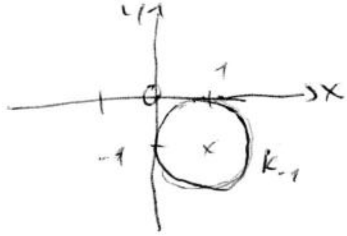
1. a) $(x-1)^2 + (y+1)^2 = 1^2$

$M_1(1|-1)$; $R_1 = 1$



b) $(0|0) \in k$:

$(0-1)^2 + (0-a)^2 = (a+2)^2$

$1 + a^2 = a^2 + 4a + 4$

$\underline{a = -\frac{3}{4}}$

c) $(0|3) \in k$:

$(0-1)^2 + (3-a)^2 = (a+2)^2$

$1 + 9 - 6a + a^2 = a^2 + 4a + 4$

$\underline{a = \frac{3}{5}}$

d) $(a|4) \in k$:

$(a-1)^2 + (4-a)^2 = (a+2)^2$

$\underline{a_1 = 1}$ $P_1(1|4)$ $(x-1)^2 + (y-1)^2 = 3^2$; $t_1: 3(y-1) = 9$ $\underline{y = 4}$

$\underline{a_2 = 13}$ $P_2(13|4)$ $(x-1)^2 + (y-13)^2 = 15^2$ $t_2: 12(x-1) - 9(y-13) = 15^2$

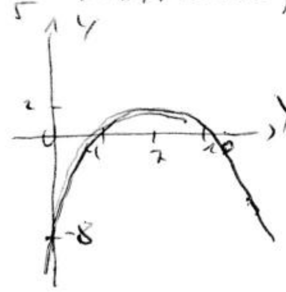
$\underline{4x - 3y - 40 = 0}$

2. a) $f(x) = -\frac{1}{5}(x^2 - 14x + 40)$

$= -\frac{1}{5}(x-4)(x-10)$

NST: $x_1 = 4$; $x_2 = 10$

Scheitel: $x = 7$; $y = \frac{9}{5}$ Maximum, $a < 0$



b) $f'(x) = -\frac{1}{5}(2x - 14) = -\frac{2}{5}(x-7)$

$f'(x) = -2$

$x = 12$ $y = -\frac{16}{5}$ $\underline{t: y = -2(x-12) - \frac{16}{5}}$

y-Achse: $\underline{104/5}$

c) $h(x) = \frac{1}{10}\underbrace{(x-7)}_{1}{}^3$

Terrassenpunkt $x = 7$; $y = 0$

$g(x) = -\frac{1}{5}(x^2 - 14x + 49) = -\frac{1}{5}(x-7)^2$ Scheitel $(7|0)$ } Steigung jeweils 0 also Berührung.

$g(x) = h(x)$

$\frac{1}{10}(x-7)^3 = -\frac{1}{5}(x-7)^2$ $| : (x-7)^2 \neq 0$ $\Leftrightarrow \underline{x \neq 7}$

$\frac{1}{10}(x-7) = -\frac{1}{5}$ $\underline{B(7|0)}$

$\underline{x = 5}$ $\underline{y = -\frac{4}{5}}$ $\underline{S(5|-\frac{4}{5})}$

d) $\int_5^7 (h-g)\,dx = \int_5^7 \left(\frac{1}{10}(x-7)^3 + \frac{1}{5}(x-7)^2\right) dx$

$= \left[\frac{1}{10}\cdot\frac{1}{4}(x-7)^4 + \frac{1}{5}\cdot\frac{1}{3}(x-7)^3\right]_5^7 = \underline{\frac{2}{15}}$

3. a) i) $(0|0)$; $(2|0)$; $(-2|0)$; $(0|2)$; $(0|-2)$

$(1|1)$; $(1|-1)$; $(-1|1)$, $(-1|-1)$

ii) $P(x\text{-Achse}) = \frac{8}{16} = \frac{1}{2}$

b) i) $4^3 = 64$ möglichen Wege

ii) rlr, rrl, lrr, oru, uro, rou, ruo, uor und our
(r=rechts, o = oben usw.)
P=1/9

4.1. $E: 2x - 4y + z + 7 = 0$ $\quad \vec{n}_1 = \begin{pmatrix} 2 \\ -4 \\ 1 \end{pmatrix}$

$F: A(2|0|-2)$ $\quad B(1|2|11)$ $\quad C(0|1|9)$

$P(5|2|-3)$

$\vec{AB} = \begin{pmatrix} -1 \\ 2 \\ 13 \end{pmatrix}$ $\quad \vec{AC} = \begin{pmatrix} -2 \\ 1 \\ 11 \end{pmatrix}$ $\quad \vec{AB} \times \vec{AC} = \begin{pmatrix} 9 \\ -15 \\ 3 \end{pmatrix} = \begin{pmatrix} 3 \\ -5 \\ 1 \end{pmatrix} = \vec{n}_2$

$\vec{n}_1 \times \vec{n}_2 = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} = \vec{n}_G$: $G: 1x + 1y + 2z + d = 0$

$P(5|2|-3)$ $\quad 5 + 2 - 6 + d = 0$

$d = -1$

$\underline{G: x + y + 2z - 1 = 0}$

4.2. $f(x) = e^{-x^2}$

$A = \text{"}\frac{1}{2} g \cdot h\text{"} = \frac{1}{2} \cdot 2x \cdot f(x) = x \cdot e^{-x^2} \to \max$ $\quad x \geq 0$

$A' = e^{-x^2} + x e^{-x^2}(-2x) = (1 - 2x^2) e^{-x^2} = 0$ $\quad e^{-x^2} > 0$

$\underline{x = \pm \frac{1}{2}\sqrt{2}}$

Vorzeichenwechsel $(+ \to -)$: $\underline{\text{Max}}$

Ränder D: $A(0) = 0$

$\lim_{x \to \infty} \underbrace{x e^{-x^2}}_{\infty \cdot 0} = 0$, da Exp. stärker als Pot.

$x = \frac{1}{2}\sqrt{2}$; $y = e^{-\frac{1}{2}} = \frac{1}{\sqrt{e}}$ $\quad P(\frac{1}{2}\sqrt{2} | e^{-\frac{1}{2}})$

$Q(-\frac{1}{2}\sqrt{2} | e^{-\frac{1}{2}})$