1a $y_1 = x^2 \cdot x^3$ en $y_2 = x^5$ komen op hetzelfde neer.

```
Plot1 Plot2 Plo
\Y1=X²*X^3
\Y2=X^5
\Y3=
\Y4=
```

X	Y1	Y2
-2	-32	-32
-1	-1	-1
0	0	0
1	1	1
2	32	32
3	243	243
4	1024	1024

X=-2

1b $y_1 = \frac{x^6}{x^3}$ en $y_2 = x^2$ komen niet op hetzelfde neer.

```
Plot1 Plot2 Plot3
\Y1=X^6/X^3
\Y2=X²
\Y3=
\Y4=
```

X	Y1	Y2
-2	-8	4
-1	-1	1
0	ERROR	0
1	1	1
2	8	4
3	27	9
4	64	16

X=-2

```
(-4)^4
              256
```

1c $y_1 = \left(2x^3\right)^2$ en $y_2 = 4x^6$ komen op hetzelfde neer.

```
Plot1 Plot2 Plot
\Y1=(2X^3)²
\Y2=4X^6
\Y3=
\Y4=
```

X	Y1	Y2
-2	256	256
-1	4	4
0	0	0
1	4	4
2	256	256
3	2916	2916
4	16384	16384

X=-2

2a $2a^2 \cdot 4a^3 = 8a^5$.

2b $-5a^7 \cdot a^3 = -5a^{10}$.

2c $\frac{-28a^6}{7a} = \frac{-28a^6}{7a^1} = -4a^5$.

2d $(-4a)^4 = (-4)^4 \cdot a^4 = 256a^4$.

2e $-\left(3a^4\right)^2 = -3^2 \cdot \left(a^4\right)^2 = -9a^8$.

2f $\left(-2a^2\right)^5 = (-2)^5 \cdot \left(a^2\right)^5 = -32a^{10}$.

```
(-2)^5
              -32
```

2g $\left(-a^3\right)^3 = -a^9$.

```
5^3
              125
```

2h $(5a)^3 \cdot -3a = 125a^3 \cdot -3a^1 = -375a^4$.

2i $\left(\frac{9a^4}{a}\right)^2 = \left(9a^3\right)^2 = 9^2 \cdot \left(a^3\right)^2 = 81a^6$.

3a $(ab)^4 \cdot a = a^4b^4 \cdot a^1 = a^5b^4$.

3b $(-2ab)^3 \cdot b = -8a^3b^3 \cdot b^1 = -8a^3b^4$.

3c $(3a)^2 + (2b)^2 = 9a^2 + 4b^2$.

3d $(3a)^3 - 8a^3 = 27a^3 - 8a^3 = 19a^3$.

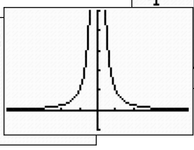
3e $\left(\frac{1}{2}a\right)^2 + (-a)^2 = \frac{1}{4}a^2 + a^2 = 1\frac{1}{4}a^2$.

3f $\left(5a^4\right)^2 + \left(-a^2\right)^4 = 25a^8 + a^8 = 26a^8$.

4a De grafieken van $y_1 = \frac{1}{x^2}$ en $y_2 = x^{-2}$ vallen samen.

```
Plot1 Plot2
\Y1=1/X²
\Y2=X^-2
\Y3=
\Y4=
```

```
WINDOW
 Xmin=-5
 Xmax=5
 Xscl=1
 Ymin=-1
 Ymax=5
 Yscl=1
↓Xres=1
```

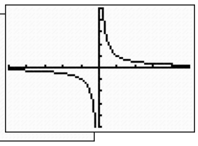


X	Y1	Y2
-2	.25	.25
-1	1	1
0	ERROR	ERROR
1	1	1
2	.25	.25
3	.11111	.11111
4	.0625	.0625

4b De grafieken van $y_3 = x^{-1}$ en $y_5 = \frac{1}{x}$ vallen samen.

```
Plot1 Plot2
\Y1=
\Y2=
\Y3=X^-1
\Y4=
\Y5=1/X
\Y6=
```

```
WINDOW
 Xmin=-5
 Xmax=5
 Xscl=1
 Ymin=-5
 Ymax=5
 Yscl=1
↓Xres=1
```



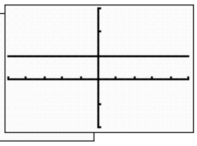
X	Y3	Y5
-2	-.5	-.5
-1	-1	-1
0	ERROR	ERROR
1	1	1
2	.5	.5
3	.33333	.33333
4	.25	.25

X=-2

4c De grafieken van $y_4 = x^0$ en $y_6 = 1$ vallen samen (voor $x \neq 0$).

```
Plot1 Plot2 P
\Y4=X^0
\Y5=
\Y6=1
\Y7=
```

```
WINDOW
 Xmin=-5
 Xmax=5
 Xscl=1
 Ymin=-2
 Ymax=3
 Yscl=1
↓Xres=1
```



X	Y4	Y6
-2	1	1
-1	1	1
0	ERROR	1
1	1	1
2	1	1
3	1	1
4	1	1

X=-2

5a Exponenten nemen (trap af) steeds met 1 af.
Getallen (achter =) worden steeds door 2 gedeeld.

5b
$2^5 = 32$ (: 2)
$2^4 = 16$ (: 2)
$2^3 = 8$ (: 2)
$2^2 = 4$ (: 2)
$2^1 = 2$ (: 2)
$2^0 = 1$ (: 2)
$2^{-1} = \frac{1}{2}$ (: 2)
$2^{-2} = \frac{1}{4}$

5c $2^{-3} = \frac{1}{8}$ en $2^{-4} = \frac{1}{16}$.

6a $a^{-5} \cdot a^2 = a^{-5+2} = a^{-3}$.

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

6c $\frac{a^3}{a^{-2}} = a^{3--2} = a^5$.

6d $\left(a^{-3}\right)^4 = a^{-12}$.

6e $a^4 : \frac{1}{a^3} = a^4 : a^{-3} = a^{4--3} = a^7$.

6f $a^7 : a^0 = a^{7-0} = a^7$.

6g $\left(\frac{1}{a^2}\right)^3 = \left(a^{-2}\right)^3 = a^{-6}$.

6h $1 = a^0$.

6i $a^3 \cdot \left(a^4\right)^{-2} = a^3 \cdot a^{-8} = a^{3+-8} = a^{-5}$.

7a $4^{-3} = \frac{1}{4^3} = \frac{1}{64}$.

```
4^3
               64
4^-3▸Frac
             1/64
```

7b $\left(\frac{5}{6}\right)^{-2} = \frac{1}{\left(\frac{5}{6}\right)^2} = \frac{1}{\frac{25}{36}} = \frac{36}{25}$.

```
(5/6)^-2▸Frac
            36/25
1/(25/36)▸Frac
            36/25
```

7c $\left(3^{-1}\right)^4 = 3^{-4} = \frac{1}{3^4} = \frac{1}{81}$.

```
3^4
               81
(3^-1)^4▸Frac
             1/81
```

7d $\left(\frac{2}{5}\right)^{-2} = \frac{1}{\left(\frac{2}{5}\right)^2} = \frac{1}{\frac{4}{25}} = \frac{25}{4}$.

```
(2/5)^-2▸Frac
             25/4
```

7e $\left(2\frac{1}{2}\right)^{-2} = \left(\frac{5}{2}\right)^{-2} = \frac{1}{\left(\frac{5}{2}\right)^2} = \frac{1}{\frac{25}{4}} = \frac{4}{25}$.

```
(2.5)^-2▸Frac
             4/25
```

7f $1 : \left(\frac{3}{7}\right)^{-2} = \frac{1}{\left(\frac{3}{7}\right)^{-2}} = \left(\frac{3}{7}\right)^2 = \frac{9}{49}$.

```
1/(3/7)^-2▸Frac
             9/49
```

8a $6a^{-3} \cdot b^2 = 6 \cdot \frac{1}{a^3} \cdot b^2 = \frac{6b^2}{a^3}$.

8b $\frac{1}{3}a^{-4} = \frac{1}{3} \cdot \frac{1}{a^4} = \frac{1}{3a^4}$.

8c $2a^{-3} = 2 \cdot \frac{1}{a^3} = \frac{2}{a^3}$.

8d $3a \cdot b^{-2} = 3a \cdot \frac{1}{b^2} = \frac{3a}{b^2}$.

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

8f $(3a)^{-2} \cdot 2b^{-1} = \frac{1}{(3a)^2} \cdot 2 \cdot \frac{1}{b} = \frac{1}{9a^2} \cdot \frac{2}{b} = \frac{2}{9a^2b}$.

9a De functies $f(x) = \sqrt{x}$ en $g(x) = x^{\frac{1}{2}}$ komen op hetzelfde neer.

```
Plot1 Plot2 Plot3
\Y1=√(X)
\Y2=X^(1/2)
\Y3=
\Y4=
```

X	Y1	Y2
-2	ERROR	ERROR
-1	ERROR	ERROR
0	0	0
1	1	1
2	1.4142	1.4142
3	1.7321	1.7321
4	2	2

X=-2

9b De grafieken van $h(x) = \sqrt[3]{x}$ en $k(x) = x^{\frac{1}{3}}$ vallen samen.

```
Plot1 Plot2 Plot3
\Y1=³√(X)
\Y2=X^(1/3)
\Y3=
\Y4=
```

X	Y1	Y2
-2	-1.26	-1.26
-1	-1	-1
0	0	0
1	1	1
2	1.2599	1.2599
3	1.4422	1.4422
4	1.5874	1.5874

X=-2

10a $5^{\frac{1}{3}}=\sqrt[3]{5}$.

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

10c $2a^{\frac{2}{5}}=2\cdot\sqrt[5]{a^2}$.

10d $-a^{-\frac{3}{5}}=-\frac{1}{a^{\frac{3}{5}}}=-\frac{1}{\sqrt[5]{a^3}}$.

10e $4a^{-2}b^{\frac{1}{2}}=4\cdot\frac{1}{a^2}\cdot\sqrt{b}=\frac{4\cdot\sqrt{b}}{a^2}$.

10f $3a^{\frac{1}{3}}b^{-\frac{1}{2}}=3\cdot\sqrt[3]{a}\cdot\frac{1}{b^{\frac{1}{2}}}=\frac{3\cdot\sqrt[3]{a}}{\sqrt{b}}$.

11a $\sqrt{x}=x^{\frac{1}{2}}$.

11b $x\cdot\sqrt[4]{x}=x^1\cdot x^{\frac{1}{4}}=x^{1\frac{1}{4}}$.

11c $\frac{1}{\sqrt[3]{x^2}}=\frac{1}{x^{\frac{2}{3}}}=x^{-\frac{2}{3}}$.

11d $\sqrt[5]{\frac{1}{x}}=\sqrt[5]{x^{-1}}=x^{-\frac{1}{5}}$.

11e $\frac{\sqrt{x}}{\sqrt[3]{x}}=\frac{x^{\frac{1}{2}}}{x^{\frac{1}{3}}}=x^{\frac{1}{2}-\frac{1}{3}}=x^{\frac{3}{6}-\frac{2}{6}}=x^{\frac{1}{6}}$.

11f $\sqrt{x}\cdot\sqrt[3]{x^2}=x^{\frac{1}{2}}\cdot x^{\frac{2}{3}}=x^{\frac{1}{2}+\frac{2}{3}}=x^{\frac{3}{6}+\frac{4}{6}}=x^{1\frac{1}{6}}$.

11g $\frac{x^2}{\sqrt[4]{x^3}}=\frac{x^2}{x^{\frac{3}{4}}}=x^{2-\frac{3}{4}}=x^{1\frac{1}{4}}$.

11h $\frac{x^2\cdot\sqrt[3]{x}}{\sqrt{x}}=\frac{x^2\cdot x^{\frac{1}{3}}}{x^{\frac{1}{2}}}=\frac{x^{2\frac{1}{3}}}{x^{\frac{1}{2}}}=x^{2\frac{1}{3}-\frac{1}{2}}=x^{1\frac{5}{6}}$.

12a $8\cdot\sqrt{2}=2^3\cdot2^{\frac{1}{2}}=2^{3\frac{1}{2}}$.

12b $\frac{8}{\sqrt{2}}=\frac{2^3}{2^{\frac{1}{2}}}=2^{3-\frac{1}{2}}=2^{2\frac{1}{2}}$.

12c $\frac{1}{2}\cdot\sqrt[3]{2}=2^{-1}\cdot2^{\frac{1}{3}}=2^{-\frac{2}{3}}$.

12d $\frac{4\sqrt{2}}{\sqrt[3]{2}}=\frac{2^2\cdot2^{\frac{1}{2}}}{2^{\frac{1}{3}}}=2^{2\frac{1}{2}-\frac{1}{3}}=2^{2\frac{1}{6}}$.

12e $\sqrt[4]{\frac{1}{9}}=\sqrt[4]{3^{-2}}=3^{-\frac{2}{4}}=3^{-\frac{1}{2}}$.

12f $\frac{1}{100}\sqrt{10}=10^{-2}\cdot10^{\frac{1}{2}}=10^{-1\frac{1}{2}}$.

12g $\frac{1}{8}\cdot\sqrt[3]{\frac{1}{4}}=2^{-3}\cdot\sqrt[3]{2^{-2}}=2^{-3}\cdot2^{-\frac{2}{3}}=2^{-3\frac{2}{3}}$.

12h $10\cdot\sqrt[3]{0{,}1}=10\cdot\sqrt[3]{10^{-1}}=10^1\cdot10^{-\frac{1}{3}}=10^{\frac{2}{3}}$.

13a $x^{2\frac{1}{3}}=x^2\cdot x^{\frac{1}{3}}=x^2\cdot\sqrt[3]{x}$.

13b $2^{2\frac{1}{2}}=2^2\cdot2^{\frac{1}{2}}=4\cdot\sqrt{2}$.

13c $2^{x+3}=2^x\cdot2^3=2^x\cdot8=8\cdot2^x$.

13d $3^{x-2}=3^x\cdot3^{-2}=3^x\cdot\frac{1}{9}=\frac{1}{9}\cdot3^x$.

14a $1{,}18^{a+5}=1{,}18^a\cdot1{,}18^5\approx2{,}29\cdot1{,}18^a$.

14b $1{,}31^{a-2}=1{,}31^a\cdot1{,}31^{-2}\approx0{,}58\cdot1{,}31^a$.

14c $0{,}78^{a+0{,}6}=0{,}78^a\cdot0{,}78^{0{,}6}\approx0{,}86\cdot0{,}78^a$.

```
1.18^5
            2.287757757
1.31^-2
            .5827166249
0.78^0.6
            .8615029355
```

14d $1{,}15^{2a+1}=1{,}15^{2a}\cdot1{,}15^1=\left(1{,}15^2\right)^a\cdot1{,}15\approx1{,}15\cdot1{,}32^a$.

14e $1{,}22^{2a-1}=1{,}22^{2a}\cdot1{,}22^{-1}\approx\left(1{,}22^2\right)^a\cdot0{,}82\approx0{,}82\cdot1{,}49^a$.

```
1.15²
                 1.3225
1.22⁻¹
            .8196721311
1.22²
                 1.4884
```

14f $8{,}35^{\frac{1}{3}a+0{,}4}=8{,}35^{\frac{1}{3}a}\cdot8{,}35^{0{,}4}\approx\left(8{,}35^{\frac{1}{3}}\right)^a\cdot2{,}34\approx2{,}34\cdot2{,}03^a$.

```
8.35^0.4
            2.337085442
8.35^(1/3)
            2.028751366
```

14g $8{,}35^{\frac{1}{3}a}=\left(8{,}35^{\frac{1}{3}}\right)^a\approx1{,}00\cdot2{,}03^a$.

14h $0{,}72^{2(a-1{,}2)}=0{,}72^{2a-2{,}4}=0{,}72^{2a}\cdot0{,}72^{-2{,}4}\approx\left(0{,}72^2\right)^a\cdot2{,}20\approx2{,}20\cdot0{,}52^a$.

```
0.72^-2.4
            2.199895283
0.72²
                  .5184
```

15a $x^{1{,}8}=50$

$x=\sqrt[1{,}8]{50}\approx8{,}79$.

```
1.8 ×√50
            8.787639344
```

15b $x^{-3}=5$

$x=\sqrt[-3]{5}\approx0{,}58$.

```
(-3) ×√5
            .5848035476
```

15c $3\cdot x^{2{,}25}+1=27$

$3\cdot x^{2{,}25}=26$

$x^{2{,}25}=\frac{26}{3}$

$x=\sqrt[2{,}25]{\frac{26}{3}}\approx2{,}61$.

```
27-1
                     26
Ans/3
            8.666666667
2.25 ×√Ans
            2.611097882
```

15d $5\cdot x^{-1}=7$

$x^{-1}=\frac{7}{5}$

$x=\sqrt[-1]{\frac{7}{5}}\approx0{,}71$.

```
7/5
                    1.4
(-1) ×√1.4
            .7142857143
```

15e $4\cdot x^{-1{,}8}+16=500$

$4\cdot x^{-1{,}8}=484$

$x^{-1{,}8}=121$

$x=\sqrt[-1{,}8]{121}\approx0{,}07$.

```
500-16
                    484
Ans/4
                    121
(-1.8) ×√121
            .0696461344
```

15f $x^9=\sqrt{3}$

$x=\sqrt[9]{\sqrt{3}}\approx1{,}06$.

```
9 ×√√(3)
             1.06293507
```

16a $5\cdot x^{-1{,}2}+7=19$

$5\cdot x^{-1{,}2}=12$

$x^{-1{,}2}=2{,}4$

$x=\sqrt[-1{,}2]{2{,}4}\approx0{,}482$.

```
19-7
                     12
Ans/5
                    2.4
(-1.2) ×√2.4
            .4821223875
```

16b $4\cdot x^{0{,}4}-5=109$

$4\cdot x^{0{,}4}=114$

$x^{0{,}4}=28{,}5$

$x=\sqrt[0{,}4]{28{,}5}\approx4\,336{,}228$.

```
109+5
                    114
Ans/4
                   28.5
0.4 ×√28.5
            4336.228405
```

16c $x^{1\frac{1}{3}}=10$

$x=\sqrt[1\frac{1}{3}]{10}\approx5{,}623$.

```
(4/3) ×√10
            5.623413252
```

16d $\sqrt[3]{x^2}=26$
$x^{\frac{2}{3}}=26$
$x=\sqrt[\frac{2}{3}]{26}\approx 132{,}575.$

```
(2/3)ˣ√26
         132.5745074
```

16e $5\cdot\sqrt[3]{x}=8$
$\sqrt[3]{x}=x^{\frac{1}{3}}=1{,}6$
$x=\sqrt[\frac{1}{3}]{1{,}6}=4{,}096.$

```
8/5
                 1.6
(1/3)ˣ√1.6
               4.096
```

16f $3\cdot\sqrt[4]{x^3}-1=36$
$\sqrt[4]{x^3}=x^{\frac{3}{4}}=\frac{37}{3}$
$x=\sqrt[\frac{3}{4}]{\frac{37}{3}}\approx 28{,}495.$

```
36+1
                  37
Ans/3
         12.33333333
(3/4)ˣ√Ans
          28.4953476
```

17a $v=67-50=17\Rightarrow B=20+0{,}7\cdot 17^{1{,}52}\approx 72$ (€).

```
20+0.7*17^1.52
         71.92546573
```

17b $20+0{,}7\cdot v^{1{,}52}=97$
$0{,}7\cdot v^{1{,}52}=77$
$v^{1{,}52}=110$
$v=\sqrt[1{,}52]{110}\approx 22.$
Ze reed $30+22=52$ km/u.

```
97-20
                  77
Ans/0.7
                 110
1.52ˣ√110
          22.0303554
```

17c $20+0{,}7\cdot v^{1{,}52}=1648$
$0{,}7\cdot v^{1{,}52}=1628$
$v^{1{,}52}=\frac{1628}{0{,}7}$
$v=\sqrt[1{,}52]{\frac{1628}{0{,}7}}\approx 164.$
De snelheidsovertreding is 164 km/u.

```
1648-20
                1628
Ans/0.7
         2325.714286
1.52ˣ√Ans
         163.9984377
```

17d Jeroen heeft geen gelijk.
$v=5\Rightarrow B=20+0{,}7\cdot 5^{1{,}52}\approx 28$ (€).
$v=10\Rightarrow B=20+0{,}7\cdot 10^{1{,}52}\approx 43$ (€).
Er geldt $10=2\cdot 5$, maar $43\neq 2\cdot 28$.

```
20+0.7*5^1.52
          28.0822531
```

```
20+0.7*10^1.52
          43.1791785
```

18a $T=-20$ (°C) en $v=60$ (km/u) $\Rightarrow F=(2\,000-16{,}3\cdot 60)(-5--20)^{-1{,}668}\approx 11$ (min).

```
(2000-16.3*60)(-
5+20)^-1.668
         11.16170849
```

18b $20=(2\,000-16{,}3v)(-5+18)^{-1{,}668}$
$2\,000-16{,}3v=\frac{20}{13^{-1{,}668}}$
$-16{,}3v\approx -557{,}5...$
$v\approx 34$ km/u.

```
20/13^-1.668
         1442.405957
Ans-2000
         -557.594043
Ans/-16.3
          34.2082235
```

18c Met 40 km/u leg je 10 km af in 15 minuten.
$15=(2\,000-16{,}3\cdot 40)(-5-T)^{-1{,}668}$
$(-5-T)^{-1{,}668}=\frac{15}{2\,000-16{,}3\cdot 40}\approx 0{,}011...$
$-5-T\approx 14{,}832...$
$-T\approx 19{,}832...\Rightarrow T\approx -19{,}8$ (°C). Dus voor $T\leq -20$ °C.

```
15/(2000-16.3*40
)
        .0111275964
(-1.668)ˣ√Ans
         14.83276794
Ans+5
         19.83276794
Ans/-1
```

19a $P=a\cdot Q^{2{,}5}$ en bij $Q=3{,}2$ hoort $P=8{,}1\Rightarrow 8{,}1=a\cdot 3{,}2^{2{,}5}\Rightarrow a=\frac{8{,}1}{3{,}2^{2{,}5}}\approx 0{,}44.$

```
8.1/3.2^2.5
        .4421911772
```

19b $y=a\cdot\frac{1}{x^{1{,}81}}$ en bij $x=12$ hoort $y=16\Rightarrow 16=a\cdot\frac{1}{12^{1{,}81}}\Rightarrow a=16\cdot 12^{1{,}81}\approx 1437.$

```
16*12^1.81
         1436.938027
```

20a $T=a\cdot R^{1{,}5}$ en bij $R=12{,}20$ hoort $T=15{,}9$ (Titan) $\Rightarrow 15{,}9=a\cdot 12{,}20^{1{,}5}\Rightarrow a=\frac{15{,}9}{12{,}20^{1{,}5}}\approx 0{,}37.$

```
15.9/12.20^1.5
        .3731276031
```

20b $R=35{,}6$ ($\times 10^5$ km) $\Rightarrow$ de omlooptijd is $T=0{,}37\cdot 35{,}6^{1{,}5}\approx 78{,}6$ dagen.

```
0.37*35.6^1.5
         78.59170688
```

20c $T=\frac{15}{24}=0{,}625$ (dagen) $\Rightarrow 0{,}625=0{,}37\cdot R^{1{,}5}\Rightarrow\frac{0{,}625}{0{,}37}=R^{1{,}5}\Rightarrow R=\sqrt[1{,}5]{\frac{0{,}625}{0{,}37}}\approx 1{,}42$ ($\times 10^5$ km).
De straal van de baan is ongeveer $1{,}42\cdot 10^5$ km.

```
15/24
                .625
Ans/0.37
         1.689189189
1.5ˣ√Ans
          1.41835691
```

21a $W=a\cdot m^{0{,}75}$ en bij $m=40$ hoort $W=6\,700$ (schaap) $\Rightarrow 6\,700=a\cdot 40^{0{,}75}\Rightarrow a=\frac{6700}{40^{0{,}75}}\approx 421.$

```
6700/40^0.75
         421.2401989
```

21b $m=4$ (kg) $\Rightarrow W=421\cdot 4^{0{,}75}\approx 1191$ (kJ).

```
421*4^0.75
           1190.76782
```

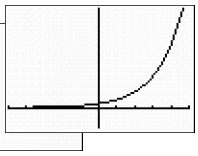
21c $W=50\,000$ (kJ) $\Rightarrow 50\,000=421\cdot m^{0{,}75}\Rightarrow\frac{50000}{421}=m^{0{,}75}\Rightarrow m=\sqrt[0{,}75]{\frac{50000}{421}}\approx 584$ (kg).

```
50000/421
         118.7648456
0.75ˣ√Ans
         583.7817911
```

22ab Zie de plot hiernaast. De grafiek van f is stijgend.
22c $f(-10)=2^{-10}\approx 9{,}77\cdot 10^{-4}$; $f(-20)=2^{-20}\approx 9{,}54\cdot 10^{-7}$
en $f(-100)=2^{-100}\approx 7{,}89\cdot 10^{-31}$.

```
Plot1 Plot2 Plot3
\Y1=2^X
\Y2=
```

```
WINDOW
 Xmin=-5
 Xmax=5
 Xscl=1
 Ymin=-5
 Ymax=25
 Yscl=0
↓Xres=1
```



```
Y1(-10)
      9.765625E-4
Y1(-20)
      9.536743164E-7
Y1(-100)
      7.88860905E-31
```

22d $f(-500)=2^{-500}=\frac{1}{2^{500}}>0.$ (De GR geeft $2^{-500}=0$)

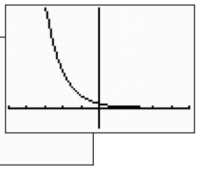
```
Y1(-500)
                   0
```

22e Voor elke x is $2^x>0$, dus er is geen x (origineel) te vinden waarvoor $f(x)=2^x$ (het beeld) $=0$.

23a Zie de plot hiernaast. De grafiek van g is dalend.
23b $g(x)=\left(\frac{1}{3}\right)^x=4$ heeft één oplossing;
$g(x)=\left(\frac{1}{3}\right)^x=-4$ heeft geen oplossingen.

```
Plot1 Plot2 Plot3
\Y1=(1/3)^X
\Y2=
```

```
WINDOW
 Xmin=-5
 Xmax=5
 Xscl=1
 Ymin=-5
 Ymax=25
 Yscl=0
↓Xres=1
```

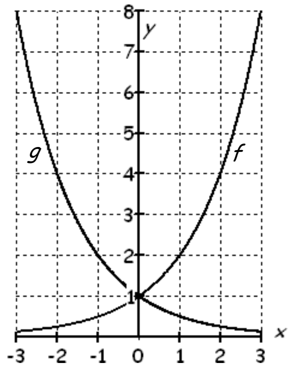


24a Zie de grafieken hiernaast. (gebruik TABLE op de GR)
24b De grafiek van g ontstaat uit de grafiek van f bij spiegelen in de y-as.

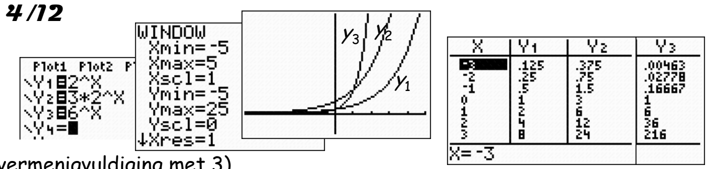
```
Plot1 Plot2 Plot3
\Y1=2^X
\Y2=(1/2)^X
\Y3=
```

X	Y1	Y2
-3	.125	8
-2	.25	4
-1	.5	2
0	1	1
1	2	.5
2	4	.25
3	8	.125

X=-3

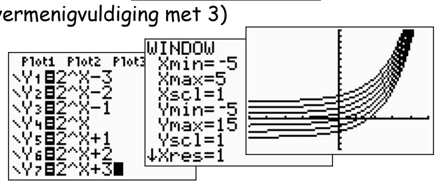


25a Zie de plot van de drie grafieken hiernaast.



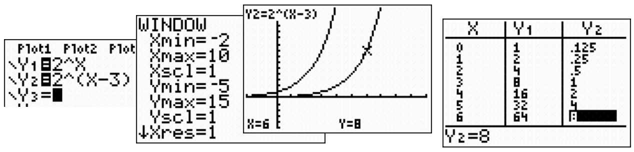
25b $y_1 = 2^x \xrightarrow{\text{vermenigvuldigen met factor 3}} y_2 = 3 \cdot 2^x$.
(dus de grafiek van y_2 ontstaat uit de grafiek van y_1 bij de vermenigvuldiging met 3)

26a Zie de plot van de grafieken hiernaast.



26b $y = 2^x \xrightarrow{\text{5 eenheden omhoog verschuiven}} y = 2^x + 5$.

27a Zie de plot van de grafieken hiernaast.

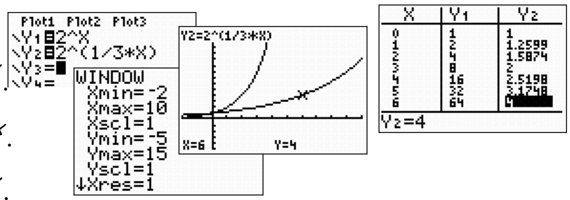


$y = 2^x \xrightarrow{\text{3 naar rechts verschuiven}} y = 2^{x-3}$.

27b $y = 2^x \xrightarrow{\text{4 naar links verschuiven}} y = 2^{x+4}$.

27c $y = 2^x \xrightarrow{b \text{ naar rechts verschuiven}} y = 2^{x-b}$.

28a Zie de plot van de grafieken hiernaast.



28b $y = 2^x \xrightarrow{\text{vermenigvuldiging t.o.v. de } y\text{-as met factor 3}} y = 2^{\frac{1}{3}x}$.

28c $y = 2^x \xrightarrow{\text{vermenigvuldiging t.o.v. de } y\text{-as met factor } \frac{1}{4}} y = 2^{4x}$.

28d $y = 2^x \xrightarrow{\text{vermenigvuldiging t.o.v. de } y\text{-as met factor } \frac{1}{a}} y = 2^{ax}$.

29a $y = 3^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (−2, 0)
$y = 3^{x+2}$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (0, −1)
$f(x) = 3^{x+2} - 1$ met H.A.: $y = -1$.

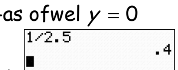
29b $y = 3^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (1, 0)
$y = 3^{x-1}$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (0, 5)
$g(x) = 3^{x-1} + 5$ met H.A.: $y = 5$.

29c $y = 0{,}5^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....vermenigvuldiging t.o.v. de x-as met 2
$y = 2 \cdot 0{,}5^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (0, 3)
$h(x) = 2 \cdot 0{,}5^x + 3$ met H.A.: $y = 3$.

29d $y = 0{,}7^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....vermenigvuldiging t.o.v. de x-as met −3
$y = -3 \cdot 0{,}7^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (0, 5)
$k(x) = -3 \cdot 0{,}7^x + 5$ met H.A.: $y = 5$.

29e $y = 2^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....vermenigvuldiging t.o.v. de x-as met 3
$y = 3 \cdot 2^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....vermenigvuldiging t.o.v. de y-as met $\frac{1}{3}$
$y = 3 \cdot 2^{3x}$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (0, 4)
$l(x) = 3 \cdot 2^{3x} + 4$ met H.A.: $y = 4$.

29f $y = 0{,}8^x$ met H.A.: de x-as ofwel $y = 0$
⇓ .....vermenigvuldiging t.o.v. de y-as met 2,5
$\frac{1}{2{,}5} = \frac{4}{10} = 0{,}4$
$y = 0{,}8^{0{,}4x}$ met H.A.: de x-as ofwel $y = 0$
⇓ .....translatie (0, −10)



$m(x) = 0{,}8^{0{,}4x} - 10$ met H.A.: $y = -10$.

30a $N = 1{,}5^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
⇓ .....vermenigvuldiging t.o.v. de t-as met 8
$N = 8 \cdot 1{,}5^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
⇓ .....translatie (0, −6)
$N = 8 \cdot 1{,}5^t - 6$ met B = $\langle -6, \rightarrow \rangle$ en H.A.: $N = -6$.

30b $N = 0{,}8^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
⇓ .....vermenigvuldiging t.o.v. de t-as met −2
$N = -2 \cdot 0{,}8^t$ met B = $\langle \leftarrow, 0 \rangle$ en H.A.: $N = 0$
⇓ .....translatie (0, 5)
$N = -2 \cdot 0{,}8^t + 5$ met B = $\langle \leftarrow, 5 \rangle$ en H.A.: $N = 5$.

30c $N = 0{,}3^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
⇓ .....verm. t.o.v. de t-as met −1
$N = -0{,}3^t$ met B = $\langle \leftarrow, 0 \rangle$ en H.A.: $N = 0$
⇓ .....translatie (1, 0)
$N = -0{,}3^{t-1}$ met B = $\langle \leftarrow, 0 \rangle$ en H.A.: $N = 0$
⇓ .....translatie (0, 1000)
$N = 1000 - 0{,}3^{t-1}$ met B = $\langle \leftarrow, 1000 \rangle$ en H.A.: $N = 1000$.

30d $N = 0{,}3^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
⇓ .....verm. t.o.v. de t-as met −1
$N = -0{,}3^t$ met B = $\langle \leftarrow, 0 \rangle$ en H.A.: $N = 0$
⇓ .....translatie (0, 1)
$N = 1 - 0{,}3^t$ met B = $\langle \leftarrow, 1 \rangle$ en H.A.: $N = 1$
⇓ .....vermenigvuldiging t.o.v. de t-as met 1000
$N = 1000(1 - 0{,}3^t)$ met B = $\langle \leftarrow, 1000 \rangle$ en H.A.: $N = 1000$.

31a $y = 3^x$
⇓ ....verm. t.o.v. de x-as met $\frac{1}{2}$
$y = \frac{1}{2} \cdot 3^x$
⇓ ....translatie (0, 3)
$f(x) = \frac{1}{2} \cdot 3^x + 3$.

31b $y = 3^x$
⇓ ....verm. t.o.v. de x-as met –1
$y = -3^x$
⇓ ....translatie (0, –1)
$g(x) = -3^x - 1$.

31c $y = 3^x$
⇓ ....translatie (0, –5)
$y = 3^x - 5$
⇓ ....translatie (4, 0)
$y = 3^{x-4} - 5$
⇓ ....verm. t.o.v. de x-as met 3
$h(x) = 3 \cdot (3^{x-4} - 5) = 3 \cdot 3^{x-4} - 15$.

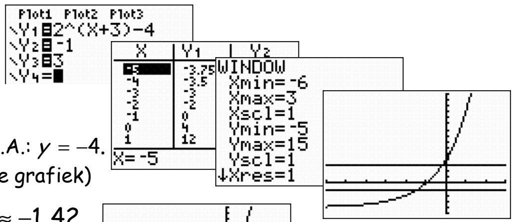
31d $y = 3^x$
⇓ ....verm. t.o.v. de x-as met 3
$y = 3 \cdot 3^x$
⇓ ....translatie (0, –5)
$y = 3 \cdot 3^x - 5$
⇓ ....translatie (4, 0)
$k(x) = 3 \cdot 3^{x-4} - 5$.

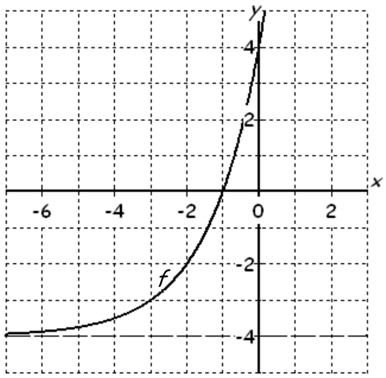
32 💻 *

33 💻 *

34 💻 *

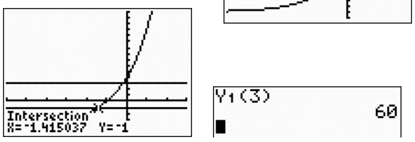
35ab $y = 2^x$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....translatie (–3, 0)
$y = 2^{x+3}$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....translatie (0, –4)
$f(x) = 2^{x+3} - 4$ met B_f = ⟨–4, →⟩ en H.A.: $y = -4$.
(neem de tabel over van de GR en teken de grafiek)





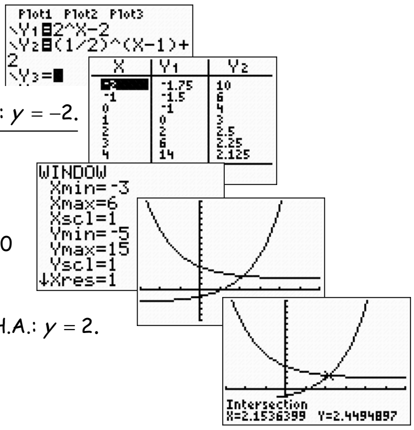
35c $f(x) = 2^{x+3} - 4 = -1$ (intersect) $\Rightarrow x \approx -1,42$.
$f(x) \le -1$ (zie plot/grafiek) $\Rightarrow x \le -1,42$.

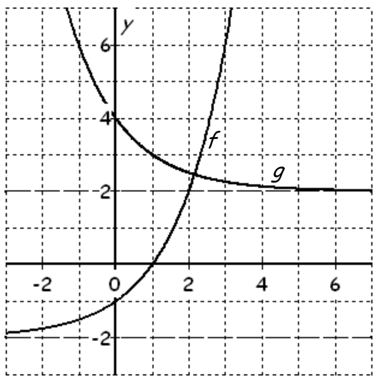
35d $f(3) = 2^6 - 4 = 64 - 4 = 60$.
$x \le 3$ (zie plot/grafiek en B_f) $\Rightarrow -4 < f(x) \le 60$.



36ab $y = 2^x$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....translatie (0, –2)
$f(x) = 2^x - 2$ met B_f = ⟨–2, →⟩ en H.A.: $y = -2$.

$y = \left(\frac{1}{2}\right)^x$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....translatie (1, 0)
$y = \left(\frac{1}{2}\right)^{x-1}$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....translatie (0, 2)
$g(x) = \left(\frac{1}{2}\right)^{x-1} + 2$ met B_g = ⟨2, →⟩ en H.A.: $y = 2$.



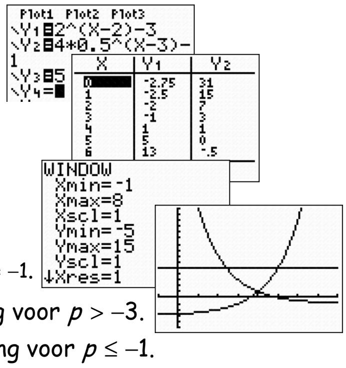


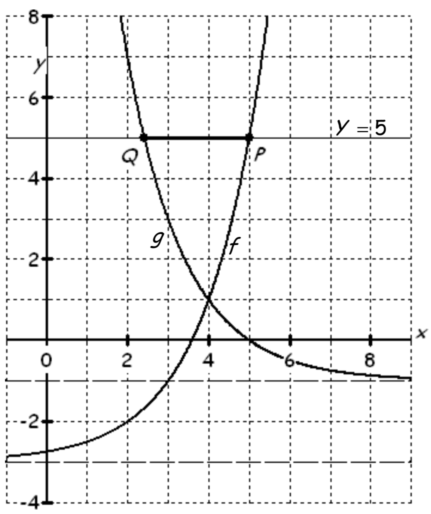
36c $f(x) = g(x)$ (intersect) $\Rightarrow x \approx 2,15$.
$f(x) \ge g(x)$ (zie grafiek) $\Rightarrow x \ge 2,15$.

36d $B_f = \langle -2, \rightarrow \rangle \Rightarrow f(x) = p$ heeft geen oplossingen voor $p \le -2$.

37a $y = 2^x$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....translatie (2, –3)
$f(x) = 2^{x-2} - 3$ met B_f = ⟨–3, →⟩ en H.A.: $y = -3$.

$y = 0,5^x$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....verm. t.o.v. de x-as met 4
$y = 4 \cdot 0,5^x$ met B = ⟨0, →⟩ en H.A.: $y = 0$
⇓ ....translatie (3, –1)
$g(x) = 4 \cdot 0,5^{x-3} - 1$ met B = ⟨–1, →⟩ en H.A.: $y = -1$.

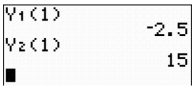




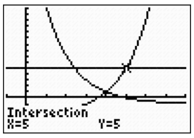
37b $B_f = \langle -3, \rightarrow \rangle \Rightarrow f(x) = p$ heeft één oplossing voor $p > -3$.
$B_g = \langle -1, \rightarrow \rangle \Rightarrow g(x) = p$ heeft geen oplossing voor $p \le -1$.
$f(x) = p$ heeft één oplossing én $g(x) = p$ heeft geen oplossing $\Rightarrow -3 < p \le -1$.

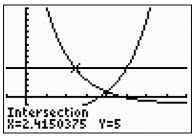
37c $f(2) = 2^0 - 3 = 1 - 3 = -2$.
$x \le 2$ (zie plot/grafiek en B_f) $\Rightarrow -3 < f(x) \le -2$.

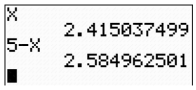
37d $f(1) = -2{,}5$ en $g(1) = 15 \Rightarrow AB = y_B - y_A = 15 - -2{,}5 = 17{,}5$.



37e $f(x) = 5$ (intersect) $\Rightarrow x = x_P = 5$ en
$g(x) = 5$ (intersect) $\Rightarrow x = x_Q \approx 2{,}415$.
$PQ = x_P - x_Q \approx 5 - 2{,}415 = 2{,}585$.

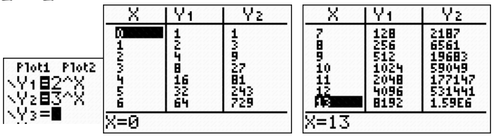


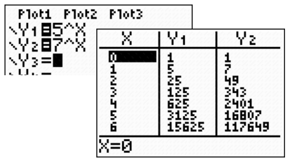




38a $f(x) = 2^{x-3} = \sqrt{2}$
aflezen in de grafiek:
$x \approx 3{,}5$.

38b $2^{x-3} = \sqrt{2} = 2^{\frac{1}{2}}$
$x - 3 = \frac{1}{2}$
$x = 3\frac{1}{2}$.





39a $2^{x+1} = 64 = 2^6$
$x + 1 = 6$
$x = 5$.

39b $2^{x-3} = \frac{1}{8} = \frac{1}{2^3} = 2^{-3}$
$x - 3 = -3$
$x = 0$.

39c $2^{2x} = 2 = 2^1$
$2x = 1$
$x = \frac{1}{2}$.

39d $2^x = 1 = 2^0$
$x = 0$.

39e $2^x = \frac{1}{4}\sqrt{2} = \frac{1}{2^2} \cdot 2^{\frac{1}{2}} = 2^{-2} \cdot 2^{\frac{1}{2}} = 2^{-1\frac{1}{2}}$
$x = -1\frac{1}{2}$.

39f $2^{x+5} = 16\sqrt{2} = 2^4 \cdot 2^{\frac{1}{2}} = 2^{4\frac{1}{2}}$
$x + 5 = 4\frac{1}{2}$
$x = -\frac{1}{2}$.

39g $5^{x+6} = \left(\frac{1}{5}\right)^x = \left(5^{-1}\right)^x = 5^{-x}$
$x + 6 = -x$
$2x = -6 \Rightarrow x = -3$.

39h $3^{2x+1} = 27\sqrt{3} = 3^3 \cdot 3^{\frac{1}{2}} = 3^{3\frac{1}{2}}$
$2x + 1 = 3\frac{1}{2}$
$2x = 2\frac{1}{2} \Rightarrow x = 1\frac{1}{4}$.

39i $10^{2x+1} = 0{,}01 = \frac{1}{100} = \frac{1}{10^2} = 10^{-2}$
$2x + 1 = -2$
$2x = -3 \Rightarrow x = -1\frac{1}{2}$.

40a $2^x + 1 = 17$
$2^x = 16 = 2^4$
$x = 4$.

40b $3^x - 2 = 25$
$3^x = 27 = 3^3$
$x = 3$.

40c $5 \cdot 2^x = 80$
$2^x = 16 = 2^4$
$x = 4$.

40d $10 \cdot 3^x = 270$
$3^x = 27 = 3^3$
$x = 3$.

40e $3 \cdot 8^{2-x} = 48$
$8^{2-x} = 16 = 2^4$
$(2^3)^{2-x} = 2^{6-3x} = 2^4$
$6 - 3x = 4 \Rightarrow -3x = -2 \Rightarrow x = \frac{2}{3}$.

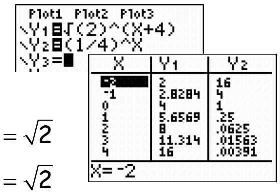
40f $3 \cdot 2^x + 4 = 28$
$3 \cdot 2^x = 24$
$2^x = 8 = 2^3$
$x = 3$.

40g $5^{2x-6} = 0{,}04 = \frac{4}{100} = \frac{1}{25} = \frac{1}{5^2} = 5^{-2}$
$2x - 6 = -2$
$2x = 4 \Rightarrow x = 2$.

40h $3 \cdot 7^{3x+1} = 147$
$7^{3x+1} = 49 = 7^2$
$3x + 1 = 2$
$3x = 1 \Rightarrow x = \frac{1}{3}$.

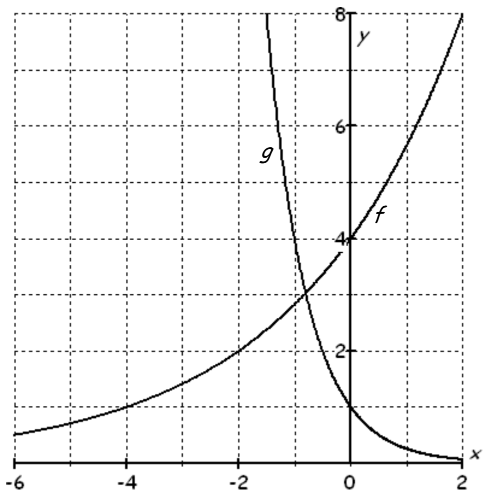
40i $32^{x-2} = \frac{1}{16}$
$(2^5)^{x-2} = \frac{1}{2^4}$
$2^{5x-10} = 2^{-4}$
$5x - 10 = -4 \Rightarrow 5x = 6 \Rightarrow x = \frac{6}{5}$.

41a Zie de grafieken hiernaast. (gebruikt een tabel)
$D_f = D_g = \mathbb{R}$ (elke x is geoorloofd) en
$B_f = B_g = \langle 0, \rightarrow \rangle$ $(y > 0)$.



41b $f(x) = g(x)$
$\left(\sqrt{2}\right)^{x+4} = \left(\frac{1}{4}\right)^x$
$\left(2^{\frac{1}{2}}\right)^{x+4} = \left(\frac{1}{2^2}\right)^x$
$2^{\frac{1}{2}(x+4)} = \left(2^{-2}\right)^x$
$2^{\frac{1}{2}x+2} = 2^{-2x}$
$\frac{1}{2}x + 2 = -2x$
$2\frac{1}{2}x = -2$
$x = \frac{-2}{2{,}5} = \frac{-4}{5} = -\frac{4}{5}$.
Lees af in de grafiek: $f(x) \geq g(x) \Rightarrow x \geq -\frac{4}{5}$.

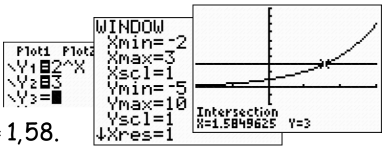
41c $g(x) = \sqrt{2}$
$\left(\frac{1}{4}\right)^x = \sqrt{2}$
$2^{-2x} = 2^{\frac{1}{2}}$
$-2x = \frac{1}{2}$
$x = -\frac{1}{4}$.
Lees af: $g(x) \geq \sqrt{2} \Rightarrow x \leq -\frac{1}{4}$.



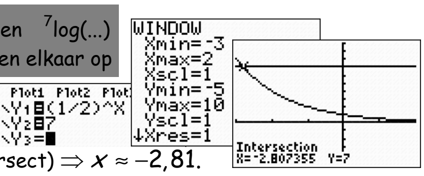
42a x [×3] 5 heeft als omkeerschema x [:3] 5

42b x [$\ldots^3$] 5 heeft als omkeerschema x [$\sqrt[3]{\ldots}$] 5

43a $2^x = 3$ (2··· en ²log(...) heffen elkaar op)
$x = {}^2\log(3)$.
$2^x = 3$ (intersect) $\Rightarrow x \approx 1{,}58$.

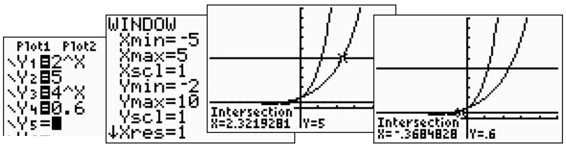


43b $\left(\frac{1}{2}\right)^x = 7$ (7··· en ⁷log(...) heffen elkaar op)
$x = {}^{\frac{1}{2}}\log(7)$.
$\left(\frac{1}{2}\right)^x = 7$ (intersect) $\Rightarrow x \approx -2{,}81$.



44a $2^x = 5$ (intersect) $\Rightarrow x = {}^2\log(5) \approx 2{,}32$.

44b $4^x = 0{,}6$ (intersect) $\Rightarrow x = {}^4\log(0{,}6) \approx -0{,}37$.



45a $2^{x-1} = 15$ (²log(... nemen)
$x - 1 = {}^2\log(15)$
$x = {}^2\log(15) + 1$.

45c $4 + 3^{x+1} = 25$
$3^{x+1} = 21$ (³log(... nemen)
$x + 1 = {}^3\log(21)$
$x = {}^3\log(21) - 1$.

45e $7 + 4^{2x} = 12$
$4^{2x} = 5$ (⁴log(... nemen)
$2x = {}^4\log(5)$
$x = \frac{1}{2} \cdot {}^4\log(5)$.

45b $1 + 2^x = 15$
$2^x = 14$ (²log(... nemen)
$x = {}^2\log(14)$.

45d $14 - 2^{x+1} = 2$
$-2^{x+1} = -12$
$2^{x+1} = 12$ (²log(... nemen)
$x + 1 = {}^2\log(12)$
$x = {}^2\log(12) - 1$.

45f $3 \cdot 5^{2x+1} = 60$
$5^{2x+1} = 20$ (⁵log(... nemen)
$2x + 1 = {}^5\log(20)$
$2x = {}^5\log(20) - 1$
$x = \frac{1}{2} \cdot {}^5\log(20) - \frac{1}{2}$.

46 $2^x = 32$ heeft als oplossing $x = {}^2\log(32)$
$2^x = 32 = 2^5$ heeft als oplossing $x = 5$
$\Rightarrow {}^2\log(32) = 5$ of ${}^2\log(32) = {}^2\log(2^5) = 5$

2··· en ²log(...) heffen elkaar op.
Dus ${}^2\log(2^a) = a$ en $2^{{}^2\log(b)} = b$

47a ${}^2\log(4) = {}^2\log(2^2) = 2$.

47b ${}^2\log(2) = {}^2\log(2^1) = 1$.

47c ${}^2\log(\frac{1}{2}) = {}^2\log(2^{-1}) = -1$.

47d ${}^2\log(\sqrt{2}) = {}^2\log(2^{\frac{1}{2}}) = \frac{1}{2}$.

47e ${}^2\log(\frac{1}{4}) = {}^2\log(\frac{1}{2^2}) = {}^2\log(2^{-2}) = -2$.

g··· en ᵍlog(...) heffen elkaar op.
Dus ${}^g\log(g^a) = a$ en $g^{{}^g\log(b)} = b$

47f ${}^2\log(1) = {}^2\log(2^0) = 0$.

47g ${}^2\log(4 \cdot \sqrt{2}) = {}^2\log(2^2 \cdot 2^{\frac{1}{2}}) = {}^2\log(2^{2\frac{1}{2}}) = 2\frac{1}{2}$.

47h ${}^2\log(\frac{1}{8} \cdot \sqrt{2}) = {}^2\log(\frac{1}{2^3} \cdot 2^{\frac{1}{2}}) = {}^2\log(2^{-3} \cdot 2^{\frac{1}{2}}) = {}^2\log(2^{-2\frac{1}{2}}) = -2\frac{1}{2}$.

48a ${}^3\log(27) = {}^3\log(3^3) = 3$.

48b ${}^7\log(49) = {}^7\log(7^2) = 2$.

48c ${}^3\log(\frac{1}{81}) = {}^3\log(\frac{1}{3^4}) = {}^3\log(3^{-4}) = -4$.

48d ${}^{10}\log(1000) = {}^{10}\log(10^3) = 3$.

48e ${}^{10}\log(0{,}01) = {}^{10}\log(\frac{1}{100}) = {}^{10}\log(\frac{1}{10^2}) = {}^{10}\log(10^{-2}) = -2$.

48f ${}^{10}\log(0{,}1 \cdot \sqrt{10}) = {}^{10}\log(\frac{1}{10} \cdot 10^{\frac{1}{2}}) = {}^{10}\log(10^{-1} \cdot 10^{\frac{1}{2}}) = {}^{10}\log(10^{-\frac{1}{2}}) = -\frac{1}{2}$.

48g ${}^7\log(1) = {}^7\log(7^0) = 0$.

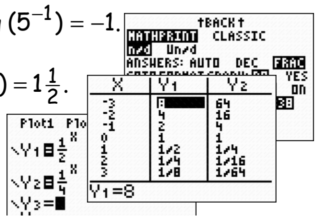
48h ${}^{23}\log(23) = {}^{23}\log(23^1) = 1$.

49a ${}^5\log(0{,}2) = {}^5\log(\frac{2}{10}) = {}^5\log(\frac{1}{5}) = {}^5\log(5^{-1}) = -1$.

49b ${}^3\log(3 \cdot \sqrt{3}) = {}^3\log(3^1 \cdot 3^{\frac{1}{2}}) = {}^3\log(3^{1\frac{1}{2}}) = 1\frac{1}{2}$.

49c ${}^{\frac{1}{2}}\log(8) = {}^{\frac{1}{2}}\log((\frac{1}{2})^{-3}) = -3$.

49d ${}^{\frac{1}{4}}\log(\frac{1}{16}) = {}^{\frac{1}{4}}\log((\frac{1}{4})^2) = 2$.



49e ${}^{0{,}25}\log(4) = {}^{\frac{1}{4}}\log(4) = {}^{\frac{1}{4}}\log((\frac{1}{4})^{-1}) = -1$.

49f ${}^4\log(0{,}25) = {}^4\log(\frac{1}{4}) = {}^4\log(4^{-1}) = -1$.

49g ${}^{\frac{1}{7}}\log(7) = {}^{\frac{1}{7}}\log((\frac{1}{7})^{-1}) = -1$.

49h ${}^{\frac{1}{7}}\log(1) = {}^{\frac{1}{7}}\log((\frac{1}{7})^0) = 0$.

50a ${}^2\log(x) = 8$ (2··· nemen)
$x = 2^8 = 256$.

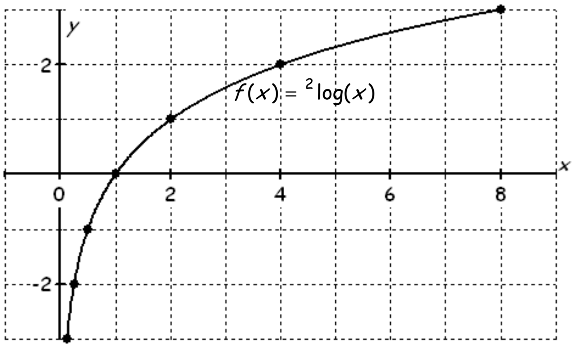
50c ${}^x\log(3) = 1$ (x··· nemen)
$3 = x^1$ (dus $x = 3$).

50e ${}^{\frac{1}{2}}\log(x - \frac{1}{2}) = -1$ ($(\frac{1}{2})$··· nemen)
$x - \frac{1}{2} = (\frac{1}{2})^{-1} = 2$
$x = 2\frac{1}{2}$.

50b ${}^3\log(x) = 1$ (3··· nemen)
$x = 3^1 = 3$.

50d ${}^2\log(x + 3) = -1$ (2··· nemen)
$x + 3 = 2^{-1} = \frac{1}{2}$
$x = -2\frac{1}{2}$.

50f ${}^3\log(x^2 + 1) = 2$ (3··· nemen)
$x^2 + 1 = 3^2 = 9$
$x^2 = 8$
$x = -\sqrt{8} \vee x = \sqrt{8}$.



51ab Zie de tabel hieronder.

x	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8
$f(x) = {}^2\log(x)$	−3	−2	−1	0	1	2	3

Zie de grafiek hiernaast.

51c Bij ${}^2\log(x)$ moet x (een macht van 2) > 0 zijn $\Rightarrow D_f = \langle 0, \rightarrow\rangle$.

51d $B_f = \mathbb{R}$.

52a $y = {}^3\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....translatie (−2, 0)
$f(x) = {}^3\log(x+2)$ met V.A.: $x = -2$.

52b $y = {}^2\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....verm. t.o.v. de x-as met 5
$y = 5 \cdot {}^2\log(x)$ met V.A.: $x = 0$
⇓.....translatie (1, 0)
$g(x) = 5 \cdot {}^2\log(x-1)$ met V.A.: $x = 1$.

52c $y = {}^{\frac{1}{2}}\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....verm. t.o.v. de x-as met 4
$y = 4 \cdot {}^{\frac{1}{2}}\log(x)$ met V.A.: $x = 0$
⇓.....translatie (0, 3)
$h(x) = 4 \cdot {}^{\frac{1}{2}}\log(x) + 3$ met V.A.: $x = 0$.

52d $y = {}^{\frac{1}{3}}\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....verm. t.o.v. de x-as met −1
$y = -{}^{\frac{1}{3}}\log(x)$ met V.A.: $x = 0$
⇓.....translatie (−1, −2)
$k(x) = -{}^{\frac{1}{3}}\log(x+1) - 2$ met V.A.: $x = -1$.

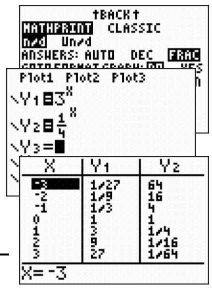
52e $y = {}^3\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....verm. t.o.v. de y-as met $\frac{1}{2}$
$y = {}^3\log(2x)$ met V.A.: $x = 0$
⇓.....translatie (0, 5)
$l(x) = {}^3\log(2x) + 5$ met V.A.: $x = 0$.

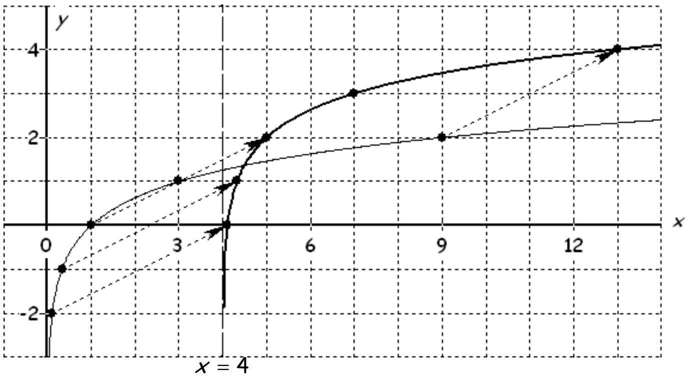
52f $y = {}^{\frac{1}{4}}\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....verm. t.o.v. de x-as met 3
$y = 3 \cdot {}^{\frac{1}{4}}\log(x)$ met V.A.: $x = 0$
⇓.....verm. t.o.v. de y-as met 2
$m(x) = 3 \cdot {}^{\frac{1}{4}}\log(\frac{1}{2}x)$ met V.A.: $x = 0$.

53a $y = {}^3\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....translatie (4, 2)
$f(x) = {}^3\log(x-4) + 2$ met V.A.: $x = 4$.

53b $D_f = \langle 4, \rightarrow\rangle$. Maak de tabel hieronder en de grafiek hiernaast.
(gebruik de tabel op de GR hiernaast)

x	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9
$y = {}^3\log(x)$	−2	−1	0	1	2

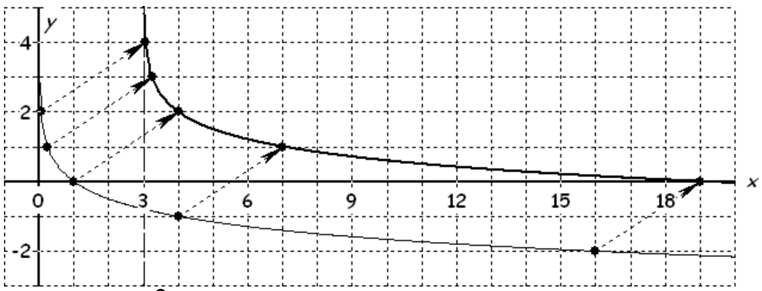




54a $y = {}^{\frac{1}{4}}\log(x)$ met V.A.: de y-as ($x = 0$)
⇓.....translatie (3, 2)
$f(x) = {}^{\frac{1}{4}}\log(x-3) + 2$ met V.A.: $x = 3$.

54b $D_f = \langle 3, \rightarrow\rangle$. Maak de tabel hieronder en de grafiek hiernaast.
(zie het TABLE-scherm van de GR naast 53b)

x	16	4	1	$\frac{1}{4}$	$\frac{1}{16}$
$y = {}^{\frac{1}{4}}\log(x)$	−2	−1	0	1	2



55a $y = {}^3\log(x)$
⇓.....verm. t.o.v. de x-as met 2
$y = 2 \cdot {}^3\log(x)$
⇓.....translatie (0, −4)
$f(x) = 2 \cdot {}^3\log(x) - 4$.

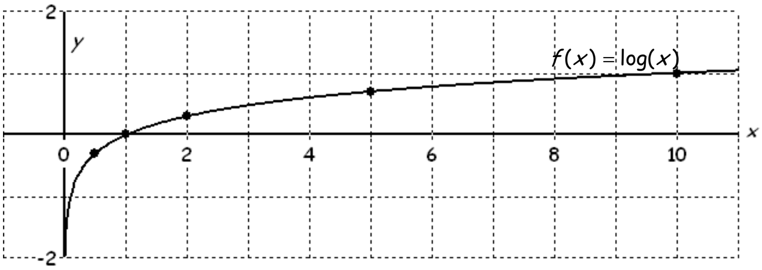
55b $y = {}^3\log(x)$
⇓.....spiegelen in de x-as
$y = -{}^3\log(x)$
⇓.....translatie (5, 0)
$g(x) = -{}^3\log(x-5)$.

55c $y = {}^3\log(x)$
⇓.....translatie (−3, 2)
$y = {}^3\log(x+3) + 2$
⇓.....verm. t.o.v. de x-as met $\frac{1}{2}$
$h(x) = \frac{1}{2} \cdot \left({}^3\log(x+3) + 2\right)$
$= \frac{1}{2} \cdot {}^3\log(x+3) + 1$.

56a Vul de tabel verder. (zie de GR-schermen hieronder)

```
log(1/2)
   -.3010299957
log(1)
              0
log(2)
    .3010299957
```

```
log(5)
    .6989700043
log(10)
              1
```



56b Zie de grafiek hiernaast.

56c Xmin = 0, Xmax = 10, Ymin = −1 en Ymax = 1.

57a $\text{din} = 1 + k \cdot \log(\text{iso})$ met 100 ISO = 21 DIN $\Rightarrow 21 = 1 + k \cdot \log(100) \Rightarrow 20 = k \cdot \log(10^2) \Rightarrow 20 = k \cdot 2 \Rightarrow k = \frac{20}{2} = 10$.

57b 400 ISO/ASA $\Rightarrow \text{din} = 1 + 10 \cdot \log(400) \approx 27$. Dus 27 DIN.

```
1+10log(400)
    27.02059991
```

```
log(100)
              2
```

```
10^2.3
    199.5262315
```

57c 24 DIN $\Rightarrow 24 = 1 + 10 \cdot \log(\text{iso}) \Rightarrow 23 = 10 \cdot \log(\text{iso}) \Rightarrow 2{,}3 = \log(\text{iso}) \Rightarrow \text{iso} = 10^{2{,}3} \approx 200$. Dus 200 ISO/ASA.

Diagnostische toets

D1a $6a^3 \cdot 8(a^2)^2 = 6a^3 \cdot 8a^4 = 48a^7$.

D1b $(6a)^3 \cdot (8a^2)^2 = 216a^3 \cdot 64a^4 = 13\,824a^7$.

```
6^3
            216
Ans*8²
          13824
```

D1c $\frac{(6a^2)^3}{(2a)^4} = \frac{216a^6}{16a^4} = 13\frac{1}{2}a^2$.

```
2^4
             16
216/16
           13.5
```

D1d $(2a^2)^4 - (3a^3)^2 = 16a^8 - 9a^6$.

D1e $(ab^2)^4 \cdot a^2b = a^4b^8 \cdot a^2b = a^6b^9$.

D1f $\left(\frac{6a^2}{2a}\right)^4 = (3a)^4 = 81a^4$.

```
3^4
             81
```

D2a $a^{-3} \cdot a^2 = a^{-3+2} = a^{-1}$.

D2b $(a^{-3})^2 = a^{-3 \cdot 2} = a^{-6}$.

D2c $\frac{a^{-3}}{a^2} = a^{-3-2} = a^{-5}$.

D3a $a^{-2} = \frac{1}{a^2}$.

D3b $10ab^{-2} = \frac{10a}{b^2}$.

D3c $(4a)^{-2} \cdot 3b^{-4} = \frac{1}{(4a)^2} \cdot \frac{3}{b^4} = \frac{3}{16a^2b^4}$.

D4a $3\frac{1}{2}a^{\frac{2}{7}} = 3\frac{1}{2} \cdot \sqrt[7]{a^2}$.

D4b $2a^{-3}b^{\frac{1}{3}} = 2 \cdot \frac{1}{a^3} \cdot \sqrt[3]{b} = \frac{2 \cdot \sqrt[3]{b}}{a^3}$.

D4c $4a^{\frac{1}{4}}b^{-\frac{2}{3}} = 4 \cdot \sqrt[4]{a} \cdot \frac{1}{b^{\frac{2}{3}}} = 4 \cdot \sqrt[4]{a} \cdot \frac{1}{\sqrt[3]{b^2}} = \frac{4 \cdot \sqrt[4]{a}}{\sqrt[3]{b^2}}$.

D5a $\frac{1}{x^3} = x^{-3}$.

D5b $\frac{1}{x^2 \cdot \sqrt{x}} = \frac{1}{x^2 \cdot x^{\frac{1}{2}}} = \frac{1}{x^{2\frac{1}{2}}} = x^{-2\frac{1}{2}}$.

D5c $\sqrt[3]{x^2} = x^{\frac{2}{3}}$.

D5d $x^3 \cdot \sqrt[5]{x^3} = x^3 \cdot x^{\frac{3}{5}} = x^{3+\frac{3}{5}} = x^{3\frac{3}{5}}$.

D5e $\frac{x^4}{\sqrt[3]{x}} = \frac{x^4}{x^{\frac{1}{3}}} = x^4 \cdot x^{-\frac{1}{3}} = x^{3\frac{2}{3}}$.

D5f $\sqrt[3]{\frac{1}{x^3}} = \sqrt[3]{x^{-3}} = x^{\frac{-3}{3}} = x^{-1}$.

D6a $16 \cdot \sqrt{2} = 2^4 \cdot 2^{\frac{1}{2}} = 2^{4\frac{1}{2}}$. $\sqrt[3]{32} = \sqrt[3]{2^5} = 2^{\frac{5}{3}} = 2^{1\frac{2}{3}}$. $\sqrt[5]{\frac{1}{8}} = \sqrt[5]{\frac{1}{2^3}} = \sqrt[5]{2^{-3}} = 2^{-\frac{3}{5}}$.

X	Y1
0	1
1	2
2	4
3	8
4	16
5	32
6	64

X=0

```
Plot1 Plot2
\Y1=2^X
\Y2=
\Y3=
```

D6b $2^{x-4} = 2^x \cdot 2^{-4} = 2^x \cdot \frac{1}{2^4} = \frac{1}{16} \cdot 2^x$. $2^{x+\frac{1}{2}} = 2^x \cdot 2^{\frac{1}{2}} = 2^x \cdot \sqrt{2} = \sqrt{2} \cdot 2^x$.

D6c $2{,}16^{a-1} = 2{,}16^a \cdot 2{,}16^{-1} \approx 0{,}46 \cdot 2{,}16^a$.

```
2.16^-1
    .462962963
```

$1{,}27^{3a+0{,}6} = 1{,}27^{3a} \cdot 1{,}27^{0{,}6} \approx 1{,}15 \cdot (1{,}27^3)^a \approx 1{,}15 \cdot 2{,}05^a$.

```
1.27^0.6
    1.15420309
```

```
1.27^3
      2.048383
```

D7a
$5x^{1{,}2} + 6 = 20$
$5x^{1{,}2} = 14$
$x^{1{,}2} = 2{,}8$
$x = \sqrt[1{,}2]{2{,}8} \approx 2{,}358$.

```
MATH NUM CPX PRB
1:▸Frac
2:▸Dec
3:³
4:³√(
5:ˣ√
```

```
20-6
             14
Ans/5
            2.8
1.2ˣ√2.8
    2.358477258
```

D7b
$6 \cdot \sqrt[3]{x^2} + 3 = 8$
$6 \cdot \sqrt[3]{x^2} = 5$
$x^{\frac{2}{3}} = \frac{5}{6}$
$x = \sqrt[\frac{2}{3}]{\frac{5}{6}} \approx 0{,}761$.

```
8-3
              5
5/6
    .8333333333
(2/3)ˣ√(5/6)
    .7607257743
```

D7c
$8x \cdot \sqrt{x} + 5 = 21$
$8x^1 \cdot x^{\frac{1}{2}} = 16$
$x^{1\frac{1}{2}} = 2$
$x = \sqrt[1\frac{1}{2}]{2} \approx 1{,}587$.

```
21-5
             16
Ans/8
              2
1.5ˣ√2
    1.587401052
```

D8a $K = a \cdot p^{1{,}3}$ en bij $p = 17$ hoort $K = 150 \Rightarrow 150 = a \cdot 17^{1{,}3} \Rightarrow a = \frac{150}{17^{1{,}3}} \approx 3{,}77$.

D8b $N = \frac{a}{t^{0{,}83}}$ en bij $t = 11$ hoort $N = 33 \Rightarrow 33 = \frac{a}{11^{0{,}83}} \Rightarrow a = 33 \cdot 11^{0{,}83} \approx 241$.

```
150/17^1.3
    3.77144398
33*11^0.83
   241.4737177
```

D9a $N = 0{,}9^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
....verm. t.o.v. de t-as met −1
$N = -0{,}9^t$ met B = $\langle \leftarrow, 0 \rangle$ en H.A.: $N = 0$
....translatie (0, 800)
$N = 800 - 0{,}9^t$ met B = $\langle \leftarrow, 800 \rangle$ en H.A.: $N = 800$.

D9b $N = 1{,}2^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
....verm. t.o.v. de t-as met 0,5
$N = 0{,}5 \cdot 1{,}2^t$ met B = $\langle 0, \rightarrow \rangle$ en H.A.: $N = 0$
....translatie (0, 3)
$N = 0{,}5 \cdot 1{,}2^t + 3$ met B = $\langle 3, \rightarrow \rangle$ en H.A.: $N = 3$.

D10ab Zie de grafieken hiernaast. (gebruikt een tabel)

$y = 3^x$ met $B = \langle 0, \rightarrow \rangle$ en H.A.: $y = 0$

.....translatie $(2, -3)$

$f(x) = 3^{x-2} - 3$ met $B_f = \langle -3, \rightarrow \rangle$ en H.A.: $y = -3$.

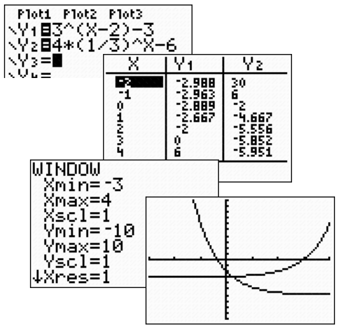
$y = \left(\frac{1}{3}\right)^x$ met $B = \langle 0, \rightarrow \rangle$ en H.A.: $y = 0$

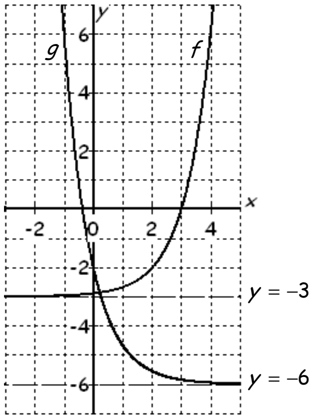
.....verm. t.o.v. de x-as met 4

$y = 4 \cdot \left(\frac{1}{3}\right)^x$ met $B = \langle 0, \rightarrow \rangle$ en H.A.: $y = 0$

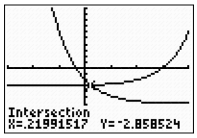
.....translatie $(0, -6)$

$g(x) = 4 \cdot \left(\frac{1}{3}\right)^x - 6$ met $B_g = \langle -6, \rightarrow \rangle$ en H.A.: $y = -6$.



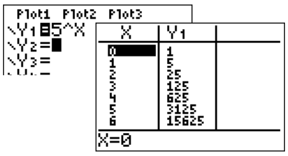


D10c $f(x) = g(x)$ (intersect) $\Rightarrow x \approx 0{,}22$.
Lees in de grafiek af: $f(x) \geq g(x) \Rightarrow x \geq 0{,}22$.

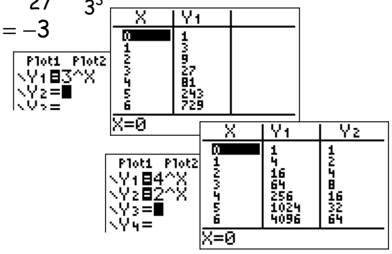


D10d $B_f = \langle -3, \rightarrow \rangle \Rightarrow f(x) = p$ heeft geen oplossingen voor $p \leq -3$.

D11a $5^{x-1} = 125 = 5^3$
$x - 1 = 3$
$x = 4$.



D11b $3^{2x-5} = \frac{1}{27} = \frac{1}{3^3} = 3^{-3}$
$2x - 5 = -3$
$2x = 2$
$x = 1$.



D11c $2 \cdot 4^{2x-1} - 3 = 61$
$2 \cdot 4^{2x-1} = 64$
$4^{2x-1} = 32 = 2^5$
$(2^2)^{2x-1} = 2^5$
$2^{4x-2} = 2^5$
$4x - 2 = 5$
$4x = 7 \Rightarrow x = \frac{7}{4} = 1\frac{3}{4}$.

D12a $7^{x-3} = 20$ ($^7\log(\ldots$ nemen)
$x - 3 = {}^7\log(20)$
$x = 3 + {}^7\log(20)$.

$^g\log(\ldots)$ en $g^{\cdots}$ heffen elkaar op

D12b $6 \cdot 2^x + 5 = 23$
$6 \cdot 2^x = 18$
$2^x = 3$ ($^2\log(\ldots$ nemen)
$x = {}^2\log(3)$.

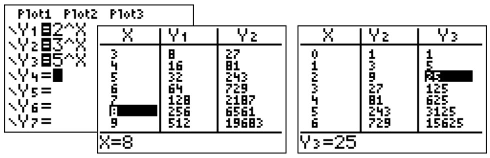
D12c $10 \cdot (\frac{1}{2})^{2x-1} = 600$
$(\frac{1}{2})^{2x-1} = 60$ ($^{\frac{1}{2}}\log(\ldots$ nemen)
$2x - 1 = {}^{\frac{1}{2}}\log(60)$
$2x = 1 + {}^{\frac{1}{2}}\log(60)$
$x = \frac{1}{2} + \frac{1}{2} \cdot {}^{\frac{1}{2}}\log(60)$.

D13a $^2\log(256) = {}^2\log(2^8) = 8$.

D13b $^3\log(3 \cdot \sqrt{3}) = {}^3\log(3^1 \cdot 3^{\frac{1}{2}}) = {}^3\log(3^{1\frac{1}{2}}) = 1\frac{1}{2}$.

D13c $^5\log(\frac{1}{25}) = {}^5\log(\frac{1}{5^2}) = {}^5\log(5^{-2}) = -2$.

$^g\log(\ldots)$ en $g^{\cdots}$ heffen elkaar op



D14a $^2\log(x) = -3$ ($2^{\cdots}$ nemen)
$x = 2^{-3} = \frac{1}{2^3} = \frac{1}{8}$.

$g^{\cdots}$ en $^g\log(\ldots)$ heffen elkaar op

D14b $^3\log(x - 4) = 2$ ($3^{\cdots}$ nemen)
$x - 4 = 3^2 = 9$
$x = 13$.

D14c $^4\log(x^2 - 5) = 1$ ($4^{\cdots}$ nemen)
$x^2 - 5 = 4^1 = 4$
$x^2 = 9$
$x = 3 \vee x = -3$.

D15a $y = {}^2\log(x)$ met $D = \langle 0, \rightarrow \rangle$ en V.A.: $x = 0$

.....translatie $(-5, 0)$

$f(x) = {}^2\log(2x + 5)$ met $D_f = \langle -5, \rightarrow \rangle$ en V.A.: $x = -5$.

$y = {}^{\frac{1}{2}}\log(x)$ met $D = \langle 0, \rightarrow \rangle$ en V.A.: $x = 0$

.....verm. t.o.v. de y-as met $\frac{1}{2}$

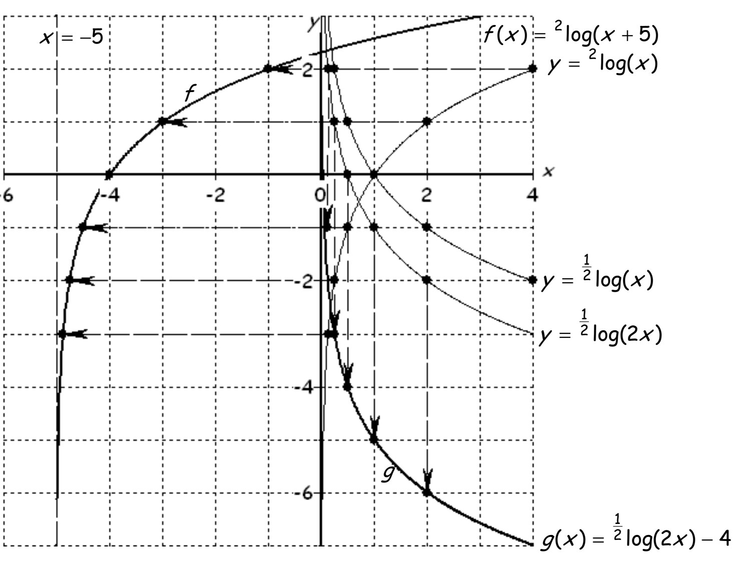
$y = {}^{\frac{1}{2}}\log(2x)$ met $D = \langle 0, \rightarrow \rangle$ en V.A.: $x = 0$

.....translatie $(0, -4)$

$g(x) = {}^{\frac{1}{2}}\log(2x) - 4$ met $D_g = \langle 0, \rightarrow \rangle$ en V.A.: $x = 0$.

D15b $D_f = \langle -5, \rightarrow \rangle$ en $D_g = \langle 0, \rightarrow \rangle$.
Maak de tabel hieronder en de grafiek hiernaast.

x	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8
$y = {}^2\log(x)$	−3	−2	−1	0	1	2	3
$y = {}^{\frac{1}{2}}\log(x)$	3	2	1	0	−1	−2	−3



Gemengde opgaven 7. Exponenten en logaritmen

G24a $\sqrt[4]{a} = a^{\frac{1}{4}}.$

G24b $\frac{1}{\sqrt[3]{a}} = \frac{1}{a^{\frac{1}{3}}} = a^{-\frac{1}{3}}.$

G24c $\frac{\sqrt[3]{a}}{a^2} = \frac{a^{\frac{1}{3}}}{a^2} = a^{\frac{1}{3}-2} = a^{-1\frac{2}{3}}.$

G24d $\frac{\sqrt{a}}{a \cdot \sqrt[4]{a}} = \frac{a^{\frac{1}{2}}}{a^1 \cdot a^{\frac{1}{4}}} = \frac{a^{\frac{1}{2}}}{a^{1\frac{1}{4}}} = a^{\frac{1}{2}-1\frac{1}{4}} = a^{-\frac{3}{4}}.$

G25a $\frac{(3b)^2}{5b} = \frac{9b^2}{5b} = \frac{9b}{5} = 1{,}8b.$

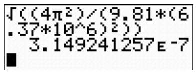
G25b $(2b^{-2})^3 + (\frac{1}{2}b^{-3})^2 = 8b^{-6} + \frac{1}{4}b^{-6} = 8\frac{1}{4}b^{-6} = \frac{33}{4} \cdot \frac{1}{b^6} = \frac{33}{4b^6}.$

G25c $\frac{(ab)^{-3}}{ab^{-3}} = \frac{a^{-3}b^{-3}}{ab^{-3}} = a^{-3-1} = a^{-4} = \frac{1}{a^4}.$

G25d $(\sqrt{9a})^2 = 9a.$

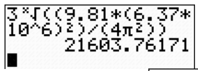
G26a $T^2 = \frac{4\pi^2 \cdot r^3}{g \cdot R^2} = \frac{4\pi^2}{g \cdot R^2} \cdot r^3 \Rightarrow T = \sqrt{\frac{4\pi^2}{g \cdot R^2}} \cdot r^{1,5}.$ Dus T is evenredig met $r^{1,5}$.

De evenredigheidsconstante is $\sqrt{\frac{4\pi^2}{g \cdot R^2}} = \sqrt{\frac{4\pi^2}{9{,}81 \cdot (6{,}37 \cdot 10^6)^2}} \approx 3{,}15 \cdot 10^{-7}.$



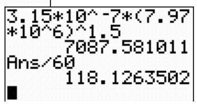
G26b $T^2 = \frac{4\pi^2}{g \cdot R^2} \cdot r^3 \Rightarrow r^3 = \frac{g \cdot R^2}{4\pi^2} \cdot T^2 \Rightarrow r = \sqrt[3]{\frac{g \cdot R^2}{4\pi^2}} \cdot T^{\frac{2}{3}}.$ Dus r is evenredig met $T^{\frac{2}{3}}$.

De evenredigheidsconstante is $\sqrt[3]{\frac{g \cdot R^2}{4\pi^2}} = \sqrt[3]{\frac{9{,}81 \cdot (6{,}37 \cdot 10^6)^2}{4\pi^2}} \approx 2{,}16 \cdot 10^4.$



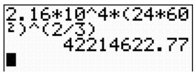
G26c $T \approx 3{,}15 \cdot 10^{-7} \cdot r^{1,5}$ met $r = 6{,}37 \cdot 10^6 + 1{,}6 \cdot 10^6 = 7{,}97 \cdot 10^6.$

Dus $T \approx 3{,}15 \cdot 10^{-7} \cdot (7{,}97 \cdot 10^6)^{1,5} \approx 7\,088$ (seconden). Dit zijn (ongeveer) 118 minuten.

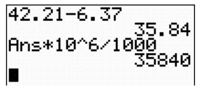


G26d $r \approx 2{,}16 \cdot 10^4 \cdot T^{\frac{2}{3}}$ met $T = 24 \cdot 60 \cdot 60$ (seconden).

Dus $r \approx 2{,}16 \cdot 10^4 \cdot (24 \cdot 60 \cdot 60)^{\frac{2}{3}} \approx 42{,}21 \cdot 10^6$ (m).



De hoogte van een geostationaire baan is $42{,}21 \cdot 10^6 - 6{,}37 \cdot 10^6 = 35{,}84 \cdot 10^6$ m. Dit zijn 35840 km.



G27a $y = 2^x$ met B $= \langle 0, \rightarrow \rangle$ en H.A.: $y = 0$

....verm. t.o.v. de x-as met $\frac{1}{10}$

$y = \frac{1}{10} \cdot 2^x$ met B $= \langle 0, \rightarrow \rangle$ en H.A.: $y = 0$

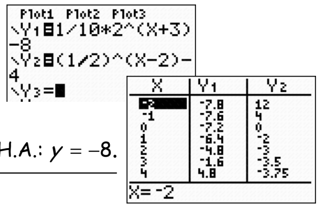
....translatie $(-3, -8)$

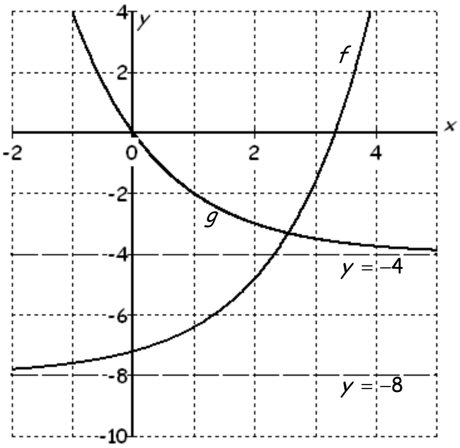
$f(x) = \frac{1}{10} \cdot 2^{x+3} - 8$ met $B_f = \langle -8, \rightarrow \rangle$ en H.A.: $y = -8$.

$y = \left(\frac{1}{2}\right)^x$ met B $= \langle 0, \rightarrow \rangle$ en H.A.: $y = 0$

....translatie $(2, -4)$

$g(x) = \left(\frac{1}{2}\right)^{x-2} - 4$ met $B_g = \langle -4, \rightarrow \rangle$ en H.A.: $y = -4$.





G27b $B_f = \langle -8, \rightarrow \rangle$ en $B_g = \langle -4, \rightarrow \rangle$.

Zie de grafiek hiernaast. (zie tabel op de GR hierboven)

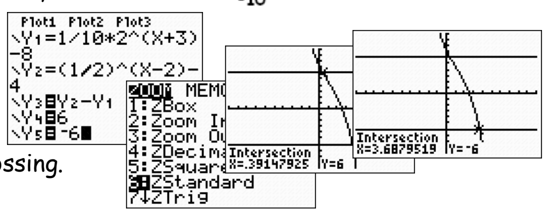
G27c $f(2) = -4{,}8.$ Nu aflezen in grafiek/plot: $x \le 2 \Rightarrow -8 < x \le -4{,}8.$

G27d Er geldt $g(p) - f(p) = 6 \;\vee\; f(p) - g(p) = 6.$

$g(p) - f(p) = 6$ (intersect) $\Rightarrow p \approx 0{,}39.$

$f(p) - g(p) = 6 \Rightarrow g(p) - f(p) = -6$ (intersect) $\Rightarrow p \approx 3{,}69.$

Dus $p \approx 0{,}39 \;\vee\; p \approx 3{,}69.$



G27e $f(x) = a$ heeft één oplossing en $g(x) = a$ heeft geen oplossing.

Aflezen in de grafieken: $-8 < a \le -4.$

G28a $2^{\frac{1}{2}x-2} = 32 = 2^5$

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

$\frac{1}{2}x = 7 \Rightarrow x = 14.$

G28b $3^{5-2x} = 81 = 3^4$

$5 - 2x = 4$

$-2x = -1 \Rightarrow x = \frac{1}{2}.$

G28c $5^{2x+1} = 2$ (^{5}log(... nemen)

$2x + 1 = {}^5\log(2)$

$2x = {}^5\log(2) - 1$

$x = \frac{1}{2} \cdot {}^5\log(2) - \frac{1}{2}.$

G28d $6^{2x} + 4 = 220$

$6^{2x} = 216 = 6^3$

$2x = 3 \Rightarrow x = 1\frac{1}{2}.$

G28e $3 \cdot 2^{5x-2} + 12 = 27$

$3 \cdot 2^{5x-2} = 15$

$2^{5x-2} = 5$ (^{2}log(... nemen)

$5x - 2 = {}^2\log(5)$

$5x = {}^2\log(5) + 2 \Rightarrow x = \frac{1}{5} \cdot {}^2\log(5) + \frac{2}{5}$

G28f $128 - 4 \cdot 3^{x+1} = 20$

$-4 \cdot 3^{x+1} = -108$

$3^{x+1} = 27 = 3^3$

$x + 1 = 3 \Rightarrow x = 2.$

G29a $^{2}\log(x^2-5)=3$ (2… nemen)
$x^2-5=2^3=8$
$x^2=13$
$x=-\sqrt{13} \vee x=\sqrt{13}$.

G29c $\log(10x+100)=3$ (10… nemen)
$10x+100=10^3=1000$
$10x=900$
$x=90$.

G29e $^{x}\log(16)=2$ (x… nemen)
$16=x^2$
$x=-4$ (vold. niet) $\vee$ $x=4$.

G29b $10^{0,02x}=5$ ($^{10}\log$(… nemen)
$0,02x=\log(5)$
$x=50\cdot\log(5)$.

```
0.02►Frac
            1/50
```

G29d $5-{}^{3}\log(x^2+6)=3$
$-{}^{3}\log(x^2+6)=-2$
$^{3}\log(x^2+6)=2$ (3… nemen)
$x^2+6=3^2=9$
$x^2=3 \Rightarrow x=-\sqrt{3} \vee x=\sqrt{3}$.

G29f $^{9}\log(3)=x$ (9… nemen)
$3=9^x=\left(3^2\right)^x=3^{2x}$
$1=2x \Rightarrow x=\frac{1}{2}$.

G30a $y={}^{2}\log(x)$ met D $=\langle 0, \rightarrow\rangle$ en V.A.: $x=0$
⇓ .....translatie (1, 0)
$f(x)={}^{2}\log(x-1)$ met $D_f=\langle 1, \rightarrow\rangle$ en V.A.: $x=1$.

$y={}^{2}\log(x)$ met D $=\langle 0, \rightarrow\rangle$ en V.A.: $x=0$
⇓ .....verm. t.o.v. de x-as met -1
$y=-{}^{2}\log(x)$ met D $=\langle 0, \rightarrow\rangle$ en V.A.: $x=0$
⇓ .....translatie (−1, 2)
$g(x)=-{}^{2}\log(x+1)+2$ met $D_g=\langle -1, \rightarrow\rangle$ en V.A.: $x=-1$.

G30b $^{2}\log(x-1)=\frac{1}{2}$ (2… nemen)
$x-1=2^{\frac{1}{2}}=\sqrt{2}$
$x=\sqrt{2}+1$.

```
√(2)+1
     2.414213562
2√(2)-1
     1.828427125
```

$-{}^{2}\log(x+1)+2=\frac{1}{2}$
$-{}^{2}\log(x+1)=-1\frac{1}{2}$
$^{2}\log(x+1)=1\frac{1}{2}$ (2… nemen)
$x+1=2^{1\frac{1}{2}}=2^1\cdot 2^{\frac{1}{2}}=2\cdot\sqrt{2}$
$x=2\cdot\sqrt{2}-1$.

Dus $AB=1+\sqrt{2}-(2\cdot\sqrt{2}-1)=1+\sqrt{2}-2\cdot\sqrt{2}+1=2-\sqrt{2}$.

G31a $t_b=80;\ t_l=20$ en $d=0,04 \Rightarrow \alpha_c=3,97(80-20)^{0,233}\cdot 0,04^{-0,3}\approx 27,1$.

```
3.97*(80-20)^0.2
33*0.04^-0.3
     27.06959454
```

G31b $t_b=70;\ t_l=22$ en $\alpha_c=23,4 \Rightarrow 23,4=3,97(70-22)^{0,233}\cdot d^{-0,3}$
$d^{-0,3}=\frac{23,4}{3,97(70-22)^{0,233}\cdot d^{-0,3}}=2,39... \Rightarrow d={}^{-3}\sqrt{Ans}\approx 0,055$ (m).

```
23.4/(3.97(70-22
)^0.233)
     2.391641839
(-0.3)×√Ans
     .0546612458
```

G31c $d=0,08;\ t_l=20$ en $\alpha_c=21,5 \Rightarrow 21,5=3,97(t_b-20)^{0,233}\cdot 0,08^{-0,3}$
$(t_b-20)^{0,233}=\frac{21,5}{3,97\cdot 0,08^{-0,3}}=2,5... \Rightarrow t_b={}^{0,233}\sqrt{Ans}+20\approx 74$ (°C).

```
21.5/(3.97*0.08^
-0.3)
     2.538487033
0.233×√Ans
     54.49707244
Ans+20
     74.49707244
```

G32a $S_{\text{André}}=12,62-0,2\cdot(52,2-50)=12,18$ en $S_{\text{Bernard}}=16,37-0,2\cdot(74,1-50)=11,55$.
Nu is de score van André de hoogste score.

```
12.62-0.2*2.2
           12.18
16.37-0.2*24.1
           11.55
```

G32b $12,62-k\cdot(52,2-50)=16,37-k\cdot(74,1-50)$
$12,62-2,2\cdot k=16,37-24,1\cdot k$
$21,9\cdot k=3,75 \Rightarrow k\approx 0,171$.

```
24.1-2.2
            21.9
16.37-12.62
            3.75
Ans/21.9
     .1712328767
```

G32c $S_{Cor}=14,32-0,1\cdot(G-50)=14,21 \Rightarrow -0,1\cdot(G-50)=-0,11 \Rightarrow G-50=1,1 \Rightarrow G=51,1$.
$T_{Cor}=14,32\cdot\left(\frac{50}{51,1}\right)^{\frac{2}{3}}\approx 14,11$.

```
14.32(50/51.1)^(
2/3)
     14.11375001
```

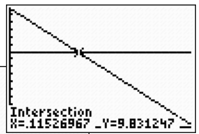
```
14.21-14.32
            -.11
Ans/-0.1
             1.1
Ans+50
            51.1
```

G32d $S=15,71-k\cdot(101-50)=15,71-51k$ en $T=15,71\cdot\left(\frac{50}{101}\right)^{\frac{2}{3}}$.
$S=T \Rightarrow 15,71-51k=15,71\cdot\left(\frac{50}{101}\right)^{\frac{2}{3}}$ (intersect of)
$-51k=15,71\cdot\left(\frac{50}{101}\right)^{\frac{2}{3}}-15,71 \Rightarrow k\approx 0,115$.
$S<T$ (zie een plot) $\Rightarrow k>0,115$.

```
15.71*(50/101)^(
2/3)
     9.831246954
Ans-15.71
    -5.878753046
Ans/-51
     .1152696676
```

```
Plot1 Plot2 Plot3
\Y1■15.71-51X
\Y2■15.71*(50/10
1)^(2/3)
\Y3=
```

```
WINDOW
 Xmin=0
 Xmax=.3
 Xscl=1
 Ymin=0
 Ymax=15.71
 Yscl=1
↓Xres=1
```



G33a Voor $x=18$ is $P=100 \Rightarrow 100=a\cdot\log(19) \Rightarrow a=\frac{100}{\log(19)}\approx 78,201$.

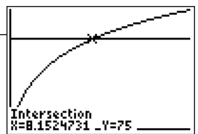
```
100/log(19)
     78.20114831
```

G33b $78\cdot\log(x+1)=75$ (intersect of)
$\log(x+1)=\frac{75}{78}$
$x+1=10^{\frac{75}{78}}$
$x=10^{\frac{75}{78}}-1\approx 8,15$. Dus op stand 8,2.

```
75/78
     .9615384615
10^Ans
     9.152473109
Ans-1
     8.152473109
```

```
Plot1 Plot2 Plot3
\Y1■78*log(X+1)
\Y2■75
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

```
WINDOW
 Xmin=0
 Xmax=18
 Xscl=0
 Ymin=0
 Ymax=100
 Yscl=0
 Xres=1
```



G33c $k=-1,3$ (bij een knop van 0 tot 6 zou de knop 1,7 aanwijzen) $\Rightarrow x=\frac{1,7}{6}\cdot 18=5,1$.
$P=78\cdot\log(5,1+1)\approx 61,3$.
Dus P is ongeveer 61%

```
1.7/6*18
             5.1
78*log(5.1+1)
     61.25572713
```