}(1 | 0)$$

$$S_{x_2}(6 | 0)$$

$$S(3,5 | (3,5))$$

$$S(3,5 | 2,5^2) = (3,5 | 6,25)$$

$$x^2 + \beta \cdot x + \gamma = 0$$

$$(x + \beta/2)^2 - (\beta/2)^2 + \gamma = 0 \quad | +(\beta/2)^2 - \gamma$$

$$(x + \beta/2)^2 = (\beta/2)^2 - \gamma \quad | \sqrt{\quad}$$

$$(x + \beta/2) = \pm \sqrt{(\beta/2)^2 - \gamma} \quad | -\beta/2$$

$$x_{1/2} = -\beta/2 \pm \sqrt{(\beta/2)^2 - \gamma} \quad \begin{array}{l} \beta = p \\ \gamma = q \end{array}$$

$$x_{1/2} = -p/2 \pm \sqrt{(p/2)^2 - q}$$

S180

$$1) \quad 3x^2 - 18x + 24 = 3 \cdot (x^2 - 6x + 8) = 3 \cdot (x-4)(x-2) = 0$$

Satz v. Vieta : $\mathcal{L} = \{2; 4\}$

$$2) \quad -0,5x^2 + 2x = -2,5 \quad | +2,5 \cdot (-2)$$
$$x^2 - 4x - 5 = 0 \quad p = -4 ; q = -5$$

p-q-Formel : $x_{1/2} = -\frac{(-4)}{2} \pm \sqrt{\left(\frac{-4}{2}\right)^2 + 5} = 2 \pm \sqrt{9}$

$$x_1 = 5 \vee x_2 = -1 \quad ; \quad \mathcal{L} = \{-1; 5\}$$

$$3) \quad x \cdot (2x - 20) = -32 \quad | +32$$
$$2x^2 - 20x + 32 = 0 \cdot (x^2 - 10x + 16) = 0 \cdot [(x-5)^2 - 25 + 16] = 0 \quad | \cdot 1/2$$

QE:

$$(x-5)^2 - 9 = 0 \quad | +9 \quad \mathcal{L} = \{2; 8\}$$

$$(x-5)^2 = 9 \quad | \sqrt{\quad}$$

$$x-5 = \pm \sqrt{9} = \pm 3 \quad | +5 \quad x_1 = 8 \vee x_2 = 2$$

$$4) \quad f(x) = -x^2 + 2x + 3 = -(x^2 - 2x - 3) = -(x-3)(x+1)$$

Nach unten geöffnete Normalparabel $S_{x_1}(3|0)$ $S_{x_2}(-1|0)$
 $S_y(0|3)$

$$\text{Scheitelpunkt } S: (1 | f(1)) = (1 | 4) \hat{=} \text{HP}$$

Achsensymmetrie zu $x=1$

$$5) \quad g(x) = \frac{1}{4}x^2 + 2x + 3 = \frac{1}{4} \cdot (x^2 + 8x + 12) = \frac{1}{4} \cdot (x+6)(x+2)$$

Nach oben geöffnet und um $\frac{1}{4}$ gestreckte Parabel

$$S_{x_1}(-6|0) \quad S_{x_2}(-2|0) \quad S_y(0|3)$$

$$\text{Scheitelpunkt } S: (-4 | f(-4)) = (-4 | -1) \hat{=} \text{TP}$$

Achsensymmetrie zu $x=-4$

$$6) \quad h(x) = 100 - 4x^2 = -4 \cdot (x^2 - 25) = -4 \cdot (x-5)(x+5)$$

→ Nach unten geöffnete um den Faktor 4 gestreckte Parabel

$S_{x_1}(5|0)$, $S_{x_2}(-5|0)$; $S_y(0|100)$ = Scheitelpunkt $\hat{=}$ HP
Achsensymmetrie zur y-Achse

$$7) \quad x^4 + 100 = 29x^2 \quad | -29x^2$$

$$x^4 - 29x^2 + 100 = (x^2 - 25)(x^2 - 4) = (x+5)(x-5)(x+2)(x-2)$$

$$\mathcal{L} = \{ \pm 2; \pm 5 \}$$

$$8) \quad x^6 = 7x^3 + 8 \quad | -7x^3 - 8 \quad \Leftrightarrow \quad x^6 - 7x^3 - 8 = 0 \quad z = x^3$$

$$z^2 - 7z - 8 = 0$$

$$z_{1/2} = \frac{7}{2} \pm \sqrt{\left(\frac{7}{2}\right)^2 + 8} = \frac{7}{2} \pm \sqrt{\frac{81}{4}} = \frac{7}{2} \pm \frac{9}{2} \quad \begin{matrix} z_1 = 8 \\ z_2 = -1 \end{matrix} \quad x = \sqrt[3]{z}$$

$$x_1 = \sqrt[3]{8} = 2 \quad \vee \quad x_2 = \sqrt[3]{-1} = -1 \quad \Rightarrow \quad \mathcal{L} = \{-1; 2\}$$