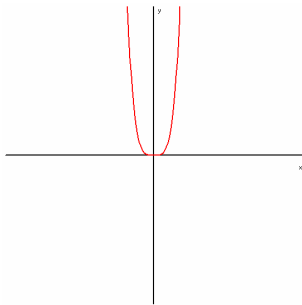


Hoofdstuk 5: Machten en exponenten.

5.1 Hogeremachtswortels

Opgave 1:

a.



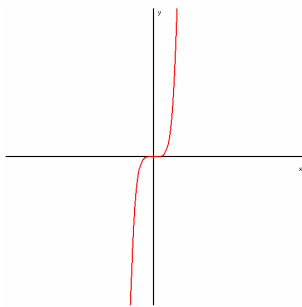
b. twee oplossingen

$$x = \sqrt[4]{30} = 2,34 \quad \vee \quad x = -\sqrt[4]{30} = -2,34$$

c. geen oplossingen

Opgave 2:

a.



b. 1 oplossing

$$x = \sqrt[5]{30} = 1,97$$

c. 1 oplossingen

$$x = \sqrt[5]{-30} = -1,97$$

Opgave 3:

a. 4

b. 2

c. -5

d. $-4 \cdot -10 = 40$

e. $3 \cdot -2 - 2 \cdot 3 = 0$

f. $3 \cdot 1 - 2 \cdot -1 = 5$

Opgave 4:

a. $x^6 = 20$

$$x = \sqrt[6]{20} \quad \vee \quad x = -\sqrt[6]{20}$$

b. $5x^3 = 135$

$$x^3 = 27$$

$$x = \sqrt[3]{27} = 3$$

- c. $0,5x^5 = 20$
 $x^5 = 40$
 $x = \sqrt[5]{40}$
- d. $x^4 + 7 = 88$
 $x^4 = 81$
 $x = \sqrt[4]{81} = 3 \quad \vee \quad x = -\sqrt[4]{81} = -3$
- e. $3x^5 - 1 = 95$
 $3x^5 = 96$
 $x^5 = 32$
 $x = \sqrt[5]{32} = 2$
- f. $\frac{1}{4}x^8 + 3 = 10$
 $\frac{1}{4}x^8 = 7$
 $x^8 = 28$
 $x = \sqrt[8]{28} \quad \vee \quad x = -\sqrt[8]{28}$

Opgave 5:

- a. $3x^5 + 7 = 15$
 $3x^5 = 8$
 $x^5 = \frac{8}{3}$
 $x = \sqrt[5]{\frac{8}{3}} = 1,22$
- b. $\frac{1}{3}x^7 = 720$
 $x^7 = 2160$
 $x = \sqrt[7]{2160} = 2,99$
- c. $0,7x^4 - 1,3 = 2$
 $0,7x^4 = 3,3$
 $x^4 = 4,71$
 $x = \sqrt[4]{4,71} = 1,47 \quad \vee \quad x = -\sqrt[4]{4,71} = -1,47$

Opgave 6:

- a. $5x^4 - 1 = 4$
 $5x^4 = 5$
 $x^4 = 1$
 $x = 1 \quad \vee \quad x = -1$
- b. $5x^4 = -4$
 $x^4 = -0,8$
geen oplossingen
- c. $5x^3 - 1 = 5$
 $5x^3 = 6$
 $x^3 = 1,2$
 $x = \sqrt[3]{1,2} = 1,06$

- d. $8x^3 + 2 = 1$
 $8x^3 = -1$
 $x^3 = -0,125$
 $x = \sqrt[3]{-0,125} = -0,5$
- e. $5x^6 + 7 = 98$
 $5x^6 = 91$
 $x^6 = 18,2$
 $x = \sqrt[6]{18,2} = 1,62 \quad \vee \quad x = -\sqrt[6]{18,2} = -1,62$
- f. $0,1x^7 - 1 = 999$
 $0,1x^7 = 1000$
 $x^7 = 10000$
 $x = \sqrt[7]{100000} = 3,73$

Opgave 7:

- a. $G = 0,4 \cdot 6,3^3 = 100 \text{ g}$
- b. $0,4d^3 = 65$
 $d^3 = 162,5$
 $d = \sqrt[3]{162,5} = 5,5 \text{ cm}$
- c. vanwege d^3 is het gewicht dan $2^3 = 8 \times$ zo groot
- d. $d^3 = 2$
 $d = \sqrt[3]{2} = 1,26$ dus de diameter is $1,26 \times$ zo groot

Opgave 8:

- a. $D = 0,0285 \cdot 300 \cdot 0,4^3 = 0,5472 = 5 \text{ mm}$
- b. $0,285 \cdot 250 \cdot L^3 = 1,2$
 $L^3 = 0,168$
 $L = \sqrt[3]{0,168} = 0,256 \text{ m} = 26 \text{ cm}$
- c. $0,285 \cdot 300 \cdot L^3 = 2,5$
 $L^3 = 0,029$
 $L = \sqrt[3]{0,029} = 0,308 \text{ m} = 30 \text{ cm}$
- d. vanwege L^3 is de doorbuiging $2^3 = 8 \times$ zo sterk

Opgave 9:

- a. $a \cdot 5^4 = 13,5$
 $a = 0,0216$
- b. $W = 0,02 \cdot 8^4 = 81,92 \text{ } \frac{1}{s} = 4915,2 \text{ } \frac{1}{\text{min}}$
- c. $16650 : 60 = 277,5 \text{ } \frac{1}{s}$
 $0,02d^4 = 277,5$
 $d^4 = 13875$
 $d = \sqrt[4]{13875} = 10,9 \text{ cm}$

Opgave 10:

$$\left(\sqrt[3]{8}\right)^3 = 8$$

$$\left(\sqrt[4]{81}\right)^4 = 81$$

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

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

Opgave 11:

a. $x^4 = 6$

$$x = \sqrt[4]{6} \quad \vee \quad x = -\sqrt[4]{6}$$

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

$$x = 6^4 = 1296$$

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

$$x = 2^5 = 32$$

d. $3x^5 - 1 = 20$

$$3x^5 = 21$$

$$x^5 = 7$$

$$x = \sqrt[5]{7}$$

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

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

$$\sqrt[4]{x} = 4$$

$$x = 4^4 = 256$$

f. $0,2x^7 + 8 = 26$

$$0,2x^7 = 18$$

$$x^7 = 90$$

$$x = \sqrt[7]{90}$$

g. $0,1\sqrt{x} + 2 = 12$

$$0,1\sqrt{x} = 10$$

$$\sqrt{x} = 100$$

$$x = 10000$$

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

$$-2 \cdot \sqrt[3]{x} = -2$$

$$\sqrt[3]{x} = 1$$

$$x = 1$$

i. $3 \cdot \sqrt[5]{x} - 1 = 20$

$$3 \cdot \sqrt[5]{x} = 21$$

$$\sqrt[5]{x} = 7$$

$$x = 7^5 = 16807$$

Opgave 12:

a. $y = x^5$

$$x = \sqrt[5]{y}$$

b. $y = 2x^5 + 4$

$$2x^5 = y - 4$$

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

$$x = \sqrt[5]{\frac{1}{2}y - 2}$$

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

$$x = y^7$$

d. $y = 2 \cdot \sqrt[3]{x} + 8$

$$2 \cdot \sqrt[3]{x} = y - 8$$

$$\sqrt[3]{x} = \frac{1}{2}y - 4$$

$$x = \left(\frac{1}{2}y - 4\right)^3$$

e. $y = 0,1x^5 - 6$

$$0,1x^5 = y + 6$$

$$x^5 = 10y + 60$$

$$x = \sqrt[5]{10y + 60}$$

f. $y = 0,1 \cdot \sqrt[5]{x} - 6$

$$0,1 \cdot \sqrt[5]{x} = y + 6$$

$$\sqrt[5]{x} = 10y + 60$$

$$x = (10y + 60)^5$$

Opgave 13:

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

$$\sqrt[3]{x} = 20$$

$$x = 20^3 = 8000$$

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

$$\sqrt[5]{x} = 4$$

$$x = 4^5 = 1024$$

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

$$2 \cdot \sqrt[3]{x} = 6$$

$$\sqrt[3]{x} = 3$$

$$x = 3^3 = 27$$

d. $5 - 2 \cdot \sqrt[5]{x} = 4$

$$-2 \cdot \sqrt[5]{x} = -1$$

$$\sqrt[5]{x} = 0,5$$

$$x = 0,5^5 = 0,03125$$

e. $3x^6 - 1 = 23$

$$3x^6 = 24$$

$$x^6 = 8$$

$$x = \sqrt[6]{8} \quad \vee \quad x = -\sqrt[6]{8}$$

f. $3 \cdot \sqrt[6]{x} - 1 = 23$

$$3 \cdot \sqrt[6]{x} = 24$$

$$\sqrt[6]{x} = 8$$

$$x = 8^6 = 262144$$

Opgave 14:

a. $y = 0,5 \cdot \sqrt[3]{x} - 8$

$$0,5 \cdot \sqrt[3]{x} = y + 8$$

$$\sqrt[3]{x} = 2y + 16$$

$$x = (2y + 16)^3$$

b. $y = 0,5x^7 - 8$

$$0,5x^7 = y + 8$$

$$x^7 = 2y + 16$$

$$x = \sqrt[7]{2y + 16}$$

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

$$x + 6 = y^3$$

$$x = y^3 - 6$$

d. $y = 2 \cdot \sqrt[5]{x} + 3$

$$2 \cdot \sqrt[5]{x} = y - 3$$

$$\sqrt[5]{x} = \frac{1}{2}y - 1\frac{1}{2}$$

$$x = \left(\frac{1}{2}y - 1\frac{1}{2}\right)^5$$

e. $y = 0,2 \cdot \sqrt[5]{2x-3}$

$$\sqrt[5]{2x-3} = 5y$$

$$2x-3 = (5y)^5$$

$$2x-3 = 3125y^5$$

$$2x = 3125y^5 + 3$$

$$x = 1562,5x^5 + 1,5$$

f. $y = 0,2x^5 - 3$

$$0,2x^5 = y + 3$$

$$x^5 = 5y + 15$$

$$x = \sqrt[5]{5y + 15}$$

Opgave 15:

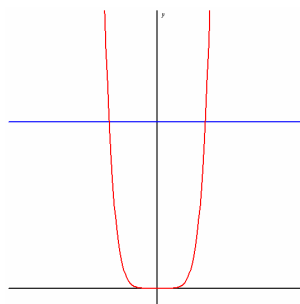
a. $x^6 < 18$

$$x = \sqrt[6]{18} \quad \vee \quad x = -\sqrt[6]{18}$$

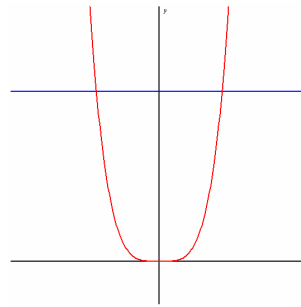
$$-\sqrt[6]{18} < x < \sqrt[6]{18}$$

b. $x^6 \geq 18$

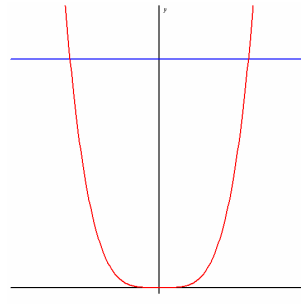
$$x \leq -\sqrt[6]{18} \quad \vee \quad x \geq \sqrt[6]{18}$$



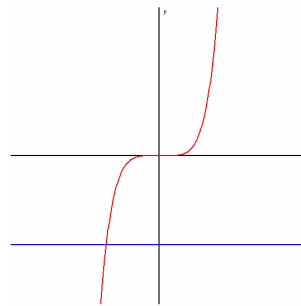
c. $2x^4 > 40$
 $x^4 > 20$
 $x = \sqrt[4]{20} \vee x = -\sqrt[4]{20}$
 $x < -\sqrt[4]{20} \vee x > \sqrt[4]{20}$



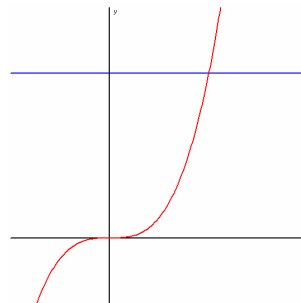
d. $5x^4 \leq 405$
 $x^4 = 81$
 $x = \sqrt[4]{81} = 3 \vee x = -\sqrt[4]{81} = -3$
 $-3 \leq x \leq 3$



e. $x^5 \geq -18$
 $x = \sqrt[5]{-18}$
 $x \geq \sqrt[5]{-18}$

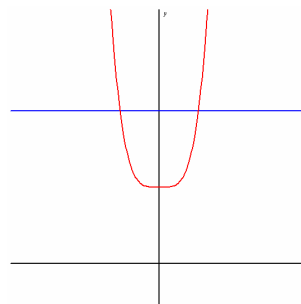


f. $4x^3 \leq 500$
 $x^3 = 125$
 $x = \sqrt[3]{125} = 5$
 $x \leq 5$

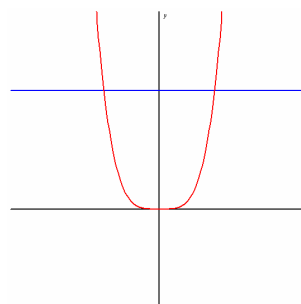


Opgave 16:

a. $3x^4 + 9 > 18$
 $3x^4 = 9$
 $x^4 = 3$
 $x = \sqrt[4]{3} \vee x = -\sqrt[4]{3}$
 $x < -\sqrt[4]{3} \vee x > \sqrt[4]{3}$



b. $0,5x^4 \leq 6$
 $x^4 = 12$
 $x = \sqrt[4]{12} \vee x = -\sqrt[4]{12}$
 $-\sqrt[4]{12} \leq x \leq \sqrt[4]{12}$

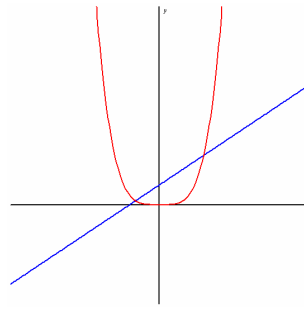


c. $0,5x^4 > x + 6$

$y_1 = 0,5x^4$ en $y_2 = x + 6$

intersect geeft: $x = -1,71$ ∨ $x = 2$

$x < -1,71$ ∨ $x > 2$

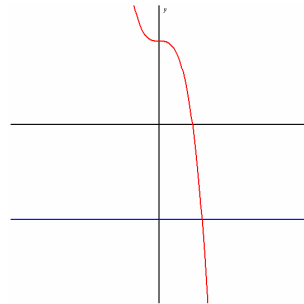


d. $-5a^3 + 7 > -8$

$y_1 = -5x^3 + 7$ en $y_2 = -8$

intersect geeft $x = 1,44$

$x < 1,44$

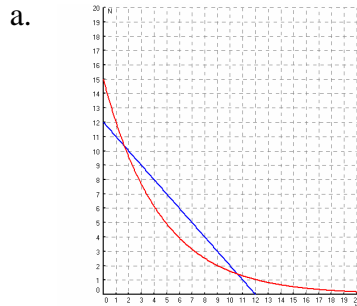


5.2 Exponentiële groei.

Opgave 17:

- a. na 3 weken: $A_w = 750 + 3 \cdot 150 = 1200 \text{ m}^2$
na 5 weken: $A_w = 750 + 5 \cdot 150 = 1500 \text{ m}^2$
- b. na 1 week: $A_a = 16 \cdot 2 = 32 \text{ m}^2$
na 4 weken: $A_a = 16 \cdot 2^4 = 256 \text{ m}^2$
- c. wateroppervlak: $A_w = 750 + 150t$
algenoppervlak: $A_a = 16 \cdot 2^t$
 $y_1 = 750 + 150x$ en $y_2 = 16 \cdot 2^x$
intersect geeft: $x = 6,8$ dus na 6,8 weken

Opgave 18:



- b. $y_1 = 15 \cdot 0,8^x$ en $y_2 = 0,5$
intersect geeft $x = 15,24$ dus vanaf $t = 16$
- c. $y_1 = 15 \cdot 0,8^x$ en $y_2 = 12 - x$
intersect geeft $t = 1,67$ ✓ $t = 10,59$

Opgave 19:

- a. $N = 18,6 \cdot 1,035^t$
- b. $t = 4$ dus $N = 18,6 \cdot 1,035^4 = 21,3$ miljoen
- c. $y_1 = 18,6 \cdot 1,035^x$ en $y_2 = 25$
intersect geeft $x = 8,6$ dus in 2014
- d. met table: $t = 12$ $N = 28,106$
 $t = 13$ $N = 29,09$
 $t = 14$ $N = 30,108$
Dus van $t = 13$ naar $t = 14$ komt er 1 miljoen bij, dus in 2019
- e. $y_1 = 18,6 \cdot 1,035^x$ en $y_2 = 37,2$
intersect geeft $x = 20,5$ dus in 2026

Opgave 20:

- a. $l = 3 + 0,2t$
- b. $t = 0$ $l = 3$
 $t = 1$ $l = 3,2$
toename $= \frac{3,2-3}{3} \cdot 100\% = 6,7\%$

De tiende dag loopt van $t = 9$ tot $t = 10$.

$$t = 9 \quad l = 4,8$$

$$t = 10 \quad l = 5$$

$$\text{toename} = \frac{5-4,8}{4,8} \cdot 100\% = 4,2\%$$

Opgave 21:

a. $N_T = 18 + 0,15t$

b. $N_P = 9,6 \cdot 1,04^t$

c. maart 2007 is $t = 14$

$$N_T = 18 + 0,15 \cdot 14 = 20,1 \text{ miljoen}$$

$$N_P = 9,6 \cdot 1,04^{14} = 16,6 \text{ miljoen}$$

$$20,1 - 16,6 = 3,5 \text{ miljoen}$$

d. $y_1 = 9,6 \cdot 1,04^x$ en $y_2 = 18$

intersect geeft $t = 16,03$ dus in juni 2007

e. $y_1 = 9,6 \cdot 1,04^x$ en $y_2 = 18 + 0,15x$

intersect geeft $t = 19,95$ dus in september 2007

Opgave 22:

$$g = 1,06$$

Opgave 23:

a. $g = 1 + \frac{12,7}{100} = 1 + 0,127 = 1,127$

b. $g = 1 - \frac{6,8}{100} = 1 - 0,068 = 0,932$

c. $1,735 - 1 = 0,735$

$$0,735 \cdot 100\% = 73,5\%$$

d. $1 - 0,845 = 0,155$

$$0,155 \cdot 100\% = 15,5\%$$

e. $2,42 - 1 = 1,42$

$$1,42 \cdot 100\% = 142\%$$

f. $g = 1 - \frac{0,7}{100} = 0,993$

Opgave 24:

a. $N_J = 300 \cdot 1,08^t$

b. $N_K = 800 \cdot 0,9^t$

c. $y_1 = 300 \cdot 1,08^x$ en $y_2 = 800 \cdot 0,9^x$

intersect geeft $t = 5,38$ dus in mei 2011

d. $y_1 = 300 \cdot 1,08^x$ en $y_2 = 1000$

intersect geeft $t = 15,64$ dus in 2021

e. $y_1 = 800 \cdot 0,9^x$ en $y_2 = 400$

intersect geeft $t = 6,58$ dus in 2012

Opgave 25:

- a. $N_C = 1,31 \cdot 1,006^t$
- b. $N_I = 1,08 \cdot 1,013^t$
- c. 1 januari 2011 is $t = 6$
 $N_C = 1,31 \cdot 1,006^6 = 1,358$ miljard = 1358 miljoen
 $N_I = 1,08 \cdot 1,013^6 = 1,167$ miljard = 1167 miljoen
- d. $y_1 = 1,31 \cdot 1,006^x$ en $y_2 = 1,08 \cdot 1,013^x$
intersect geeft $x = 27,84$ dus in 2032
- e. $y_2 = 1,08 \cdot 1,013^x$ met table:
 $t = 10$ $N = 1,2289$
 $t = 11$ $N = 1,2449$
 $t = 12$ $N = 1,2611$
Dus van $t = 11$ naar $t = 12$, dus in 2016

Opgave 26:

- a. $g = 0,6$
- b. $P_b = 100 \cdot 0,7^d$
- c. rood licht: $100 \cdot 0,6^4 = 12,96\%$ dus 13%
blauw licht: $100 \cdot 0,7^4 = 24,01\%$ dus 24%
- d. $y_1 = 100 \cdot 0,7^x$ en $y_2 = 1$
intersect geeft $x = 9$ dus 9 meter
 $P_b = 100 \cdot 0,7^9 = 4$ dus 4 × zo veel

5.3 Machten met gehele en gebroken exponenten.

Opgave 27:

- $x^2 \cdot x^3 = x^6$ is niet waar want $x^2 \cdot x^3 = x^5$
- $x^6 : x^2 = x^4$ is waar
- $(2x)^3 = 6x^3$ is niet waar want $(2x)^3 = 2^3 \cdot x^3 = 8x^3$
- $(x^3)^2 = x^6$ is waar

Opgave 28:

- $2a^3 \cdot 4a^7 = 8a^{10}$
- $(2a^3)^7 = 2^7 \cdot a^{21} = 128a^{21}$
- $\frac{15a^8}{3a^6} = 5a^2$
- $(3a^2b)^4 = 3^4 \cdot a^8b^4 = 81a^8b^4$
- $(5a^3)^3 \cdot 2b^7 = 5^3 \cdot a^9 \cdot 2b^7 = 125a^3 \cdot 2b^7 = 250a^9b^7$
- $21a^6 \cdot \frac{1}{3a} = \frac{21a^6}{3a} = 7a^5$
- $(-2a)^3 \cdot 3a^3 = -8a^3 \cdot 3a^3 = -24a^6$
- $(-2a)^2 + 3a^2 = 4a^2 + 3a^2 = 7a^2$
- $10a^2b \cdot \frac{2}{ab} = \frac{20a^2b}{ab} = 20a$

Opgave 29:

- $7a^3 + 5a^3 = 12a^3$
- $7a^3 - a^3 = 6a^3$
- $7a^5 : a^3 = 7a^2$
- $7a^5 \cdot 3a = 21a^6$
- $7a^3 \cdot 5a^3 = 35a^6$
- $(7a)^5 = 16807a^5$
- $(7a)^3 + 5a^3 = 343a^3 + 5a^3 = 348a^3$
- $7a \cdot 5a^3 = 35a^4$
- $(2a)^2 + (3a)^2 = 4a^2 + 9a^2 = 13a^2$
- $(-2a)^3 - 3a^3 = -8a^3 - 3a^3 = -11a^3$
- $(-3a)^2 : 2a = 9a^2 : 2a = 4\frac{1}{2}a$
- $(-3a)^2 \cdot 2a^3 = 9a^2 \cdot 2a^3 = 18a^5$

Opgave 30:

- $N = 750 \cdot 1,05^{3t+4}$
 $N = 750 \cdot 1,05^4 \cdot 1,05^{3t}$
 $N = 912 \cdot (1,05^3)^t$
 $N = 912 \cdot 1,16^t$
- $N = 18 - 3,2 \cdot 1,83^{2t+3}$

$$N = 18 - 3,2 \cdot 1,83^3 \cdot 1,83^{2t}$$

$$N = 18 - 19,61 \cdot (1,83^2)^t$$

$$N = 18 - 19,61 \cdot 3,35^t$$

c. $y = 4 \cdot (1,05x^3)^5$

$$y = 4 \cdot 1,05^5 \cdot x^{15}$$

$$y = 5,11 \cdot x^{15}$$

Opgave 31:

a. $N = 500 \cdot 1,32^{5t+2}$

$$N = 500 \cdot 1,32^2 \cdot 1,32^{5t}$$

$$N = 871,2 \cdot (1,32^5)^t$$

$$N = 871,2 \cdot 4,01^t$$

b. $P = 8,3 \cdot (5,1x^2)^3 \cdot 0,26 \cdot (x^4)^3$

$$P = 8,3 \cdot 5,1^3 \cdot x^6 \cdot 0,26 \cdot x^{12}$$

$$P = 286 \cdot x^{18}$$

Opgave 32:

a.

datum	11 mei	18 mei	25 mei	1 juni	8 juni	15 juni
t	-3	-2	-1	0	1	2
opp O	2	4	8	16	32	64

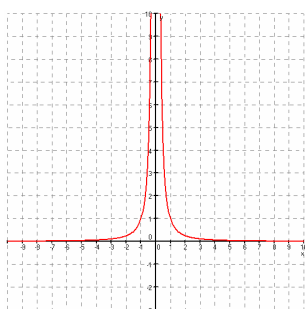
b. $2^0 = 1$

c. $2^{-1} = \frac{1}{2}$

d. $O = 2$ dus $2^{-3} = \frac{1}{8}$

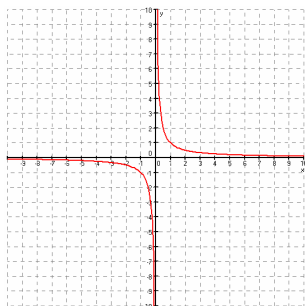
Opgave 33:

a.

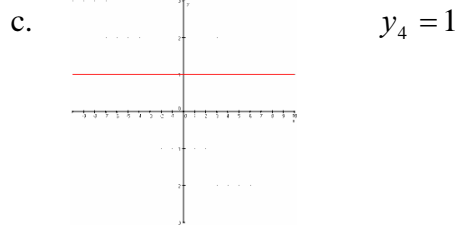


y_1 en y_2 leveren dezelfde grafiek op

b.



$$y_3 = \frac{1}{x}$$



Opgave 34:

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

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

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

d. $a^8 : a^0 = a^8 : 1 = a^8$

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

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

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

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

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

Opgave 35:

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

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

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

d. $(\frac{2}{5})^{-2} = \frac{2^{-2}}{5^{-2}} = \frac{5^2}{2^2} = \frac{25}{4} = 6\frac{1}{4}$

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

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

Opgave 36:

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

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

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

- d. $\frac{3}{5}a^{-4} = \frac{3}{5} \cdot \frac{1}{a^4} = \frac{3}{5a^4}$
- e. $(\frac{1}{2}a)^{-3} = (2^{-1} \cdot a)^{-3} = 2^3 \cdot a^{-3} = 8 \cdot \frac{1}{a^3} = \frac{8}{a^3}$
- f. $\frac{1}{6}a^{-2} \cdot b^4 = \frac{1}{6} \cdot \frac{1}{a^2} \cdot b^4 = \frac{b^4}{6a^2}$
- g. $-4 \cdot (3a)^{-2} = -4 \cdot \frac{1}{(3a)^2} = -4 \cdot \frac{1}{9a^2} = \frac{-4}{9a^2}$
- h. $(3a)^{-2} \cdot b^{-3} = \frac{1}{(3a)^2} \cdot \frac{1}{b^3} = \frac{1}{9a^2} \cdot \frac{1}{b^3} = \frac{1}{9a^2b^3}$
- i. $\frac{3}{8}a^{-1} \cdot b = \frac{3}{8} \cdot \frac{1}{a} \cdot b = \frac{3b}{8a}$

Opgave 37:

- a. $y = (\frac{1}{3}x^2)^{-1} \cdot x^4$
 $y = (3^{-1} \cdot x^2)^{-1} \cdot x^4$
 $y = 3 \cdot x^{-2} \cdot x^4$
 $y = 3x^2$
- b. $y = 75 \cdot (5x)^{-2} \cdot 3x^{12}$
 $y = 75 \cdot 5^{-2} \cdot x^{-2} \cdot 3x^{12}$
 $y = 75 \cdot \frac{1}{5^2} \cdot x^{-2} \cdot 3x^{12}$
 $y = 75 \cdot \frac{1}{25} \cdot x^{-2} \cdot 3x^{12}$
 $y = 9x^{10}$
- c. $y = \frac{5}{x^2} \cdot (3x^{-2})^3$
 $y = 5x^{-2} \cdot 3^3 \cdot x^{-6}$
 $y = 5x^{-2} \cdot 27x^{-6}$
 $y = 135x^{-8}$
- d. $y = 50 \cdot 2^{3x-1}$
 $y = 50 \cdot 2^{3x} \cdot 2^{-1}$
 $y = 50 \cdot (2^3)^x \cdot \frac{1}{2}$
 $y = 25 \cdot 8^x$
- e. $y = 275 \cdot 5^{-2x}$
 $y = 275 \cdot (5^{-2})^x$
 $y = 275 \cdot (\frac{1}{5^2})^x$
 $y = 275 \cdot (\frac{1}{25})^x$
- f. $y = 5000 \cdot 10^{-x-3}$
 $y = 5000 \cdot 10^{-x} \cdot 10^{-3}$
 $y = 5000 \cdot (10^{-1})^x \cdot \frac{1}{10^3}$
 $y = 5000 \cdot (\frac{1}{10})^x \cdot \frac{1}{1000}$

$$y = 5 \cdot \left(\frac{1}{10}\right)^x$$

Opgave 38:

- klopt, want $\left(2^{\frac{1}{7}}\right)^7 = 2^{\frac{1}{7} \cdot 7} = 2^1 = 2$
- klopt
- als $\left(2^{\frac{1}{7}}\right)^7 = 2$ en $\left(\sqrt[7]{2}\right)^7 = 2$ dan moet gelden $\left(2^{\frac{1}{7}}\right)^7 = \left(\sqrt[7]{2}\right)^7$ dus $2^{\frac{1}{7}} = \sqrt[7]{2}$
- klopt

Opgave 39:

- $5a^{\frac{1}{3}} = 5 \cdot \sqrt[3]{a}$
- $\frac{1}{2} a^{-\frac{1}{4}} b = \frac{1}{2} \cdot \frac{1}{a^{\frac{1}{4}}} \cdot b = \frac{1}{2} \cdot \frac{1}{\sqrt[4]{a}} \cdot b = \frac{b}{2 \cdot \sqrt[4]{a}}$
- $3a^{-\frac{2}{3}} = 3 \cdot \frac{1}{a^{\frac{2}{3}}} = \frac{3}{\sqrt[3]{a^2}}$
- $\frac{2}{3} \cdot a^{-3} \cdot b^{\frac{1}{3}} = \frac{2}{3} \cdot \frac{1}{a^3} \cdot \sqrt[3]{b} = \frac{2 \cdot \sqrt[3]{b}}{3a^3}$
- $\frac{1}{5} a^{-\frac{1}{2}} \cdot b^{\frac{1}{3}} = \frac{1}{5} \cdot \frac{1}{a^{\frac{1}{2}}} \cdot \sqrt[3]{b} = \frac{\sqrt[3]{b}}{5 \cdot \sqrt{a}}$
- $(5a)^{-\frac{1}{2}} = \frac{1}{(5a)^{\frac{1}{2}}} = \frac{1}{\sqrt{5a}}$

Opgave 40:

- $a \cdot \sqrt[3]{a} = a^1 \cdot a^{\frac{1}{3}} = a^{\frac{4}{3}}$
- $\frac{1}{\sqrt{a}} = \frac{1}{a^{\frac{1}{2}}} = a^{-\frac{1}{2}}$
- $\frac{1}{a} = a^{-1}$
- $\frac{1}{a^3} = a^{-3}$
- $a^2 \cdot \sqrt{a} = a^2 \cdot a^{\frac{1}{2}} = a^{\frac{5}{2}}$
- $\sqrt[3]{\frac{1}{a^2}} = \sqrt[3]{a^{-2}} = a^{-\frac{2}{3}}$
- $\sqrt[3]{a^{12}} = a^{\frac{12}{3}} = a^4$
- $a^4 \cdot \sqrt[3]{a} = a^4 \cdot a^{\frac{1}{3}} = a^{\frac{13}{3}}$
- $\frac{a^3}{\sqrt[3]{a}} = \frac{a^3}{a^{\frac{1}{3}}} = a^{\frac{8}{3}}$

Opgave 41:

- $\frac{x^6}{x^2 \cdot \sqrt{x}} = \frac{x^6}{x^2 \cdot x^{\frac{1}{2}}} = \frac{x^6}{x^{\frac{5}{2}}} = x^{\frac{7}{2}}$
- $x \cdot \sqrt[7]{x^3} = x^1 \cdot x^{\frac{3}{7}} = x^{\frac{10}{7}}$

- c. $\frac{x}{\sqrt[5]{x}} = \frac{x^1}{x^{\frac{1}{5}}} = x^{\frac{4}{5}}$
- d. $x^4 \cdot \sqrt{x} = x^4 \cdot x^{\frac{1}{2}} = x^{4\frac{1}{2}}$
- e. $\frac{\sqrt[3]{x}}{\sqrt{x}} = \frac{x^{\frac{1}{3}}}{x^{\frac{1}{2}}} = x^{-\frac{1}{6}}$
- f. $\frac{1}{x^2} : \sqrt{x} = x^{-2} : x^{\frac{1}{2}} = \frac{x^{-2}}{x^{\frac{1}{2}}} = x^{-2\frac{1}{2}}$
- g. $x^2 \cdot \frac{1}{x^3} = \frac{x^2}{x^3} = x^{-1}$
- h. $x^5 \cdot \sqrt[3]{x^6} = x^5 \cdot x^{\frac{6}{3}} = x^5 \cdot x^2 = x^7$
- i. $\frac{x^4 \cdot \sqrt[5]{x}}{x^5 \cdot \sqrt[4]{x}} = \frac{x^4 \cdot x^{\frac{1}{5}}}{x^5 \cdot x^{\frac{1}{4}}} = \frac{x^{4\frac{1}{5}}}{x^{5\frac{1}{4}}} = x^{-1\frac{1}{20}}$

Opgave 42:

- a. $y = \frac{5}{x\sqrt{x}}$
 $y = \frac{5}{x^1 \cdot x^{\frac{1}{2}}}$
 $y = \frac{5}{x^{1\frac{1}{2}}}$
 $y = 5x^{-1\frac{1}{2}}$
- b. $y = 5x \cdot \sqrt[3]{x^2}$
 $y = 5x \cdot x^{\frac{2}{3}}$
 $y = 5x^{1\frac{2}{3}}$
- c. $y = \frac{5}{x^3} \cdot 2\sqrt{x}$
 $y = 5x^{-3} \cdot 2x^{\frac{1}{2}}$
 $y = 10x^{-2\frac{1}{2}}$
- d. $y = 3 \cdot \sqrt[4]{x^3}$
 $y = 3x^{\frac{3}{4}}$
- e. $y = 5x^{-0,2} \cdot x^{1,3}$
 $y = 5x^{1,1}$
- f. $y = \frac{50x^{1,9}}{10x^{1,1}}$
 $y = 5x^{0,8}$

Opgave 43:

- a. $-3\sqrt[3]{210} = -5,944$ en $(-3)\sqrt[3]{210} = 0,168$

- b. $(-3)\sqrt[5]{210}$
 c. nee
 $x^3 = -7$ geeft $x = \sqrt[3]{-7} = -1,91$
 $x^{-3} = 7$ geeft $x = \sqrt[3]{7} = 0,52$

Opgave 44:

- a. $x^{1,6} = 50$
 $x = \sqrt[1,6]{50} = 11,53$
 b. $x^{-4} = 5$
 $x = \sqrt[4]{5} = 0,67$
 c. $x^{-1,3} = 11$
 $x = \sqrt[1,3]{11} = 0,16$
 d. $x^{-1} = 21$
 $x = \sqrt[1]{21} = 0,05$
 e. $x^{0,55} = 18$
 $x = \sqrt[0,55]{18} = 191,56$
 f. $\sqrt[3]{x^2} = 28$
 $x^2 = 28^3 = 21952$
 $x = \sqrt{21952} = 148,16$

Opgave 45:

- a. $3x^{2,25} + 1 = 27$
 $3x^{2,25} = 26$
 $x^{2,25} = \frac{26}{3}$
 $x = \sqrt[2,25]{\frac{26}{3}} = 2,611$
 b. $5x^{-1,3} + 8 = 21$
 $5x^{-1,3} = 13$
 $x^{-1,3} = 2,6$
 $x = \sqrt[1,3]{2,6} = 0,480$
 c. $4x^{-1,8} + 16 = 5000$
 $4x^{-1,8} = 4984$
 $x^{-1,8} = 1246$
 $x = \sqrt[1,8]{1246} = 0,019$
 d. $8 - 3x^{1,16} = 1$
 $-3x^{1,16} = -7$
 $x^{1,16} = \frac{7}{3}$
 $x = \sqrt[1,16]{\frac{7}{3}} = 2,076$
 e. $5 \cdot \sqrt[3]{x} = 8$
 $\sqrt[3]{x} = 1,6$
 $x = 1,6^3 = 4,096$

$$\begin{aligned}
 \text{f. } & 3 \cdot \sqrt[4]{x^3} - 1 = 36 \\
 & 3 \cdot \sqrt[4]{x^3} = 37 \\
 & \sqrt[4]{x^3} = \frac{37}{3} \\
 & x^3 = \left(\frac{37}{3}\right)^4 = 23137,79 \\
 & x = \sqrt[3]{23137,79} = 28,495
 \end{aligned}$$

Opgave 46:

$$\begin{aligned}
 \text{a. } & H = 12 \cdot 10^{0,67} = 56 \text{ gram} \\
 \text{b. } & 12 \cdot G^{0,67} = 18 \\
 & G^{0,67} = 1,5 \\
 & G = \sqrt[0,67]{1,5} = 1,8 \text{ kg} \\
 \text{c. } & H = 12 \cdot 40^{0,67} = 142 \\
 & I = \frac{130}{142} = 0,91 \\
 \text{d. } & H = 12 \cdot 70^{0,67} = 206,7 \\
 & I = \frac{1650}{206,7} = 8,0 \\
 \text{e. } & \frac{1050}{H} = 1,04 \\
 & H = \frac{1050}{1,04} = 1009,6 \\
 & 12 \cdot G^{0,67} = 1009,6 \\
 & G^{0,67} = \frac{1009,6}{12} = 84,1 \\
 & G = \sqrt[0,67]{84,1} = 747 \text{ kg}
 \end{aligned}$$

Opgave 47:

$$\text{a. } P = 800 \cdot l^{-2,25} = \frac{800}{l^{2,25}}$$

dus als l groter wordt, dan wordt $l^{2,25}$ groter, dus wordt P kleiner omdat $l^{2,25}$ in de noemer staat.

Als P kleiner wordt betekent dat dat er minder organismen per km^2 leven, dus de bewering klopt.

$$\begin{aligned}
 \text{b. } & P = 800 \cdot 0,9^{-2,25} = 1014 \\
 \text{c. } & 800 \cdot l^{-2,25} = 1350 \\
 & l^{-2,25} = 1,6875 \\
 & l = \sqrt[-2,25]{1,6875} = 0,79 \text{ m dus } 79 \text{ cm} \\
 \text{d. } & P = 800 \cdot 2,15^{-2,25} = 142,9 \\
 & 142,9 \cdot 250 = 35731 \text{ kariboes} \\
 \text{e. } & \frac{160000}{5} = 32000 \\
 & 800 \cdot l^{-2,25} = 32000 \\
 & l^{-2,25} = 40 \\
 & l = \sqrt[-2,25]{40} = 0,19 \text{ m}
 \end{aligned}$$

Opgave 48:

a. $0,059 \cdot G^{0,92} = 4$

$G^{0,92} = 67,8$

$G = \sqrt[0,92]{67,8} = 97,8 \text{ kg}$

b. omnivoor: $0,059 \cdot G^{0,92} = 6$

$G^{0,92} = 101,7$

$G = \sqrt[0,92]{101,7} = 152$

carnivoor: $0,11 \cdot G^{1,36} = 6$

$G^{1,36} = 54,5$

$G = \sqrt[1,36]{54,5} = 19$

de omnivoor is het zwaarst, het verschil is $152 - 19 = 133 \text{ kg}$

c. het leefgebied is dan $4^{1,36} = 6,6 \times$ zo groot

d. $L_C^* = 0,11 \cdot (0,001 \text{ g})^{1,36} = 0,11 \cdot 0,001^{1,36} \cdot \text{g}^{1,36} = 0,000009 \text{ g}^{1,36}$

Opgave 49:

$2,5 \cdot 16^{1,5} = 160$

Opgave 50:

$a \cdot 12^{-1,81} = 16$

$a = \frac{16}{12^{-1,81}} = 1437$

Opgave 51:

$a \cdot 18^{1,83} = 350$

$a = \frac{350}{18^{1,83}} = 1,7$

$y = 1,766 \cdot 25^{1,83} = 638$

Opgave 52:

a. $a \cdot 40^{0,75} = 6700$

$a = \frac{6700}{40^{0,75}} = 421,2$

$W = 421,2 \text{ m}^{0,75}$

b. $W = 421,2 \cdot 4^{0,75} = 1191 \text{ kJ}$

c. $421,2 \text{ m}^{0,75} = 50000$

$m^{0,75} = 118,7$

$m = \sqrt[0,75]{118,7} = 583 \text{ kg}$

Opgave 53:

a. $a \cdot 30^{0,88} = 90$

$a = \frac{90}{30^{0,88}} = 4,51$

$$W = 4,51m^{0,88}$$

- b. $W = 4,51 \cdot 200^{0,88} = 477,6 \frac{ml}{uur}$
dus per dag: $24 \cdot 477,6 = 11463 \text{ ml} = 11,5 \text{ liter}$
- c. per uur: $\frac{1200}{24} = 50 \text{ ml}$
 $4,51m^{0,88} = 50$
 $m^{0,88} = 11,09$
 $m = \sqrt[0,88]{11,09} = 15 \text{ kg}$
- d. $W = \frac{24}{1000} \cdot 4,51m^{0,88} = 0,10824m^{0,88}$
- e. $4^{0,88} = 3,4 \times \text{zo veel}$

5.4 Groeifactoren

Opgave 54:

a.

tijd in jaren	0	1	2	3	4	5
hoeveelheid N	2	18	162	1458	13122	118098

b. $\frac{162}{2} = 81$

c. met minder, want dan zou de groeifactor per jaar $4,5 \cdot 4,5 = 20,25$ zijn

Opgave 55:

a. $g_{\text{kwartier}} = 1,12$

$$g_{\text{uur}} = 1,12^4 = 1,574 \text{ dus de toename is } 57,4\%$$

b. $g_{5 \text{ min}} = 1,12^{\frac{1}{3}} = 1,038$ dus de toename is 3,8%

c. $g_{5 \text{ uur}} = 1,12^{20} = 9,646$ dus de toename is 864,6%

Opgave 56:

a. $g_{\text{dag}} = 0,84$

$$g_{\text{week}} = 0,84^7 = 0,295$$

b. $g_{\text{uur}} = 0,84^{\frac{1}{24}} = 0,993$ dus de afname is 0,7%

Opgave 57:

a. $g_{\text{week}} = 1,3^7 = 6,27$ dus de toename is 527%

b. $g_{4 \text{ uur}} = 1,3^{\frac{1}{6}} = 1,045$ dus de toename is 4,5%

Opgave 58:

a. $g_{\text{uur}} = 0,805$

$$g_{\text{kwartier}} = 0,805^{\frac{1}{4}} = 0,947 \text{ dus de afname is } 5,3\%$$

b. $g_{\text{jaar}} = 1,086$

$$g_{25 \text{ jaar}} = 1,086^{25} = 7,87 \text{ dus de toename is } 687\%$$

c. $g_{\text{week}} = 2,8$

$$g_{\text{dag}} = 2,8^{\frac{1}{7}} = 1,158 \text{ dus de toename is } 15,8\%$$

Opgave 59:

$$g^{15} = 10$$

$$g = \sqrt[15]{10} = 1,166 \text{ dus een jaarlijkse stijging van } 16,6\%$$

Opgave 60:

a. $g^{10} = 0,05$

$$g = \sqrt[10]{0,05} = 0,741 \text{ dus een afname van } 25,9\%$$

b. $g^{20} = 12$

$$g = \sqrt[20]{12} = 1,132 \text{ dus een toename van } 13,2\%$$

c. $\frac{14000}{12} = 1167$

$$\frac{1167}{0,05} = 23333$$

Opgave 61:

a. $g_{\text{dag}} = 1,05$

$$g_{\text{week}} = 1,05^7 = 1,407 \text{ dus een toename van } 40,7\%$$

b. $g_{\text{week}} = 1,5^7 = 17,1$

c. $g_{\text{uur}} = 0,8$

$$g_{\text{kwartier}} = 0,8^{\frac{1}{4}} = 0,946 \text{ dus een afname van } 5,4\%$$

d. $g_{\text{kwartier}} = 0,7^{\frac{1}{4}} = 0,915$

Opgave 62:

a. $g^4 = \frac{300000}{50000} = 6$

b. $g = \sqrt[4]{6} = 1,565$

Opgave 63:

$$g^7 = \frac{4100}{1600} = 2,5625$$

$$g = \sqrt[7]{2,5625} = 1,14$$

$$b = \frac{1600}{1,14^3} = 1069$$

$$N = 1069 \cdot 1,14^t$$

Opgave 64:

$$g^6 = \frac{2500}{1000} = 2,5$$

$$g = \sqrt[6]{2,5} = 1,165$$

$$b = \frac{1000}{1,165^4} = 543$$

$$N = 543 \cdot 1,165^t$$

Opgave 65:

a. $g^4 = \frac{11}{31} = 0,355$

$$g = \sqrt[4]{0,355} = 0,772$$

$$b = \frac{31}{0,772^3} = 67$$

$$A = 67 \cdot 0,772^t$$

b. 67 mm^2

c. $60 \text{ uur} = 2\frac{1}{2} \text{ dag}$, dus $A = 67 \cdot 0,772^{2,5} = 35 \text{ mm}^2$

Opgave 66:

a. $g^3 = \frac{8}{10} = 0,8$

$$g = \sqrt[3]{0,8} = 0,928 \text{ dus een afname van } 7,2\%$$

- b. $b = \frac{10}{0,928^6} = 15,625$ knopen
 c. $v = 15,625 \cdot 0,928^{30} = 1,7$ knopen
 d. $15,625 \cdot 0,928^t = 1$
 $y_1 = 15,625 \cdot 0,928^x$ en $y_2 = 1$
 intersect geeft $x = 37$, dus na 37 minuten

Opgave 67:

- a. $g^{40} = 2$
 $g = \sqrt[40]{2} = 1,017$
 $b = 270$ (want de bevolking verdubbelde tot 540 miljoen)
 $N_{plat} = 270 \cdot 1,017^t$
- b. $g^{40} = 10$
 $g = \sqrt[40]{10} = 1,059$
 $90\% = 270$ dus $10\% = 30$ dus $b = 30$
 $N_{urban} = 30 \cdot 1,059^t$
- c. $g^{40} = \frac{710}{207} = 3,43$
 $g = \sqrt[40]{3,43} = 1,031$
 $N_{kip} = 207 \cdot 1,031^t$
- d. $N_{tot} = 270 \cdot 1,017^t + 30 \cdot 1,059^t$
 $270 \cdot 1,017^t + 30 \cdot 1,059^t = 650$
 $y_1 = 270 \cdot 1,017^x + 30 \cdot 1,059^x$ en $y_2 = 650$
 intersect geeft $x = 31,95$ dus in 1991
- e. $\frac{30 \cdot 1,059^t}{270 \cdot 1,017^t} = \frac{40}{60}$
 $y_1 = \frac{30 \cdot 1,059^x}{270 \cdot 1,017^x}$ en $y_2 = \frac{40}{60}$
 intersect geeft $x = 44,3$ dus in 2004

Opgave 68:

- a. $\frac{550}{315} = 1,746$; $\frac{960}{550} = 1,745$; $\frac{1670}{960} = 1,740$; $\frac{2900}{1670} = 1,737$
- b. $g^8 = \frac{2900}{315} = 9,206$
 $g = \sqrt[8]{9,206} = 1,320$
 $O = 315 \cdot 1,320^t$
- c. $O = 315 \cdot 1,320^{17} = 35328$ miljoen
 $\frac{35328}{16,8} = 2102$ dus ongeveer € 2100,-

Opgave 69:

- a. $1,020^t = 2$
 $y_1 = 1,020^x$ en $y_2 = 2$

- intersect geeft $x = 35$ dus na 35 jaar
- na 35 jaar
 - de verdubbelingstijd is onafhankelijk van de beginhoeveelheid

Opgave 70:

- $g = 1,131$
 $1,131^t = 2$
 $y_1 = 1,131^x$ en $y_2 = 2$
 intersect geeft $x = 5,63$ jaar dus na 5 jaar en 8 maanden
- $g = 0,915$
 $0,915^t = 0,5$
 $y_1 = 0,915^x$ en $y_2 = 0,5$
 intersect geeft $x = 7,8$ weken dus na 7 weken en 6 dagen

Opgave 71:

- $g = 1,023$
 $1,023^t = 2$
 $y_1 = 1,023^x$ en $y_2 = 2$
 intersect geeft $x = 30,5$ dus na 30,5 jaar
- $g_{10 \text{ jaar}} = 1,018$
 $1,018^t = 2$
 $y_1 = 1,018^x$ en $y_2 = 2$
 intersect geeft $x = 38,85$ dus na $10 \cdot 38,85 = 389$ jaar

Opgave 72:

- $g = 0,917$
 $0,917^t = 0,5$
 $y_1 = 0,917^x$ en $y_2 = 0,5$
 intersect geeft $x = 8$ dus 8 dagen
- $0,917^t = 0,1$
 $y_1 = 0,917^x$ en $y_2 = 0,1$
 intersect geeft $x = 26,6$ dus na 27 dagen

Opgave 73:

- $g_{\text{dag}} = 2^{\frac{1}{10}} = 1,072$ dus een toename van 7,2%
- $g^{25} = 2$
 $g = \sqrt[25]{2} = 1,028$ dus een toename van 2,8%
- $g^{28} = 0,5$
 $g = \sqrt[28]{0,5} = 0,976$ dus een afname van 2,4%

Opgave 74:

Periode 1: $g^{1500} = 2$

$g = \sqrt[150]{2} = 1,00046$ dus een toename van 0,05%
 Periode 2: $g^{300} = 2$
 $g = \sqrt[300]{2} = 1,0023$ dus een toename van 0,23%
 Periode 3: $g^{150} = 2$
 $g = \sqrt[150]{2} = 1,0046$ dus een toename van 0,46%
 Periode 4: $g^{36} = 2$
 $g = \sqrt[36]{2} = 1,0194$ dus een toename van 1,94%
 Periode 5: $g^{20} = \frac{6,5}{4,8} = 1,354$
 $g = \sqrt[20]{1,354} = 1,0153$ dus een toename van 1,53%

5.5 Diagnostische toets

Opgave 1:

- a. $5x^6 = 30$
 $x^6 = 6$
 $x = \sqrt[6]{6} \quad \vee \quad x = -\sqrt[6]{6}$
- b. $6x^5 + 17 = -51$
 $6x^5 = -68$
 $x^5 = -11\frac{1}{3}$
 $x = \sqrt[5]{-11\frac{1}{3}}$
- c. $3x^4 - 8 = 40$
 $3x^4 = 48$
 $x^4 = 16$
 $x = 2 \quad \vee \quad x = -2$
- d. $3x^4 + 8 = 20$
 $3x^4 = 12$
 $x^4 = 4$
 $x = \sqrt[4]{4} \quad \vee \quad x = -\sqrt[4]{4}$

Opgave 2:

- a. $0,1x^3 = 18$
 $x^3 = 180$
 $x = \sqrt[3]{180} = 5,65$
- b. $7x^4 - 5 = -19$
 $7x^4 = -14$
 $x^4 = -2$
geen oplossingen
- c. $11x^6 - 91 = 68$
 $11x^6 = 159$
 $x^6 = 14,45$
 $x = 1,56 \quad \vee \quad x = -1,56$
- d. $11x^5 + 9 = -8$
 $11x^5 = -17$
 $x^5 = -1,55$
 $x = -1,09$

Opgave 3:

- a. $G = 13,4 \cdot 1,73^3 = 69 \text{ kg}$
- b. $13,4 \cdot l^3 = 32$
 $l^3 = 2,39$
 $l = 1,34 \text{ m}$

Opgave 4:

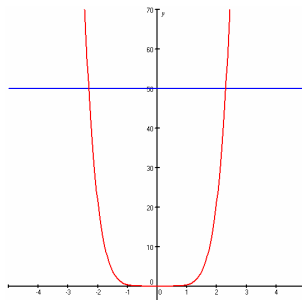
- a. $7 - 3 \cdot \sqrt[5]{x} = 1$
 $-3 \cdot \sqrt[5]{x} = -6$
 $\sqrt[5]{x} = 2$
 $x = 2^5 = 32$
- b. $5 \cdot \sqrt[4]{x} + 2 = 27$
 $5 \cdot \sqrt[4]{x} = 25$
 $\sqrt[4]{x} = 5$
 $x = 5^4 = 625$

Opgave 5:

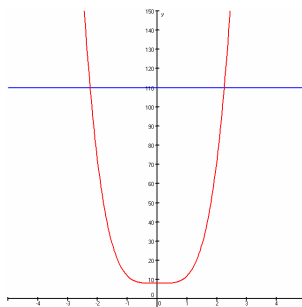
- a. $y = 0,2x^5 - 8$
 $y + 8 = 0,2x^5$
 $5y + 40 = x^5$
 $x = \sqrt[5]{5y + 40}$
- b. $y = 5 \cdot \sqrt[3]{x} - 3$
 $y + 3 = 5 \cdot \sqrt[3]{x}$
 $\frac{1}{5}y + \frac{3}{5} = \sqrt[3]{x}$
 $x = (\frac{1}{5}y + \frac{3}{5})^3$

Opgave 6:

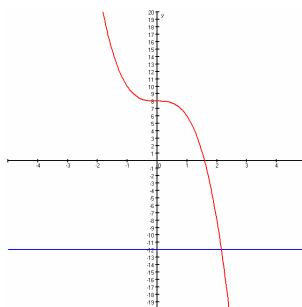
- a. $\frac{1}{3}x^6 > 50$
 $x^6 = 150$
 $x = 2,31 \vee x = -2,31$
 $x < -2,31 \vee x > 2,31$



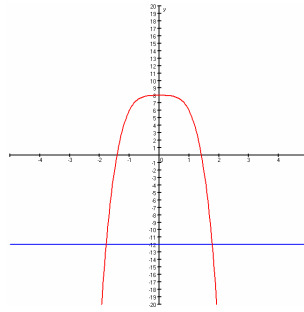
- b. $4x^4 + 8 \leq 110$
 $4x^4 = 102$
 $x^4 = 25,5$
 $x = 2,25 \vee x = -2,25$
 $-2,25 \leq x \leq 2,25$



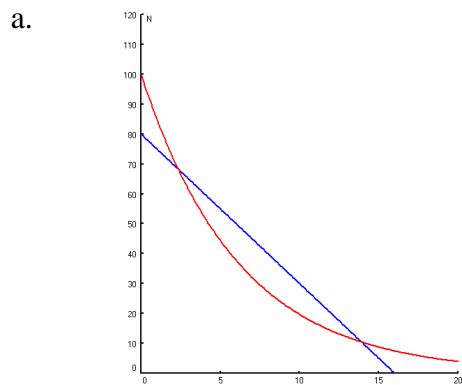
- c. $-2x^3 + 8 \geq -12$
 $-2x^3 = -20$
 $x^3 = 10$
 $x = 2,15$
 $x \leq 2,15$



- d. $-2x^4 + 8 \leq -12$
 $-2x^4 = -20$
 $x^4 = 10$
 $x = 1,78 \quad \vee \quad x = -1,78$
 $x \leq -1,78 \quad \vee \quad x \geq 1,78$



Opgave 7:



- b. $y_1 = 100 \cdot 0,85^x$ met tabel: $x = 19$ dus vanaf $t = 19$
c. $y_1 = 100 \cdot 0,85^x$ en $y_2 = 80 - 5x$
intersect geeft: $t = 2,35 \quad \vee \quad t = 13,92$

Opgave 8:

- a. $g = 0,873$
b. $0,85\%$

Opgave 9:

- a. $H = 20 \cdot 1,07^t$
b. $y_1 = 20 \cdot 1,07^x$ en $y_2 = 55$
intersect geeft $x = 14,95$ dus op 15 mei
c. $y_1 = 20 \cdot 1,07^x$ en $y_2 = y_1 - y_1(x-1)$
kijk in de tabel wanneer $y_2 > 5$
dat is voor $x = 20$ dus op 20 mei

Opgave 10:

- a. $2a^5 + 5a^5 = 7a^5$
b. $2a^3 \cdot 3a^6 = 6a^9$
c. $14a^8 : (2a^5) = 7a^3$
d. $(2a)^3 - a \cdot 7a^2 = 8a^3 - 7a^3 = a^3$
e. $(4a^2b)^2 = 16a^4b^2$
f. $(3a^2)^4 + 5(a^4)^2 = 81a^8 + 5a^8 = 86a^8$

Opgave 11:

- a. $N = 860 \cdot 1,125^{4t-5}$
 $N = 860 \cdot 1,125^{-5} \cdot 1,125^{4t}$
 $N = 860 \cdot 0,555 \cdot (1,125^4)^t$
 $N = 477 \cdot 1,602^t$
- b. $R = 15 \cdot (2,5q^2)^3$
 $R = 15 \cdot 15,625q^6$
 $R = 234q^6$

Opgave 12:

- a. $\frac{1}{a^3} = a^{-3}$
- b. $a^4 \cdot \frac{1}{a^7} = a^4 \cdot a^{-7} = a^{-3}$
- c. $\sqrt{a} = a^{\frac{1}{2}}$
- d. $\sqrt[5]{a^3} = a^{\frac{3}{5}}$
- e. $a^2 \cdot \sqrt[3]{a} = a^2 \cdot a^{\frac{1}{3}} = a^{2\frac{1}{3}}$
- f. $\frac{1}{\sqrt[3]{a^2}} = \frac{1}{a^{\frac{2}{3}}} = a^{-\frac{2}{3}}$

Opgave 13:

- a. $(a^{-\frac{1}{4}})^3 = a^{-\frac{3}{4}} = \frac{1}{a^{\frac{3}{4}}} = \frac{1}{\sqrt[4]{a^3}}$
- b. $a^{-2} \cdot b^{\frac{1}{5}} = \frac{1}{a^2} \cdot \sqrt[5]{b} = \frac{\sqrt[5]{b}}{a^2}$
- c. $7a^{-\frac{1}{3}} \cdot b^{\frac{3}{5}} = 7 \cdot \frac{1}{a^{\frac{1}{3}}} \cdot \sqrt[5]{b^3} = \frac{7 \cdot \sqrt[5]{b^3}}{\sqrt[3]{a}}$

Opgave 14:

- a. $3x^{1,6} + 2 = 7$
 $3x^{1,6} = 5$
 $x^{1,6} = \frac{5}{3}$
 $x = 1,376$
- b. $\frac{1}{4}x^{-3} = 160$
 $x^{-3} = 640$
 $x = 0,116$
- c. $7 \cdot \sqrt[5]{x^3} = 48$
 $\sqrt[5]{x^3} = 6,857$
 $x^3 = 15160,586$
 $x = 24,750$
- d. $6x^{-2,5} + 5 = 7$

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

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

$$x = 1,552$$

Opgave 15:

$$A = c \cdot p^{0,32}$$

$$64,2 = c \cdot 53,8^{0,32}$$

$$c = \frac{64,2}{53,8^{0,32}} = 17,93$$

$$A = 17,93 \cdot p^{0,32}$$

Opgave 16:

- a. $g_{dag} = 1,1$
 $g_{week} = 1,1^7 = 1,949$ dus een toename van 94,9%
- b. $g_{jaar} = 0,64$
 $g_{maand} = 0,64^{\frac{1}{12}} = 0,963$ dus een afname van 3,7%

Opgave 17:

$$g^3 = \frac{1200}{1500} = 0,8$$

$$g = 0,928$$

$$b = \frac{1500}{0,928^4} = 2020$$

$$N = 2020 \cdot 0,928^t$$

Opgave 18:

- a. $1,1^t = 2$
 $y_1 = 1,1^x$ en $y_2 = 2$
intersect geeft $x = 7,27$ jaar , dus 7 jaar en 3 maanden
- b. $0,8^t = 0,5$
 $y_1 = 0,8^x$ en $y_2 = 0,5$
intersect geeft $x = 3,1$ weken , dus 22 dagen

Opgave 19:

$$g^{25} = 0,5$$

$$g_{min} = \sqrt[25]{0,5} = 0,973$$

$$g_{uur} = 0,973^{60} = 0,189$$
 dus een afname van 81,1%