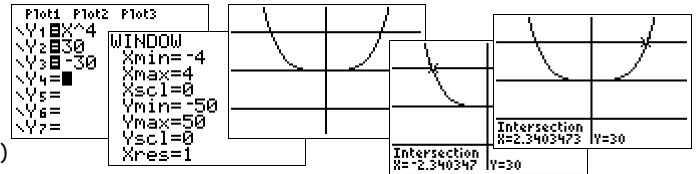


1a Zie de plot hiernaast.

1b $x^4 = 30$ heeft twee oplossingen. (zie de plot hiernaast)

$x^4 = 30$ optie intersect $\Rightarrow x \approx -2,34$ en $x \approx 2,34$.

1c $x^4 = -30$ heeft geen oplossingen. (zie de plot hiernaast)



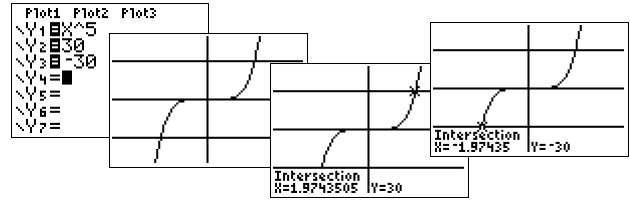
2a Zie de plot hiernaast.

2b $x^5 = 30$ heeft één oplossing. (zie de plot hiernaast)

$x^5 = 30$ optie intersect $\Rightarrow x \approx 1,97$.

2c $x^5 = -30$ heeft één oplossing. (zie de plot hiernaast)

$x^5 = -30$ optie intersect $\Rightarrow x \approx -1,97$.



3a $\sqrt[3]{64} = \sqrt[3]{4^3} = 4$.

3d $-4 \cdot \sqrt[3]{-1000} = -4 \cdot \sqrt[3]{(-10)^3} = -4 \cdot -10 = 40$.

3b $\sqrt[4]{16} = \sqrt[4]{2^4} = 2$.

3e $3 \cdot \sqrt[5]{32} - 2 \cdot \sqrt[4]{81} = 3 \cdot \sqrt[5]{2^5} - 2 \cdot \sqrt[4]{3^4} = 3 \cdot 2 - 2 \cdot 3 = 6 - 6 = 0$.

3c $\sqrt[3]{-125} = \sqrt[3]{(-5)^3} = -5$.

3f $3 \cdot \sqrt[4]{1} - 2 \cdot \sqrt[5]{-1} = 3 \cdot \sqrt[4]{1^4} - 2 \cdot \sqrt[5]{(-1)^5} = 3 \cdot 1 - 2 \cdot -1 = 3 + 2 = 5$.

4a $x^6 = 20$
 $x = \pm \sqrt[6]{20}$

0,5x⁵ = 20
 $x^5 = 40$
 $x = \sqrt[5]{40}$

4e $3x^5 - 1 = 95$
 $3x^5 = 96$
 $x^5 = 32$
 $x = \sqrt[5]{32} = 2$

4b $5x^3 = 135$
 $x^3 = 27$
 $x = \sqrt[3]{27} = 3$

4d $x^4 + 7 = 88$
 $x^4 = 81$
 $x = \pm \sqrt[4]{81} = \pm 3$

4f $\frac{1}{4}x^8 + 3 = 10$
 $\frac{1}{4}x^8 = 7$
 $x^8 = 28$
 $x = \pm \sqrt[8]{28}$

5a $3x^5 + 7 = 15$
 $3x^5 = 8$
 $x^5 = \frac{8}{3}$
 $x = \sqrt[5]{\frac{8}{3}} \approx 1,22$

of $3x^5 + 7 = 15$
intersect:
 $x \approx 1,22$

5b $\frac{1}{3}x^7 = 720$
 $x^7 = 2160$
 $x = \sqrt[7]{2160} \approx 2,99$

of $\frac{1}{3}x^7 = 720$
intersect:
 $x \approx 2,99$

5c $0,7x^4 - 1,3 = 2$
 $0,7x^4 = 3,3$
 $x^4 = \frac{3,3}{0,7}$
 $x = \pm \sqrt[4]{\frac{3,3}{0,7}} \approx \pm 1,47$

of $0,7x^4 - 1,3 = 2$
intersect:
 $x \approx -1,47 \vee x \approx 1,47$

6a $5x^4 - 1 = 4$
 $5x^4 = 5$
 $x^4 = 1$
 $x = \pm \sqrt[4]{1} = \pm 1$

6c $5x^3 - 1 = 5$
 $5x^3 = 6$
 $x^3 = 1,2$
 $x = \sqrt[3]{1,2}$

6e $5x^6 + 7 = 98$
 $5x^6 = 91$
 $x^6 = 18,2$
 $x = \pm \sqrt[6]{18,2}$

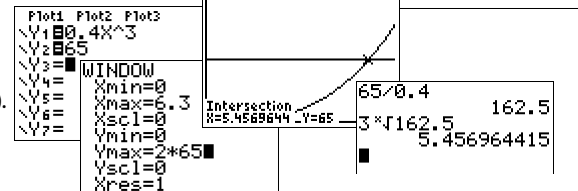
6b $5x^4 = -4$
 $x^4 = -\frac{4}{5}$
geen oplossing.

6d $8x^3 + 2 = 1$
 $8x^3 = -1$
 $x^3 = -\frac{1}{8}$
 $x = \sqrt[3]{-\frac{1}{8}} = -\frac{1}{2}$

6f $0,1x^7 - 1 = 999$
 $0,1x^7 = 1000$
 $x^7 = 10000$
 $x = \sqrt[7]{10000}$

7a $d = 6,3$ (cm) $\Rightarrow G = 0,4 \cdot 6,3^3 \approx 100$ (gram).

7b $G = 65$ (gram) $\Rightarrow 0,4d^3 = 65$ (intersect of algebraïsch) $\Rightarrow d \approx 5,5$ (cm).



7c Noem de kleinste diameter x , dan is de grootste diameter $2x$.

$$\left. \begin{aligned} d = x &\Rightarrow G = 0,4x^3 \\ d = 2x &\Rightarrow G = 0,4 \cdot (2x)^3 = 0,4 \cdot 8x^3 = 8 \cdot 0,4x^3 \end{aligned} \right\} \Rightarrow \text{de grootste appel is 8 keer zo zwaar.}$$

7d Noem het kleinste gewicht y , dan is het grootste gewicht $2y$.

$$\left. \begin{aligned} G = y &\Rightarrow 0,4d^3 = y \Rightarrow d^3 = \frac{y}{0,4} \Rightarrow d = \sqrt[3]{\frac{y}{0,4}} \\ G = 2y &\Rightarrow 0,4d^3 = 2y \Rightarrow d^3 = 2 \cdot \frac{y}{0,4} \Rightarrow d = \sqrt[3]{2 \cdot \frac{y}{0,4}} = \sqrt[3]{2} \cdot \sqrt[3]{\frac{y}{0,4}} \end{aligned} \right\} \Rightarrow \text{de grootste diameter is } \sqrt[3]{2} \approx 1,26 \text{ keer zo groot.}$$

(het is niet voldoende als bij 7c en 7d alleen getallenvoorbeelden worden genomen)

8a $L = 0,4$ (m) en $G = 300$ (kg) $\Rightarrow D = 0,0285 \cdot 300 \cdot 0,4^3 \approx 0,5$ (cm).

8b $G = 250$ (kg) en $D = 1,2$ (cm) $\Rightarrow 1,2 = 0,0285 \cdot 250 \cdot L^3$ (algebraïsch of intersect) $\Rightarrow L \approx 0,55$ (m).

8c $D = 2,5$ (cm) en $G = 300$ (kg) $\Rightarrow 2,5 = 0,0285 \cdot 300 \cdot L^3$ (algebraïsch of intersect) $\Rightarrow L \approx 0,66$ (m).

8d Noem de kleinste afstand $L_{II} = x$ dan is de grootste afstand $L_I = 2x$.

$$\left. \begin{aligned} L_{II} = x &\Rightarrow D_{II} = 0,0285 \cdot G \cdot x^3 \\ L_I = 2x &\Rightarrow D_I = 0,0285 \cdot G \cdot (2x)^3 = 0,0285 \cdot G \cdot 8x^3 \end{aligned} \right\} \Rightarrow D_I = 8 \cdot D_{II}.$$

9a $d = 5$ (cm) en $W = 13,5$ (l/s) $\Rightarrow 13,5 = a \cdot 5^4 \Rightarrow \frac{13,5}{5^4} = a = 0,0216$.

9b $d = 8$ (cm) en $a = 0,02 \Rightarrow W = 0,02 \cdot 8^4 = 81,92$ (l/s).
Dat is $81,92 \cdot 60 = 4915,2$ liter per minuut.

9c $W = \frac{16650}{60 \cdot 60} = 4,625$ (l/s) en $a = 0,02 \Rightarrow 4,625 = 0,02 \cdot d^4$ (algebraïsch of intersect) $\Rightarrow d = 3,9$ (cm).

10 $(\sqrt[3]{8})^3 = 8$ ((...)³ en $\sqrt[3]{\dots}$ heffen elkaar op).

$(\sqrt[4]{81})^4 = 81$ ((...)⁴ en $\sqrt[4]{\dots}$ heffen elkaar op).

$(\sqrt[5]{32})^5 = 32$.

$(\sqrt[3]{1000})^3 = 1000$.

11a $x^4 = 6$
 $x = \pm \sqrt[4]{6}$.

11d $3x^5 - 1 = 20$
 $3x^5 = 21$
 $x^5 = 7$
 $x = \sqrt[5]{7}$.

11g $0,1 \cdot \sqrt{x} + 2 = 12$
 $0,1 \cdot \sqrt{x} = 10$
 $\sqrt{x} = 100$
 $x = 100^2 = 10000$.

11b $\sqrt[4]{x} = 6$
 $x = 6^4 = 1296$.

11e $3 \cdot \sqrt[4]{x} + 2 = 14$
 $3 \cdot \sqrt[4]{x} = 12$
 $\sqrt[4]{x} = 4$
 $x = 4^4 = 256$.

11h $5 - 2 \cdot \sqrt[3]{x} = 3$
 $-2 \cdot \sqrt[3]{x} = -2$
 $\sqrt[3]{x} = 1$
 $x = 1^3 = 1$.

11c $\sqrt[5]{x} = 2$
 $x = 2^5 = 32$.

11f $0,2x^7 + 8 = 26$
 $0,2x^7 = 18$
 $x^7 = 90$
 $x = \sqrt[7]{90}$.

11i $3 \cdot \sqrt[5]{x} - 1 = 20$
 $3 \cdot \sqrt[5]{x} = 21$
 $\sqrt[5]{x} = 7$
 $x = 7^5 = 16807$.

12a $y = x^5$
 $x^5 = y$
 $x = \sqrt[5]{y}$.

12c $y = \sqrt[7]{x}$
 $\sqrt[7]{x} = y$
 $x = y^7$.

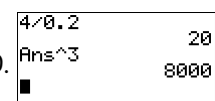
12e $y = 0,1x^5 - 6$
 $0,1x^5 - 6 = y$
 $0,1x^5 = y + 6$
 $x^5 = 10y + 60$
 $x = \sqrt[5]{10y + 60}$.

12b $y = 2x^5 + 4$
 $2x^5 + 4 = y$
 $2x^5 = y - 4$
 $x^5 = \frac{1}{2}y - 2$
 $x = \sqrt[5]{\frac{1}{2}y - 2}$.

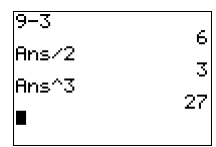
12d $y = 2 \cdot \sqrt[3]{x} + 8$
 $2 \cdot \sqrt[3]{x} + 8 = y$
 $2 \cdot \sqrt[3]{x} = y - 8$
 $\sqrt[3]{x} = \frac{1}{2}y - 4$
 $x = (\frac{1}{2}y - 4)^3$.

12f $y = 0,1 \cdot \sqrt[5]{x} - 6$
 $0,1 \cdot \sqrt[5]{x} - 6 = y$
 $0,1 \cdot \sqrt[5]{x} = y + 6$
 $\sqrt[5]{x} = 10y + 60$
 $x = (10y + 60)^5$.

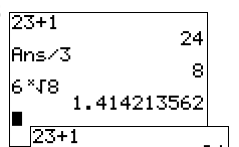
13a $0,2 \cdot \sqrt[3]{x} = 4$
 $\sqrt[3]{x} = 20$
 $x = 20^3 = 8000.$



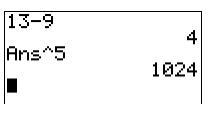
13c $3 + 2 \cdot \sqrt[3]{x} = 9$
 $2 \cdot \sqrt[3]{x} = 6$
 $\sqrt[3]{x} = 3$
 $x = 3^3 = 27.$



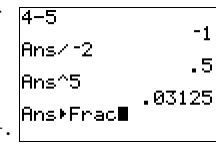
13e $3x^6 - 1 = 23$
 $3x^6 = 24$
 $x^6 = 8$
 $x = \pm \sqrt[6]{8}.$



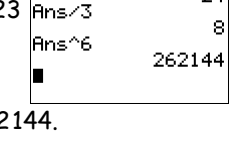
13b $9 + \sqrt[5]{x} = 13$
 $\sqrt[5]{x} = 4$
 $x = 4^5 = 1024.$



13d $5 - 2 \cdot \sqrt[5]{x} = 4$
 $-2 \cdot \sqrt[5]{x} = -1$
 $\sqrt[5]{x} = \frac{1}{2}$
 $x = (\frac{1}{2})^5 = \frac{1}{32}.$



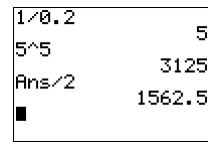
13f $3 \cdot \sqrt[6]{x} - 1 = 23$
 $3 \cdot \sqrt[6]{x} = 24$
 $\sqrt[6]{x} = 8$
 $x = 8^6 = 262144.$



14a $y = 0,5 \cdot \sqrt[7]{x} - 8$
 $0,5 \cdot \sqrt[7]{x} - 8 = y$
 $0,5 \cdot \sqrt[7]{x} = y + 8$
 $\sqrt[7]{x} = 2y + 16$
 $x = (2y + 16)^7.$

14c $y = \sqrt[3]{x} + 6$
 $\sqrt[3]{x} + 6 = y$
 $x + 6 = y^3$
 $x = y^3 - 6.$

14e $y = 0,2 \cdot \sqrt[5]{2x-3}$
 $0,2 \cdot \sqrt[5]{2x-3} = y$
 $\sqrt[5]{2x-3} = 5y$
 $2x - 3 = (5y)^5 = 3125y^5$
 $2x = 3125y^5 + 3$
 $x = 1562,5y^5 + 1,5.$

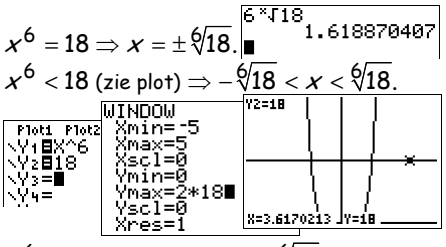


14b $y = 0,5 \cdot x^7 - 8$
 $0,5 \cdot x^7 - 8 = y$
 $0,5 \cdot x^7 = y + 8$
 $x^7 = 2y + 16$
 $x = \sqrt[7]{2y + 16}.$

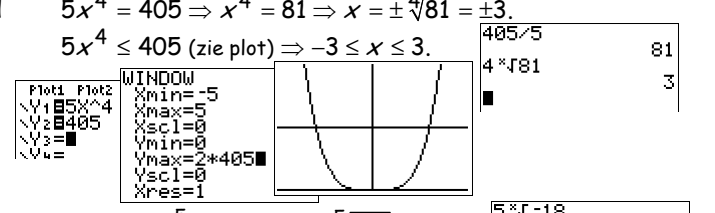
14d $y = 2 \cdot \sqrt[5]{x} + 3$
 $2 \cdot \sqrt[5]{x} + 3 = y$
 $2 \cdot \sqrt[5]{x} = y - 3$
 $\sqrt[5]{x} = \frac{1}{2}y - 1\frac{1}{2}$
 $x = (\frac{1}{2}y - 1\frac{1}{2})^5.$

14f $y = 0,2 \cdot x^5 - 3$
 $0,2 \cdot x^5 - 3 = y$
 $0,2 \cdot x^5 = y + 3$
 $x^5 = 5y + 15$
 $x = \sqrt[5]{5y + 15}.$

15a $x^6 = 18 \Rightarrow x = \pm \sqrt[6]{18}.$
 $x^6 < 18$ (zie plot) $\Rightarrow -\sqrt[6]{18} < x < \sqrt[6]{18}.$

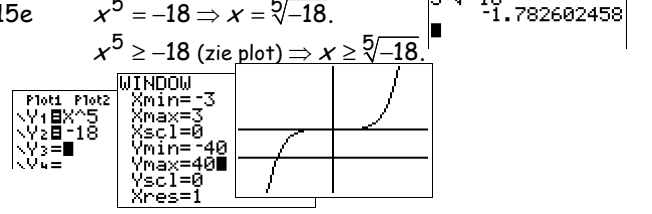


15d $5x^4 = 405 \Rightarrow x^4 = 81 \Rightarrow x = \pm \sqrt[4]{81} = \pm 3.$
 $5x^4 \leq 405$ (zie plot) $\Rightarrow -3 \leq x \leq 3.$

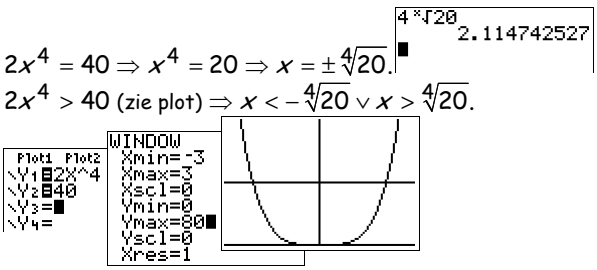


15b $x^6 = 18$ (zie 15a) $\Rightarrow x = \pm \sqrt[6]{18}.$
 $x^6 \geq 18$ (zie plot van 15a) $\Rightarrow x \leq -\sqrt[6]{18} \vee x \geq \sqrt[6]{18}.$

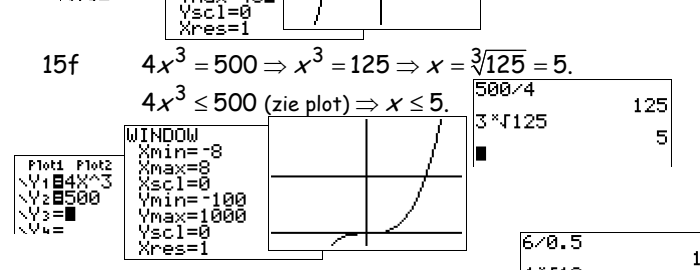
15e $x^5 = -18 \Rightarrow x = \sqrt[5]{-18}.$
 $x^5 \geq -18$ (zie plot) $\Rightarrow x \geq \sqrt[5]{-18}.$



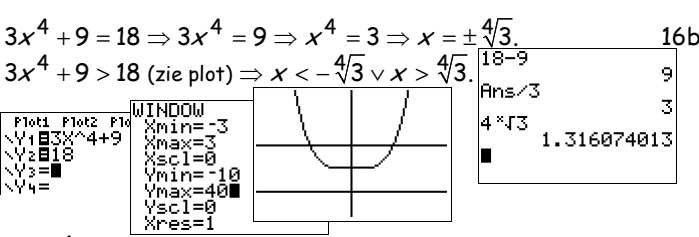
15c $2x^4 = 40 \Rightarrow x^4 = 20 \Rightarrow x = \pm \sqrt[4]{20}.$
 $2x^4 > 40$ (zie plot) $\Rightarrow x < -\sqrt[4]{20} \vee x > \sqrt[4]{20}.$



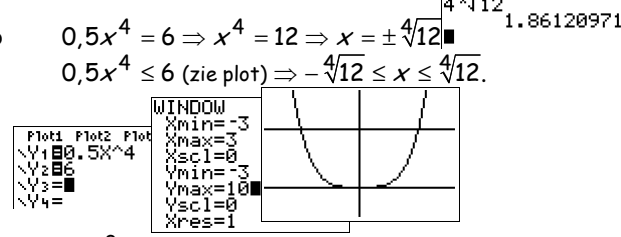
15f $4x^3 = 500 \Rightarrow x^3 = 125 \Rightarrow x = \sqrt[3]{125} = 5.$
 $4x^3 \leq 500$ (zie plot) $\Rightarrow x \leq 5.$



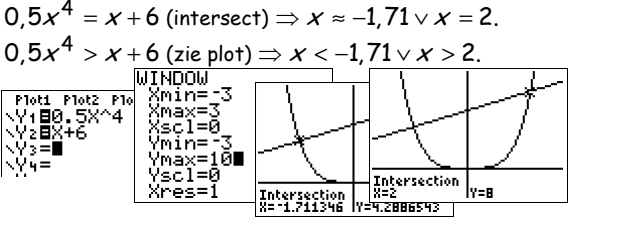
16a $3x^4 + 9 = 18 \Rightarrow 3x^4 = 9 \Rightarrow x^4 = 3 \Rightarrow x = \pm \sqrt[4]{3}.$
 $3x^4 + 9 > 18$ (zie plot) $\Rightarrow x < -\sqrt[4]{3} \vee x > \sqrt[4]{3}.$



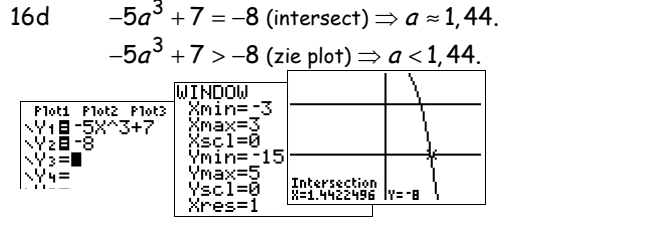
16b $0,5x^4 = 6 \Rightarrow x^4 = 12 \Rightarrow x = \pm \sqrt[4]{12}.$
 $0,5x^4 \leq 6$ (zie plot) $\Rightarrow -\sqrt[4]{12} \leq x \leq \sqrt[4]{12}.$



16c $0,5x^4 = x + 6$ (intersect) $\Rightarrow x \approx -1,71 \vee x = 2.$
 $0,5x^4 > x + 6$ (zie plot) $\Rightarrow x < -1,71 \vee x > 2.$



16d $-5a^3 + 7 = -8$ (intersect) $\Rightarrow a \approx 1,44.$
 $-5a^3 + 7 > -8$ (zie plot) $\Rightarrow a < 1,44.$



17a Na drie weken $750 + 3 \cdot 150 = 1200$ (m²);
na vijf weken $750 + 5 \cdot 150 = 1500$ (m²).

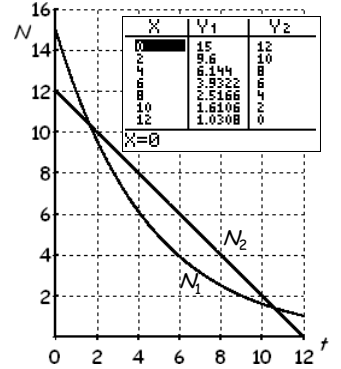
17b Na één week $16 \cdot 2 = 32$ (m²);
na vier weken $16 \cdot 2 \cdot 2 \cdot 2 = 16 \cdot 2^4 = 256$ (m²).

17c $750 + w \cdot 150 = 16 \cdot 2^w$ (intersect) $\Rightarrow w \approx 6,8 \Rightarrow$ (bijna) 7 weken na 1 juni.

18a Zie de grafieken hiernaast. (gebruik TABLE op de GR)

18b $15 \cdot 0.8^t = 0,5$ (intersect) $\Rightarrow t \approx 15,2$. Dus vanaf $t = 16$.

18c $15 \cdot 0.8^t = 12 - t$ (intersect) $\Rightarrow t \approx 1,67 \vee t \approx 10,59$.



19a $N = 18,6 \cdot 1,035^t$ (met $t = 0$ in januari 2006).

19b $t = 4 \Rightarrow N = 18,6 \cdot 1,035^4 \approx 21,3$ (miljoen inwoners).

19c $N = 18,6 \cdot 1,035^t = 25$ (intersect of blader in TABLE) $\Rightarrow t \approx 8,6$.
Dus 8,6 jaar na januari 2006 \Rightarrow in 2014.

19d $N(t) - N(t-1) > 1$ (blader in TABLE) $\Rightarrow t = 14$.
Dus voor het eerst van $t = 13$ tot $t = 14 \Rightarrow$ in 2019.

X	Y2	Y3
10	20,0000	20,0000
11	20,725	20,725
12	21,544	21,544
13	22,447	22,447
14	23,447	23,447
15	24,548	24,548
16	25,756	25,756

19e $N = 18,6 \cdot 1,035^t = 2 \cdot 18,6$ (intersect) $\Rightarrow t \approx 20,1$.
Dus 20,1 jaar na januari 2006 \Rightarrow in 2026.

20a $l = 3 + 0,2t$.

20b De eerste dag (van $t = 0$ tot $t = 1$) een toename van 3 naar 3,2 (m) \Rightarrow toename is $\frac{0,2}{3} \times 100 \approx 6,7\%$.
De tiende dag (van $t = 9$ tot $t = 10$) een toename van 4,8 naar 5 (m) \Rightarrow toename is $\frac{0,2}{4,8} \times 100 \approx 4,2\%$.

20c $l = 6 \Rightarrow 3 + 0,2t = 6 \Rightarrow 0,2t = 3 \Rightarrow t = \frac{3}{0,2} = 15$. Dus na 15 dagen.

21a $N_T = 0,15t + 18$ (in miljoenen met t in maanden en $t = 0$ in maand 1 in 2006).

21b $N_P = 9,6 \cdot 1,04^t$ (in miljoenen met t in maanden en $t = 0$ in maand 1 in 2006).

21c $t = 12 + 2 = 14 \Rightarrow N_T = 0,15 \cdot 14 + 18 = 20,1$ en $N_P = 9,6 \cdot 1,04^{14} \approx 16,6$.
Het verschil is (ongeveer) $20,1 - 16,6 = 3,5$ (miljoen).

21d $N_P = 9,6 \cdot 1,04^t = 18$ (intersect) $\Rightarrow t \approx 16,02 \Rightarrow$ voor het eerst bij $t = 17$.
 $N_P > 18$ (zie plot) voor het eerst bij $t = 17 = 12 + 5 \Rightarrow$ (maand 6) juni 2007.

21e $N_P = N_T \Rightarrow 9,6 \cdot 1,04^t = 0,15t + 18$ (intersect) $\Rightarrow t \approx 19,95 \Rightarrow$ bij $t = 20$.
 $N_P > N_T$ (zie plot) voor het eerst bij $t = 20 = 12 + 8 \Rightarrow$ (maand 9) september 2007.

22 Toename: 6% (toename van 100% naar 106% = $1,06 \times 100\%$) \Rightarrow groeifactor (per jaar): 1,06.

23a Toename: 12,7% (toename van 100% naar 112,7% = $1,127 \times 100\%$) \Rightarrow groeifactor (per jaar): 1,127.

23b Afname: 6,8% (afname van 100% naar 93,2% = $0,932 \times 100\%$) \Rightarrow groeifactor (per maand): 0,932.

23c Groeifactor: 1,735 (toename van 100% naar $1,735 \times 100\% = 173,5\%$) \Rightarrow groeipercentage (per maand): 73,5%.

23d Groeifactor: 0,845 (afname van 100% naar $0,845 \times 100\% = 84,5\%$) \Rightarrow afname (per dag): 15,5%.

23e Groeifactor: 2,42 (toename van 100% naar $2,42 \times 100\% = 242\%$) \Rightarrow groeipercentage (per jaar): 142%.

23f Afname: 0,7% (afname van 100% naar 99,3% = $0,993 \times 100\%$) \Rightarrow groeifactor (per dag): 0,993.

24a $N_J = 300 \cdot 1,08^t$ (t in jaren en $t = 0$ op 1-1-2006).

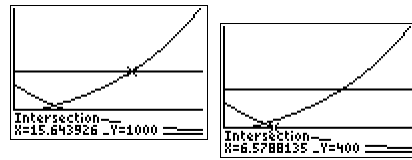
24b $N_K = 800 \cdot 0,90^t$ (t in jaren en $t = 0$ op 1-1-2006).

24c $N_J = N_K \Rightarrow 300 \cdot 1,08^t = 800 \cdot 0,90^t$ (intersect) $\Rightarrow t \approx 5,38$.

$t = 5,38$ jaar is 5 jaar en 4,56 maanden (na 1-1-2006 \Rightarrow maand 5,46 in 2007) \Rightarrow mei 2011.

24d $N_J = 1000 \Rightarrow 300 \cdot 1,08^t = 1000$ (intersect) $\Rightarrow t \approx 15,6 \Rightarrow$ in 2021.

24e $N_K = \frac{1}{2} \cdot 800 \Rightarrow 800 \cdot 0,90^t = 400$ (intersect) $\Rightarrow t \approx 6,6 \Rightarrow$ in 2012.

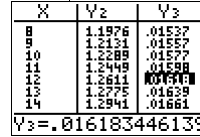
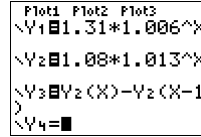
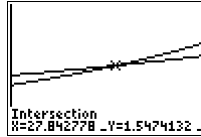
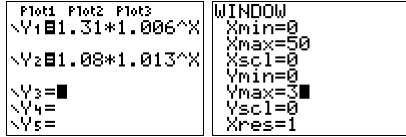


25a $N_C = 1,31 \cdot 1,006^t$.

25b $N_I = 1,08 \cdot 1,013^t$.

25c $t = 6$ geeft $N_C = 1,31 \cdot 1,006^6 \approx 1,358$ (miljard) en $N_I = 1,08 \cdot 1,013^6 \approx 1,167$ (miljard).

25d $N_C = N_I$ (intersect) $\Rightarrow t \approx 27,8$. Dus in (de loop van) het jaar 2032.



$1,31 \cdot 1,006^6$
 $1,357873085$
 $1,08 \cdot 1,013^6$
 $1,16702572$

$Y_2(12) - Y_2(11)$
 $0,0161834461$
 $Y_2(11) - Y_2(10)$
 $0,0159757612$

25e Van $t = 11$ (1 januari 2016) tot $t = 12$ (1 januari 2017). (gebruik de tabel op de GR) Dus in het jaar 2016.

26a Er wordt per meter 40% geabsorbeerd \Rightarrow 60% blijft er over \Rightarrow de groeifactor per meter is 0,6.

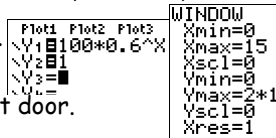
26b $P_b = 100 \cdot 0,70^d$.

26c $d = 4$ (m) $\Rightarrow P_r = 100 \cdot 0,60^4 = 12,96 \approx 13$ (%) en $P_b = 100 \cdot 0,70^4 = 24,01 \approx 24$ (%).

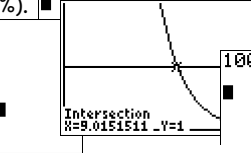
26d $P_r = 100 \cdot 0,60^d$ (intersect) = 1 (%) $\Rightarrow d \approx 9,02 \approx 9$ (m).

$d = 9$ (m) $\Rightarrow P_b = 100 \cdot 0,70^9 = 4,04 \approx 4$ (%).

Dus tot deze diepte dringt 4 keer zoveel blauw licht door.



$100 \cdot 0,60^4$
12,96
 $100 \cdot 0,70^4$
24,01



$100 \cdot 0,70^9$
4,0353607

27a $x^2 \cdot x^3 = x^{2+3} = x^5 \neq x^6$.

27c $(2x)^3 = 2x \cdot 2x \cdot 2x = 2^3 \cdot x^3 = 8x^3 \neq 6x^3$.

27b $\frac{x^6}{x^2} = x^{6-2} = x^4$.

27d $(x^3)^2 = x^3 \cdot x^3 = x^{3+3} = x^6$.

28a $2a^3 \cdot 4a^7 = 8a^{10}$. 28d $(3a^2b)^4 = 3^4 \cdot a^8b^4 = 81a^8b^4$. 28g $(-2a)^3 \cdot 3a^3 = -8a^3 \cdot 3a^3 = -24a^6$.
28b $(2a^3)^7 = 2^7 \cdot a^{21} = 128a^{21}$. 28e $(5a^3)^3 \cdot 2b^7 = 125a^9 \cdot 2b^7 = 250a^9b^7$. 28h $(-2a)^2 + 3a^2 = 4a^2 + 3a^2 = 7a^2$.
28c $\frac{15a^8}{3a^6} = 5a^2$. 28f $\frac{21a^6}{3a} = 7a^5$. 28i $10a^2b \cdot \frac{2}{ab} = \frac{20a^2b}{ab} = 20a$.

29a $7a^3 + 5a^3 = 12a^3$. 29e $7a^3 \cdot 5a^3 = 35a^6$. 29i $(2a)^2 + (3a)^2 = 4a^2 + 9a^2 = 13a^2$.
29b $7a^3 - a^3 = 6a^3$. 29f $(7a^3)^5 = 16807a^{15}$. 29j $(-2a)^3 - 3a^3 = -8a^3 - 3a^3 = -11a^3$.
29c $7a^5 : a^3 = 7a^2$. 29g $(7a)^3 + 5a^3 = 343a^3 + 5a^3 = 348a^3$. 29k $(-3a)^2 : 2a = 9a^2 : 2a = 4,5a$.
29d $7a^5 \cdot 3a = 21a^6$. 29h $7a \cdot 5a^3 = 35a^4$. 29l $(-3a)^2 \cdot 2a^3 = 9a^2 \cdot 2a^3 = 18a^5$.

30a $N = 750 \cdot 1,05^{3t+4} = 750 \cdot 1,05^{3t} \cdot 1,05^4 = 750 \cdot 1,05^4 \cdot (1,05^3)^t \approx 912 \cdot 1,16^t$.

30b $N = 18 - 3,2 \cdot 1,83^{2t+3} = 18 - 3,2 \cdot 1,83^{2t} \cdot 1,83^3 = 18 - 3,2 \cdot 1,83^3 \cdot (1,83^2)^t \approx 18 - 19,61 \cdot 3,35^t$.

30c $y = 4 \cdot (1,05x^3)^5 = 4 \cdot 1,05^5 \cdot x^{15} \approx 5,11 \cdot x^{15}$.

31a $N = 500 \cdot 1,32^{5t+2} = 500 \cdot 1,32^{5t} \cdot 1,32^2 = 500 \cdot 1,32^2 \cdot (1,32^5)^t \approx 871,2 \cdot 4,01^t$.

31b $P = 8,3 \cdot (5,1x^2)^3 \cdot 0,26 \cdot (x^4)^3 = 8,3 \cdot 5,1^3 \cdot x^6 \cdot 0,26 \cdot x^{12} = 8,3 \cdot 5,1^3 \cdot 0,26 \cdot x^{18} \approx 286 \cdot x^{18}$.

32a In de onderste rij komen de getallen 2, 4, 8, 16, 32 en 64.

32b Er geldt dat $16 = 16 \cdot 2^0 \Rightarrow 2^0 = 1$.

32c Er geldt dat $8 = 16 \cdot 2^{-1} \Rightarrow 2^{-1} = \frac{1}{2}$.

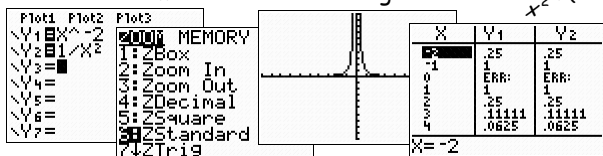
32d Op $t = -3$ is $O = 2$ (volgens de tabel). Dus $2 = 16 \cdot 2^{-3} \Rightarrow 2^{-3} = \frac{1}{8}$.

$750 \cdot 1,05^4$
911,6296875
 $1,05^3$
1,157625
 $3,2 \cdot 1,83^3$
19,6111584
 $1,83^2$
3,3489

$500 \cdot 1,32^2$
871,2
 $1,32^5$
4,007464243
 $8,3 \cdot 5,1^3 \cdot 0,26$
286,260858

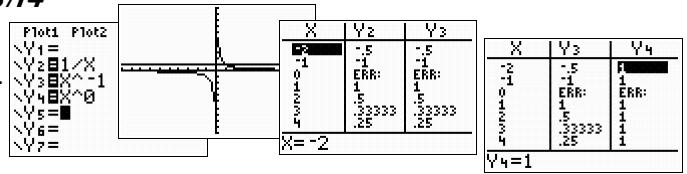
2^0
1
 $2^{-1} \cdot \text{Frac}$
1/2
 $2^{-3} \cdot \text{Frac}$
1/8

33a Zie de schermen hieronder \Rightarrow er geldt: $x^{-2} = \frac{1}{x^2}$. (zie ook de antwoorden in de tabel)



33b Zie de schermen hiernaast \Rightarrow er geldt: $x^{-1} = \frac{1}{x^1} = \frac{1}{x}$.

33c De grafiek is de horizontale lijn $y = 1$ voor $x \neq 0$.



34a $\frac{1}{a^2} = a^{-2}$.

34d $a^8 : a^0 = a^{8-0} = a^8$.

34g $\frac{1}{a^5} : a = a^{-5} : a^1 = a^{-5-1} = a^{-6}$.

34b $a^4 \cdot \frac{1}{a^6} = a^4 \cdot a^{-6} = a^{-2}$.

34e $(a^3)^{-2} = a^{-6}$.

34h $\frac{1}{a^n} : a^{-3} = a^{-n} : a^{-3} = a^{-n-(-3)} = a^{-n+3}$.

34c $a^n : \frac{1}{a^4} = a^n : a^{-4} = a^{n-(-4)} = a^{n+4}$.

34f $\frac{a}{a^{12}} = \frac{a^1}{a^{12}} = a^{1-12} = a^{-11}$.

34i $\frac{1}{a^8} \cdot (a^3)^n = a^{-8} \cdot a^{3n} = a^{3n-8}$.

35a $7^{-2} = \frac{1}{7^2} = \frac{1}{49}$.

35c $3 \cdot 5^{-2} = 3 \cdot \frac{1}{25} = \frac{3}{25}$.

35e $4 \cdot 10^{-3} = 4 \cdot \frac{1}{10^3} = \frac{4}{1000} = \frac{1}{250}$.

35b $(\frac{1}{3})^{-2} = (3^{-1})^{-2} = 3^2 = 9$.

35d $(\frac{2}{5})^{-2} = (\frac{5}{2})^2 = \frac{25}{4}$.

35f $\frac{1}{2} : 6^{-2} = \frac{1}{2} : \frac{1}{6^2} = \frac{1}{2} : \frac{1}{36} = \frac{1}{2} \times 36 = 18$.

36a $6a^{-5} \cdot b^3 = 6 \cdot \frac{1}{a^5} \cdot b^3 = \frac{6b^3}{a^5}$.

36d $\frac{3}{5} a^{-4} = \frac{3}{5} \cdot \frac{1}{a^4} = \frac{3}{5a^4}$.

36f $\frac{1}{6} a^{-2} \cdot b^4 = \frac{1}{6} \cdot \frac{1}{a^2} \cdot b^4 = \frac{b^4}{6a^2}$.

36b $\frac{1}{3} a^{-3} = \frac{1}{3} \cdot \frac{1}{a^3} = \frac{1}{3a^3}$.

36e $(\frac{1}{2} a)^{-3} = (\frac{1}{2})^{-3} \cdot a^{-3} = (2^{-1})^{-3} \cdot \frac{1}{a^3} = \frac{2^3}{a^3} = \frac{8}{a^3}$.

36g $-4 \cdot (3a)^{-2} = -4 \cdot \frac{1}{(3a)^2} = \frac{-4}{9a^2}$.

36c $5a^{-4} \cdot b^2 = 5 \cdot \frac{1}{a^4} \cdot b^2 = \frac{5b^2}{a^4}$.

36h $(3a)^{-2} \cdot b^{-3} = \frac{1}{(3a)^2} \cdot \frac{1}{b^3} = \frac{1}{9a^2} \cdot \frac{1}{b^3} = \frac{1}{9a^2 b^3}$.

36i $\frac{3}{8} a^{-1} \cdot b = \frac{3}{8} \cdot \frac{1}{a} \cdot b = \frac{3b}{8a}$.

37a $y = (\frac{1}{3} x^2)^{-1} \cdot x^4 = (\frac{1}{3})^{-1} \cdot x^{-2} \cdot x^4 = (3^{-1})^{-1} \cdot x^2 = 3x^2$.

37b $y = 75 \cdot (5x)^{-2} \cdot 3x^{12} = 75 \cdot 5^{-2} \cdot x^{-2} \cdot 3x^{12} = 75 \cdot \frac{1}{5^2} \cdot x^{-2} \cdot 3x^{12} = 75 \cdot \frac{1}{25} \cdot x^{-2} \cdot 3x^{12} = 9x^{10}$.

37c $y = \frac{5}{x^2} \cdot (3x^{-2})^3 = 5 \cdot x^{-2} \cdot 3^3 \cdot (x^{-2})^3 = 5 \cdot x^{-2} \cdot 27 \cdot x^{-6} = 135x^{-8}$.

37d $y = 50 \cdot 2^{3x-1} = 50 \cdot 2^{3x} \cdot 2^{-1} = 50 \cdot (2^3)^x \cdot \frac{1}{2} = 25 \cdot 8^x$.

37e $y = 275 \cdot 5^{-2x} = 275 \cdot (5^{-2})^x = 275 \cdot (\frac{1}{5^2})^x = 275 \cdot (\frac{1}{25})^x$.

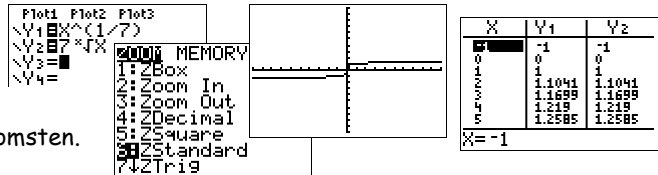
37f $y = 5000 \cdot 10^{-x-3} = 5000 \cdot 10^{-x} \cdot 10^{-3} = 5000 \cdot (10^{-1})^x \cdot \frac{1}{10^3} = \frac{5000}{1000} \cdot (\frac{1}{10})^x = 5 \cdot (\frac{1}{10})^x$.

38a Klopt.

38b Klopt ook.

38c $(2^{\frac{1}{7}})^7 = 2$ (zie 38a) en $(\sqrt[7]{2})^7 = 2$ (zie 38b) $\Rightarrow 2^{\frac{1}{7}} = \sqrt[7]{2}$.

38d Zie een plot van de grafieken en een tabel met uitkomsten.



39a $5a^{\frac{1}{3}} = 5 \cdot \sqrt[3]{a}$.

39c $3a^{-\frac{2}{3}} = 3 \cdot \frac{1}{a^{\frac{2}{3}}} = \frac{3}{\sqrt[3]{a^2}}$.

39e $\frac{1}{5} a^{-\frac{1}{2}} \cdot b^{\frac{1}{3}} = \frac{1}{5} \cdot \frac{1}{a^{\frac{1}{2}}} \cdot \sqrt[3]{b} = \frac{\sqrt[3]{b}}{5 \cdot \sqrt{a}}$.

39b $\frac{1}{2} a^{-\frac{1}{4}} \cdot b = \frac{1}{2} \cdot \frac{1}{a^{\frac{1}{4}}} \cdot b = \frac{b}{2 \cdot \sqrt[4]{a}}$.

39d $\frac{2}{3} a^{-3} \cdot b^{\frac{1}{3}} = \frac{2}{3} \cdot \frac{1}{a^3} \cdot \sqrt[3]{b} = \frac{2 \cdot \sqrt[3]{b}}{3a^3}$.

39f $(5a)^{-\frac{1}{2}} = \frac{1}{(5a)^{\frac{1}{2}}} = \frac{1}{\sqrt{5a}}$.

40a $a \cdot \sqrt[3]{a} = a^1 \cdot a^{\frac{1}{3}} = a^{\frac{4}{3}}$.

40d $\frac{1}{a^3} = a^{-3}$.

40g $\sqrt[3]{a^{12}} = a^{\frac{12}{3}} = a^4$.

40b $\frac{1}{\sqrt{a}} = \frac{1}{a^{\frac{1}{2}}} = a^{-\frac{1}{2}}$.

40e $a^2 \cdot \sqrt{a} = a^2 \cdot a^{\frac{1}{2}} = a^{\frac{5}{2}}$.

40h $a^4 \cdot \sqrt[3]{a} = a^4 \cdot a^{\frac{1}{3}} = a^{\frac{13}{3}}$.

40c $\frac{1}{a} = a^{-1}$.

40f $\sqrt[3]{\frac{1}{a^2}} = \sqrt[3]{a^{-2}} = a^{-\frac{2}{3}}$.

40i $\frac{a^3}{\sqrt[3]{a}} = \frac{a^3}{a^{\frac{1}{3}}} = a^{\frac{8}{3}}$.

41a $\frac{x^6}{x^2 \cdot \sqrt{x}} = \frac{x^6}{x^2 \cdot x^{\frac{1}{2}}} = \frac{x^6}{x^{\frac{5}{2}}} = x^{\frac{7}{2}}$.

41d $x^4 \cdot \sqrt{x} = x^4 \cdot x^{\frac{1}{2}} = x^{\frac{9}{2}}$.

41g $x^2 \cdot \frac{1}{x^3} = x^2 \cdot x^{-3} = x^{-1}$.

41b $x \cdot \sqrt[7]{x^3} = x^1 \cdot x^{\frac{3}{7}} = x^{\frac{10}{7}}$.

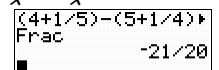
41e $\frac{\sqrt[3]{x}}{\sqrt{x}} = \frac{x^{\frac{1}{3}}}{x^{\frac{1}{2}}} = x^{\frac{1}{3} - \frac{1}{2}} = x^{-\frac{1}{6}}$.

41h $x^5 \cdot \sqrt[3]{x^6} = x^5 \cdot x^{\frac{6}{3}} = x^7$.

41c $\frac{x}{\sqrt[5]{x}} = \frac{x^1}{x^{\frac{1}{5}}} = x^{\frac{4}{5}}$.

41f $\frac{1}{x^2} : \sqrt{x} = x^{-2} : x^{\frac{1}{2}} = x^{-2 - \frac{1}{2}} = x^{-\frac{5}{2}}$.

41i $\frac{x^4 \cdot \sqrt[5]{x}}{x^5 \cdot \sqrt[4]{x}} = \frac{x^4 \cdot x^{\frac{1}{5}}}{x^5 \cdot x^{\frac{1}{4}}} = \frac{x^{\frac{21}{5}}}{x^{\frac{21}{4}}} = x^{-\frac{1}{20}}$.



42a $y = \frac{5}{x \cdot \sqrt{x}} = \frac{5}{x^1 \cdot x^{\frac{1}{2}}} = \frac{5}{x^{\frac{3}{2}}} = 5x^{-\frac{3}{2}}$

42d $y = 3 \cdot \sqrt[4]{x^3} = 3 \cdot x^{\frac{3}{4}} = 3x^{\frac{3}{4}}$

42b $y = 5x \cdot \sqrt[3]{x^2} = 5x^1 \cdot x^{\frac{2}{3}} = 5x^{\frac{5}{3}}$

42e $y = 5 \cdot x^{-0,2} \cdot x^{1,3} = 5x^{1,1}$

42c $y = \frac{5}{x^3} \cdot 2 \cdot \sqrt{x} = 5 \cdot x^{-3} \cdot 2 \cdot x^{\frac{1}{2}} = 10x^{-2\frac{1}{2}}$

42f $y = \frac{50x^{1,9}}{10x^{1,1}} = 5x^{0,8}$

43a Het eerste scherm -5,944.
Het tweede scherm 0,168.

43b $x^{-3} = 210 \Rightarrow x = \sqrt[3]{210}$. Hierbij hoort het tweede scherm.

43c $x^3 = -7 \Rightarrow x = \sqrt[3]{-7} \approx -1,913$ en $x^{-3} = 7 \Rightarrow x = \sqrt[3]{7} \approx 0,523$. (dus niet dezelfde oplossing)

44a $x^{1,6} = 50$
 $x = \sqrt[1,6]{50} \approx 11,53$

44c $x^{-1,3} = 11$
 $x = \sqrt[1,3]{11} \approx 0,16$

44e $x^{0,55} = 18$
 $x = \sqrt[0,55]{18} \approx 191,56$

44b $x^{-4} = 5$
 $x = \sqrt[4]{5} \approx 0,67$

44d $x^{-1} = 21$
 $x = \sqrt[1]{21} \approx 0,05$

44f $\sqrt[3]{x^2} = 28$
 $x^{\frac{2}{3}} = 28$
 $x = \sqrt[3]{28} \approx 148,16$

45a $3x^{2,25} + 1 = 27$
 $3x^{2,25} = 26$
 $x^{2,25} = \frac{26}{3}$
 $x = \sqrt[2,25]{\frac{26}{3}} \approx 2,611$

45c $4x^{-1,8} + 16 = 5000$
 $4x^{-1,8} = 4984$
 $x^{-1,8} = 1246$
 $x = \sqrt[1,8]{1246} \approx 0,019$

45e $5 \cdot \sqrt[3]{x} = 8$
 $\sqrt[3]{x} = \frac{8}{5}$
 $x^{\frac{1}{3}} = 1,6$
 $x = \sqrt[3]{1,6} = 4,096$

45b $5x^{-1,3} + 8 = 21$
 $5x^{-1,3} = 13$
 $x^{-1,3} = \frac{13}{5}$
 $x = \sqrt[1,3]{\frac{13}{5}} \approx 0,480$

45d $8 - 3x^{1,16} = 1$
 $-3x^{1,16} = -7$
 $x^{1,16} = \frac{7}{3}$
 $x = \sqrt[1,16]{\frac{7}{3}} \approx 2,076$

45f $3 \cdot \sqrt[4]{x^3} - 1 = 36$
 $3 \cdot \sqrt[4]{x^3} = 37$
 $\sqrt[4]{x^3} = \frac{37}{3}$
 $x^{\frac{3}{4}} = \frac{37}{3}$
 $x = \sqrt[4]{\frac{37}{3}} \approx 28,495$

46a $G = 10$ (kg) $\Rightarrow H = 12 \cdot 10^{0,67} \approx 56$ (gram).

46b $H = 18$ (gram) $\Rightarrow 18 = 12 \cdot G^{0,67}$ (intersect of) $\Rightarrow G^{0,67} = 1,5 \Rightarrow G = \sqrt[0,67]{1,5} \approx 1,8$ (kg).

46c $G = 40$ (kg) $\Rightarrow H = 12 \cdot 40^{0,67}$ (gram) $\Rightarrow I = \frac{130}{12 \cdot 40^{0,67}} \approx 0,91$.

46d $G = 70$ (kg) $\Rightarrow H = 12 \cdot 70^{0,67}$ (gram) $\Rightarrow I = \frac{1650}{12 \cdot 70^{0,67}} \approx 8,0$.

46e $I = 1,04 = \frac{1050}{H} \Rightarrow H = \frac{1050}{1,04} \approx 1010$ (gram).

$H = 1010$ (gram) $\Rightarrow 1010 = 12 \cdot G^{0,67}$ (intersect of) $\Rightarrow G^{0,67} = \frac{1010}{12} \Rightarrow G = \sqrt[0,67]{\frac{1010}{12}} \approx 747$ (kg).

47a $P = 800 \cdot I^{-2,25} = 800 \cdot \frac{1}{I^{2,25}} = \frac{800}{I^{2,25}}$

Als I groter wordt, dan wordt de noemer van de breuk groter en dan wordt de breuk zelf, dus P, kleiner.

Dat wil zeggen dat er minder organismen per km² leven ofwel de organismen leven gemiddeld verder van elkaar.

47b $I = 0,9$ (m) $\Rightarrow P = 800 \cdot 0,9^{-2,25} \approx 1014$ (ringslangen/km²).

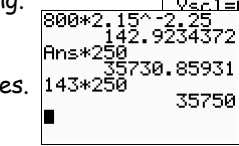
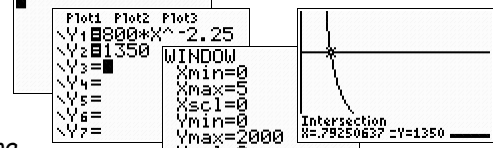
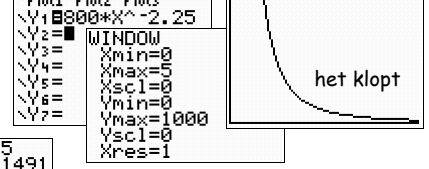
De populatiedichtheid is ongeveer 1000 ringslangen per km².

47c $P = 800 \cdot I^{-2,25} = 1350$ (intersect of)
 $I^{-2,25} = \frac{1350}{800} = 1,6875$
 $I = \sqrt[2,25]{1,6875} \approx 0,79$ (m). Dus gemiddeld ongeveer 80 cm lang.

47d $I = 2,15$ (m) $\Rightarrow P = 800 \cdot 2,15^{-2,25} \approx 143$ (kariboes/km²).

In een gebied van 250 km² geeft dit ongeveer 36000 kariboes.

Alternatieve uitwerking (met een plot)



47e $P = \frac{160000}{5} = 32000$
 $800 \cdot I^{-2,25} = 32000$ (intersect of)
 $I^{-2,25} = \frac{32000}{800} = 40$
 $I = \sqrt[2,25]{40} \approx 0,194$ (m). Dus gemiddeld ongeveer 19 cm lang.

48a $L_0 = 4 \text{ (km}^2) \Rightarrow 4 = 0,059 \cdot G^{0,92}$ (intersect of) $\Rightarrow G^{0,92} = \frac{4}{0,059} \Rightarrow G = 0,92 \sqrt[0,92]{\frac{4}{0,059}} \approx 97,8$ (kg).

48b $L_0 = 6 \text{ (km}^2) \Rightarrow 6 = 0,059 \cdot G^{0,92}$ (intersect of) $\Rightarrow G^{0,92} = \frac{6}{0,059} \Rightarrow G = 0,92 \sqrt[0,92]{\frac{6}{0,059}} \approx 152$ (kg).

$L_c = 6 \text{ (km}^2) \Rightarrow 6 = 0,11 \cdot G^{1,36}$ (intersect of) $\Rightarrow G^{1,36} = \frac{6}{0,11} \Rightarrow G = 1,36 \sqrt[1,36]{\frac{6}{0,11}} \approx 19$ (kg).

De omnivoor is $152 - 19 = 133$ kg zwaarder.

48c Stel de lichtere weegt x kg \Rightarrow de zwaardere weegt $4x$ kg.
 $G = x \Rightarrow L_c = 0,11 \cdot x^{1,36}$
 $G = 4x \Rightarrow L_c = 0,11 \cdot (4x)^{1,36} = 0,11 \cdot 4^{1,36} \cdot x^{1,36}$

Dus het leefgebied van de zwaardere is $4^{1,36} \approx 6,6$ keer zo groot dan het gewicht van de lichtere.

48d $G = 0,001g$ ($g = 1000G$) $\Rightarrow L_c^* = 0,11 \cdot (0,001g)^{1,36} = 0,11 \cdot 0,001^{1,36} \cdot g^{1,36} \approx 0,000009 \cdot g^{1,36}$

49 $x = 16 \Rightarrow y = 2,5 \cdot 16^{1,5} = 160$ klopt.

50 $x = 12$ en $y = 16 \Rightarrow 16 = a \cdot 12^{-1,81} \Rightarrow a = \frac{16}{12^{-1,81}} \approx 1437$.

51 $x = 18$ en $y = 350 \Rightarrow 350 = a \cdot 18^{1,83} \Rightarrow a = \frac{350}{18^{1,83}} \approx 1,766$.

$x = 25$ en $y = p \Rightarrow p = \text{Ans} \cdot 25^{1,83} \approx 638$ (te vroeg afronden geeft $p \approx 639$).

52a $W = a \cdot m^{0,75}$ geldt voor $m = 40$ (kg) en $W = 6700$ (kJ/dag) $\Rightarrow 6700 = a \cdot 40^{0,75} \Rightarrow a = \frac{6700}{40^{0,75}} \approx 421,2$

52b $m = 4$ (kg) $\Rightarrow W = 421 \cdot 4^{0,75} \approx 1191$ (kJ/dag).

52c $W = 50000$ (kJ/dag) $\Rightarrow 50000 = 421 \cdot m^{0,75}$ (intersect of) $\Rightarrow m^{0,75} = \frac{50000}{421} \Rightarrow m = 0,75 \sqrt[0,75]{\frac{50000}{421}} \approx 584$ (kg).

53a $W = a \cdot m^{0,88}$ geldt voor $m = 30$ (kg) en $W = 90$ (ml/u) $\Rightarrow 90 = a \cdot 30^{0,88} \Rightarrow a = \frac{90}{30^{0,88}} \approx 4,51$.

53b $m = 200$ (kg) $\Rightarrow W = 4,51 \cdot 200^{0,88}$ (ml/u). Dus $4,51 \cdot 200^{0,88} \cdot 24 : 1000 \approx 11,5$ liter per dag.

53c $1,2$ liter per dag $\Rightarrow W = \frac{1,2}{24} \cdot 1000 = 50$ (ml/u) \Rightarrow
 $50 = 4,51 \cdot m^{0,88}$ (intersect of) $\Rightarrow m^{0,88} = \frac{50}{4,51} \Rightarrow m = 0,88 \sqrt[0,88]{\frac{50}{4,51}} \approx 15$ (kg).

53d $W^* = W \cdot \frac{24}{1000} \Rightarrow W^* = 4,51 \cdot m^{0,88} \cdot \frac{24}{1000} = 0,10824 \cdot m^{0,88}$.

53e $(4m)^{0,88} = 4^{0,88} \cdot m^{0,88} \approx 3,4 \cdot m^{0,88} \Rightarrow$ (ongeveer) 3,4 keer zoveel.

54a Gebruik het basisscherm van de GR hiernaast om de tabel af te maken.

54b Per twee jaar met $9 \times 9 = 9^2 = 81$.

54c Als per half jaar met 4,5 wordt vermenigvuldigd, dan per jaar met $4,5^2 = 20,5$.
 Per jaar wordt echter met 9 vermenigvuldigd, dus per half jaar met minder dan 4,5.
 OF: $x \times x = 9 \Rightarrow x^2 = 9 \Rightarrow x = 3$. Dus per half jaar wordt met 3 (< 4,5) vermenigvuldigd.

55a $g_{\text{kwartier}} = 1,12 \Rightarrow g_{\text{uur}} = 1,12^4 \approx 1,574$. De toename per uur is 57,4%.

55b $g_{\text{kwartier}} = 1,12 \Rightarrow g_{5 \text{ min}} = 1,12^{\frac{1}{3}} \approx 1,038$. De toename per 5 minuten is 3,8%.

55c $g_{\text{uur}} = 1,12^4$ (zie 55a) $\Rightarrow g_{5 \text{ uur}} = (1,12^4)^5 = 1,12^{20} \approx 9,65$. De toename per 5 uur is 865%.

56a $g_{\text{dag}} = 0,84 \Rightarrow g_{\text{week}} = 0,84^7 \approx 0,295$. (de afname per week is 70,5%)

```
(100-16)/100 .84
0.84^7
Ans*100-100
-70.49096534
```

```
0.84^(1/24)
Ans*100-100
-7.238400138
```

56b $g_{\text{dag}} = 0,84 \Rightarrow g_{\text{uur}} = 0,84^{\frac{1}{24}} \approx 0,993$. De afname per uur is 0,7%.

57a $g_{\text{dag}} = 1,3 \Rightarrow g_{\text{week}} = 1,3^7 \approx 6,27$. Het groeipercentage per week is 527%.

```
1.3^7
Ans*100-100
527.48517
```

57b $g_{\text{dag}} = 1,3 \Rightarrow g_{4 \text{ uur}} = 1,3^{\frac{1}{6}} \approx 1,045$. Het groeipercentage per 4 uur is 4,5%.

```
1.3^(1/6)
Ans*100-100
4.469750792
```

58a $g_{\text{uur}} = 0,805 \Rightarrow g_{\text{kwartier}} = 0,805^{\frac{1}{4}} \approx 0,947$. De afname per kwartier is 5,3%.

```
(100-19.5)/100
0.805^(1/4)
Ans*100-100
-5.278412057
```

58b $g_{\text{jaar}} = 1,086 \Rightarrow g_{25 \text{ jaar}} = 1,086^{25} \approx 7,87$. De toename per 25 jaar is 687%.

```
(100+8.6)/100
1.086^25
Ans*100-100
686.5849476
```

58c $g_{\text{week}} = 2,8 \Rightarrow g_{\text{dag}} = 2,8^{\frac{1}{7}} \approx 1,158$. De toename per dag is 15,8%.

```
(100+180)/100
2.8^(1/7)
Ans*100-100
15.84564682
```

59 $g_{15 \text{ jaar}} = 10 \Rightarrow g_{\text{jaar}} = 10^{\frac{1}{15}} \approx 1,166 \Rightarrow$ het groeipercentage per jaar is 16,6%.

```
10^(1/15)
Ans*100-100
16.59144012
```

60a $g_{10 \text{ jaar}} = 0,05 \Rightarrow g_{\text{jaar}} = 0,05^{\frac{1}{10}} \approx 0,741$. De afname per jaar is 25,9%.

```
(100-95)/100
0.05^(1/10)
Ans*100-100
-25.88655509
```

60b $g_{20 \text{ jaar}} = 12 \Rightarrow g_{\text{jaar}} = 12^{\frac{1}{20}} \approx 1,132$. De toename per jaar is 13,2%.

```
12^(1/20)
Ans*100-100
13.22936253
```

60c In 1965 waren er $\frac{14000}{12}$; in 1955 waren er $\frac{14000}{12} : 0,05 \approx 23000$ (broedparen).

```
14000/12
Ans/0.05
23333.33333
```

61a $g_{\text{dag}} = 1,05 \Rightarrow g_{\text{week}} = 1,05^7 \approx 1,407$. De toename per week is 40,7%.

```
(100+5)/100
1.05^7
Ans*100-100
40.71004227
```

61b $g_{\text{dag}} = 1,5 \Rightarrow g_{\text{week}} = 1,5^7 (\approx 17,1)$.

```
1.5^7
Ans*100-100
17.0859375
```

61c $g_{\text{uur}} = 0,8 \Rightarrow g_{\text{kwartier}} = 0,8^{\frac{1}{4}} \approx 0,946$. De afname per kwartier is 5,4%.

```
(100-20)/100 .8
0.8^(1/4)
Ans*100-100
-5.4258391
```

61d $g_{\text{uur}} = 0,7 \Rightarrow g_{\text{kwartier}} = 0,7^{\frac{1}{4}} (\approx 0,915)$.

```
0.7^(1/4)
Ans*100-100
-9.146912192
```

62a Tussen $t = 5$ en $t = 9$ zit 4 uur $\Rightarrow g_{4 \text{ uur}} = \frac{300000}{50000} = 6$.

```
300000/50000
6
6^(1/4)
Ans*100-100
1.56508458
```

62b $g_{4 \text{ uur}} = 6 \Rightarrow g_{\text{uur}} = 6^{\frac{1}{4}} \approx 1,565$.

63 $g_{7 \text{ uur}} = \frac{4100}{1600} \Rightarrow g_{\text{uur}} = \left(\frac{4100}{1600}\right)^{\frac{1}{7}} \approx 1,14$.

$N = b \cdot 1,14^t$
voor $t = 3$ is $N = 1600$ $\Rightarrow 1600 = b \cdot 1,14^3 \Rightarrow b = \frac{1600}{1,14^3} \approx 1070$. Dus $N = 1070 \cdot 1,14^t$.

```
4100/1600
Ans^(1/7)
1.143880228
1600/Ans^3
1069.001519
```

64 $g_{6 \text{ dagen}} = \frac{2500}{1000} = 2,5 \Rightarrow g_{\text{dag}} = 2,5^{\frac{1}{6}} \approx 1,165$.

$N = b \cdot 1,165^t$
voor $t = 4$ is $N = 1000$ $\Rightarrow 1000 = b \cdot 1,165^4 \Rightarrow b = \frac{1000}{1,165^4} \approx 540$. Dus $N = 540 \cdot 1,165^t$.

```
2500/1000
2.5
2.5^(1/6)
Ans*100-100
1.164993051
1000/Ans^4
542.8835233
```

65a $g_{4 \text{ dagen}} = \frac{11}{31} \Rightarrow g_{\text{dag}} = \left(\frac{11}{31}\right)^{\frac{1}{4}} \approx 0,772$.

$A = b \cdot 0,772^t$
voor $t = 3$ is $A = 31$ $\Rightarrow 31 = b \cdot 0,772^3 \Rightarrow b = \frac{31}{0,772^3} \approx 67$. Dus $A = 67 \cdot 0,772^t$.

```
11/31
Ans^(1/4)
0.7718052845
31/Ans^3
67.42771622
```

65b De oorspronkelijke wond ($t = 0$) was 67 mm^2 .

65c Na 60 uur is $t = \frac{60}{24} = 2,5$ (dagen) en $A = 67 \cdot 0,772^{2,5} \approx 35$ (mm^2).

```
60/24
2.5
67*0.772^2.5
35.08472312
```

66a $g_{3 \text{ minuten}} = \frac{8}{10} = 0,8 \Rightarrow g_{\text{minuut}} = 0,8^{\frac{1}{3}} \approx 0,928$. De afname per minuut is 7,2%.

66b $v = b \cdot 0,928^t$
voor $t = 6$ is $v = 10$ $\Rightarrow 10 = b \cdot 0,928^6 \Rightarrow b = \frac{10}{0,928^6} \approx 15,6$. Dus $v = 15,6 \cdot 0,928^t$.

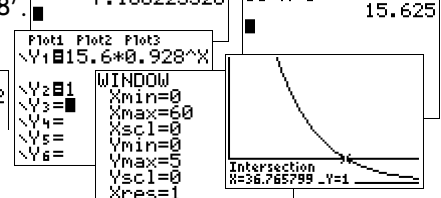
```
8/10
Ans^(1/3)*X
0.9283177667
Ans*100-100
-7.168223328
```

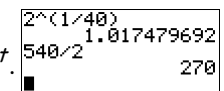
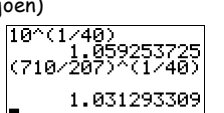
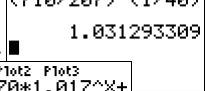
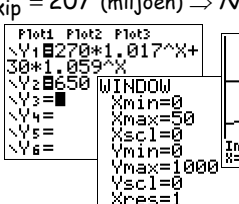
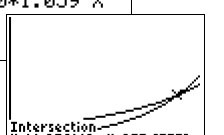
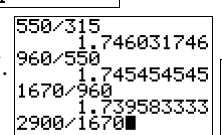
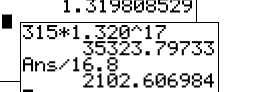
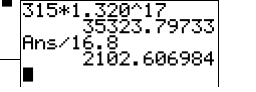
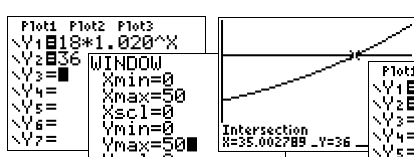
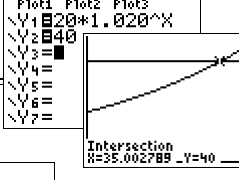

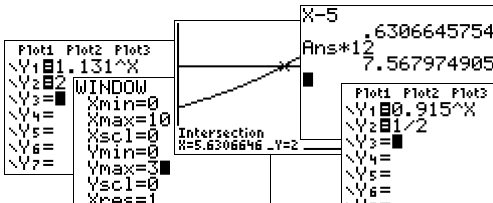
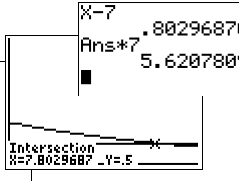
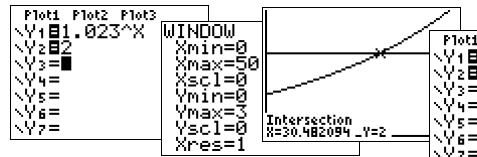
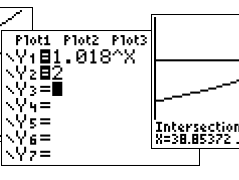
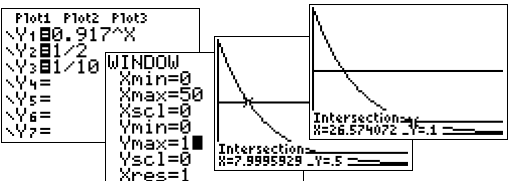
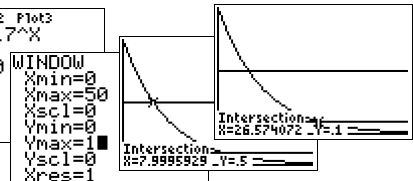
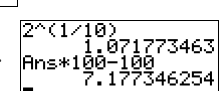
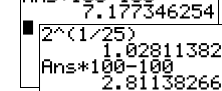
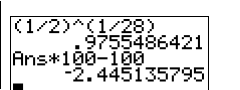
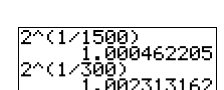
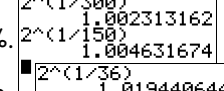
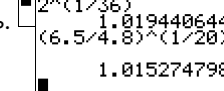
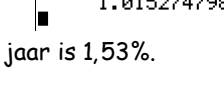

De snelheid v op moment $t = 0$ was $15,6$ knopen.

66c Na een half uur is $t = 30$ en $v = 15,6 \cdot 0,928^{30} \approx 1,7$ (knopen).

```
15.6*0.928^30
1.6579212
```

66d $v = 15,6 \cdot 0,928^t = 1$ (intersect) $\Rightarrow t \approx 36,8$. Dus na 37 minuten.



- 67a $g_{40 \text{ jaar}} = 2 \Rightarrow g_{\text{jaar}} = 2^{\frac{1}{40}} \approx 1,017$ en in 1960 was $N_{\text{plat}} = \frac{540}{2} = 270$ (miljoen) $\Rightarrow N_{\text{plat}} = 270 \cdot 1,017^t$. 
- 67b In 1960: $N_{\text{plat}} (= 90\% \text{ van de bevolking}) = 270$ (miljoen) $\Rightarrow N_{\text{urban}} (= 10\% \text{ van de bevolking}) = \frac{270}{9} = 30$ (miljoen)
en $g_{40 \text{ jaar}} = 10 \Rightarrow g_{\text{jaar}} = 10^{\frac{1}{40}} \approx 1,059 \Rightarrow N_{\text{urban}} = 30 \cdot 1,059^t$. 
- 67c $g_{40 \text{ jaar}} = \frac{710}{207} \Rightarrow g_{\text{jaar}} = \left(\frac{710}{207}\right)^{\frac{1}{40}} \approx 1,031$ en in 1960 was $N_{\text{kip}} = 207$ (miljoen) $\Rightarrow N_{\text{kip}} = 207 \cdot 1,031^t$. 
- 67d $N_{\text{totaal}} = N_{\text{plat}} + N_{\text{urban}} = 270 \cdot 1,017^t + 30 \cdot 1,059^t = 650$.
Intersect geeft $t \approx 31,95$. Dus in (eind) 1960 + 31 = 1991. 
- 67e $0,4 \cdot N_{\text{totaal}} = N_{\text{urban}} \text{ (intersect)} \Rightarrow t \approx 44,3$.
Dus in 1960 + 44 = 2004. 
- 68a $\frac{550}{315} \approx 1,746$; $\frac{960}{550} \approx 1,745$; $\frac{1670}{960} \approx 1,740$; en $\frac{2900}{1670} \approx 1,737$.
De quotiënten verschillen weinig, dus er bij benadering exponentiële groei. 
- 68b $g_{8 \text{ jaar}} \approx \frac{2900}{315} \Rightarrow g_{\text{jaar}} = \left(\frac{2900}{315}\right)^{\frac{1}{8}} \approx 1,320 \Rightarrow O = 315 \cdot 1,320^t$. 
- 68c In 2015 is $t = 17 \Rightarrow O = 315 \cdot 1,320^{17} \approx 35324$ (miljoen euro).
De omzet per Nederlander is $\frac{35324}{16,8} \approx 2100$ euro. 
- 69a $N = 18 \cdot 1,020^t = 36$ (intersect) $\Rightarrow t \approx 35,0$ (jaar). 
- 69b $N = 20 \cdot 1,020^t = 40$ (intersect) $\Rightarrow t \approx 35,0$ (jaar). 
- 69c De antwoorden bij 69a en 69b zijn gelijk.
Vermoeden: de verdubbelingstijd is onafhankelijk van de beginhoeveelheid. 
- 70a $1,131^T = 2$ (intersect) $\Rightarrow T \approx 5,63$ (jaar).
Dit is (ongeveer) 5 jaar en 8 maanden. 
- 70b $0,915^T = \frac{1}{2}$ (intersect) $\Rightarrow T \approx 7,80$ (weken).
Dit is (ongeveer) 7 weken en 6 dagen. 
- 71a $1,023^T = 2$ (intersect) $\Rightarrow T \approx 30,5$ (jaar).
De verdubbelingstijd is (ongeveer) 30,5 jaar. 
- 71b $1,018^T = 2$ (intersect) $\Rightarrow T \approx 39$ (x10 jaar).
De verdubbelingstijd is (ongeveer) 390 jaar. 
- 72a $0,917^T = \frac{1}{2}$ (intersect) $\Rightarrow T \approx 8,00$ (dagen).
De halveringstijd is (ongeveer) 8 dagen. 
- 72b $0,917^T = \frac{1}{10}$ (intersect) $\Rightarrow T \approx 26,6$ (dagen).
Dus nog maar 10% over na (ongeveer) 27 dagen. 
- 73a $g_{10 \text{ dagen}} = 2 \Rightarrow g_{\text{dag}} = 2^{\frac{1}{10}} \approx 1,072 \Rightarrow$ het groeipercentage per dag is 7,2%. 
- 73b $g_{25 \text{ jaar}} = 2 \Rightarrow g_{\text{jaar}} = 2^{\frac{1}{25}} \approx 1,028 \Rightarrow$ het groeipercentage per jaar is 2,8%. 
- 73c $g_{28 \text{ jaar}} = \frac{1}{2} \Rightarrow g_{\text{jaar}} = \left(\frac{1}{2}\right)^{\frac{1}{28}} \approx 0,976 \Rightarrow$ de afname per jaar is 2,4%. 
- 74 Van 0 tot 1500: $g_{1500 \text{ jaar}} = 2 \Rightarrow g_{\text{jaar}} = 2^{\frac{1}{1500}} \approx 1,0005 \Rightarrow$ het groeipercentage per jaar is 0,05%. 
Van 1500 tot 1800: $g_{300 \text{ jaar}} = 2 \Rightarrow g_{\text{jaar}} = 2^{\frac{1}{300}} \approx 1,0023 \Rightarrow$ het groeipercentage per jaar is 0,23%. 
Van 1800 tot 1950: $g_{150 \text{ jaar}} = 2 \Rightarrow g_{\text{jaar}} = 2^{\frac{1}{150}} \approx 1,0046 \Rightarrow$ het groeipercentage per jaar is 0,46%. 
Van 1950 tot 1986: $g_{36 \text{ jaar}} = 2 \Rightarrow g_{\text{jaar}} = 2^{\frac{1}{36}} \approx 1,0194 \Rightarrow$ het groeipercentage per jaar is 1,94%. 
Van 1986 tot 2006: $g_{20 \text{ jaar}} = \frac{4,8+1,7}{4,8} = \frac{6,5}{4,8} \Rightarrow g_{\text{jaar}} = \left(\frac{6,5}{4,8}\right)^{\frac{1}{20}} \approx 1,0153 \Rightarrow$ het groeipercentage per jaar is 1,53%. 

Diagnostische toets

D1a $5x^6 = 30$ D1b $6x^5 + 17 = -51$ D1c $3x^4 - 8 = 40$ D1d $3x^4 + 8 = 20$

$x^6 = 6$
 $x = \pm \sqrt[6]{6}$

$6x^5 = -68$
 $x^5 = -\frac{34}{3}$
 $x = \sqrt[5]{-\frac{34}{3}}$

$3x^4 = 48$
 $x^4 = 16$
 $x = \pm \sqrt[4]{16} = \pm 2$

$3x^4 = 12$
 $x^4 = 4$
 $x = \pm \sqrt[4]{4}$

D2a $0,1x^3 = 18$ (intersect of)
 $x^3 = 180$
 $x = \sqrt[3]{180} \approx 5,65$

D2c $11x^6 - 91 = 68$ (intersect of)
 $11x^6 = 159$
 $x^6 = \frac{159}{11}$
 $x = \pm \sqrt[6]{\frac{159}{11}} \approx \pm 1,56$

D2b $7x^4 - 5 = -19$ (intersect of)
 $7x^4 = -14$
 $x^4 = -2$
geen oplossingen.

D2d $11x^5 + 9 = -8$ (intersect of)
 $11x^5 = -17$
 $x^5 = -\frac{17}{11}$
 $x = \sqrt[5]{-\frac{17}{11}} \approx -1,09$

D3a $l = 1,73$ (m) $\Rightarrow G = 13,4 \cdot 1,73^3 \approx 69$ (kg).

D3b $G = 32$ (kg) $\Rightarrow 13,4 \cdot l^3 = 32$ (intersect of) $\Rightarrow l^3 = \frac{32}{13,4} \Rightarrow l = \sqrt[3]{\frac{32}{13,4}} \approx 1,34$ (m).

D4a $7 - 3 \cdot \sqrt[5]{x} = 1$
 $-3 \cdot \sqrt[5]{x} = -6$
 $\sqrt[5]{x} = 2$
 $x = 2^5 = 32$

D4b $5 \cdot \sqrt[4]{x} + 2 = 27$
 $5 \cdot \sqrt[4]{x} = 25$
 $\sqrt[4]{x} = 5$
 $x = 5^4 = 625$

D5a $y = 0,2x^5 - 8$
 $0,2x^5 - 8 = y$
 $0,2x^5 = y + 8$
 $x^5 = 5y + 40$
 $x = \sqrt[5]{5y + 40}$

D5b $y = 5 \cdot \sqrt[3]{x} - 3$
 $5 \cdot \sqrt[3]{x} - 3 = y$
 $5 \cdot \sqrt[3]{x} = y + 3$
 $\sqrt[3]{x} = \frac{1}{5}y + \frac{3}{5}$
 $x = (\frac{1}{5}y + \frac{3}{5})^3$

D6a $\frac{1}{3}x^6 = 50$ (intersect) $\Rightarrow x \approx -2,31 \vee x \approx 2,31$.
 $\frac{1}{3}x^6 > 50$ (zie plot) $\Rightarrow x < -2,31 \vee x > 2,31$.

D6c $-2x^3 + 8 = -12$ (intersect) $\Rightarrow x \approx 2,15$.
 $-2x^3 + 8 \geq -12$ (zie plot) $\Rightarrow x \leq 2,15$.

D6b $4x^4 + 8 = 110$ (intersect) $\Rightarrow x \approx -2,25 \vee x \approx 2,25$.
 $4x^4 + 8 \leq 110$ (zie plot) $\Rightarrow -2,25 \leq x \leq 2,25$.

D6d $-2x^4 + 8 = -12$ (intersect) $\Rightarrow x \approx -1,78 \vee x \approx 1,78$.
 $-2x^4 + 8 \leq -12$ (zie plot) $\Rightarrow x \leq -1,78 \vee x \geq 1,78$.

D7a Teken zelf de grafieken (neem de t-as van 0 tot 16 en de N-as van 0 tot 100). Gebruik daarbij TABLE op de GR. (zie een plot van de grafieken bij D7b)

D7b $N_1 = 100 \cdot 0,85^t = 5$ (intersect) $\Rightarrow t \approx 18,4$.
Bekijk nu de plot \Rightarrow vanaf $t = 19$ is $N_1 < 5$.

D7c $N_1 = N_2$ (intersect) $\Rightarrow t \approx 2,35 \vee t \approx 13,92$.

X	Y1	Y2
0	100	80
2	72,25	70
4	52,201	60
6	37,715	50
8	27,249	40
10	19,687	30
12	14,224	20

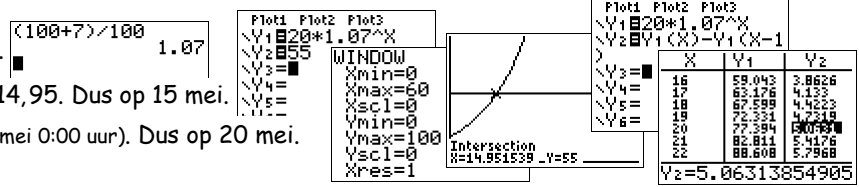
D8a \square Afname: 12,7% (afname van 100% naar 87,3% = $\frac{0,873}{100}$) \Rightarrow groeifactor: 0,873.

D8b \square Groeifactor: 1,0085 (toename van 100% naar $\frac{1,0085}{100}$) \Rightarrow groeipercentage: 0,85%.

D9a \square $H = 20 \cdot 1,07^t$ ($t = 0$ op 1 mei 0:00 uur).

D9b \square $H = 20 \cdot 1,07^t = 55$ (intersect) $\Rightarrow t \approx 14,95$. Dus op 15 mei.

D9c \square $t = 19$ (20 mei 0:00 uur) tot $t = 20$ (21 mei 0:00 uur). Dus op 20 mei.



D10a \square $2a^5 + 5a^5 = 7a^5$.

D10d \square $(2a)^3 - a \cdot 7a^2 = 8a^3 - 7a^3 = a^3$.

D10b \square $2a^3 \cdot 3a^6 = 2 \cdot 3 \cdot a^3 \cdot a^6 = 6a^{3+6} = 6a^9$.

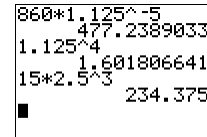
D10e \square $(4a^2b)^2 = 4^2 \cdot (a^2)^2 \cdot b^2 = 16a^4b^2$.

D10c \square $\frac{14a^8}{2a^5} = 7a^3$.

D10f \square $(3a^2)^4 + 5(a^4)^2 = 81a^8 + 5a^8 = 86a^8$.

D11a \square $N = 860 \cdot 1,125^{4t-5} = 860 \cdot 1,125^{4t} \cdot 1,125^{-5} = 860 \cdot 1,125^{-5} \cdot (1,125^4)^t \approx 477 \cdot 1,602^t$.

D11b \square $R = 15 \cdot (2,5q^2)^3 = 15 \cdot 2,5^3 \cdot (q^2)^3 \approx 234 \cdot q^6$.



D12a \square $\frac{1}{a^3} = a^{-3}$.

D12d \square $\sqrt[5]{a^3} = a^{\frac{3}{5}}$.

D12b \square $a^4 \cdot \frac{1}{a^7} = \frac{a^4}{a^7} = a^{4-7} = a^{-3}$.

D12e \square $a^2 \cdot \sqrt[3]{a} = a^2 \cdot a^{\frac{1}{3}} = a^{2\frac{1}{3}}$.

D12c \square $\sqrt{a} = a^{\frac{1}{2}}$.

D12f \square $\frac{1}{\sqrt[3]{a^2}} = \frac{1}{a^{\frac{2}{3}}} = a^{-\frac{2}{3}}$.

D13a \square $\left(a^{-\frac{1}{4}}\right)^3 = a^{-\frac{3}{4}} = \frac{1}{a^{\frac{3}{4}}} = \frac{1}{\sqrt[4]{a^3}}$.

D13b \square $a^{-2} \cdot b^{\frac{1}{5}} = \frac{1}{a^2} \cdot \sqrt[5]{b} = \frac{\sqrt[5]{b}}{a^2}$.

D13c \square $7a^{-\frac{1}{3}} \cdot b^{\frac{3}{5}} = 7 \cdot \frac{1}{a^{\frac{1}{3}}} \cdot \sqrt[5]{b^3} = \frac{7 \cdot \sqrt[5]{b^3}}{\sqrt[3]{a}}$.

D14a \square $3x^{1,6} + 2 = 7$

D14b \square $\frac{1}{4}x^{-3} = 160$

D14c \square $7 \cdot \sqrt[5]{x^3} = 48$

D14c \square $6 \cdot x^{-2,5} + 5 = 7$

$3x^{1,6} = 5$

$x^{-3} = 640$

$\sqrt[5]{x^3} = x^{\frac{3}{5}} = \frac{48}{7}$

$6 \cdot x^{-2,5} = 2$

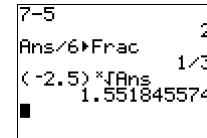
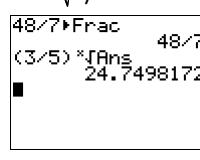
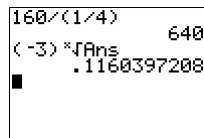
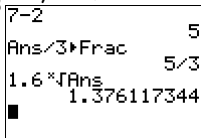
$x^{1,6} = \frac{5}{3}$

$x = \sqrt[3]{640} \approx 0,116$.

$x = \sqrt[5]{\frac{48}{7}} \approx 24,750$.

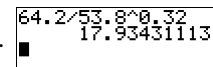
$x^{-2,5} = \frac{1}{3}$

$x = 1,6 \sqrt[5]{\frac{5}{3}} \approx 1,376$.

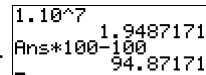


$x = -2,5 \sqrt[5]{\frac{1}{3}} \approx 1,552$.

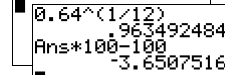
D15 \square $A = a \cdot p^{0,32}$ met voor $p = 53,8$ is $A = 64,2 \Rightarrow 64,2 = a \cdot 53,8^{0,32} \Rightarrow a = \frac{64,2}{53,8^{0,32}} \approx 17,93$.



D16a \square $g_{\text{dag}} = 1,10 \Rightarrow g_{\text{week}} = 1,10^7 \approx 1,949 \Rightarrow$ het groeipercentage per week is 94,9%.

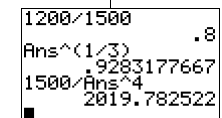


D16b \square $g_{\text{jaar}} = 0,64 \Rightarrow g_{\text{maand}} = 0,64^{\frac{1}{12}} \approx 0,963 \Rightarrow$ de afname per maand is 3,7%.

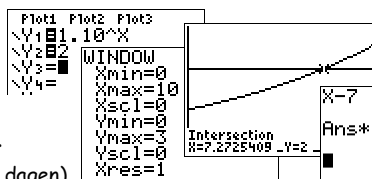


D17 \square $g_{3 \text{ dagen}} = \frac{1200}{1500} = 0,8 \Rightarrow g_{\text{dag}} = 0,8^{\frac{1}{3}} \approx 0,928 \Rightarrow N = b \cdot 0,928^t$.

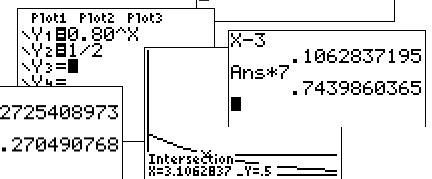
Voor $t = 4$ is $N = 1500 \Rightarrow 1500 = b \cdot 0,928^4 \Rightarrow b = \frac{1500}{0,928^4} \approx 2020$. Dus $N = 2020 \cdot 0,928^t$.



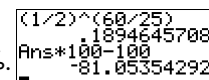
D18a \square $1,10^T = 2$ (intersect) $\Rightarrow T \approx 7,27$ (jaar). Dit is (ongeveer) 7 jaar en 3 maanden.



D18b \square $0,80^T = \frac{1}{2}$ (intersect) $\Rightarrow T \approx 3,11$ (weken). Dit is (ongeveer) 3 weken en 1 dag (of 22 dagen).



D19 \square $g_{25 \text{ minuten}} = \frac{1}{2} \Rightarrow g_{60 \text{ minuten}} = \left(\frac{1}{2}\right)^{\frac{60}{25}} \approx 0,189 \Rightarrow$ de afname per uur is 81,1%.



Gemengde opgaven 5. Machten en exponenten

G1a $2x^3 + 15 = 69$
 $2x^3 = 54$
 $x^3 = 27$
 $x = \sqrt[3]{27} = 3$

G1d $0,1x^4 + 5 = 13$
 $0,1x^4 = 8$
 $x^4 = 80$
 $x = \pm\sqrt[4]{80}$

G1g $0,8 \cdot \sqrt[3]{x+1} + 0,2 = 5$
 $0,8 \cdot \sqrt[3]{x+1} = 4,8$
 $\sqrt[3]{x+1} = 6$
 $x+1 = 6^3 = 216$
 $x = 215$

G1b $5x^6 - 1 = 9$
 $5x^6 = 10$
 $x^6 = 2$
 $x = \pm\sqrt[6]{2}$

G1e $6 \cdot \sqrt[4]{x} + 7 = 25$
 $6 \cdot \sqrt[4]{x} = 18$
 $\sqrt[4]{x} = 3$
 $x = 3^4 = 81$

G1h $16 - 3 \cdot \sqrt[4]{2x-1} = 10$
 $-3 \cdot \sqrt[4]{2x-1} = -6$
 $\sqrt[4]{2x-1} = 2$
 $2x-1 = 2^4 = 16$
 $2x = 17$
 $x = 8\frac{1}{2}$

G1c $8x^3 + 34 = -6$
 $8x^3 = -40$
 $x^3 = -5$
 $x = \sqrt[3]{-5}$

G1f $10 - \sqrt[3]{x} = 15$
 $-\sqrt[3]{x} = 5$
 $\sqrt[3]{x} = -5$
 $x = (-5)^3 = -125$

G2a $x^4 \cdot \sqrt[3]{x} = x^4 \cdot x^{\frac{1}{3}} = x^{4\frac{1}{3}}$

G2d $\frac{1}{x} \cdot (\sqrt[4]{x^3})^8 = x^{-1} \cdot (x^{\frac{3}{4}})^8 = x^{-1} \cdot x^6 = x^5$

G2b $\frac{x^{-3}}{x^2} = x^{-3-2} = x^{-5}$

G2e $\frac{x^3 \cdot x^{-5}}{\sqrt{x}} = \frac{x^{-2}}{x^{\frac{1}{2}}} = x^{-2-\frac{1}{2}} = x^{-2\frac{1}{2}}$

G2c $x \cdot \sqrt{\frac{1}{x^5}} = x \cdot \sqrt{x^{-5}} = x \cdot x^{-\frac{5}{2}} = x^{1-2\frac{1}{2}} = x^{-\frac{1}{2}}$

G2f $(x\sqrt{x})^{-3} = (x \cdot x^{\frac{1}{2}})^{-3} = (x^{\frac{3}{2}})^{-3} = x^{-4\frac{1}{2}}$

G3a $y = 0,2x^4 + 2$
 $0,2x^4 + 2 = y$
 $0,2x^4 = y - 2$
 $x^4 = 5y - 10$
 $x = \pm\sqrt[4]{5y-10}$

G3b $y = 8 \cdot \sqrt[3]{x+5}$
 $8 \cdot \sqrt[3]{x+5} = y$
 $\sqrt[3]{x+5} = \frac{1}{8}y$
 $x+5 = (\frac{1}{8}y)^3 = \frac{1}{512}y^3$
 $x = \frac{1}{512}y^3 - 5$

G3c $y = 4 \cdot \sqrt[5]{x-1}$
 $4 \cdot \sqrt[5]{x-1} = y$
 $\sqrt[5]{x-1} = \frac{1}{4}y$
 $x-1 = (\frac{1}{4}y)^5 = \frac{1}{1024}y^5$
 $x = \frac{1}{1024}y^5 + 1$

G3d $N = 1500 \cdot 1,175^{2t+5} = 1500 \cdot 1,175^{2t} \cdot 1,175^5 = 1500 \cdot 1,175^5 \cdot (1,175^2)^t \approx 3360 \cdot 1,381^t$

G3e $B = 80 \cdot (1,5a)^4 \cdot 0,074 \cdot (2,5a)^{1,15} = 80 \cdot 1,5^4 \cdot a^4 \cdot 0,074 \cdot 2,5^{1,15} \cdot a^{1,15}$
 $= 80 \cdot 1,5^4 \cdot 0,074 \cdot 2,5^{1,15} \cdot a^4 \cdot a^{1,15} \approx 86 \cdot a^{5,15}$

G4a $v = 60$ (km/uur) en $T = -20$ (°C) $\Rightarrow F = (2000 - 16,3 \cdot 60)(-5 - -20)^{-1,668} \approx 11$ (min).

G4b $T = -18$ (°C) en $F = 20$ (min) $\Rightarrow 20 = (2000 - 16,3 \cdot v)(-5 - -18)^{-1,668}$ (intersect of)

$\frac{20}{13^{-1,668}} - 2000 = -16,3 \cdot v$
 $v = \frac{\frac{20}{13^{-1,668}} - 2000}{-16,3} \approx 34$ (km/uur).

G4c De wedstrijd duurt $\frac{10}{40} = \frac{1}{4}$ uur $\Rightarrow F = 15$ (min).

$v = 40$ (km/uur) en $F = 15$ (min) $\Rightarrow (2000 - 16,3 \cdot 40)(-5 - T)^{-1,668} = 15$ (intersect of)
 $(-5 - T)^{-1,668} = \frac{15}{2000 - 16,3 \cdot 40} = \frac{15}{1348}$

$-5 - T = -1,668 \sqrt[1,668]{\frac{15}{1348}}$
 $-T = -1,668 \sqrt[1,668]{\frac{15}{1348}} + 5$
 $T \approx -20$ (°C).

Dus bij temperaturen lager dan -20 °C.

G5a $A = a \cdot m^{0,67}$ met voor $m = 40$ (kg) is $A = 136$ (dm²) $\Rightarrow 136 = a \cdot 40^{0,67} \Rightarrow a = \frac{40^{0,67}}{136} \approx 11,5$

G5b $m = 275$ (kg) $\Rightarrow A = 11,5 \cdot 275^{0,67} \approx 496$ (dm²).

G5c $A = 1,16$ (dm²) $\Rightarrow 1,16 = 11,5 \cdot m^{0,67}$ (intersect of)

$m^{0,67} = \frac{1,16}{11,5} \Rightarrow m = 0,67 \sqrt[0,67]{\frac{1,16}{11,5}} \approx 0,033$ (kg of 33 gram).

G6a $L = 22,84$ (m) en $D = 19,34$ (m³) $\Rightarrow 22,84 + 1,25S^{0,50} - 9,8 \cdot 19,34^{0,33} \leq 16,296 \Rightarrow 1,25S^{0,50} \leq 19,50 \Rightarrow S^{0,50} \leq 15,6$.
Voor de maximale S geldt $S^{0,50} = 15,6 \Rightarrow S = \sqrt[0,50]{15,6} \approx 243,43$ (m²).

16.296-22.84+9.8
*19.34^0.33
19.50294007
Ans/1.25
15.60235205
0.50*Ans
243.4333896

16.296-22.58-1.2
5*308.52^0.50
-9.8
2.23992175
Ans/-9.8
2.881624669
0.33*Ans
24.70817374

G6b $L = 22,58$ (m) en $S = 308,52$ (m²) $\Rightarrow 22,58 + 1,25 \cdot 308,52^{0,50} - 9,8 \cdot D^{0,33} \leq 16,296$.
Voor de minimale D geldt $D^{0,33} = 15,6 \Rightarrow D = \sqrt[0,33]{15,6} \approx 24,7082$ (m³).
De minimale waterverplaatsing is 24708,2 dm³.

1.06^15
2.396558193
Ans*100-100
139.6558193
1.40^(1/7)
1.049241437
Ans*100-100

Plot1 Plot2 Plot3
V1=0.97^X
V2=1/2
V3=

WINDOW
Xmin=0
Xmax=50
Xscl=0
Ymin=0
Ymax=1
Yscl=0
Xres=1

Intersection
N=22.756573 _V=5

G7a $g_{\text{jaar}} = 1,06 \Rightarrow g_{15 \text{ jaar}} = 1,06^{15} \approx 2,40 \Rightarrow$ de toename per 15 jaar is 140%.

G7b $g_{\text{week}} = 1,40 \Rightarrow g_{\text{dag}} = 1,40^{1/7} \approx 1,049 \Rightarrow$ de toename per dag is 4,9%.

G7c $0,97^T = \frac{1}{2}$ (intersect) $\Rightarrow T \approx 23$ (maanden).

G8a $\frac{897}{1013} \approx 0,885$; $\frac{793}{897} \approx 0,884$; $\frac{702}{793} \approx 0,885$; $\frac{621}{702} \approx 0,885$ en $\frac{550}{621} \approx 0,886$.
De quotiënten verschillen weinig, dus er is sprake van een exponentieel verband.

897/1013
8854886476

793/897
884057971

702/793
8852459016

621/702
8846153846

550/621
885668277

G8b $P = b \cdot g^h$ met beginwaarde 1013 en $g = 0,885 \Rightarrow P = 1013 \cdot 0,885^h$.

G8c $g_{\text{km}} = 0,885 \Rightarrow g_{200 \text{ m}} = 0,885^{1/5} \approx 0,976$. De afname per 200 m is 2,4%.

G8d $h = 7,5 \Rightarrow P = 1013 \cdot 0,885^{7,5} \approx 405$ (hPa).

(567/1013)^(1/4.
750)
8849970303
Ans^(1/5)
9758619006
Ans*100-100
-2.413809945

G9a $g_{4\frac{19}{24} \text{ dagen}} = \frac{1}{2} \Rightarrow g_{\text{week}} = (\frac{1}{2})^{4\frac{19}{24}} \approx 0,363 \Rightarrow$ er is nog 36,3% van de stof over.

(1/2)^(7/(4+19/24))
.3632741047

(1/2)^(1/(4+19/24))
.8653192172
2.00/Ans
2.311285778

G9b $g_{4\frac{19}{24} \text{ dagen}} = \frac{1}{2} \Rightarrow g_{\text{dag}} = g_{24 \text{ uur}} = (\frac{1}{2})^{4\frac{19}{24}} \approx 0,8653 \Rightarrow 24$ uur daarvoor was er $\frac{2,00}{0,8653} \approx 2,31$ (gram).

G10a Van 1 mei tot 21 mei zijn 20 dagen; van 21 mei tot en met 31 mei zijn 11 dagen.
Op 31 mei zijn er $1000 \cdot 1,05^{20} \cdot 0,92^{11} \approx 1060$ bacteriën.

G10b $1000 \cdot 1,05^{20} \cdot g^{11} = 1000 \Rightarrow 1,05^{20} \cdot g^{11} = 1 \Rightarrow g^{11} = \frac{1}{1,05^{20}} \Rightarrow g = \sqrt[11]{\frac{1}{1,05^{20}}} \approx 0,915$.
Dus een afname van 8,5% per dag.

(100+5)/100 1.05
(100-8)/100 .92
1000*1.05^20*0.9
^11
1060.356938

11*(1/1.05^20)
.915111476
Ans*100-100
-8.488852397

G10c Stel de toename duurt n dagen dan is er daarna nog $31 - n$ dagen een afname.
Er geldt: $1000 \cdot 1,05^n \cdot 0,90^{31-n} = 1000$ (intersect) $\Rightarrow n \approx 21,2$. Hierbij hoort 22 mei.

Plot1 Plot2 Plot3
V1=1000*1.05^X
V2=0.90^(31-X)
V3=

WINDOW
Xmin=0
Xmax=31
Xscl=0
Ymin=0
Ymax=2000
Yscl=0
Xres=1

Intersection
N=21.188204 _V=1000

G11a $g_{\text{mm}} = 0,7 \Rightarrow g_{5 \text{ mm}} = 0,7^5 \approx 0,168 \Rightarrow 16,8\%$.

G11b $g_{1 \text{ cm}} = g_{10 \text{ mm}} = 0,7^{10} \approx 0,028$.
Er wordt dus 97,2% geabsorbeerd.

G11c $0,7^n = 0,01$ (intersect) $\Rightarrow n \approx 13$ (mm).

(100-30)/100 .7
0.7^5 .16807
Ans*100 16.807

0.7^10
.0282475249
Ans*100-100
-97.17524751

G12a $V = 8$ (liter) $\Rightarrow L = 2,6 \cdot 8^{0,47} \approx 6,91$ (cm); $V = 13$ (liter) $\Rightarrow L = 2,6 \cdot 13^{0,47} \approx 8,68$ (cm).
 $\frac{8,68}{6,91} \approx 1,26 \Rightarrow$ hij kan dan dus (ongeveer) 26% langer worden.

2.6*8^0.47
6.909166233
2.6*13^0.47
8.680139874
8.68/6.91
1.256150502
Ans*100-100
(17.67-3.53)/20
707
-3.54

G12b Half vol met $V > 15 \Rightarrow h = r$ (én $V > 15$) $\Rightarrow V = 16,76 \vee V = 32,73 \vee V = 56,55$.

G12c $V = a \cdot r + b$ met $a = \frac{\Delta V}{\Delta r} = \frac{17,67 - 3,53}{30 - 10} = 0,707$ en $b = 3,53 - 0,707 \cdot 10 = -3,54$.

G12d $L = 2,6 \cdot (0,00105 \cdot h^2 \cdot (60 - h))^{0,47} = 10$ (intersect) $\Rightarrow h \approx 20,6$ (cm).

Plot1 Plot2 Plot3
V1=2.6*(0.00105X
^2*(60-X))^0.47
V2=10
V3=

WINDOW
Xmin=0
Xmax=30
Xscl=0
Ymin=0
Ymax=20
Yscl=0
Xres=1

Intersection
N=20.610202 _V=10

G13a $h = 0,21$ (m) en $s = 0,35$ (m) $\Rightarrow v = 2,81 \cdot 0,35^{1,67} \cdot 0,21^{-1,17} \approx 3,0$ (km/u).

G13b $v = 15$ (km/u) en $h = 0,40$ (m) $\Rightarrow 15 = 2,81 \cdot s^{1,67} \cdot 0,40^{-1,17}$ (intersect of algebraïsch)
 $s^{1,67} = \frac{15}{2,81 \cdot 0,40^{-1,17}} \Rightarrow s = \sqrt[1,67]{\frac{15}{2,81 \cdot 0,40^{-1,17}}} \approx 1,43$ (m).

G13c $h = 4 \cdot 0,91 = 3,64$ (m) en $s = 3,5$ (m) $\Rightarrow v = 2,81 \cdot 3,5^{1,67} \cdot 3,64^{-1,17} \approx 5,0$ (km/u).

G13d $h = 4/$ (m) $\Rightarrow v = 2,81 \cdot s^{1,67} \cdot (4/)^{-1,17} \approx 0,555 \cdot s^{1,67} \cdot /^{-1,17}$ (km/u).

G13e $v = 16,5$ (km/u) en $s = 4,5$ (m) $\Rightarrow 16,5 = 2,81 \cdot 4,5^{1,67} \cdot h^{-1,17}$ (intersect of algebraïsch)
 $h^{-1,17} = \frac{16,5}{2,81 \cdot 4,5^{1,67}} \Rightarrow h = \sqrt[1,17]{\frac{16,5}{2,81 \cdot 4,5^{1,67}}} \approx 1,88$ (m). $\Rightarrow l = \frac{1}{4} h \approx 0,47$ (m).

2.81*0.35^1.67*0.
21^-1.17
3.022062064

15/(2.81*0.40^-1.
17)
1.827238044
1.67*Ans
1.4347081

2.81*3.5^1.67*3.
64^-1.17
5.021244108
2.81*4^-1.17
0.555040216

16.5/(2.81*4.5^1.
67)
0.4792221355
(-1.17)*Ans
1.875190569
Ans/4
.4687976423