(1) $n = 5$

nachschüss.

A: $r = 708{,}75\,€$ (Jahresende)

B: $r_1 = 500{,}00\,€$ (im 1. u. 2. Jahr)

$r_2 = 980{,}00\,€$ (im 3., 4. und 5. Jahr)

C: $R_n = 4000{,}00\,€$

$q = 1{,}045$

ALLE ANGEBOTE HEUTE

Barwert für 5 Jahre:

1.1. (A) $R_0 = r \cdot \frac{q^n - 1}{q^n \cdot (q-1)} = 708{,}75 \cdot \frac{1{,}045^5 - 1}{1{,}045^5 (1{,}045 - 1)}$

$= 3111{,}396\,€$

$\approx \underline{\underline{3111{,}40\,€}}$

(B) $R_0 = r \cdot \frac{q^n - 1}{q^n (q-1)}$

Bauf

$R_{01} = 500 \cdot \frac{1{,}045^2 - 1}{1{,}045^2 \cdot 0{,}045} = \underline{\underline{936{,}33\,€}}$

$R_{01} = 980 \cdot \frac{1{,}045^3 - 1}{1{,}045^3 \cdot 0{,}045} = \underline{\underline{2693{,}99\,€}}$

Rückverzinsen um 2 Jahre:

$R_{02} = \frac{R_n}{q^n} = \frac{2693{,}99}{1{,}045^2} = \underline{\underline{2466{,}97\,€}}$

$R_{01} + R_{02} = 936{,}33 + 2466{,}97 = \underline{\underline{3403{,}30\,€}}$

(C) $R_0 = \frac{R_n}{q^n} = \frac{4000{,}00\,€}{1{,}045^5} = \underline{\underline{3209{,}80\,€}}$

Angebot 2 (B) ist das einträglichste für Herrn Metzler.

8

Alternative Lösung für 1.1

A) Rentenendwert, nachschü. f. 5 J.: ALLE ANGEBOTE IN 5 JAHREN

$$R_n = r \cdot \frac{q^n - 1}{q - 1} = 708{,}75 \cdot \frac{1{,}045^5 - 1}{1{,}045 - 1} = \underline{\underline{3877{,}37\ €}}$$

B) 1.) Rentenendwert f. 2 J., danach f. 3. J. Zinseszins

$$R_{n1} = r \cdot \frac{q^n - 1}{q - 1} = 500 \cdot \frac{1{,}045^2 - 1}{1{,}045 - 1} = \underline{1022{,}50\ €}$$

$$K_n = K_0 \cdot q^n = 1022{,}50 \cdot 1{,}045^3 = \underline{1166{,}84\ €}$$

2.) Rentenendwert f. 3 J.

$$R_{n2} = r \cdot \frac{q^n - 1}{q - 1} = 980 \cdot \frac{1{,}045^3 - 1}{1{,}045 - 1} = \underline{3074{,}28\ €}$$

$$R_{n\,gesamt} = K_n + R_{n2} = 1166{,}84 + 3074{,}28 =$$

$$= \underline{\underline{4241{,}14\ €}}$$

C. $K_n = 4000{,}00\ €$
(bleibt so)

A: Angebot 2 (B) ist das beste für Herrn Metzler.

8

2.1 ar. Folge

$d = -3$

$a_1 = 159$

$n = 44$

$a_{44} = ?$

$a_n = a_1 + (n-1)d$

$a_{44} = 159 + (44-1)\cdot(-3) = \underline{\underline{30}}$

4

2.2 $15 \cdot 200 = 3000$

$S_n = 3000$

$S_n = \frac{n}{2} \cdot \left(2a_1 + (n-1)\cdot d\right)$

$3000 = \frac{n}{2} \cdot (2 \cdot 159 + (n-1)(-3)) \quad | \cdot 2$

$2 \cdot 3000 = n \cdot (318 - 3n + 3)$

$6000 = n \cdot (321 - 3n)$

$6000 = 321n - 3n^2 \quad | -6000$

$-3n^2 + 321n - 6000 = 0$

6

$n_{1,2} = \frac{-b \pm \sqrt{b^2 - 4 \cdot a \cdot c}}{2a} =$

$= \frac{-321 \pm \sqrt{321^2 - 4 \cdot (-3) \cdot (-6000)}}{2 \cdot (-3)}$

$\underline{\underline{n_1 = 24{,}14}} \qquad n_2 = 82{,}86 > 44$ Reihen

↯

$\Rightarrow$ Es reicht für 24 Reihen.

2.3 $g_1 = 100\,000$

$g_2 = 100.000 \cdot 1{,}04$ (4)

$g_{20} = 100\,000 \cdot 1{,}04^{19} = 210.684{,}92\ m^3$

2.4 $\dfrac{210.684{,}92}{100.000{,}00} = 210{,}68\%$ (2)

Unterschied: $211\% - 100\% = 110{,}68\%$

A: Um 110,68% gewachsen

2.5 $25m \longrightarrow a_1 = 10^\circ$ (4)

$3925m - 25m = 3900\ m$

$3900\ m : 60m = 60$ mal

$60 \cdot 2^\circ C = 120^\circ C$ mehr

$10^\circ C + 120^\circ C = \underline{\underline{130^\circ C}}$

oder:

$25m \longrightarrow a_1 = 10^\circ$

$a_2 = 10^\circ + d = 10 + 2$

$a_3 = 10 + 2d$

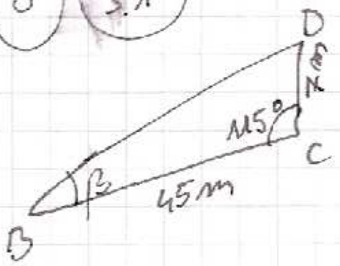
$\vdots$

$3925m \longrightarrow a_{61} = 10 + (61-1)\,d =$

$= 10 + 60 \cdot 2 = \underline{130^\circ C}$

60 mal

(3) 3.1



Kosinussatz in ΔBCD:

$$BD = \sqrt{BC^2 + DC^2 - 2 \cdot BC \cdot DC \cdot \cos 115°} =$$

$$= \sqrt{45^2 + 7^2 - 2 \cdot 45 \cdot 7 \cdot \cos 115°} =$$

$$= \underline{\underline{48{,}38\ m}}$$ 3

3.2 Sinussatz in ΔBCD:

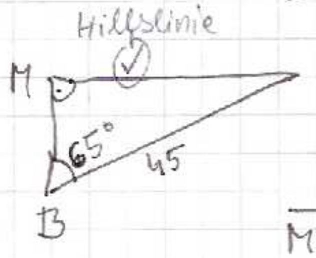
$$\frac{\overline{DC}}{\overline{BD}} = \frac{\sin\beta}{\sin 115°}$$

$$\frac{7}{48{,}38} = \frac{\sin\beta}{\sin 115°} \quad \Big| \cdot \sin 115°$$

$$\frac{7 \cdot \sin 115°}{48{,}38} = \sin\beta$$

$$\underline{\underline{\beta = 7{,}53°}}$$ (od. mit Kos.-Satz) 4

3.3



$$\cos\beta = \frac{\overline{MB}}{\overline{BC}} \quad \Big| \cdot \overline{BC}$$

$$\overline{MB} = \overline{BC} \cdot \cos\beta = 45 \cdot \cos 65° = 19{,}02$$

$$\overline{AB} = \overline{AM} + \overline{MB} = 7\,m + 19{,}02\,m = \underline{\underline{26{,}02\,m}}$$

(od: ΔABD
$\delta = 32{,}54°$
$\sin\delta = \frac{x}{48{,}37}$
$x = 26{,}02$) 4

3.4 $A_{Gesamt} = A_{\square} + A_{\Delta MBC}$

$$A_{\Delta MBC} = \frac{g \cdot h}{2} = \frac{\overline{MB} \cdot \overline{MC}}{2}$$

$$\sin\beta = \frac{\overline{MC}}{\overline{BC}} \qquad \overline{MC} = \overline{BC} \cdot \sin\beta = 45 \cdot \sin 65° = 40{,}78$$

(od. Pyth.)

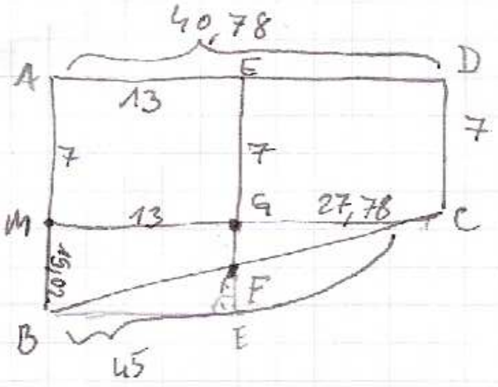
$$A_{\Delta MBC} = \frac{19{,}02 \cdot 40{,}78}{2} = 387{,}82\ m^2$$ 5

$$A_{\square} = \overline{AM} \cdot \overline{MC} = 7 \cdot 40{,}78 = 285{,}46\ m^2$$ (284,9)

$$A_{Gesamt} = 285{,}46\ m^2 + 387{,}82\ m^2 = \underline{\underline{673{,}28\ m^2}}$$

(od. als Trapez ABCD)

(3.5)



$$\overline{GC} = 40{,}78 - 13 = 27{,}78\ m$$

$$\frac{\overline{GF}}{\overline{MB}} = \frac{\overline{GC}}{\overline{CM}}$$

$$\frac{\overline{GF}}{19{,}02} = \frac{27{,}78}{40{,}78} \quad \Big| \cdot 19{,}02$$

$$GF = \frac{27 \cdot 19{,}02}{40{,}78} = 12{,}59\ m$$

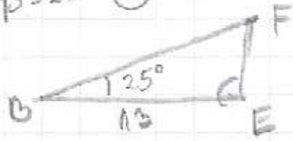
$$\overline{EF} = \overline{EG} + \overline{GF} = 7 + 12{,}59 = \underline{\underline{19{,}59\ m}}$$

4

oder! im Δ BEF:

$$\tan 25^\circ = \frac{EF}{13}$$

$\beta = 25^\circ$



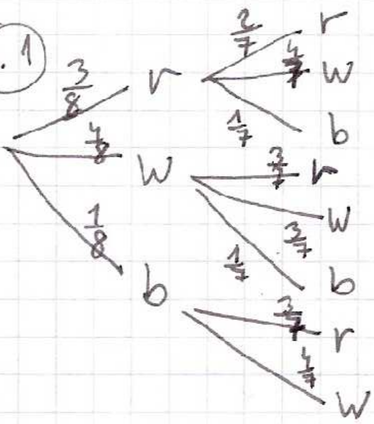
$$EF = \tan 25^\circ \cdot 13 = 6{,}06\ m$$

$$EF = AB - FE = 26{,}02 - 6{,}06 = \underline{\underline{19{,}96\ m}}$$

oder mit sin-Satz im Δ GFC ...

(4) $3r, 4w, 1b$ 2x Ziehen ohne Zurücklegen

(4.1)



Baumdiagramm

Wahrsch. 1. Ziehen

Wahrsch. 2. Ziehen

3

(4.2) $E_1 =$ „keine Kugel rot" $= \{(w,w);(w b);(b,w)\}$

$P(E_1) = \frac{4}{8} \cdot \frac{3}{7} + \frac{4}{8} \cdot \frac{1}{7} + \frac{1}{8} \cdot \frac{4}{7} = \frac{5}{14} = \underline{\underline{35{,}71\%}}$

2

(4.3) E_2 = „mind. 1 K. weiß" $= \{(r w);(w r);(w b);(w w)(b w)\}$

2

$= \frac{3}{8} \cdot \frac{4}{7} + \frac{4}{8} \cdot \frac{3}{7} + \frac{4}{8} \cdot \frac{1}{7} + \frac{4}{8} \cdot \frac{3}{7} + \frac{1}{8} \cdot \frac{4}{7}$

$= \frac{1}{56}(12 + 12 + 4 + 12 + 4) = \frac{44}{56} = \frac{11}{14} = \underline{\underline{78{,}57\%}}$

(4.4) E_3 = „1. Kugel ist blau" $= \{(b,r);(b w)\}$

2

$P(E_3) = \frac{1}{8} \cdot \frac{3}{7} + \frac{1}{8} \cdot \frac{4}{7} = \frac{1}{8} = \underline{\underline{12{,}5\%}}$

4.5

n	1	2	3	4	5	6	7
Preis (€)	229	237	242	249	258	279	284

$x_{med} = x_4 = \underline{\underline{249,00\,€}}$

4

$$\bar{x} = \frac{229 + 237 + 242 + 249 + 258 + 279 + 284}{7}$$

$$= \frac{1778}{7} = \underline{\underline{254,00\,€}}$$

4.6

$R = x_{max} - x_{min} = 284 - 229 = \underline{\underline{55,00\,€}}$

$$MA = \frac{|229-254| + |237-254| + |242-254| + |249-254| + |258-254| + |279-254| + |284-254|}{7} =$$

3

$$= \frac{25 + 17 + 12 + 5 + 4 + 25 + 30}{7}$$

$$= \frac{118}{7} = \underline{\underline{16,86\,€}}$$

4.7

$$\bar{x}_{neu} = \frac{x_1 + x_2 + \ldots + x_7 + x_{neu}}{8}$$

$$260 = \frac{1778 + x_{neu}}{8} \quad | \cdot 8$$

4

$260 \cdot 8 = 1778 + x_{neu}$

$2080 = 1778 + x_{neu} \quad | -1778$

$\underline{\underline{302 = x_{neu}}}$

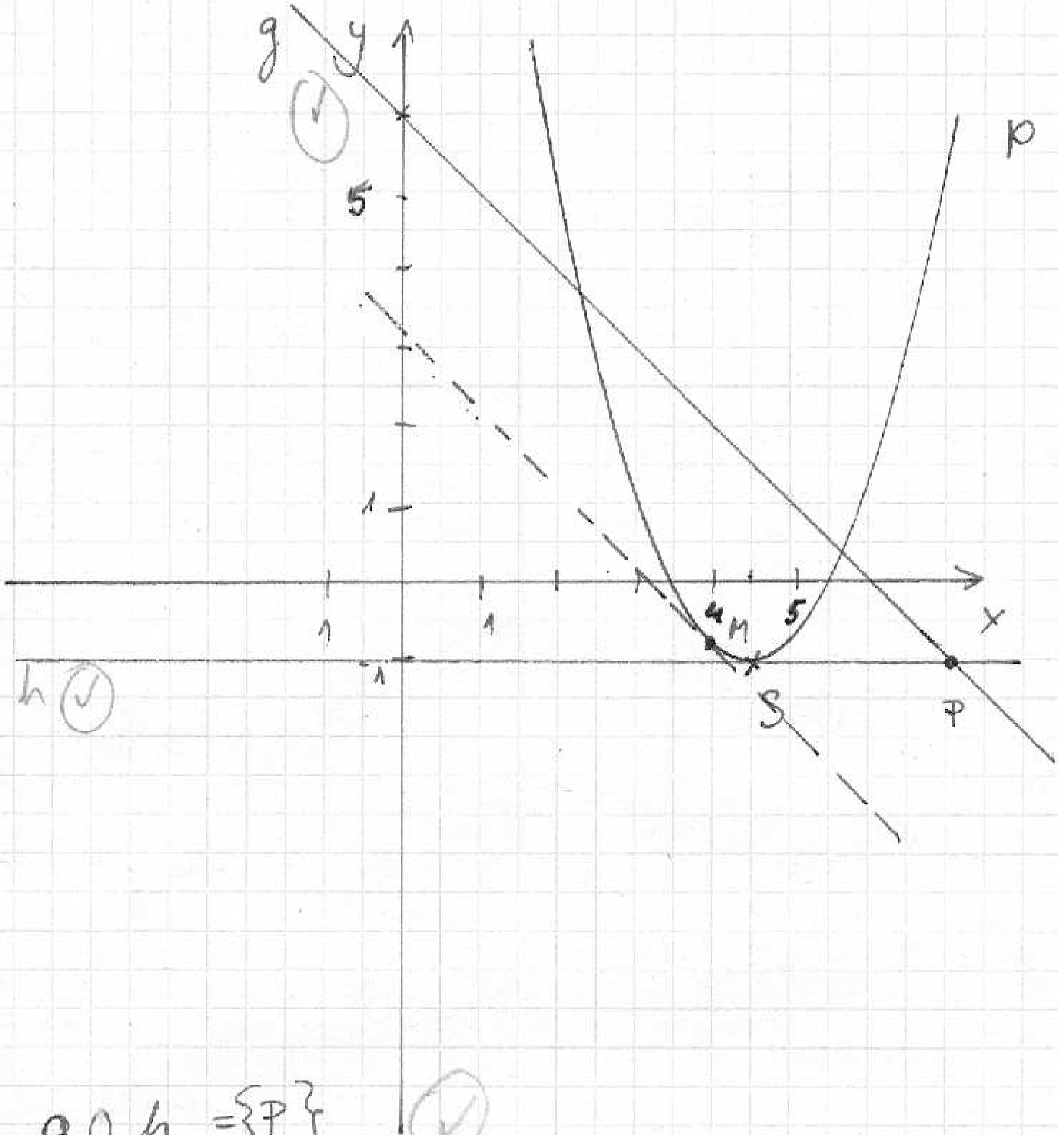
A: Der Preis des Staubsaugers aus dem 8. Kaufhaus ist 302,00 €.

5

$g: y = -x + 6$

$h: y = -1$

5.1



2

5.2

$g \cap h = \{P\}$

$-x + 6 = -1 \quad | -6$

$-x = -7 \quad | \cdot(-1)$

$x = 7$

$y = -7 + 6 = -1$

$P(7|-1)$

2

5.3

$m = 2 \quad ; \quad B(-3|-1)$

$y = m \cdot x + t$

$y = 2 \cdot x + t$

B einsetzen: $\quad -1 = 2 \cdot (-3) + t$

$-1 = -6 + t \quad | +6$

$5 = t$

$\underline{\underline{y = 2x + 5}}$

3

5.4 $p: y = x^2 - 9x + 19{,}25$

$a = 1$
$b = -9$
$c = 19{,}25$

$x_s = \frac{-b}{2a}$

$x_s = \frac{-(-9)}{2 \cdot 1} = \frac{9}{2}$

$\underline{\underline{x_s = 4{,}5}}$

$y_s = c - \frac{b^2}{4a} = 19{,}25 - \frac{(-9)^2}{4 \cdot 1} =$

$= 19{,}25 - \frac{81}{4} =$

$\underline{\underline{y_s = -1}}$

3

$S(4{,}5 \mid -1)$ Parabel einzeichnen

5.5 $g \cap p = \{A, B\}$

$g: y = -x + 6$
$p: y = x^2 - 9x + 19{,}25$

$-x + 6 = x^2 - 9x + 19{,}25 \quad | +x - 6$

$0 = x^2 - 8x + 13{,}25$

$a = 1$
$b = -8$
$c = 13{,}25$

4

$D = b^2 - 4ac =$

$= (-8)^2 - 4 \cdot 1 \cdot 13{,}25$

$= 64 - 53 = 11 > 0 \Rightarrow$ 2 Schnittpkt.

5.6 $t: y = mx + n$

$t \parallel g \Rightarrow m_t = m_g = -1$

$t: y = -x + n$

$$-x + n = x^2 - 9x + 19{,}25 \quad | +x - n$$

$$0 = x^2 - 8x + 19{,}25 - n = 0$$

$a = 1$
$b = -8$
$c = 19{,}25 - n$

1 Berührpunkt $\Rightarrow D = 0$

$$D = b^2 - 4 \cdot a \cdot c = (-8)^2 - 4 \cdot 1 \cdot (19{,}25 - n)$$

$$64 - 4 \cdot (19{,}25 - n) = 0$$

$$64 - 77 + 4n = 0$$

$$-13 + 4n = 0 \quad | +13$$

$$4n = 13 \quad | :4$$

$$n = \frac{13}{4} = \underline{\underline{3{,}25}}$$

$$t: \underline{\underline{y = -x + 3{,}25}}$$

<u>M bestimmen:</u>

$$-x + 3{,}25 = x^2 - 9x + 19{,}25 \quad | +x - 3{,}25$$

$$0 = x^2 - 8x + 16$$

$$x_{1,2} = \frac{8 \pm \sqrt{(-8)^2 - 4 \cdot 1 \cdot 16}}{2 \cdot 1} = \frac{8 \pm 0}{2} = 4$$

$$y_M = -1 \cdot 4 + 3{,}25 = -0{,}75$$

$$\underline{\underline{M\,(4 \,|\, -0{,}75)}}$$

6