① a) i) $D=\mathbb{R}\setminus\{0\}$ ⑤

ii) $x^2+4x+4=0 \Rightarrow x=\frac{-4\pm\sqrt{16-16}}{2}=\underline{\underline{-2}}$

iii) $f'(x)=\frac{(2x+4)\cdot x^2-2x(x^2+4x+4)}{x^4}=0$ für

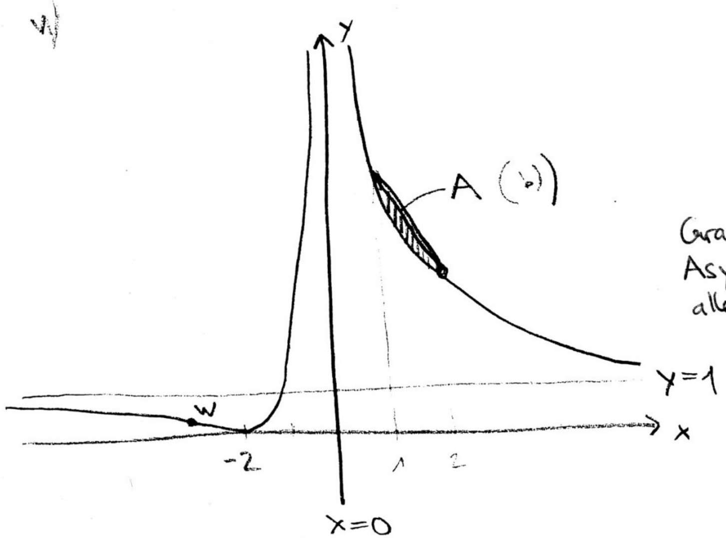
$x=-2 \Rightarrow$ $E_1(-2|0)$ (Min)

iv) $f''(x)=0$ für $x=-3 \Rightarrow W(-3,\frac{1}{9})$

2.5 pro Fehler $-\frac{1}{2}$

v) $f(x)=1+\frac{4}{x}+\frac{4}{x^2} \Rightarrow \underline{y=1}$ ①

vi)



Graph $\frac{1}{2}$
Asympt $\frac{1}{2}$
alles √ $\frac{1}{2}$

b) ③ $(1|9)$, $(2|4) \Rightarrow A_{Trapez} = m\cdot h = \frac{9+4}{2}\cdot 1 = \underline{6.5}$ $\frac{1}{2}$

$A = A_{Trapez} - \int_1^2 f(x)\,dx = 6.5 - \left[x + 4\ln(x) + \frac{4x^{-1}}{-1}\right]_1^2$ $\frac{1}{2}$

$= 6.5 - \left([2+4\ln 2 - \frac{4}{2}] - [1 + 4\ln 1 - \frac{4}{1}]\right) = \frac{7}{2} - 4\ln 2 = \underline{0.7274}$ $\frac{1}{2}$ $\frac{1}{2}$

Idee $\frac{1}{2}$

alles √ $\frac{1}{2}$ ohne TR

c) i) ③ $f'(2) = -2$ ← $\frac{1}{2}$

$\Rightarrow$ Für $a=-2$ ist $g: y=-2x+8$ Tangente

+ 2. Lösung siehe ii)

ii) $g \cap f$:

$ax - 2a + 4 = \frac{x^2+4x+4}{x^2}$ Idee $\frac{1}{2}$

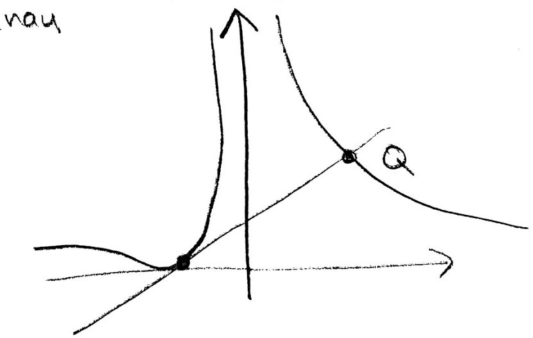
$\Rightarrow x=2$ oder $x = \frac{-3 \pm \sqrt{9-8a}}{2a}$

nur 1 Schnittpkt, wenn $9-8a < 0$ (Idee $\frac{1}{2}$)

$\Rightarrow a > \frac{9}{8}$ $\frac{1}{2}$

Für $a = \frac{9}{8}$ ⇒ Tangente $\frac{1}{2}$

da genau



alles √ $\frac{1}{2}$

2 a) 1.5

$(6+t)+3(-3+4t)-(3+t)-18=0$ (1/2)

$12t-24=0$

$t=2$ (1/2) $\Rightarrow A(8|5|5)$ (1/2)

b) 1.5

$\sin(\alpha) = \dfrac{\begin{pmatrix}1\\4\\1\end{pmatrix}\cdot\begin{pmatrix}1\\3\\-1\end{pmatrix}}{\sqrt{18}\cdot\sqrt{11}}$ (1/2) $= \dfrac{12}{\sqrt{18}\sqrt{11}} \Rightarrow \alpha = 31{,}48°$ (1/2) alles (1/2)

(0.549467)

c) 1.5

$\underset{\vec{v}_g}{\begin{pmatrix}1\\4\\1\end{pmatrix}}\cdot\underset{\vec{n}_E}{\begin{pmatrix}2\\-1\\2\end{pmatrix}}=0$ (1/2) ✓ Idee (1/2) alles (1/2)

d) 1.5

da $g \parallel F$ $d = \dfrac{2\cdot6-(-3)+2\cdot3-12}{3} = \dfrac{9}{3} = 3$ (1/2) Idee (1/2) alles (1/2)

e) 2

$\begin{vmatrix} x+3y-z-18=0 \\ 2x-y+2z-12=0 \end{vmatrix}$ $\left.\begin{matrix} x=0 \rightarrow (0|9.6|16.8) \\ y=0 \rightarrow (12|0|-6) \end{matrix}\right\}$ Pkte wählen (1)

$\Rightarrow s: \begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}12\\0\\-6\end{pmatrix} + t\begin{pmatrix}12\\-9.6\\-16.8\end{pmatrix}$ (1/2) alles (1/2)

$:12 \cdot 5 \rightarrow \begin{pmatrix}5\\-4\\-7\end{pmatrix}$

f) 2

$s \subset F$, $g \parallel F$ aber $g \nparallel s$ } Idee (1/2)

$\Rightarrow d(g,s) = d(g,F) = 3$ (wie d) → 1.5

bzw

2 oder $\vec{n}_H = \begin{pmatrix}1\\4\\1\end{pmatrix}\times\begin{pmatrix}5\\-4\\-7\end{pmatrix} = \begin{pmatrix}-24\\12\\-24\end{pmatrix}$ } Idee (1/2)

$(12|0|-6)$ $-24x+12y-24z+D=0$ $D=144$ (1/2)

$d = \dfrac{-24(6)+12(-3)-24\cdot3+144}{\sqrt{24^2+12^2+24^2}}$ (1/2) $= \underline{\underline{-3}}$ (1/2)

3 a) 4

i) $B(72, 0.2, 0\le k\le 11) = \underline{0{,}1986}$ (1)

ii) ges n mit $B(n, 0.8, 0\le k\le 60) \le 2\%$ (1/2)

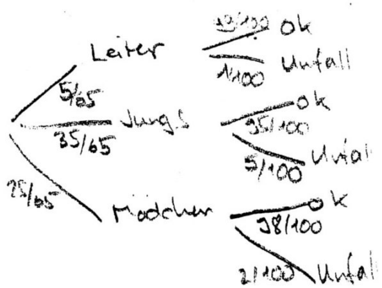
$n=65 \Rightarrow 0.998$

$n=68 \Rightarrow 0.974$

$n=67 \Rightarrow 0.988$ $\Rightarrow$ Max 67 sonst über 2% (1)

iii) $B(72, 0.85, 0\le k\le 60) = \underline{0.3946}$ (1) alles (1/2)

b) 3.5



Baum (1)

i) $\frac{5}{65}\cdot\frac{1}{100}+\frac{35}{65}\cdot\frac{5}{100}+\frac{25}{65}\cdot\frac{2}{100} = \frac{23}{650} = 0.035385$ (1)

$= 3{,}5\%$

ii) $\dfrac{35/65 \cdot 5/100}{0.035385} = 0.76087 = \underline{76\%}$ (1)

↑aus i) bed. Wk (1/2)

c) 2.5

i) $10! = \underline{3'628'800}$ (1)

ii) $4!\cdot6! = \underline{17'280}$ (1) (oder 34560 wenn Jungs / Mädchen vertauscht) alles (1/2)

d) 3

i) $\binom{5}{1}\cdot\binom{35}{3}\cdot\binom{25}{2} = \underline{9'817'500}$ Formel (1/2) Rest (1)

ii) $\binom{5}{1}\cdot\binom{34}{2}\cdot\binom{24}{1} = 67'320$ (ungünstig)

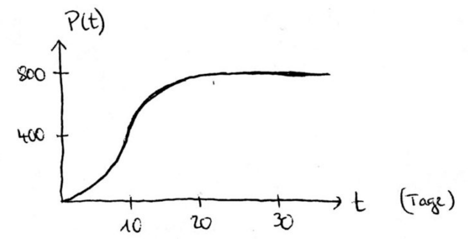
Hans dabei Maria dabei

aufteilen (1/2)

$\Rightarrow$ günstig $\underline{9750180}$ (1)

4

a) 3



i) $P(10) =$ 125 Personen 1

ii) $P(t) = 500$ für $t = 14,4$ Tage 1

→ am 15. Tag

iii) $P''(t) = 0$ für $t = 13,4$ Tage 1

→ am 14. Tag

b) 1,5

$\lim_{t \to \infty} P(t) = \frac{800}{1+0} = 800$ 1/2

$(e^{-0.5t} \to 0)$

Maximale Anzahl Personen, welche das Gerücht erfahren (können). Die Schule hat so viele Angehörige(?) 1/2

alles 1/2

c) 2,5

$P(10) = 400$ (Hälfte der Personen)

$\rightarrow 400 = \frac{800}{1+799e^{-k\cdot 10}}$ 1 $\quad$ | ·Nenner, :400, −1

$799e^{-k\cdot 10} = 1$

$-k\cdot 10 = \ln\left(\frac{1}{799}\right)$ 1/2 $\rightarrow$ $k = 0.668$ 1/2

alles 1/2

d) 4,5

① $f(0) = 1 \rightarrow$ $d = 1$ 1/2

② $f(10) = 125 \rightarrow$ $a\cdot 10^3 + b\cdot 10^2 + c\cdot 10 + d = 125$ 1/2

③ $f(36) = 800 \rightarrow$ $a\cdot 36^3 + b\cdot 36^2 + c\cdot 36 + d = 800$ 1/2

④ $f'(36) = 0 \rightarrow$ $3a\cdot 36^2 + 2b\cdot 36 + c = 0$ 1/2

TR: $a = -0.0382$ $\quad b = 2,1339$ $\quad c = -5,1194$

$d = 1$

2,5 i) $f(t) = -0.0382t^3 + 2.1339t^2 - 5.1194t + 1$ 1/2 (alles)

2 ii) $\int_0^{36} f(t) - P(t)\, dt = -4239,535$ (gerichtet)

$\Rightarrow \varnothing$ 117,765 falsche Lösung!!!

Mit NS: 0, 3,14033 ; 9,98796 ; 36

$\downarrow$ −8.5995 $\quad$ $\downarrow$ +107.848 $\quad$ $\downarrow$ 4338.784

Idee 1/2

$\Rightarrow$ Summe der Beträge: 4455.23

Idee Integral 1/2

$\Rightarrow \varnothing$ 123.7564

TR: $\int_0^{36} |f(t) - P(t)|\, dt = 4455.23$

$\Rightarrow \varnothing = \frac{1}{36} \cdot 4455.23 = 123.76$ 1/2

alles 1/2

5) a) 1
$\left|\begin{pmatrix}6\\-5\\-0.2\end{pmatrix}\right| = 7{,}8128\ \frac{km}{min} = \underline{468.77\ \frac{km}{h}}$ 1

b) 2
$\vec{AB} \times \vec{AC} = \begin{pmatrix}2\\0\\0.4\end{pmatrix} \times \begin{pmatrix}1\\2\\0.2\end{pmatrix} = \begin{pmatrix}-8\\0\\4\end{pmatrix} \parallel \begin{pmatrix}-1\\0\\5\end{pmatrix}$ 1/2

$\hookrightarrow C$: $-x+5z+D=0 \rightarrow -29+5+D=0$
$D=24$ 1/2

$\boxed{-x+5z+24=0}$ $(-0.8x+4z+19.2=0)$ 1/2

alles 1/2

c) 2.5
$\ell : \begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}25.8\\-12\\4\end{pmatrix} + t\begin{pmatrix}-1\\0\\5\end{pmatrix} \cap E$ Idee 1/2

$-(25.8-t) + 5(4+5t) + 24 = 0$ 1/2
$-25.8 + t + 20 + 25t + 24 = 0$
$26t = -18.2$
$t = -0.7$ 1/2

$\hookrightarrow$ Schatten $\boxed{(26.5 \mid -12 \mid 0.5)}$ 1/2

alles 1/2

Alternativ: $\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}25.8\\-12\\4\end{pmatrix} + t\begin{pmatrix}1\\1\\4\end{pmatrix} \cap E$

$25.8 + t - 12 + t + 16 + 16t - 13.6 = 0$
$16.2 + 18t = 0$
$t = -0.9$

$\boxed{\text{Schatten } (24.9 \mid -12.9 \mid 0.4)}$

d) 3
$\vec{BF} = \begin{pmatrix}25.8+6t-30\\-12-5t-(-20)\\4-0.2t-1.2\end{pmatrix} = \begin{pmatrix}6t-4.2\\8-5t\\2.8-0.2t\end{pmatrix}$ Idee 1/2

$|\vec{BF}| \leq 18$: $|\vec{BF}| = \sqrt{(6t-4.2)^2+(8-5t)^2+(2.8-0.2t)^2} = 18$ 1/2
1/2

TR $t = -1{,}159$ oder 3.314 1/2
$\downarrow$ 1 Min 9,56 s $\downarrow$ 3 Min 18.84 s

$\Rightarrow$ Zwischen 12.29 Uhr 50/51 sek
und 12.34 Uhr 18/19 sek 1/2

alles 1/2

6 a) 4
Sei x die halbe Länge der Seite BC
$\rightarrow A_{ABCM} = A_{BMC} + A_{AMB}$ (2 Dreiecke)
$= x \cdot h + \frac{1}{2} \cdot 1 \cdot h = \max$ 1/2

NB: $x^2+h^2 = 1^2 \Rightarrow x = \sqrt{1-h^2}$ (Pythagoras) 1/2

$\hookrightarrow$ ZF: $A = \sqrt{1-h^2} \cdot h + \frac{1}{2}h$ 1

$A'(h) = \frac{1}{2}(1-h^2)^{-\frac{1}{2}} \cdot (-2h^2) + \sqrt{1-h^2} + \frac{1}{2} = 0$ für 1/2

$\Rightarrow \underline{h = 0.805}$ $(\Rightarrow x = 0{,}593)$ $(A = 0.88)$ 1/2

alles 1

b) 4

X	-27	-18	72	81
P	$\frac{\binom{8}{3}}{\binom{10}{3}} = \frac{7}{15}$	$\frac{\binom{8}{2}\cdot 1}{\binom{10}{3}} = \frac{7}{30}$	$\frac{\binom{8}{2}\cdot 1}{\binom{10}{3}} = \frac{7}{30}$	$\frac{\binom{8}{1}\cdot 1\cdot 1}{\binom{10}{3}} = \frac{1}{15}$
S	3×1	2×1, 1×10	2×1, 1×100	1×1, 1×10, 1×100

1/2 $\left(\frac{\dots}{120}\right)$ $\leftarrow$ Wkn 1 1/2 (total 2)

1/2
$\Rightarrow E(X) = \frac{7}{15}(-27) + \frac{7}{30}(-18) + \frac{7}{30}(72) + \frac{1}{15}(81) = \underline{5.4}$ 1/2

$s^2 = \frac{7}{15}(-27)^2 + \frac{7}{30}(-18)^2 + \frac{7}{30}(72)^2 + \frac{1}{15}(81)^2 - 5.4^2$ 1/2 (mit Lösg)

$\Rightarrow s^2 = 2062.8 - 5.4^2 = 2033.64$

$\Rightarrow \underline{s = 45{,}096}$

alles 1/2