A1 D: $x \geq 4$, $x > \frac{3}{4}$, $8 > x$ $\Rightarrow$ $\boxed{4 \leq x < 8}$

$$\sqrt{8-x} = \sqrt{(x-4)(4x-3)} \Rightarrow 8-x = 4x^2 - 19x + 12$$

$$\Leftrightarrow 0 = 4x^2 - 18x + 4 \Leftrightarrow (2x)^2 - 2 \cdot \frac{9}{2} \cdot 2x + \left(\frac{9}{2}\right)^2 - \frac{81}{4} + \frac{16}{4} = 0$$

$$\Leftrightarrow \left(2x - \frac{9}{2}\right)^2 = \frac{65}{4} = 5 \Leftrightarrow 2x = \frac{9}{2} \pm \frac{\sqrt{65}}{2}$$

$$\Leftrightarrow x = \frac{9}{4} \pm \frac{\sqrt{65}}{4}$$

$$= \begin{cases} 4.266 \\ 0.234 \end{cases}$$

Probe machen

Einsetzen, in D?

$\Rightarrow$ nur + Lsg. bleibt

$\boxed{7 \text{ min}}$

A2

(a)
$$\frac{n(n-1)}{2(2n^2-50)} + \frac{3n(1-n) - n(n+1)}{-(n^2-1)}$$

$$= \frac{n^2-1}{4n^2-100} + \frac{4n^2+3n+n}{n^2-1} \longrightarrow \frac{1}{4} + 4 = \underline{\underline{\frac{17}{4}}}$$

(b)
$$\lim_{x\to 0} \frac{2\cancel{\ln(x)}}{\cancel{\ln x}} \frac{(1-\cos^2 x)}{1-\cos x} \underset{\substack{\text{L'Hopital} \\ 0/0}}{\overset{=}{T}} 2 \lim_{x\to 0} \frac{+2\cos x \cancel{\sin x}}{+\cancel{\sin x}} = \underline{\underline{4}}$$

$\boxed{5 \text{ min}}$

A3

n	$f^{(n)}(x)$	$f^{(n)}(1)$
0	$2\ln x + 3(x-2)^2$	3
1	$2x^{-1} + 6(x-2)$	$2-6=-4$
2	$-2x^{-2}+6$	$-2+6=4$
3	$+4x^{-3}$	4
4	$-12x^{-4}$	-12

$$T(x) = 3 - 4(x-1) + \frac{4}{2}(x-1)^2 + \frac{4}{6}(x-1)^3 - \frac{12}{24}(x-1)^4$$

$$= 3 - 4(x-1) + 2(x-1)^2 + \frac{2}{3}(x-1)^3 - \frac{1}{2}(x-1)^4$$

$\boxed{4 \text{ min}}$

A4

a) b) $\left(\begin{array}{ccc|c} 0 & 3 & 9 & -1 \\ 2 & -1 & 4 & 1 \\ 4 & -1 & -1 & 1 \\ 6 & -1 & -6 & 1 \end{array}\right) \to \left(\begin{array}{ccc|c} 2 & -1 & 4 & 1 \\ 0 & 3 & 9 & -1 \\ 0 & +1 & -9 & -1 \\ \cancel{0} & \cancel{2} & \cancel{-18} & \cancel{-2} \end{array}\right) \xrightarrow{-3 \cdot z_3} \left(\begin{array}{ccc|c} 2 & -1 & 4 & 1 \\ 0 & 1 & -9 & -1 \\ 0 & 0 & +36 & +2 \end{array}\right)$

$x_3 = +\frac{1}{18}$, $x_2 - 9(+\frac{1}{18}) = -1 \iff x_2 = -\frac{1}{2}$

$2x_1 + \frac{1}{2} + \frac{4}{18} = 1 \iff 2x_1 = \frac{18+9-4}{18} \iff x_1 = \frac{5}{36}$

$L = \{\frac{5}{36}, -\frac{1}{2}, \frac{1}{18}\}$

7 min

A5 $\qquad E_x = -2(x-1) + \frac{4}{(x-1)^2}$

(a) $\qquad E_y = 18y\cos y + 9y^2 \sin x - 6y^2$

$(\text{grad } E)_{(x,y)} = \begin{pmatrix} 4(x-1)^{-2} - 2(x-1) \\ 18y\cos y - 9y^2\sin x - 6y^2 \end{pmatrix}$

$(\text{grad } E)(4,1) = \begin{pmatrix} 4/9 - 6 \\ 18\cos 1 - 9\sin 1 - 6 \end{pmatrix} = \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -5{,}556 \\ -3{,}848 \end{pmatrix}$

1. Schritt: $P_1 = \begin{pmatrix} 4 \\ 1 \end{pmatrix} - \frac{1}{\sqrt{a^2+b^2}} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 4.822 \\ 1{,}569 \end{pmatrix}$

(b)

$(\text{grad } E)(4.822, 1.569) = \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} -7{,}370 \\ -36{,}876 \end{pmatrix}$

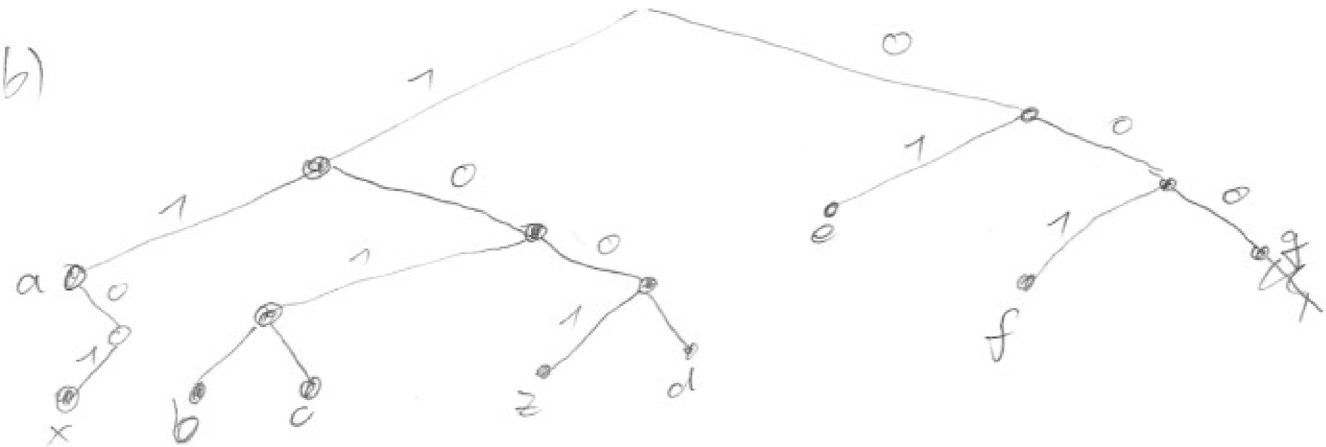
2. Schritt: $P_2 = \begin{pmatrix} 4.822 \\ 1{,}569 \end{pmatrix} + \frac{1}{\sqrt{c^2+d^2}} \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} 4{,}626 \\ 0.589 \end{pmatrix}$

$P_2 \neq$ Startpunkt, weil die Richtung von $(\text{grad } E)(4,1)$ ungleich Richtung $(\text{grad } E)(P_1)$

≈ 10 min

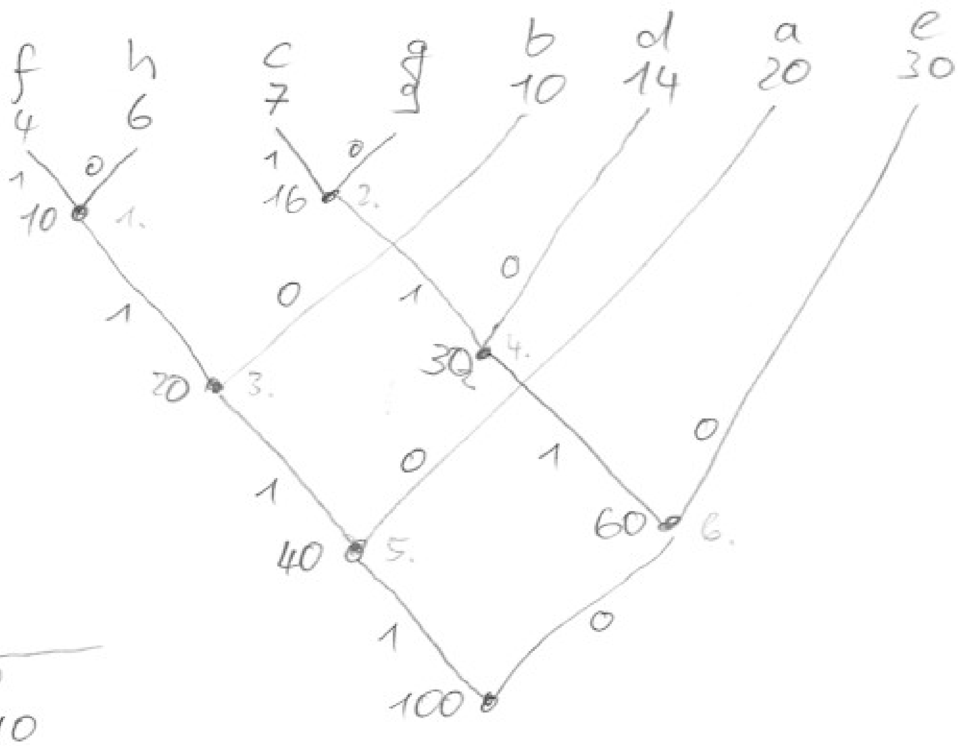
A6 a) kein Wort ist Anfangsteil eines ander Wortes

b)



{a,x} verletzt Präfixcode

(c)



a	10
b	110
c	0111
d	010
e	00
f	1111
g	0110
h	1110

4 4elementige, 2 3el., 2 2el. Wörter

19 min

A8

$$\boxed{\int_{-\pi}^{\pi} e^{i(n-m)x}\,dx = 2\pi\delta_{nm}}$$

(a) $c_n = \frac{1}{2\pi}\int_{-\pi}^{\pi}(3+e^{-5ix})e^{-inx}\,dx = \frac{1}{2\pi}\int_{-\pi}^{\pi}\left(3e^{i(0-n)x}+e^{i(-5-n)x}\right)dx$

$= 3\delta_{n0} + \delta_{n,-5}$

$F(x) = 3 + e^{-5ix} = 3 + \cos(5x) - i\sin(5x)$

$a_0 = 2c_0 = 6$

$a_n = c_n + c_{-n} = 1$ für $n=5$, 0 sonst

$b_n = i(c_n - c_{-n}) = -i$ " " "

(b) Taylor: nicht-periodische Fkt. gehen auch

Fourier: überall gut approximierend

Fourier: auch über Unstetigkeiten hinweg

" : braucht (diskrete) Werte $f(x)$

Taylor: " Ableitungen, aber nur bei x_0

(davon 3 bringen)

$\boxed{8 \text{ min}}$

A7

$\mu = np = 182 \cdot 0.4 = 72.8$ $\underbrace{> 5 \quad , \quad n(1-p) > 5}$

$\sigma = \sqrt{np(1-p)} = 6.609$ ↳ Moivre-Laplace erlaubt

$P(X \le 80) \approx \Phi\left(\frac{80-\mu}{\sigma}\right) = \Phi(1.089)$

$= \underline{0.8621}$

$= 86.21\%$

$\boxed{5 \text{ min}}$ (½ Pkt Abzug)

$$\boxed{\begin{aligned}\text{genauer: } &\Phi\left(\frac{80-\mu+0.5}{\sigma}\right) = \Phi(1.165)\\ &= 0.879\\ &= \underline{87.9\%}\end{aligned}}$$