6.4 Toepassingen van logaritmen

Opgave 61:

a. $\frac{100000}{10} = 10000$

$\frac{100000}{0{,}002} = 50000000$

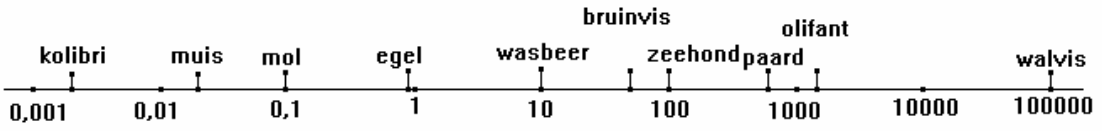
b. $100000\,\text{kg} = 10^8\,\text{g}$

$\frac{10^8}{10} = 10^7\,\text{cm} = 100000\,\text{m}$

c. $\frac{100000}{1000} = 100\,\text{mm} = 10\,\text{cm}$

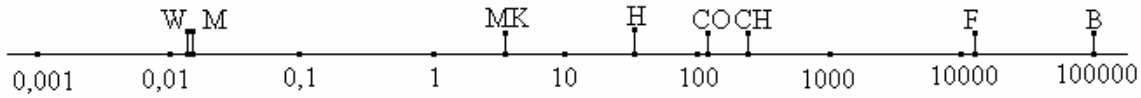
bezwaar: de eerste acht dieren liggen allemaal binnen 1 mm.

Opgave 62:



Opgave 63:

a.



b. Technopower: $10^{-0{,}04} = 0{,}91$

Allison: $10^{3{,}1} = 1259$

Opgave 64:

Mercurius: $\log 88 = 1{,}94$

Venus: $\log 225 = 2{,}35$

Aarde: $\log 365 = 2{,}56$

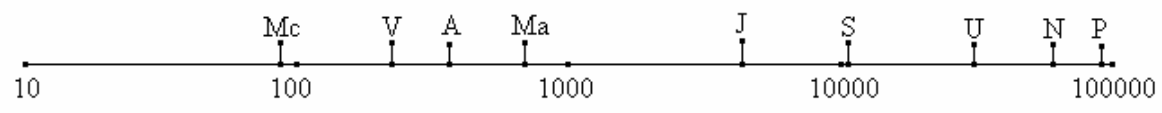
Mars: $\log 687 = 2{,}84$

Jupiter: $\log(11{,}86 \cdot 365) = 3{,}64$

Saturnus: $\log(29{,}46 \cdot 365) = 4{,}03$

Uranus: $\log(84{,}08 \cdot 365) = 4{,}49$

Pluto: $\log(248{,}4 \cdot 365) = 4{,}96$



Opgave 65:

a. $A = 1{,}3 \quad B = 7{,}5 \quad C = 23 \quad D = 55 \quad E = 150 \quad F = 2400$

b. 550 , 210 , 9,5 , 2,4

c. $A = 1300 \quad B = 7500 \quad C = 23000 \quad D = 55000 \quad E = 150000 \quad F = 2400000$

Opgave 66:

a. minimum: $1{,}1 \cdot 10^4 \cdot 1000 = 1{,}1 \cdot 10^7$ kg

maximum: $2{,}6 \cdot 10^4 \cdot 1000 = 2{,}6 \cdot 10^7$ kg

b. schol: $5{,}3 \cdot 10^4$

tarbot: $2{,}9 \cdot 10^3$

dus: $\dfrac{5{,}3 \cdot 10^4}{2{,}9 \cdot 10^3} = 18$ keer

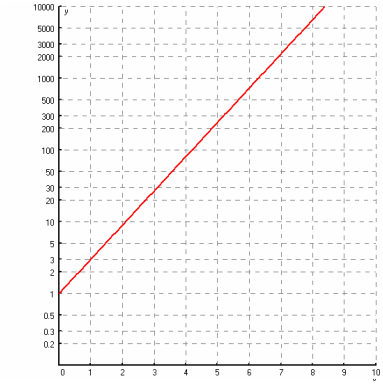
c. $\dfrac{1{,}3 \cdot 10^4 - 2{,}6 \cdot 10^4}{2{,}6 \cdot 10^4} \cdot 100\% = -50\%$

d. $6{,}5 \cdot 10^4 \cdot 1000 : 1000000 = 65\,\text{cm}$

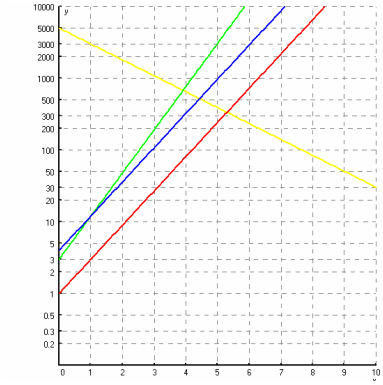
Opgave 67:

a.

x	0	2	4	6	8
3^x	1	9	81	729	6561

b. 

De punten liggen op logaritmisch papier op een rechte lijn.

c. 

Opgave 68:

a. $t = 1 \quad N = 30$

$t = 7 \quad N = 400$

$g^6 = \frac{400}{30}$ dus $g = \sqrt[6]{\frac{400}{30}} = 1{,}54$

$30 = b \cdot 1{,}54^1$

$b = \frac{30}{1{,}54^1} = 19$

$N = 19 \cdot 1{,}54^t$

b. $t = 2 \quad N = 100$

$t = 6 \quad N = 20$

$g^4 = \frac{20}{100} = 0{,}2$ dus $g = \sqrt[4]{0{,}2} = 0{,}67$

$100 = b \cdot 0{,}76^2$

$b = \frac{100}{0{,}67^2} = 224$

$N = 224 \cdot 0{,}67^t$

Opgave 69:

a. planten B en C

plant B: $t = 0 \quad l = 60$

$t = 21 \quad l = 200$

$g^{21} = \frac{200}{60} = 3{,}33$ dus $g = \sqrt[21]{3{,}33} = 1{,}059$

$l_B = 60 \cdot 1{,}059^t$

plant C: $t = 5 \quad l = 40$

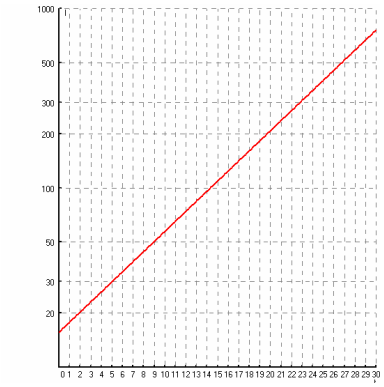
$t = 21 \quad l = 200$

$g^{16} = \frac{200}{40} = 5$ dus $g = \sqrt[16]{5} = 1{,}106$

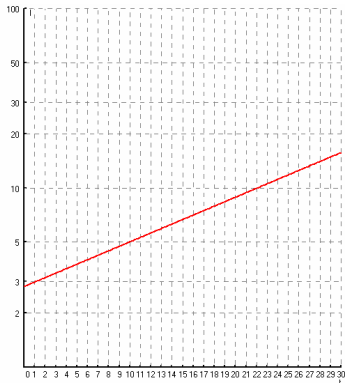
$b = \frac{40}{1{,}106^5} = 24{,}2$

$l_C = 24{,}2 \cdot 1{,}106^t$

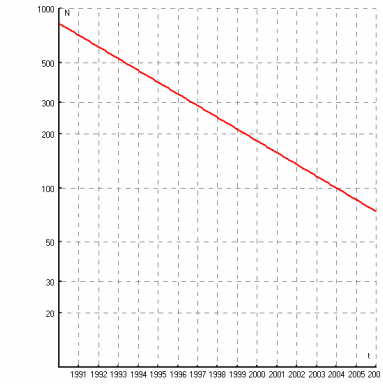
b.



c.



Opgave 70:

a. 

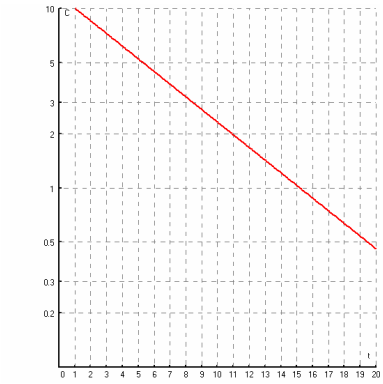
De punten liggen op logaritmisch papier op een rechte lijn.

b. $g^{14} = \frac{75}{610} = 0{,}123$ dus $g = \sqrt[14]{0{,}123} = 0{,}86$

$b = \frac{610}{0{,}86^2} = 825$

$N = 825 \cdot 0{,}86^t$

Opgave 71:

a. 

b. $g^{18} = \frac{0{,}5}{10} = 0{,}05$ dus $g = \sqrt[18]{0{,}05} = 0{,}85$

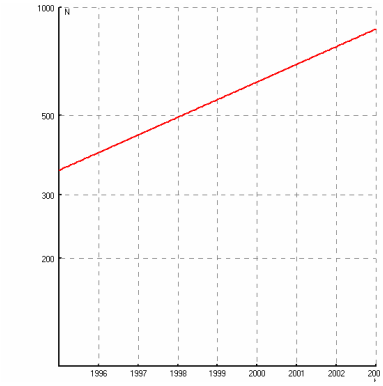
$b = \frac{10}{0{,}85} = 11{,}8$

$C = 11{,}8 \cdot 0{,}85^t$

c. $C(0) = 11{,}8$

$\frac{60}{11{,}8} = 5{,}1 \text{liter}$

Opgave 72:

a. 

b. de eerste twee waarden liggen niet op de rechte lijn, dus vanaf 1997.

c. $g^6 = \frac{870}{441} = 1{,}97$ dus $g = \sqrt[6]{1{,}97} = 1{,}12$

$b = \frac{441}{1{,}12^2} = 352$

$N = 352 \cdot 1{,}12^t$

Opgave 73:

a. $21{,}7 \cdot 1{,}026^t = 43{,}4$

$1{,}026^t = 2$

$t = \frac{\log 2}{\log 1{,}026} = 27$ dus na 27 jaar

b. $21{,}7 \cdot 1{,}026^t = 39{,}2$

$1{,}026^t = 1{,}806$

$t = \frac{\log 1{,}806}{\log 1{,}026} = 23$ dus in 2027, dus na 27 jaar

c. de verdubbelingstijd is onafhankelijk van je begintijdstip (dus je beginhoeveelheid).

Opgave 74:

$g_{jaar} = 0{,}88$ dus $g_{maand} = 0{,}88^{\frac{1}{12}}$

halveringstijd: $\left(0{,}88^{\frac{1}{12}}\right)^t = \frac{1}{2}$

$t = \frac{\log \frac{1}{2}}{\log 0{,}88^{\frac{1}{12}}}$

Opgave 75:

a. $g = 1{,}131$

$1{,}131^t = 2$

$t = \frac{\log 2}{\log 1{,}131} = 5{,}63$ jaar , dus 68 maanden

b. $g = 0{,}915$

$0{,}915^t = \frac{1}{2}$

$t = \frac{\log \frac{1}{2}}{\log 0{,}915} = 7{,}8$ weken , dus 55 dagen

Opgave 76:

a. $1{,}011^t = 2$

$t = \frac{\log 2}{\log 1{,}011} = 63{,}4$ jaar

b. $1{,}083^t = 2$

$t = \frac{\log 2}{\log 1{,}083} = 8{,}7$ dus 87 jaar

Opgave 77:

a. $g = 0{,}917$

$0{,}917^t = \frac{1}{2}$

$t = \frac{\log \frac{1}{2}}{\log 0{,}917} = 8$ dagen

b. $0{,}917^t = 0{,}1$

$t = \frac{\log 0{,}1}{\log 0{,}917} = 26{,}6$ dagen

Opgave 78:

a. $2^{\frac{1}{10}} = 1{,}072$ dus 7,2%

b. $g^{25} = 2$

$g = \sqrt[25]{2} = 1{,}028$ dus 2,8%

c. $g^{28} = \frac{1}{2}$

$g = \sqrt[28]{\frac{1}{2}} = 0{,}976$ dus 2,4%

Opgave 79:

0-1500: $g^{1500} = 2$ dus $g = \sqrt[1500]{2} = 1{,}00046$ dus 0,046%

1500-1800: $g^{300} = 2$ dus $g = \sqrt[300]{2} = 1{,}0023$ dus 0,23%

1800-1950: $g^{150} = 2$ dus $g = \sqrt[150]{2} = 1{,}0046$ dus 0,46%

1950-1986: $g^{36} = 2$ dus $g = \sqrt[36]{2} = 1{,}0194$ dus 1,94%

1986-2005: $4{,}8 + 1{,}7 = 6{,}5$ miljard

$g^{19} = \frac{6{,}5}{4{,}8} = 1{,}35$ dus $g = \sqrt[19]{1{,}35} = 1{,}0161$ dus 1,61%

Opgave 80:

$(\frac{1}{2})^t = 0{,}53$

$t = \frac{\log 0{,}53}{\log \frac{1}{2}} = 0{,}916$

$0{,}916 \cdot 5730 = 5248$

$1991 - 5248 = -3257$ dus 3257 voor Christus

Opgave 81:

a. $217 + 2006 = 2223$

$(\frac{1}{2})^{\frac{2223}{5730}} = 0{,}764$ dus 76,4%

b. $(\frac{1}{2})^t = 0{,}77293$

$t = \frac{\log 0{,}77293}{\log \frac{1}{2}} = 0{,}3716$

$0{,}3716 \cdot 5730 = 2129$

$2223 - 2129 = 94$ jaar

Opgave 82:

a. $(\frac{1}{2})^t = 0{,}0002$

$t = \frac{\log 0{,}0002}{\log \frac{1}{2}} = 12{,}29$

$12{,}29 \cdot 8 = 98{,}3$ dagen

b. $g^8 = \frac{1}{2}$

$g = \sqrt[8]{\frac{1}{2}} = 0{,}917$

dus 8,3%