

Groefactoren, procenten, exponentiële functies

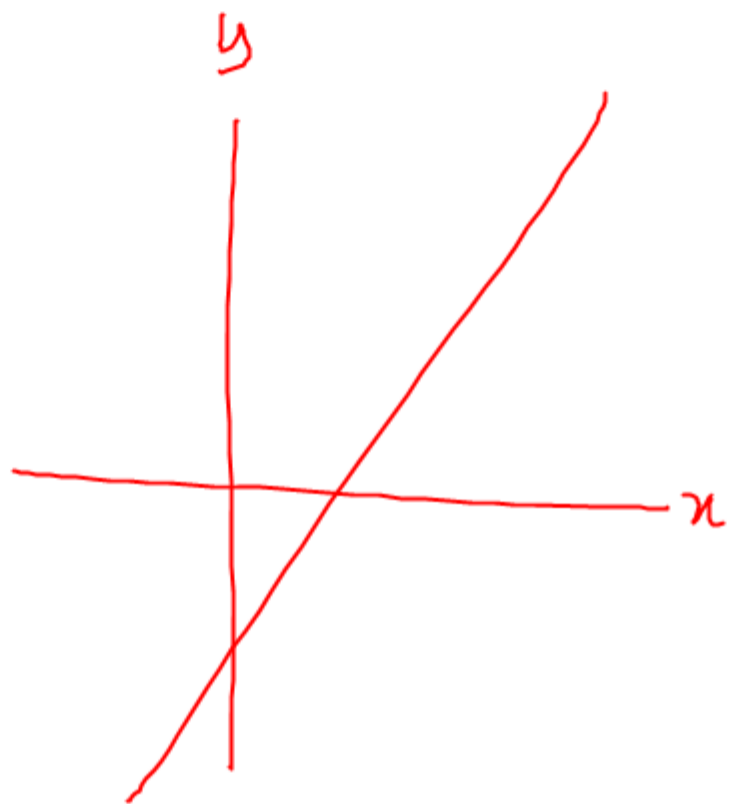
we hebben gehad

x	0	1	2	3	4
y	-3	-1	1	3	5

↘ ↘ ↘ ↘  
+2 +2 +2 +2

lineaire formule

$$y = -3 + 2x$$



We kijken nu naar

x	0	1	2	3	4
y	2	6	18	54	162

$\xrightarrow{\times 3}$   $\xrightarrow{\times 3}$   $\xrightarrow{\times 3}$   $\xrightarrow{\times 3}$

groeifactor

$$\frac{\text{Nieuw}}{\text{oud}} = \frac{\text{rechts}}{\text{links}} = g$$

exponentiële formule

$$y = 2 \cdot 3^x$$

$$2 = 2$$

$$6 = 2 \cdot 3$$

$$18 = 2 \cdot 3 \cdot 3$$

$$54 = 2 \cdot 3 \cdot 3 \cdot 3$$

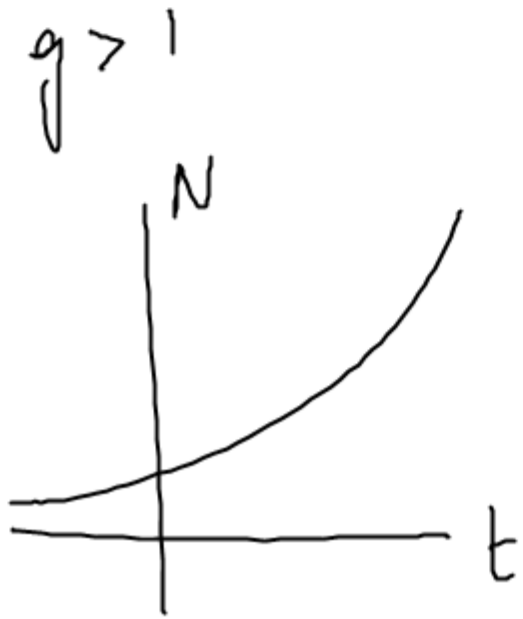
$$\begin{aligned} &= 2 \cdot 3^2 \\ &= 2 \cdot 3^3 \\ &= 2 \cdot 3^x \end{aligned}$$



horizontale asymptoot

Exponentielle Formulas

$$N = b \cdot q^t$$



groefactor  $\leftrightarrow$  en procenten

$$2\% \text{ enaf} \longrightarrow g = 1,02$$

$$5\% \text{ enaf} \longrightarrow g = 0,95$$

~~NIET  $\times$   $\frac{1}{1,05}$~~

Verandering van  $p\%$  betekent een

$$g = 1 + \frac{p}{100}$$

omgekeerd: een groefactor  $g$  betekent een

$$p = (g - 1) \times 100$$

$$\begin{aligned}
 3^4 &= 81 \\
 3^3 &= 27 \\
 3^2 &= 9 \\
 3^1 &= 3 \\
 3^0 &= 1 \\
 3^{-1} &= \frac{1}{3} \\
 3^{-2} &= \frac{1}{9} \\
 3^{-3} &= \frac{1}{27} \\
 3^{-4} &= \frac{1}{81}
 \end{aligned}$$

$$3^0 = 1$$

$$3 \times 27$$

$$\begin{array}{r}
 3 \times 20 = 60 \\
 3 \times 7 = 21 \\
 \hline
 81 +
 \end{array}$$

$$\begin{array}{r}
 3 \times 30 = 90 \\
 3 \times 3 = 9 \\
 \hline
 81 -
 \end{array}$$

DUS

$$3^{-4} = \frac{1}{3^4}$$

# Exponentiële vergelijkingen oplossen <sup>ongelijkheid</sup>

1<sup>e</sup> los op

$$3 \cdot 1,8^x > 15$$

$$3 \cdot 1,8 = 15$$

$$y_1 = 3 \cdot 1,8^x$$

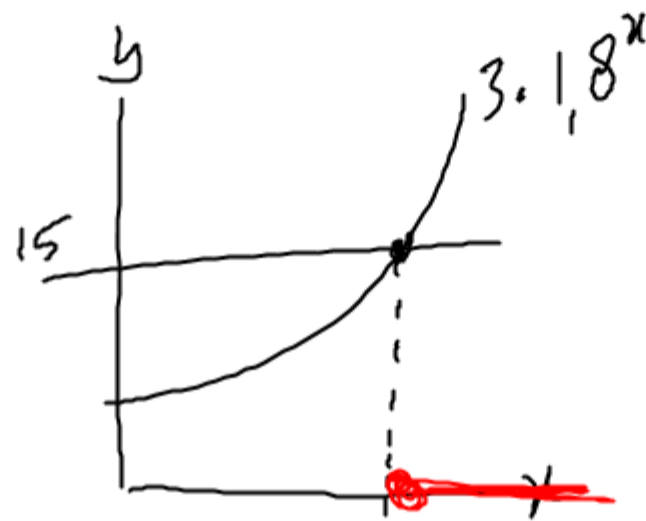
$$y_2 = 15$$

$$x_{\min} = 0$$

$$x_{\max} = 10$$

$$y_{\min} = 0$$

$$y_{\max} = 20$$



calc menu intersect geeft  $x =$

$$x \geq \dots$$

2<sup>e</sup> los op, op exacte wijze

$2^x$  op exacte wijze

$$4 \cdot \left(\frac{1}{2}\right)^x = 1 \quad :4$$

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

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

$$x = 2$$

werk toe naam:  $g^A = g^B$

want dan geldt:  $A = B$

Gebruik

$$2^3 = 8$$

$$2^{-3} = \frac{1}{8}$$

$$y_1 = 2^x$$

en legt in de tabel

$$y_2 = 3^x$$

$$y_3 = 5^x$$

$x$	$y_1$	$y_2$	$y_3$
0	1	1	1
1	2	3	5
2	4	9	25
3	8	27	125
4	16	81	625
5	32	243	3125

los exact op =

$$6 \cdot 3^t = 162$$

$$3^t = 27$$

$$3^t = 3^3$$

$$t = 3$$

$$\therefore 6 g^A = g^B$$

$x$	$y$
0	1
1	3
2	9
3	27
4	81
5	243

21  $P = 2 \cdot g^t$   $t$  in uren

Wat is  $g$ ?

$$g_{24 \text{ uur}} = 0,40$$

$$(g_{1 \text{ uur}})^{24} = 0,40$$

$$g_{1 \text{ uur}} = 0,40^{\frac{1}{24}} \quad 0,40 \wedge (1/24)$$
$$= 0,963$$

Dus  $P = 2 \cdot 0,963^t$  *dit is een afgerond getal*

$$P = 2 \cdot (0,40^{\frac{1}{24}})^t$$
$$P = 2 \cdot 0,40^{\frac{1}{24} \cdot t}$$

met  $t$  in uren

b

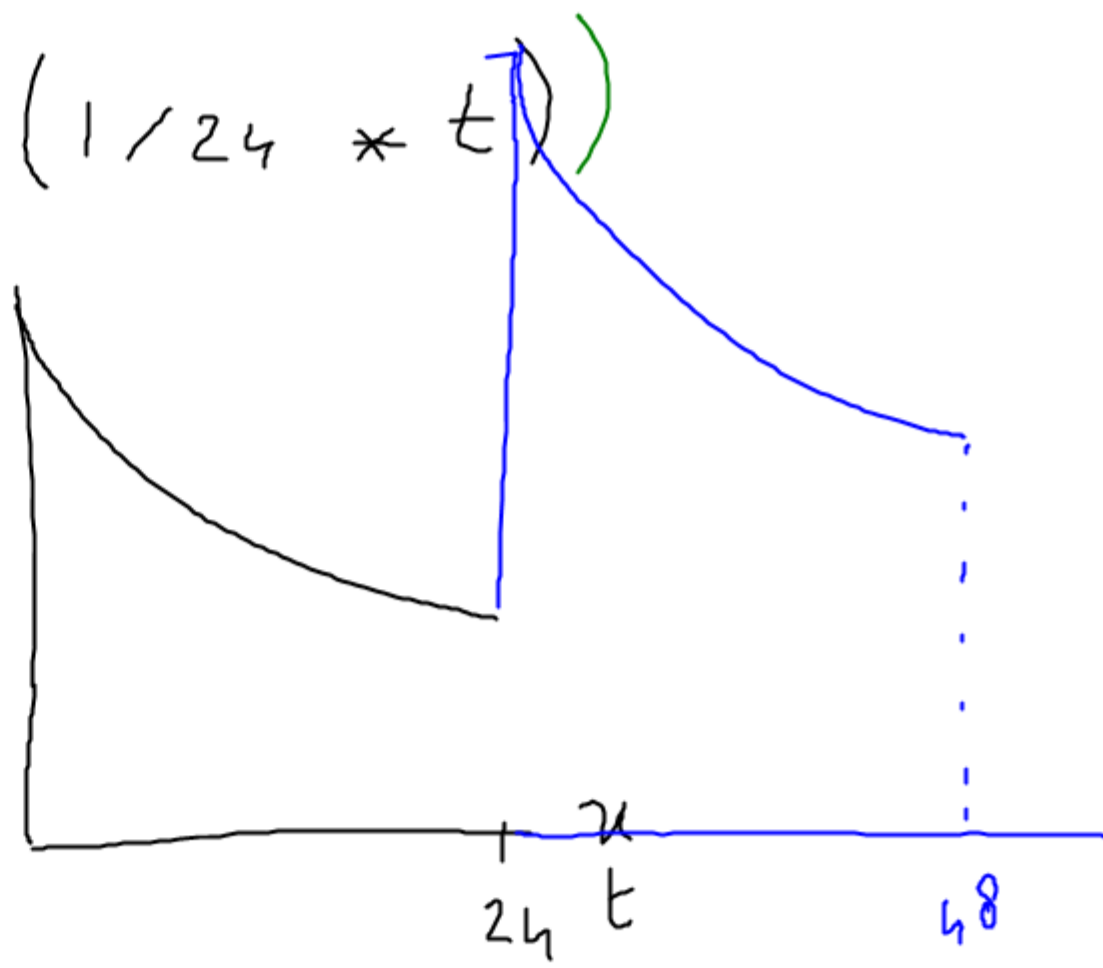
$$y(t) = 2 * \left( 0.40 \wedge \left( \frac{1}{24} * t \right) \right)$$

$$x_{\min} = 0$$

$$x_{\max} = 24$$

$$y_{\min} = 0$$

$$y_{\max} = 2$$



23 b

$$27 = 3^3$$

$$f(t) = 3$$

$$\rightarrow 27^t = 3$$

$$3^{3t} = 3$$

$$3^{3t} = 3^1$$

$$3t = 1$$

$$t = \frac{1}{3}$$

24 a

$$4 \cdot 3^x = 1750$$

$$y_1 = 4 * 3^x$$

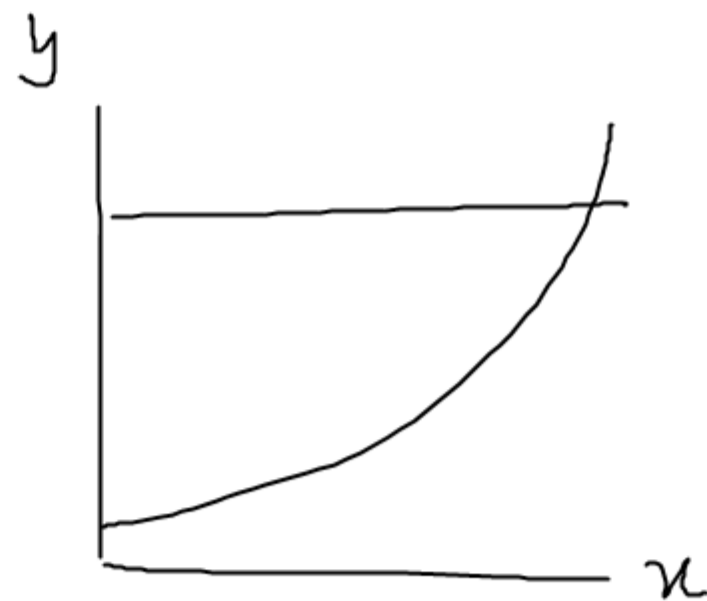
$$y_2 = 1750$$

$$x_{\min} = 0$$

$$x_{\max} = 6$$

$$y_{\min} = 0$$

$$y_{\max} = 2000$$



calc menu intersect  $x = 5,5$

$$25 \leq$$

$$16 \cdot \left(\frac{1}{2}\right)^x = \frac{1}{4}$$

$$2^4 \cdot (2^{-1})^x = 2^{-2}$$

$$2^4 \cdot 2^{-x} = 2^{-2}$$

$$2^{4-x} = 2^{-2}$$

$$4-x = -2 \quad (+2)$$

$$6-x = 0$$

$$x = 6$$

$$g^A = g^B$$

$$y_1 = 2^x$$

x	y'
0	1
1	2
2	4
3	8
4	16

$$16 = 2^{\dots}$$

$$4 = 2^{\dots}$$

$$5 \mid 32$$

$$6 \mid 64$$

$$16 \cdot \left(\frac{1}{2}\right)^x = \frac{1}{4} \quad :16$$

$$\left(\frac{1}{2}\right)^x = \frac{1}{64}$$

$$\left(\frac{1}{2}\right)^x = \left(\frac{1}{2}\right)^6$$

$$x = 6$$

27

$$800 \cdot 0,933^x \geq 100$$

$$800 \cdot 0,933^x = 100$$

$$y_1 = 800 \cdot 0,933^x$$

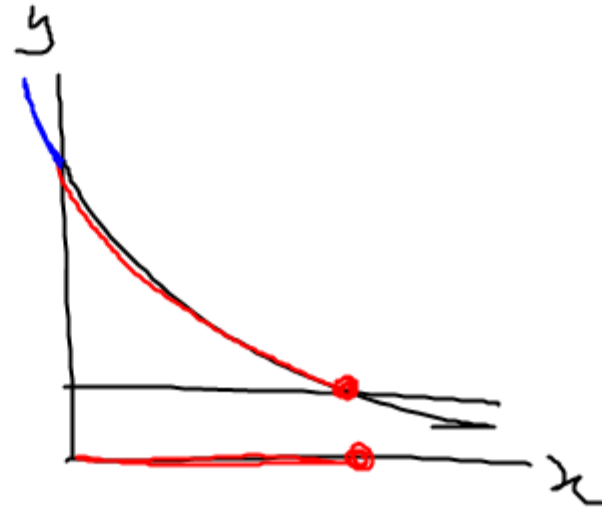
$$y_2 = 100$$

$$x_{\min} = -2$$

$$x_{\max} = 40$$

$$y_{\min} = 0$$

$$y_{\max} = 1000$$



Calc menu intersect geeft  $x = 29,98$   
 $x = 30,0$

dus  ~~$0 \leq x \leq 40$~~   $0 \leq x \leq 30,0$

3|a

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

ga "alles" als machten van 2 schrijven  
en werk naar  $2^A = 2^B$  toe  
want dan geldt  $A = B$

$$2^2 \cdot 2^{x+3} = 2^{-x}$$

$$2^{x+5} = 2^{-x}$$

$$x+5 = -x$$

$$5 = -2x$$

$$x = -\frac{5}{2}$$

31 b

$$\begin{aligned} \frac{1}{3} \cdot 3^{-2x+3} &= 27^x \\ 3^{-1} \cdot 3^{-2x+3} &= (3^3)^x && \therefore 3^{3x} \\ 3^{-1} \cdot 3^{-2x+3-3x} &= 1 \\ 3^{-1} \cdot 3^{-5x+3} &= 1 \\ 3^{-5x+2} &= 1 \\ -5x+2 &= 0 \\ -5x &= -2 \\ x &= \frac{2}{5} \end{aligned}$$

$$\frac{1}{3} \cdot 3^{-2x+3} = 7^x$$

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

$$3^{-1-2x+3} = 3^{3x}$$

$$3^{-2x+2} = 3^{3x}$$

$$-2x+2 = 3x$$

$$2 = 5x$$

$$\frac{2}{5} = x$$

31 c

$$\left(\frac{1}{3}\right)^x \cdot 3^x = \frac{1}{3} \cdot 3^{-x}$$

$$3^{-x} \cdot 3^x = 3^{-1} \cdot 3^{-x}$$

$$-x + x = -1 - x$$

3

$$-x + x = -1 - x$$

$$0 = -1 - x$$

$$x = -1$$

32 a

$$16 \cdot \left(\frac{1}{4}\right)^x = \frac{1}{16}$$

$$4^2 \cdot 4^{-x} = 4^{-2}$$

$$4^{2-x} = 4^{-2}$$

$$2-x = -2$$

$$x = 4$$

32 b

$$3.2 \cdot 2^t = \frac{1}{4}$$

$$2^5 \cdot 2^t = 2^{-2}$$

$$2^{5+t} = 2^{-2}$$

$$5+t = -2 \quad (17)$$

$$7+t = 0$$

$$t = -7$$

32  $\leq$

$$16_4 \cdot 0,5_{11}^x = \frac{1}{8_3}$$

$$2 \cdot 2 = 2$$

$$2^{4-x} = 2^{-3}$$

$$4 - x = -3 \quad (-4)$$

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

$$x = 7$$

30

el

begin  
4200

groef factor  
 $g_{\text{jaar}} = 1,19$

wanneer 10650 eind waarde

$$4200 \cdot 1,19^t = 10650$$

$$y_1 = 4200 \cdot 1,19^x$$

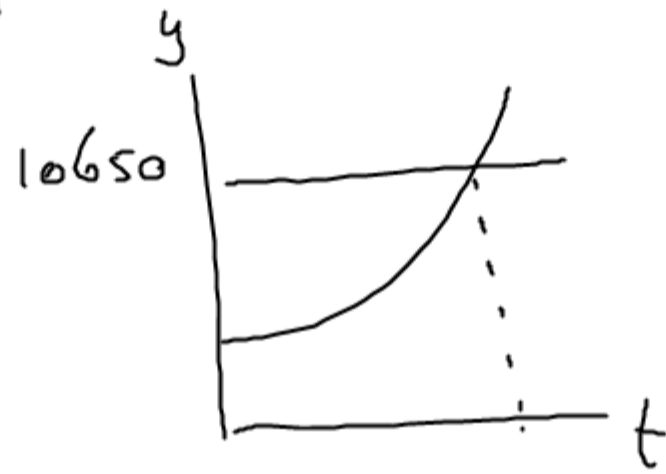
$$y_2 = 10650$$

$x_{\min}$

$x_{\max}$

$y_{\min}$

$y_{\max}$



calc menu intersect geeft ...