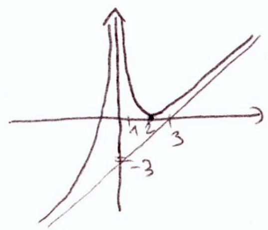
1 (5)

- $D = \mathbb{R} \setminus \{0\}$ (1/2)
- $\lim\limits_{\substack{x \to 0 \\ x<0}} f(x) = \lim\limits_{\substack{x \to 0 \\ x>0}} f(x) = \infty$ (1/2)
- NS: $x = 1$, $x = 2$ (1/2)
- horiz. Tang: $f'(x) = \dfrac{x^2 \cdot (3x^2 - 6x) - 2x(x^3 - 3x^2 + 4)}{x^4} = 0$ (1/2) Abl

für $x = 2$ $\Rightarrow$ $E(2|0)$ (1/2)

- Asympt: $y = x - 3$ (1/2) $x = 0$ (1/2)



Asympt (1/2)
~~Pkte~~ (1/2) Skalen + Graph + Pkte (1/2)
+ (1/2) alles

b) (3) $y = -x + 3$ (1)

Schnittpkte: $f(x) = g(x)$

$\Rightarrow$ $P_1(1-\sqrt{3} \mid 2+\sqrt{3})$ $P_2(1|2)$
$P_3(1+\sqrt{3} \mid 2-\sqrt{3})$ (1/2)

(1/2) Ansatz $y = mx + q$ oder Vek., Berechn (1/2)

+ (1/2) alles

c) (2) $A = \int_1^{\infty} \frac{2}{x^2}\,dx = \int 2x^{-2}\,dx = \left[2\frac{x^{-1}}{-1}\right]_1^{\infty}$ (1/2) (1/2)

$= -2\frac{1}{\infty} - \left[-2 \cdot \frac{1}{1}\right] = \underline{\underline{2}}$ + (1/2)

$\to 0$ (1/2)

2 (2,5)

E: $\vec{n}_E = \begin{pmatrix} 2 \\ -1 \\ -2 \end{pmatrix} \times \begin{pmatrix} 1 \\ 1 \\ 5 \end{pmatrix} = \begin{pmatrix} -7 \\ -8 \\ 3 \end{pmatrix}$

Idee (1/2) HA (1/2)

M in E: $-7 \cdot (-1) - 8 \cdot 1 + 3 \cdot 3 + D = 0 \Rightarrow D = -8$ (1/2)

$\boxed{-7x - 8y + 3z - 8 = 0}$ (1/2) + (1/2) alles

b) (1) $|\overrightarrow{MD}| = \left|\begin{pmatrix} 1 \\ 1 \\ 5 \end{pmatrix}\right| = \sqrt{27} = 3\sqrt{3}$ (1/2) 5,196 ✓ (1/2)

c) (1,5) $F = M + \overrightarrow{DM} = \begin{pmatrix} -1 \\ 1 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 5 \end{pmatrix} = \begin{pmatrix} 0 \\ 2 \\ 8 \end{pmatrix} \Rightarrow F(0|2|8)$

Idee (1/2) (1/2) + (1/2) alles

d) (2,5) $P \in g$: $P(-2+2t \mid 0-t \mid -2-2t)$ (1/2)

$\Rightarrow |\overrightarrow{MP}| = \left|\begin{pmatrix} -1+2t \\ -1-t \\ -5-2t \end{pmatrix}\right| = \sqrt{(-1+2t)^2 + (-1-t)^2 + (-5-2t)^2} = 3\sqrt{3}$ (1/2) (1/2)

$\Rightarrow t = 0$, $t = -2$ (1/2) $\Rightarrow$ $\boxed{\begin{matrix} P_1(-2|0|-2) \\ P_2(-6|2|2) \end{matrix}}$ (1/2)

Schnittpunkte! (1/2 Trost bei Fehler)

e) (2) HNF: Idee (1/2)

$d(E,F) = \dfrac{-2 + 56 - 18}{\sqrt{\ldots}} = (+)$

$d(E,H) = \dfrac{-72 - 2 + 14 - 18}{\sqrt{\ldots}} = (-)$ (1/2)

schneidet (1/2)

+ (1) alles

③

1.5 a) $8! \cdot 5! = 40320 \cdot 120 = 4'838'400$ (1/2) Fak (1/2) (1/2)

2 b) $\dfrac{\binom{8}{6}\cdot\binom{5}{3}}{\binom{13}{9}} = \dfrac{28\cdot 10}{715} = \underline{\underline{0{,}391608}}$ (1/2) (1/2) (1/2) (1/2)

3 c) i) $\sum_{k=0}^{4} B(10, \frac{8}{13}, k) = \underline{\underline{0{,}14167744}}$ (1/2) → {ci alleine 1.5}

Begr. (1/2)

ii) ges.: n mit $\sum_{k=5}^{n} B(n, \frac{8}{13}, k) > 0.99$ (1/2)

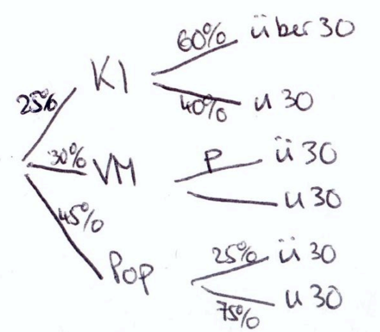
$n =$ 12	13	14	15	20
$P =$ 0,95	97,55%	98,7%	99,3%	99,98%

(1/2) probieren

↓

Mind 15 Stücke (1/2) Lösgn

3.5 a)



Baum (1/2)

a alleine 1.5

b alleine 2.5

i) $0{,}25\cdot 0.6 + 0.3\, p + 0{,}45\cdot 0{,}25 = 0{,}48 \Rightarrow p = \underline{\underline{72{,}5\%}}$ Calch (1/2) (1/2)

ii) $p = \dfrac{0{,}25\cdot 0.6 + 0{,}45\cdot 0.25}{0.48} = \underline{\underline{54{,}687\%}}$ (1/2) (1/2) bed Wk (1/2) +(1/2)

$\left\{ p = \dfrac{0.25\cdot 0.6 + 0.45\cdot 0{,}25}{0,\ \text{"}\quad \text{"} + 0.3\cdot 0{,}7498} = 54{,}866\% \right\}$ bzw. 75,7

④ a) 2

$\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}2\\3\\0\end{pmatrix} + t\begin{pmatrix}-2\\2\\1\end{pmatrix}$ (1/2) $\qquad \vec{n}_{xy} = \begin{pmatrix}0\\0\\1\end{pmatrix}$ (1/2)

$\sin(\alpha) = \dfrac{\begin{pmatrix}-2\\2\\1\end{pmatrix}\cdot\begin{pmatrix}0\\0\\1\end{pmatrix}}{3\cdot 1} = \dfrac{1}{3} \Rightarrow \alpha = \underline{\underline{19{,}47°}}$ (1/2) (1/2)

b) Projziere 1 Punkt (1/2) $\qquad t = 1 \Rightarrow (0|5|1)$ wähle Pkt (1/2)

$\begin{pmatrix}0\\5\\1\end{pmatrix} + t\begin{pmatrix}2\\-0.5\\-0.5\end{pmatrix} \cap \underbrace{z = 0}_{xy\text{-Ebene}}$ (1/2) $\Rightarrow t = 2$

↓

Schatten $(4|4|0)$ (1/2)

zudem: $A \in$ Schatten (1/2) $\Rightarrow \boxed{\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}2\\3\\0\end{pmatrix} + s\begin{pmatrix}2\\1\\0\end{pmatrix}}$ (1/2) +(1/2)

c) 2 $d = \dfrac{\left|\begin{pmatrix}-1\\8\\4\end{pmatrix}\times\begin{pmatrix}-2\\2\\1\end{pmatrix}\right|}{\left|\begin{pmatrix}-2\\2\\1\end{pmatrix}\right|} = \dfrac{\left|\begin{pmatrix}0\\3\\-6\end{pmatrix}\right|}{3} = \dfrac{\sqrt{45}}{3} = \sqrt{5} = \underline{\underline{2{,}236}}$ (1/2) Formel (1/2) (1/2) +(1/2)

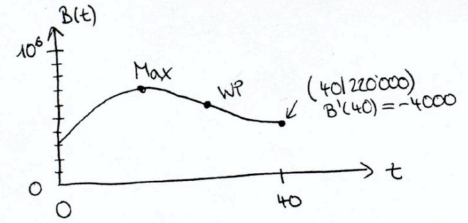
2.5 d) E: $n_E = \begin{pmatrix}-2\\2\\1\end{pmatrix}\times\begin{pmatrix}5\\4\\0\end{pmatrix} = \begin{pmatrix}-4\\5\\-18\end{pmatrix}$ (1/2) $\xrightarrow{A} -4\cdot(2) + 5\cdot(3) - 18\cdot(0) + D = 0$

Idee E (1/2) $\qquad D = -7$ (1/2)

$-4x + 5y - 18z - 7 = 0$

$\xrightarrow{\text{HNF}} (-3|12|10) \qquad \dfrac{12 + 60 - 180 - 7}{\sqrt{16 + 25 + 18^2}} = \dfrac{-115}{\sqrt{365}} = \underline{\underline{6{,}019}}$ (1/2) +(1/2)

Lösung der Anwendung Kurvendiskussion



a) 1 Maximum berechnen, $B'(t)=0$

$\Rightarrow t = 13{,}01$ / $40{,}99 \notin D$ $\Rightarrow$ Max (13.01 | 765'400) 1/4 1/4

1980

b) 1 Wendepunkt berechnen, $B''(t)=0$ 1/2

$\Rightarrow t = 27$ $\Rightarrow$ Bei $t=27$ 1/2 1994

c) 1.5 $B'(12) = 4400 \, \frac{\text{Frösche}}{\text{Jahr}}$ 1/2

$\rightarrow$ Zunahme der Frösche im Moment von 4400 pro Jahr 1/2 + 1/2

d) 1.5 $B(40) = 220'000$, $B'(40) = -4000$ 1/2

$\Rightarrow \frac{220'000}{4000} = 55$ 1/2 $\rightarrow$ Nach 55 Jahren +1/2 2062

e) 1 $\frac{1}{40} \cdot \int_0^{40} B(t)\,dt = \frac{1}{40} \cdot 21'600'000 = 540'000$ 1

f) 4 Ansatz $E(t) = at^3 + bt^2 + ct + d$, $0 \le t \le 17$

E wird in Mio. Einwohner angegeben, $t=0$ entspricht Mitte 1990

- $E(17) = 1.25$ (heute 1.25 Mio.)
- $E(0) = 1.5$ (1990: 1.5 Mio)
- $E'(5) = 0$ (1995 Maximum)
- $E'(17) = -0{,}05$ (Abnahme 2007)

$$\Rightarrow \left| \begin{array}{ll} a \cdot 17^3 + b \cdot 17^2 + c \cdot 17 + d & = 1.25 \\ d & = 1.5 \\ 3a \cdot 5^2 + 2b \cdot 5 + c & = 0 \\ 3 \cdot a \cdot 17^2 + 2 \cdot b \cdot 17 + c & = -0.05 \end{array} \right|$$

1/2 1/2 1/2 1/2 pro zu viel $-\frac{1}{2}$!

$\Rightarrow \boxed{E(t) = 0.00000721t^3 - 0.00232t^2 + 0.0227t + 1.5}$ 1/2 + 1

Bei E in Anz Einwohner:
$E(t) = 7{,}21t^3 - 2321t^2 + 22672t + 1'500'000$

$E(5) \cong 1'556'200$ 1/2 je nach Art des Rundens

d) 220000

bei +50000:
$1722{,}89t^3 - 54772t^2 + 418504$
$\rightarrow 2'438'581$

6) 2.5 a) i) $\sum_{k=0}^{X} B(50, 85, k) \ge 0.95$ 1/2

Bei $n=50$ 1/2
$p=0.85$ 1/2
k ges. mit $\sum_0^X$ 1/2

X	40	46	45	47
	0.208	0.954	0.8879	98%

1/2

$\Rightarrow$ Mind 46 Betten +1

ii) 3 $1000 = 120 \cdot q^4$ 1/2 $\Rightarrow q = \left(\frac{1000}{120}\right)^{\frac{1}{4}} = 1{,}699\ldots$ 1/2 +

$120 \cdot q^t = 100'000$ 1/2

$t = \frac{\ln\left(\frac{100'000}{120}\right)}{\ln(q)} = 12{,}68$ 1/2 + 1/2 +

$\Rightarrow$ Nach 13 Jahren bei der 14. Austragung +1/2

{→ Mit Löse 1.5}

iii) 2.5 $S_n = n \cdot 5 + \frac{n(n-1)}{2} \cdot 2 > 10'000$ 1/2 | quadr Gl

AF $a_1 = 5$ $d = 2$ 1/2

$n^2 + 4n - 10'000 > 0$ 1/2 + $\Rightarrow n = \frac{-4 \pm \sqrt{16 + 40'000}}{2}$ 1/2 +

$n = 98{,}019$ / $-102{,}01$ $\Rightarrow$ $\boxed{\text{Nach 99 Tagen}}$ + 1/2

{mit TR 1.5}

b) 4

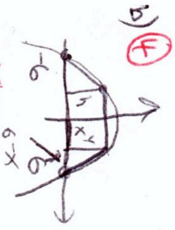


Bild 1/2

$h = f(x)$ 1/2
$a = 12$
$c = 2x$ 1/2

$A = \frac{(12+2x)}{2} \cdot f(x)$ 1/2
$= (6+x) \cdot \left(-\frac{1}{4}x^2 + 9\right) = -\frac{1}{4}x^3 - 1{,}5x^2 + 9x + 54$ 1

$\Rightarrow$ Max (2 | 64)

$\Rightarrow B(-2|8)$ $C(2|8)$ 1/2 (Punkte)

+1/2