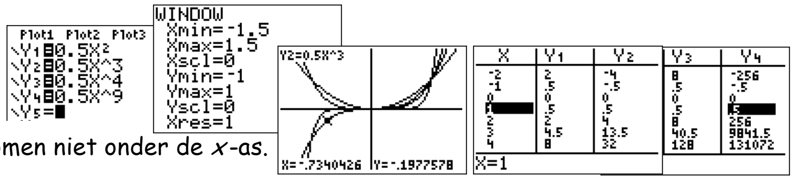
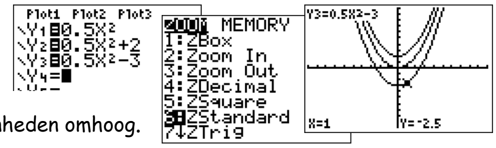


1a Zie de plot hiernaast.

1b Alle grafiek gaan door $O(0,0)$ en $(1;0,5)$.

1c De grafieken van $y = 0,5x^2$ en $y = 0,5x^6$ komen niet onder de x-as.

1d De grafieken van $y = 0,5x^2$ en $y = 0,5x^6$ hebben de y-as als symmetrieas.



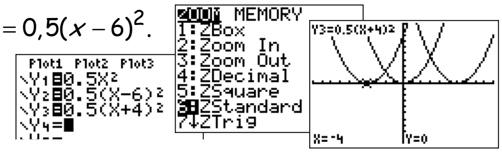
2a Zie de plot hiernaast.

2b $y_1 = 0,5x^2 \xrightarrow[\text{(2 omhoog)}]{\text{translatie }(0,2)} y_2 = 0,5x^2 + 2.$

Translatie $(0,2)$ is een verschuiving van 0 naar rechts en 2 eenheden omhoog.

2c $y_1 = 0,5x^2 \xrightarrow[\text{(3 omlaag)}]{\text{translatie }(0,-3)} y_3 = 0,5x^2 - 3.$

2d $y = 0,5x^2 \xrightarrow[\text{(6 omhoog)}]{\text{translatie }(0,6)} y = 0,5x^2 + 6.$



3a Zie de plot hiernaast; $y_1 = 0,5x^2 \xrightarrow[\text{(6 naar rechts)}]{\text{translatie }(6,0)} y_2 = 0,5(x-6)^2.$

3b $y_1 = 0,5x^2 \xrightarrow[\text{(4 naar links)}]{\text{translatie }(-4,0)} y_3 = 0,5(x+4)^2.$

3c $y = 0,5x^2 \xrightarrow[\text{(2 naar rechts)}]{\text{translatie }(2,0)} y = 0,5(x-2)^2.$

4a $y = -5(x-2)^2 + 5.$

4b $y = -5(x+3)^2 + 6.$

4c $y = -5(x-7)^2.$

4d $y = 4(x+5)^5 + 7.$

4e $y = 4x^5 - 10.$

4f $y = 4(x-320)^5 + 50.$

5a $y = 5x^2$ met top $(0, 0) \xrightarrow{\text{translatie }(4,7)} y = 5(x-4)^2 + 7$ met top $(4, 7)$.

5b $y = x^2$ met top $(0, 0) \xrightarrow{\text{translatie }(10,6)} y = (x-10)^2 + 6$ met top $(10, 6)$.

5c $y = -x^2$ met top $(0, 0) \xrightarrow{\text{translatie }(4,8)} y = -(x-4)^2 + 8$ met top $(4, 8)$.

5d $y = 3x^2$ met top $(0, 0) \xrightarrow{\text{translatie }(-2,14)} y = 3(x+2)^2 + 14$ met top $(-2, 14)$.

5e $y = -2x^5$ met punt van symmetrie $(0, 0) \xrightarrow{\text{translatie }(0,-10)} y = -2x^5 - 10$ met punt van symmetrie $(0, -10)$.

5f $y = -5x^2$ met top $(0, 0) \xrightarrow{\text{translatie }(-8,-3)} y = -5(x+8)^2 - 3$ met top $(-8, -3)$.

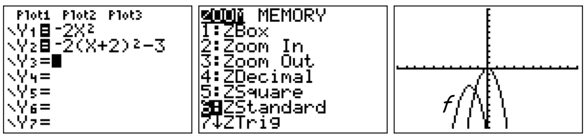
6a $y = 5(x-8)^6 - 3.$

6b $y = (x+4)^5.$

6c $y = -3x^4 + 7.$

6d $y = 3(x-6)^7 + 5.$

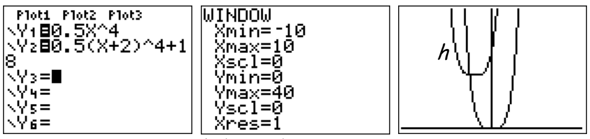
7a



$y = -2x^2 \xrightarrow{\text{transl. }(-2,-3)} f(x) = -2(x+2)^2 - 3.$

max. $y(0) = 0$ max. $f(-2) = -3.$

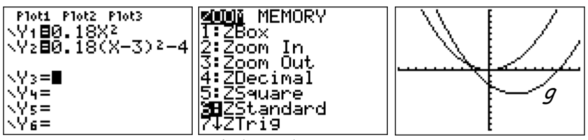
7c



$y = 0,5x^4 \xrightarrow{\text{transl. }(-2,18)} h(x) = 0,5(x+2)^4 + 18.$

min. $y(0) = 0$ min. $h(-2) = 18.$

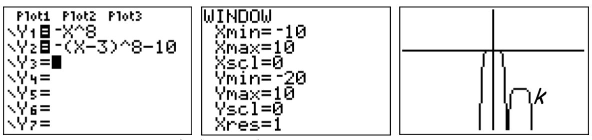
7b



$y = 0,18x^2 \xrightarrow{\text{transl. }(3,-4)} g(x) = 0,18(x-3)^2 - 4.$

min. $y(0) = 0$ min. $g(3) = -4.$

7d



$y = -x^8 \xrightarrow{\text{transl. }(3,-10)} k(x) = -(x-3)^8 - 10.$

max. $y(0) = 0$ max. $k(3) = -10.$

8a $y = -3x^2 \xrightarrow{\text{transl. }(5,8)} f(x) = -3(x-5)^2 + 8 \Rightarrow \text{max. } f(5) = 8.$

8b $y = 5x^2 \xrightarrow{\text{transl. }(0,7)} g(x) = 5x^2 + 7 \Rightarrow \text{min. } g(0) = 7.$

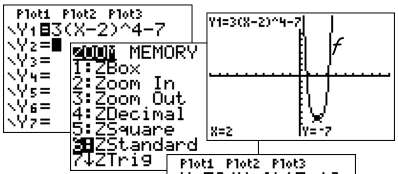
8c $y = 2x^2 \xrightarrow{\text{transl. }(-8,0)} h(x) = 2(x+8)^2 \Rightarrow \text{min. } h(-8) = 0.$

8d $y = 6x^2 \xrightarrow{\text{transl. } (8,12)} k(x) = 6(x-8)^2 + 12 \Rightarrow$ min. $k(8) = 12$.

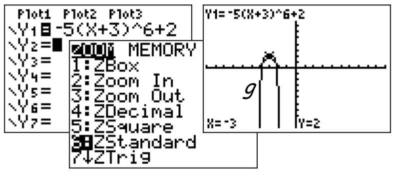
8e $y = -0{,}5x^2 \xrightarrow{\text{transl. } (100,0)} l(x) = -0{,}5(x-100)^2 \Rightarrow$ max. $l(100) = 0$.

8f $y = -0{,}4x^2 \xrightarrow{\text{transl. } (-0{,}15;\,-0{,}3)} m(x) = -0{,}4(x+0{,}15)^2 - 0{,}3 \Rightarrow$ max. $m(-0{,}15) = -0{,}3$.

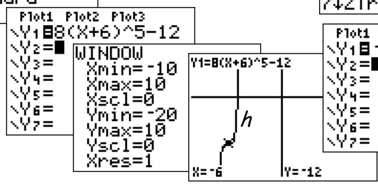
9a $f(x) = 3(x-2)^4 - 7 \Rightarrow$ top $(2,\ -7)$.
(maak een schets van de plot)



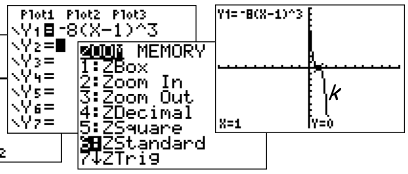
9b $g(x) = -5(x+3)^6 + 2 \Rightarrow$ top $(-3,\ 2)$.
(maak een schets van de plot)



9c $h(x) = 8(x+6)^5 - 12 \Rightarrow$ punt van symm. $(-6,\ -12)$.
(maak een schets van de plot)

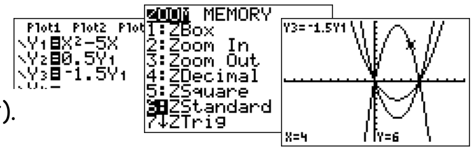


9d $k(x) = -8(x-1)^3 \Rightarrow$ punt van symm. $(1,\ 0)$.
(maak een schets van de plot)



10a Zie de plot hiernaast.

10b $y_1 = x^2 - 5x \xrightarrow{y\text{-waarden met 0,5 vermenigvuldigen}} y_2 = 0{,}5(x^2 - 5x)$.
$y_1 = x^2 - 5x \xrightarrow{y\text{-waarden met } -1{,}5 \text{ vermenigvuldigen}} y_3 = -1{,}5(x^2 - 5x)$.



11a $y = -3(x+5)^2 + 6 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -3} y = 9(x+5)^2 - 18$.
top $(-5,\ 6)$ top $(-5,\ -18)$

11b $y = 0{,}5(x+3)^2 + 5 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -4} y = -2(x+3)^2 - 20$.
top $(-3,\ 5)$ top $(-3,\ -20)$

11c $y = -3x^4 + 4 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 6} y = -18x^4 + 24$.
top $(0,\ 4)$ top $(0,\ 24)$

12a $y = -0{,}12x^2 \xrightarrow{\text{transl. } (-4,5)} y = -0{,}12(x+4)^2 + 5$.
top $(0,\ 0)$ top $(-4,\ 5)$

12b $y = 5(x-6)^2 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -3} y = -15(x-6)^2$.
top $(6,\ 0)$ top $(6,\ 0)$

12c $y = -x^2 + 7 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 4} y = -4x^2 + 28$.
top $(0,\ 7)$ top $(0,\ 28)$

12d $y = -1{,}5(x+4)^2 + 9 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -2} y = 3(x+4)^2 - 18$.
top $(-4,\ 9)$ top $(-4,\ -18)$

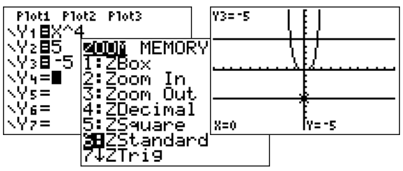
12d $y = 5(x-1)^3 \xrightarrow{\text{transl. } (0,-1)} y = 5(x-1)^3 - 1$
punt van symm. $(1,\ 0)$ punt van symm. $(1,\ -1)$

12d $y = -(x+1)^5 - 1 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -0{,}1} y = 0{,}1(x+1)^5 + 0{,}1$.
punt van symm. $(-1,\ -1)$ punt van symm. $(-1;\ 0{,}1)$

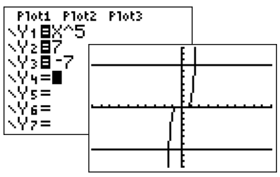
13a Spiegelen in de x-as komt op hetzelfde neer als verm. t.o.v. de x-as met -1. (de y-coördinaten tegengesteld nemen)

13b $y = 3(x-1)^2 - 6 \xrightarrow[\text{(spiegel in de } x\text{-as)}]{\text{verm. t.o.v. de } x\text{-as met } -1} y = -3(x-1)^2 + 6$.

14a De vergelijking $x^4 = 5$ heeft twee oplossingen.
(de y-as is symmetiras van de grafiek van $y = x^4$)
De vergelijking $x^4 = -5$ heeft geen oplossingen.
(de grafiek van $y = x^4$ komt niet onder de x-as)



14b De vergelijking $x^5 = 7$ heeft één oplossing.
De vergelijking $x^5 = -7$ heeft één oplossing.



15a $3x^6-1=5$
$3x^6=6$
$x^6=2$
$x=\sqrt[6]{2} \vee x=-\sqrt[6]{2}$
$x\approx 1{,}12 \vee x\approx -1{,}12.$

```
5+1
                 6
Ans/3
                 2
6*√2
       1.122462048
```

15b $\frac{1}{3}x^4+7=11$
$\frac{1}{3}x^4=4$
$x^4=12$
$x=\sqrt[4]{12} \vee x=-\sqrt[4]{12}$
$x\approx 1{,}86 \vee x\approx -1{,}86.$

```
11-7
                 4
Ans/(1/3)
                12
4*√12
       1.861209718
```

15c $-2x^5+8=15$
$-2x^5=7$
$x^5=\frac{7}{-2}=-3\frac{1}{2}$
$x=\sqrt[5]{-3\frac{1}{2}}$
$x\approx -1{,}28.$

```
15-8
                 7
Ans/-2
              -3.5
5*√-3.5
      -1.284735157
```

15d $3x^4-7=11$
$3x^4=18$
$x^4=6$
$x=\sqrt[4]{6} \vee x=-\sqrt[4]{6}$
$x\approx 1{,}57 \vee x\approx -1{,}57.$

```
11+7
                18
Ans/3
                 6
4*√6
        1.56508458
```

15e $5(2x-1)^6+7=12$
$5(2x-1)^6=5$
$(2x-1)^6=1$
$2x-1=1 \vee 2x-1=-1$
$2x=2 \vee 2x=0$
$x=1 \vee x=0.$

```
12-7
                 5
Ans/5
                 1
6*√1
                 1
```

15f $-\frac{1}{4}(3x-1)^3+8=10$
$-\frac{1}{4}(3x-1)^3=2$
$(3x-1)^3=-8$
$3x-1=\sqrt[3]{-8}=-2$
$3x=-1$
$x=-\frac{1}{3}.$

```
10-8
                 2
Ans/(-1/4)
                -8
3*√-8
                -2
```

16a 2 meter zijn 20 dm $\Rightarrow l=20$ (dm).
$20\cdot 4=80 \Rightarrow g=\frac{80}{2000}=0{,}04$ (kg/mm).
$d=0{,}0005\cdot 0{,}04\cdot 20^4=3{,}2$ (mm).

```
80/2000
               .04
0.0005*0.04*20^4
               3.2
```

16b $d=0{,}0005g\cdot 25^4=2{,}5$ (mm) $\Rightarrow g=\frac{2{,}5}{0{,}0005\cdot 25^4}=0{,}0128$. Het totale gewicht van de stenen is $0{,}0128\cdot 2500=32$ kg.

```
2.5/(0.0005*25^4
)
             .0128
Ans*2500
                32
```

16c 150 cm zijn 15 dm $\Rightarrow l=15$ (dm).
$d=0{,}0005\cdot 0{,}05\cdot 15^4\approx 1{,}27$ (mm).

```
0.0005*0.05*15^4
          1.265625
```

16d $d=0{,}0005\cdot 0{,}05\cdot l^4=2{,}2$ (mm) $\Rightarrow l^4=\frac{2{,}2}{0{,}0005\cdot 0{,}05}=88\,000 \Rightarrow l=\sqrt[4]{88\,000}\approx 17{,}2$ dm.

```
2.2/(0.0005*0.05
)
             88000
4*√Ans
        17.2234706
```

17a $\frac{1}{5}x^3-7=1$
$\frac{1}{5}x^3=8$
$x^3=40$
$x=\sqrt[3]{40}\approx 3{,}42.$

```
1+7
                 8
Ans/(1/5)
                40
3*√40
       3.419951893
```

17b $-3x^6+2=20$
$-3x^6=18$
$x^6=-6$
$x=\sqrt[6]{-6}$ (kan niet).

```
20-2
                18
Ans/-3
                -6
6*√-60
```

```
ERR:NONREAL ANS
1:Quit
2:Goto
```

17c $3(\frac{1}{2}x+1)^4+5=41$
$3(\frac{1}{2}x+1)^4=36$
$(\frac{1}{2}x+1)^4=12$
$\frac{1}{2}x+1=\sqrt[4]{12} \vee \frac{1}{2}x+1=-\sqrt[4]{12}$
$\frac{1}{2}x=-1+\sqrt[4]{12} \vee \frac{1}{2}x=-1-\sqrt[4]{12}$
$x=-2+2\sqrt[4]{12}\approx 1{,}72 \vee x=-2-2\sqrt[4]{12}\approx -5{,}72.$

```
41-5
                36
Ans/3
                12
4*√12
       1.861209718
```

```
Ans-1
      .8612097182
Ans/(1/2)
       1.722419436
```

```
-4*√12
      -1.861209718
Ans-1
      -2.861209718
Ans/(1/2)
      -5.722419436
```

17d $-(x+1)^5-1=8$
$-(x+1)^5=9$
$(x+1)^5=-9$
$x+1=\sqrt[5]{-9}$
$x=-1+\sqrt[5]{-9}\approx -2{,}55.$

```
8+1
                 9
Ans/-1
                -9
5*√-9
      -1.551845574
Ans-1
```

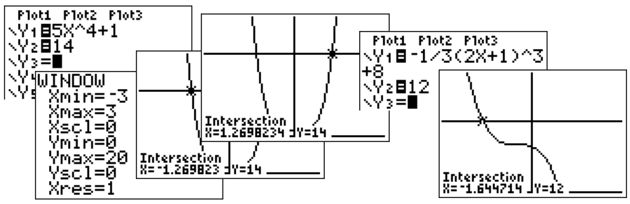
18a $f(-6)>g(-6),\ f(-1)<g(-1),\ f(2)<g(2)$ en $f(5)>g(5)$.

18b Bijvoorbeeld: -3, 0 en 3. (noem drie waarden tussen -5 en 4)

18c $f(x)<g(x)\Rightarrow -5<x<4$ (of x ligt tussen -5 en 4).

19a $5x^4+1=14$ (intersect of algebraïsch) $\Rightarrow x\approx -1{,}27 \vee x\approx 1{,}27.$
$5x^4+1>14$ (zie een plot) $\Rightarrow x<-1{,}27 \vee x>1{,}27.$

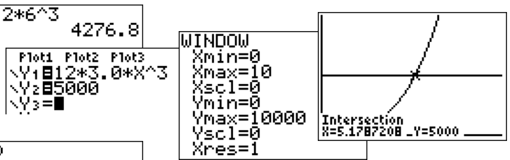
19b $-\frac{1}{3}(2x+1)^3+8=12$ (intersect of algebraïsch) $\Rightarrow x\approx -1{,}64.$
$-\frac{1}{3}(2x+1)^3+8\geq 12$ (zie een plot) $\Rightarrow x\leq -1{,}64.$



20a $K=2{,}2;\ x=6$ en $\Delta T=9\Rightarrow C=9\cdot 2{,}2\cdot 6^3\approx 4280$ (Kcal).

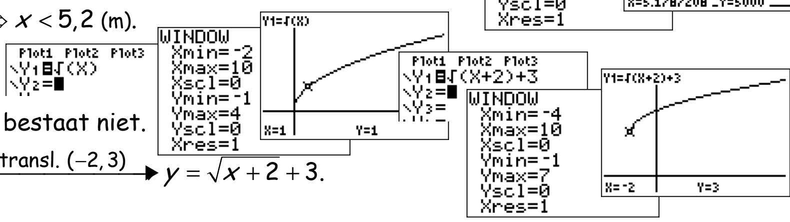
```
9*2.2*6^3
            4276.8
```

20b $C=5000;\ K=3{,}0$ en $\Delta T=12\Rightarrow 5000=12\cdot 3{,}0\cdot x^3.$
$5000=12\cdot 3{,}0\cdot x^3$ (intersect of algebraïsch) $\Rightarrow x\approx 5{,}1787.$
$12\cdot 3{,}0\cdot x^3<5000$ (zie een plot) $\Rightarrow x<5{,}2$ (m).



21a Zie de plot hiernaast.
De wortel uit een negatief getal bestaat niet.

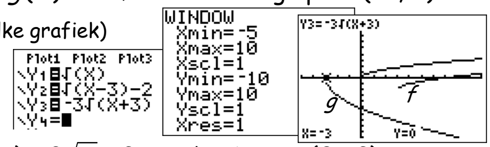
21b Zie de plot hiernaast. $y=\sqrt{x} \xrightarrow{\text{transl. }(-2,3)} y=\sqrt{x+2}+3.$



22a $y=\sqrt{x}\xrightarrow{\text{transl. }(3,-2)} f(x)=\sqrt{x-3}-2$ met beginpunt $(3,-2)$.
$y=\sqrt{x}\xrightarrow{\text{transl. }(-3,0)} y=\sqrt{x+3}\xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -3} g(x)=-3\sqrt{x+3}$ met beginpunt $(-3, 0)$.

22b Maak een schets van de plot hiernaast. (vermeld het beginpunt bij elke grafiek)

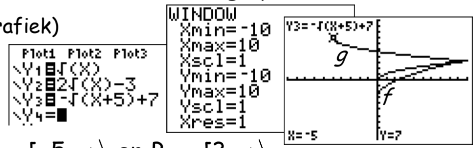
22c $D_f=[3,\rightarrow\rangle$; $B_f=[-2,\rightarrow\rangle$; $D_g=[-3,\rightarrow\rangle$ en $B_g=\langle\leftarrow,0]$.



23a $y=\sqrt{x}\xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 2} y=2\sqrt{x}\xrightarrow{\text{transl. }(0,-3)} f(x)=2\sqrt{x}-3$ met beginpunt $(0,-3)$.
$y=\sqrt{x}\xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -1} y=-\sqrt{x}\xrightarrow{\text{transl. }(-5,7)} g(x)=-\sqrt{x+5}+7$ met beginpunt $(-5, 7)$.

23b Maak een schets van de plot hiernaast. (vermeld het beginpunt bij elke grafiek)

23c $D_f=[0,\rightarrow\rangle$; $B_f=[-3,\rightarrow\rangle$; $D_g=[-5,\rightarrow\rangle$ en $B_g=\langle\leftarrow,7]$.



24a $y=\sqrt{x}\xrightarrow{\text{transl. }(-5,3)} f(x)=\sqrt{x+5}+3$ met beginpunt $(-5, 3)$; $D_f=[-5,\rightarrow\rangle$ en $B_f=[3,\rightarrow\rangle$.

24b $y=\sqrt{x}\xrightarrow{\text{transl. }(-3,-7)} g(x)=\sqrt{x+3}-7$ met beginpunt $(-3,-7)$; $D_g=[-3,\rightarrow\rangle$ en $B_g=[-7,\rightarrow\rangle$.

24c $y=\sqrt{x}\xrightarrow{\text{transl. }(-1,0)} y=\sqrt{x+1}\xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -2} h(x)=-2\sqrt{x+1}$.
Het beginpunt van de grafiek van h is $(-1, 0)$; $D_h=[-1,\rightarrow\rangle$ en $B_h=\langle\leftarrow,0]$.

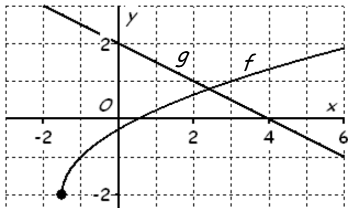
24d $y=\sqrt{x}\xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 3} y=3\sqrt{x}+1\xrightarrow{\text{transl. }(0,1)} k(x)=3\sqrt{x}+1$.
Het beginpunt van de grafiek van k is $(0, 1)$; $D_k=[0,\rightarrow\rangle$ en $B_k=[1,\rightarrow\rangle$.

24e $y=\sqrt{x}\xrightarrow{\text{transl. }(1,-1)} m(x)=\sqrt{x-1}-1$ met beginpunt $(1,-1)$; $D_m=[1,\rightarrow\rangle$ en $B_m=[-1,\rightarrow\rangle$.

24f $y=\sqrt{x}\xrightarrow{\text{transl. }(0,-3)} p(x)=\sqrt{x}-3$ met beginpunt $(0,-3)$; $D_p=[0,\rightarrow\rangle$ en $B_p=[-3,\rightarrow\rangle$.

25a Het beginpunt is $(2, 1)$.

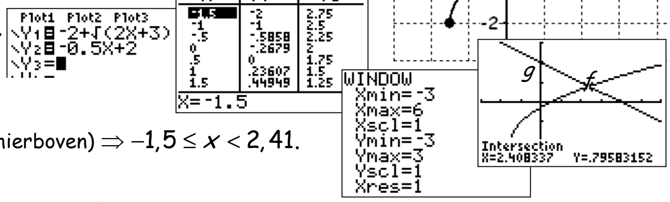
25b Het beginpunt kan niet worden aangewezen.
Dat komt doordat de trace-cursor met een vaste stapgrootte over de grafiek loopt.



26a $2x+3\geq 0\Rightarrow 2x\geq -3\Rightarrow x\geq -1\frac{1}{2}$. Dus $D_f=[-1\frac{1}{2},\rightarrow\rangle$. Het beginpunt is $(-1\frac{1}{2},-2)$.
De grafiek van g is de lijn door $(0, 2)$ en $(2, 1)$.
Maak met de GR een tabel en teken de grafieken.

26b $B_f=[-2,\rightarrow\rangle$.

26c $f(x)=g(x)$ (intersect) $\Rightarrow x\approx 2{,}41$.
$f(x)<g(x)$ (zie een plot, het domein en de berekening hierboven) $\Rightarrow -1{,}5\leq x<2{,}41$.



X	Y1	Y2
−1.5	−2	2.75
−1	−1	2.5
−.5	−.5858	2.25
0	−.2679	2
.5	0	1.75
1	.23607	1.5
1.5	.44949	1.25

X=−1.5

27a $8-4x\geq 0\Rightarrow -4x\geq -8\Rightarrow x\leq 2$. Dus $D_f=\langle\leftarrow,2]$; $B_f=[3,\rightarrow\rangle$ (gebruik eventueel een plot) en het beginpunt is $(2, 3)$.

27b $4x-8\geq 0\Rightarrow 4x\geq 8\Rightarrow x\geq 2$. Dus $D_g=[2,\rightarrow\rangle$; $B_g=[3,\rightarrow\rangle$ en het beginpunt is $(2, 3)$.

27c $2x+6\geq 0\Rightarrow 2x\geq -6\Rightarrow x\geq -3$. Dus $D_h=[-3,\rightarrow\rangle$; $B_h=\langle\leftarrow,5]$ en het beginpunt is $(-3, 5)$.

27d $x\geq 0$. Dus $D_k=[0,\rightarrow\rangle$; $B_k=\langle\leftarrow,3]$ en het beginpunt is $(0, 3)$.

```
3+√(8-4*2)
                 3
3+√(4*2-8)
                 3
5-√(2*-3+6)
                 5
-2*√(0)+3
                 3
```

28a $y=5\sqrt{x}\xrightarrow{\text{transl. }(5,-1)} f(x)=\sqrt{x-5}-1$ met beginpunt $(5,\ -1)$.

28b $y=\sqrt{5x}\xrightarrow{\text{transl. }(-1,3)} g(x)=\sqrt{5(x+1)}+3$ met beginpunt $(-1, 3)$.

28c $y=2\sqrt{x}-1\xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 3} h(x)=6\sqrt{x}-3$ met beginpunt $(0,\ -3)$.

28d $y=\sqrt{2x}-1\xrightarrow{\text{transl. }(-3,0)} j(x)=\sqrt{2(x+3)}-1$ met beginpunt $(-3,\ -1)$.

29a Omdat $\sqrt{x-3}$ niet negatief wordt.

```
√(28-3)
                 5
```

```
√(64)-3
                 5
```

29b $\sqrt{x-3}=5$ (kwadrateren) $\Rightarrow x-3=25\Rightarrow x=28$ (voldoet) en $\sqrt{x}-3=5\Rightarrow\sqrt{x}=8$ (kwadrateren) $\Rightarrow x=64$ (voldoet).

30a $\sqrt{2x-1}=3$ (kwadrateren)
$2x-1=9$
$2x=10$
$x=5$ (voldoet).

```
3²            9
Ans+1        10
Ans/2         5
√(2*5-1)      3
```

30b $7+\sqrt{2x-1}=3$
$\sqrt{2x-1}=-4$
geen opl. (een wortel kan niet negatief zijn).

```
3-7          -4
```

30c $3\sqrt{x}-1=7$
$3\sqrt{x}=8$
$\sqrt{x}=\frac{8}{3}$ (kwadrateren)
$x=\frac{64}{9}$ (voldoet).

```
7+1                   8
Ans/3       2.666666667
Ans²▸Frac          64/9
3√(64/9)-1            7
```

30d $2+\sqrt{x}=9$
$\sqrt{x}=7$ (kwadrateren)
$x=49$ (voldoet).

```
9-2           7
Ans²         49
2+√(49)       9
```

30e $5+3\sqrt{x}=41,3$
$3\sqrt{x}=36,3$
$\sqrt{x}=12,1$ (kwadrateren)
$x=146,41$ (voldoet).

```
41.3-5          36.3
Ans/3           12.1
Ans²          146.41
5+3√(146.41)    41.3
```

30f $2-4\sqrt{x}=-8$
$-4\sqrt{x}=-10$
$\sqrt{x}=2,5$ (kwadrateren)
$x=6,25$ (voldoet).

```
-8-2          -10
Ans/-4        2.5
Ans²         6.25
2-4√(6.25)     -8
```

31a $5-3\sqrt{x}=-7$
$-3\sqrt{x}=-12$
$\sqrt{x}=4$
$x=16$ (voldoet).

```
-7-5         -12
Ans/-3         4
Ans²          16
5-3√(16)      -7
```

31b $2\sqrt{5-2x}=16$
$\sqrt{5-2x}=8$
$5-2x=64$
$-2x=59$
$x=-29,5$ (voldoet).

```
16/2              8
Ans²             64
Ans-5            59
Ans/-2        -29.5
2√(5-2*-29.5)    16
```

31c $1-0,5\sqrt{1-x}=-7$
$-0,5\sqrt{1-x}=-8$
$\sqrt{1-x}=16$
$1-x=256$
$-x=255$
$x=-255$ (voldoet).

```
-7-1                -8
Ans/-0.5            16
Ans²               256
Ans-1              255
Ans/-1            -255
1-0.5√(1--255)      -7
```

32a $q=20 \Rightarrow K=15+\sqrt{2\cdot 20+30}\approx 23,37$ (€).

```
15+√(2*20+30)
          23.36660027
```

32b $15+\sqrt{2q+30}=25$
$\sqrt{2q+30}=10$
$2q+30=100$
$2q=70$
$q=35$

```
25-15              10
Ans²              100
Ans-30             70
Ans/2              35
15+√(2*35+30)      25
```

32c $R=p\cdot q=1,65q$ (€).

32d $W=R-K=1,65q-(15+\sqrt{2q+30})=1,65q-15-\sqrt{2q+30}$ (€).

33a $g=10$ en $w=6 \Rightarrow S=\frac{1000\cdot(6-\sqrt{6})}{10}\approx 355.$

```
1000*(6-√(6))/10
          355.0510257
```

33b $S_{\text{Ton}}=\frac{1000\cdot(5-\sqrt{5})}{10}\approx 276$ en $S_{\text{Lex}}=\frac{1000\cdot(6-\sqrt{6})}{12}\approx 296 \Rightarrow$ Lex heeft de hoogste score.

```
1000*(5-√(5))/10
          276.3932023
1000*(6-√(6))/12
          295.8758548
```

33c $S=\frac{1000\cdot(w-\sqrt{w})}{16}$ (TABLE) $\Rightarrow$ de maximale score is $S(16)=750$.

```
Plot1 Plot2 Plot3
\Y1=1000*(X-√(X))/16
\Y2=
```

X	Y1
10	427.36
11	480.21
12	533.49
13	587.15
14	641.15
15	695.44
16	750

X=16

33d $S=\frac{1000\cdot(w-\sqrt{w})}{16}=375$ (TABLE) $\Rightarrow w=9$. Dus Eline 9 partijen gewonnen.

X	Y1
7	272.14
8	323.22
9	375
10	427.36
11	480.21
12	533.49
13	587.15

Y1=375

34a $l=8,6 \Rightarrow v_t=4,8\cdot\sqrt{8,6}\approx 14,08$ (km/u) en $l=5,8 \Rightarrow v_t=4,8\cdot\sqrt{5,8}\approx 11,56$ (km/u).
Dus $\frac{14,08-11,56}{11,56}\times 100\%\approx 21,8\%$ meer.

```
4.8*√(8.6)
          14.07636317
4.8*√(5.8)
          11.5599308
(4.8*√(8.6)-Ans)/Ans*100
          21.76857643
```

34b Bij schip II is $v_t=4,8\cdot\sqrt{l_{II}} \Rightarrow$ bij schip I is $v_t=4,8\cdot\sqrt{2l_{II}}=4,8\cdot\sqrt{2}\cdot\sqrt{l_{II}}$.
Dus de rompsnelheid bij schip I is $\sqrt{2}\approx 14$ keer zo groot als bij schip II.

```
√(2)      1.414213562
```

34c $v_t=4,8\cdot\sqrt{l}=24 \Rightarrow \sqrt{l}=\frac{24}{4,8}=5 \Rightarrow l=25$ (m).

```
24/4.8        5
Ans²         25
```

34d $v_t=4,8\cdot\sqrt{l}=10 \Rightarrow \sqrt{l}=\frac{10}{4,8} \Rightarrow l\approx 4,3$ (m) en $v_t=4,8\cdot\sqrt{l}=20 \Rightarrow \sqrt{l}=\frac{20}{4,8} \Rightarrow l\approx 17,4$ (m).
De waterlijn heeft een lengte tussen 4,3 en 17,4 meter.

```
(10/4.8)²
          4.340277778
(20/4.8)²
          17.36111111
```

35a Zie de plot hiernaast.

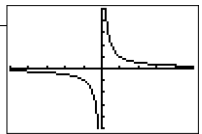
35b Als je x steeds groter kiest, komt de waarde van $f(x)$ steeds dichter bij 0.

35c Voor $x<0$ en heel dicht bij 0 wordt $f(x)$ heel groot negatief.
Voor $x>0$ en heel dicht bij 0 wordt $f(x)$ heel groot positief.

35d $\frac{1}{0}=\ldots$ zou betekenen $\ldots\times 0=1$ (hieraan voldoet geen enkel getal).

```
Plot1 Plot2 Plot3
\Y1=1/X
\Y2=
```

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



X	Y1
-.05	-20
-.04	-25
-.03	-33.33
-.02	-50
-.01	-100
0	ERROR
.01	100

Y1=1/X

36 $y=\frac{1}{x} \xrightarrow{\text{transl. }(-2,-3)} f(x)=\frac{1}{x+2}-3.$

36b De verticale asymptoot (V.A.) is $x=-2$ en de horizontale asymptoot (H.A.) is $y=-3$.

37a V.A.: $x = 5$ en H.A.: $y = 6$.

37b V.A.: $x = -1$ en H.A.: $y = -3$.

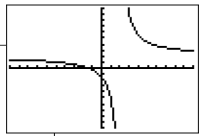
37c V.A.: $x = 3$ en H.A.: $y = 0$ (de x-as).

37d V.A.: $x = 0$ (de y-as) en H.A.: $y = -3$.

38 $y = \frac{1}{x} \xrightarrow{\text{transl. }(3,-2)} f(x) = \frac{1}{x-3} - 2$. (met V.A.: $x = 3$ en H.A.: $y = -2$)

```
Plot1 Plot2 Plot3
\Y1■(4X+6)/(2X-4)
)
\Y2=■
```

```
ZOOM MEMORY
1:ZBox
2:Zoom In
3:Zoom Out
4:ZDecimal
5:ZSquare
6:ZStandard
```



```
X     Y1
0     -1.5
100   2.0714
200   2.0354
300   2.0235
400   2.0176
500   2.0141
600   2.0117
X=0
```

```
X     Y1
1.95  -138
1.96  -173
1.97  -231.3
1.98  -348
1.99  -698
2     ERROR
2.01  702
Y1■(4X+6)/(2X-4)
```

39a Zie de plot hiernaast. (denk op de GR aan de haakjes in de teller en in de noemer)

39b Als je x steeds groter kiest, komt de waarde van $f(x)$ steeds dichter bij 2.
De grafiek van f heeft als horizontale asymptoot de lijn $y = 2$.

39c $f(x)$ wordt heel groot positief of juist heel goot negatief als je x dicht bij 2 kiest.
De grafiek van f heeft als verticale asymptoot de lijn $x = 2$.

40a V.A.: $x = -3$ en H.A.: $y = 2$. 40b V.A.: $x = -2{,}5$ en H.A.: $y = 1$. 40c V.A.: $x = 1{,}5$ en H.A.: $y = 0$.

41a $t = 3 \Rightarrow N = 1200 - \frac{800}{1+2\cdot 3} \approx 1086$ (of 1085 insecten).

41b $t = 5 \Rightarrow N = 1200 - \frac{800}{1+2\cdot 5} \approx 1127$ (insecten).
De toename is $\frac{1127-1086}{1086} \times 100\% \approx 3{,}8\%$ (of $\frac{1127-1085}{1085} \times 100\% \approx 3{,}9\%$).

```
1200-800/(1+2*3)
        1085.714286
1200-800/(1+2*5)
        1127.272727
```

```
1127-1086
                 41
Ans/1086
       .0377532228
Ans*100
        3.775322284
```

```
1127-1085
                 42
Ans/1085
       .0387096774
Ans*100
        3.870967742
```

41c $t = 4 \Rightarrow N = 1200 - \frac{800}{1+2\cdot 4} \approx 1111$ (insecten).
De vijfde dag (loopt van $t = 4$ tot $t = 5$) zijn er $1127 - 1111 = 16$ insecten bijgekomen.

```
1200-800/(1+2*4)
        1111.111111
1127-1111
                 16
```

41d $t = 100 \Rightarrow N = 1200 - \frac{800}{1+2\cdot 100} \approx 1196$ (insecten).
$t = 1000 \Rightarrow N = 1200 - \frac{800}{1+2\cdot 1000} \approx 1199{,}6$ (insecten).
$t = 10\,000 \Rightarrow N = 1200 - \frac{800}{1+2\cdot 10000} \approx 1199{,}96$ (insecten). Dus $G = 1200$.

```
1200-800/(1+2*10
0)
          1196.0199
1200-800/(1+2*10
00)
          1199.6002
```

```
1200-800/(1+2*10
000)
        1199.960002
```

42a $K = \frac{55x+30}{2x}$ en H.A.: $K = \frac{55}{2} = 27{,}5$ (als je x steeds groter kiest, komt K steeds dichter bij 27,5).
De kosten per m^2/jaar komen niet beneden € 27,50.

```
(55*100+30)/(2*1
00)
              27.65
(55*10000+30)/(2
*10000)
            27.5015
```

42b $x = 2 \Rightarrow K = \frac{55\cdot 2+30}{2\cdot 2} = 35$ (€/m^2/jaar). De firma H&M betaalt per jaar $2\,000 \cdot 35 = 70\,000$ (€).

```
(55*2+30)/(2*2)
                 35
Ans*2000
              70000
```

42c De totale oppervlakte is $3 \cdot 20 \cdot 40 = 2\,400$ m^2.
$x = 2{,}4 \Rightarrow K = \frac{55\cdot 2{,}4+30}{2\cdot 2{,}4} = 33{,}75$ (€/m^2/jaar). De school betaalt per jaar $2\,400 \cdot 33{,}75 = 81\,000$ (€).

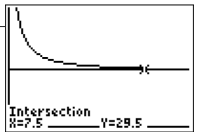
```
3*20*40
               2400
(55*2.4+30)/(2*2
.4)
              33.75
Ans*2400
              81000
```

42d Nee, de kosten per m^2 nemen af, maar de totale schoonmaakkosten nemen juist toe.

42e $K = \frac{55x+30}{2x} = 29{,}50$ (intersect) $\Rightarrow x = 7{,}5$.
De oppervlakte van dit bedrijf is meer dan $7\,500$ m^2.

```
Plot1 Plot2 Plot3
\Y1■(55X+30)/(2X
)
\Y2■29.5
\Y3=■
```

```
WINDOW
 Xmin=0
 Xmax=10
 Xscl=0
 Ymin=0
 Ymax=60
 Yscl=0
 Xres=1
```



42f $K^* = 1000x \cdot \frac{55x+30}{2x}$ $(= 500 \cdot (55x+30) = 27500x + 15000)$.

```
500*55
              27500
500*30
              15000
```

43a $\frac{3}{a} = \frac{2}{5} \Rightarrow 3 \cdot 5 = 2 \cdot a \Rightarrow 2a = 15 \Rightarrow a = 7{,}5$.

43b $\frac{5}{x} = \frac{3}{12} \Rightarrow 5 \cdot 12 = 3 \cdot x \Rightarrow 3x = 60 \Rightarrow x = 20$.

44a $\frac{x}{x+1} = \frac{2}{1} \Rightarrow x = 2 \cdot (x+1) \Rightarrow x = 2x + 2 \Rightarrow -x = 2 \Rightarrow x = -2$.

44b $\frac{3}{x+1} = \frac{1}{3} \Rightarrow x + 1 = 9 \Rightarrow x = 8$.

44c $5 + \frac{x-2}{2x+6} = 8 \Rightarrow \frac{x-2}{2x+6} = \frac{3}{1} \Rightarrow 3(2x+6) = x - 2 \Rightarrow 6x + 18 = x - 2 \Rightarrow 5x = -20 \Rightarrow x = -4$.

44d $8 + \frac{2x-3}{x-3} = 8 \Rightarrow \frac{2x-3}{x-3} = 0$ (teller = 0) $\Rightarrow 2x - 3 = 0 \Rightarrow 2x = 3 \Rightarrow x = 1\frac{1}{2}$.

44e $1 - \frac{5}{x} = 0{,}8 \Rightarrow -\frac{5}{x} = -0{,}2 \Rightarrow \frac{5}{x} = \frac{0{,}2}{1} \Rightarrow 0{,}2x = 5$ (keer 5) $\Rightarrow x = 25$.

44f $\frac{5-2x}{x-1} = 0$ (teller = 0) $\Rightarrow 5 - 2x = 0 \Rightarrow -2x = -5 \Rightarrow x = 2\frac{1}{2}$.

45a $4 + \frac{2x-6}{x+1} = 7 \Rightarrow \frac{2x-6}{x+1} = \frac{3}{1} \Rightarrow 3 \cdot (x+1) = 2x - 6 \Rightarrow 3x + 3 = 2x - 6 \Rightarrow x = -9$.

45b $\frac{12x+10}{3x} = 7\frac{1}{3} \Rightarrow \frac{12x+10}{3x} = \frac{22}{3} \Rightarrow 3(12x+10) = 66x \Rightarrow 36x + 30 = 66x \Rightarrow -30x = -30 \Rightarrow x = 1$.

45c $100 - \frac{5}{x-1} = 98 \Rightarrow -\frac{5}{x-1} = -2 \Rightarrow \frac{5}{x-1} = \frac{2}{1} \Rightarrow 2 \cdot (x-1) = 5 \Rightarrow 2x - 2 = 5 \Rightarrow 2x = 7 \Rightarrow x = 3\frac{1}{2}$.

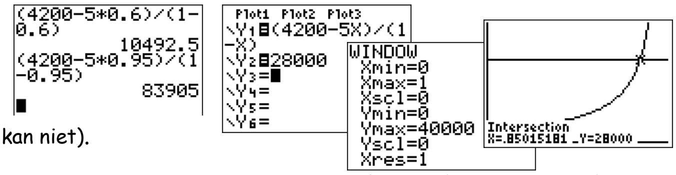
45d $100\cdot\frac{2x-3}{2x}=90 \Rightarrow \frac{2x-3}{2x}=0,9 \Rightarrow \frac{2x-3}{2x}=\frac{0,9}{1} \Rightarrow 2x-3=2\cdot 0,9x \Rightarrow 2x-3=1,8x \Rightarrow 0,2x=3$ (keer 5) $\Rightarrow x=15$.

45e $15\cdot\frac{0,2x-20}{x+8}=0 \Rightarrow \frac{0,2x-20}{x+8}=0$ (teller = 0) $\Rightarrow 0,2x-20=0 \Rightarrow 0,2x=20$ (keer 5) $\Rightarrow x=100$.

45f $\frac{5+x}{2x-1}=\frac{18}{25} \Rightarrow 25(5+x)=18(2x-1) \Rightarrow 125+25x=36x-18 \Rightarrow -11x=-143 \Rightarrow x=\frac{143}{11}=13$.

46a $p=0,6 \Rightarrow K=\frac{4200-5\cdot 0,6}{1-0,6}=10\,492,50$ (€).

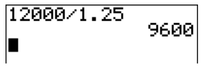
46b $p=0,95 \Rightarrow K=\frac{4200-5\cdot 0,95}{1-0,95}=83\,905$ (€).



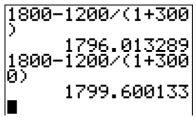
46c $p=1 \Rightarrow$ de noemer wordt nul (delen door nul kan niet).

46d $K=\frac{4200-5p}{1-p}=\frac{20000}{1}$ (algebraïsch of intersect) $\Rightarrow p\approx 0,850$. Dus (ongeveer) 85% van de markt wordt bereikt.

47 $GK=\frac{12q+12000}{q}=\frac{13,25}{1} \Rightarrow 13,25q=12q+12\,000 \Rightarrow 1,25q=12\,000 \Rightarrow q=9\,600$.

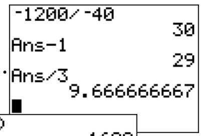


48a $\left.\begin{matrix} N(100)\approx 1796 \\ N(1000)\approx 1799,6 \end{matrix}\right\} \Rightarrow$ H.A.: $N=1800$.



Betekenis: N komt niet boven de 1800 uit, maar komt er wel heel dicht bij.

48b $N=1800-\frac{1200}{1+3t}=1760$ (intersect of) $\Rightarrow -\frac{1200}{1+3t}=-40 \Rightarrow \frac{-1200}{-40}=1+3t \Rightarrow 29=3t \Rightarrow t=\frac{29}{3}=9\frac{2}{3}$.

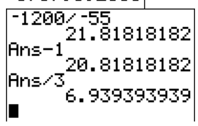


1 mei loopt van $t=0$ tot $t=1$ (gegeven) $\Rightarrow$ van $t=9$ tot $t=10$ is 10 mei $\Rightarrow$ op 10 mei.

48c 4 mei loopt van $t=3$ tot $t=4$. $N(3)=1800-\frac{1200}{10}=1680$ en $N(4)=1800-\frac{1200}{13}\approx 1708$.

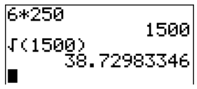
Dus er zijn op 4 mei $1708-1680=28$ insecten bij gekomen.

48d $N=1800-\frac{1200}{1+3t}=1745$ (intersect of) $\Rightarrow -\frac{1200}{1+3t}=-55 \Rightarrow \frac{-1200}{-55}=1+3t \Rightarrow 3t=\frac{1200}{55}-1 \Rightarrow t\approx 7$.



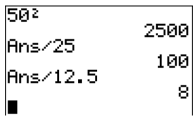
$N=1680 \Rightarrow t=3$ (hierboven berekend). Het duurt dus (ongeveer) $7-3=4$ dagen.

49a $L=6 \Rightarrow 6=\frac{v^2}{250} \Rightarrow v^2=6\cdot 250=1500 \Rightarrow v=\sqrt{1500}\approx 39$ (km/u).

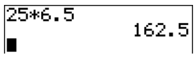


49b $f=4 \Rightarrow L=\frac{v^2}{25\cdot 4}=\frac{v^2}{100}=\frac{1}{100}v^2$.

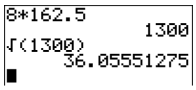
49c $v=50$ en $L=12,5 \Rightarrow 12,5=\frac{50^2}{25f} \Rightarrow 12,5=\frac{2500}{25f} \Rightarrow \frac{12,5}{1}=\frac{100}{f} \Rightarrow 12,5f=100 \Rightarrow f=\frac{100}{12,5}=8$.



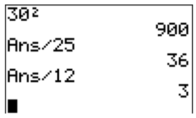
50a $f=6,5 \Rightarrow L=\frac{v^2}{25\cdot 6,5}=\frac{v^2}{162,5}=\frac{1}{162,5}v^2$.



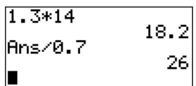
50b $L=8 \Rightarrow \frac{8}{1}=\frac{v^2}{162,5} \Rightarrow v^2=8\cdot 162,5=1300 \Rightarrow v=\sqrt{1300}\approx 36$ (km/u).



50c $v=30$ en $L=12 \Rightarrow 12=\frac{30^2}{25f} \Rightarrow 12=\frac{900}{25f} \Rightarrow \frac{12}{1}=\frac{36}{f} \Rightarrow 12f=36 \Rightarrow f=\frac{36}{12}=3$.



51a $a=5$ en $P=0,08 \Rightarrow 0,08=\frac{2\cdot 5}{5+4b} \Rightarrow 0,08=\frac{10}{5+4b} \Rightarrow 5+4b=\frac{10}{0,08}=\frac{1000}{8}=125 \Rightarrow 4b=120 \Rightarrow b=30$.

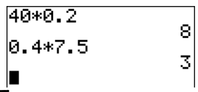


51b $b=3,5$ en $P=1,3 \Rightarrow 1,3=\frac{2a}{a+4\cdot 3,5} \Rightarrow \frac{1,3}{1}=\frac{2a}{a+14} \Rightarrow 2a=1,3(a+14) \Rightarrow 2a=1,3a+18,2 \Rightarrow 0,7a=18,2 \Rightarrow a=26$.

51c Voor grote waarden van a geldt: $P=\frac{2a}{a+4b}\approx\frac{2a}{a}=2 \Rightarrow$ de grenswaarde is 2.

51d Voor grote a (neem a miljarden keer zo groot als $4b$) valt $4b$ in het niets $\Rightarrow$ de grenswaarde is voor elke (vaste) b.

52a $p=0,2$ en $L=7,5 \Rightarrow 7,5=\frac{40\cdot 0,2\cdot q}{2\cdot 0,2+q} \Rightarrow \frac{7,5}{1}=\frac{8q}{0,4+q} \Rightarrow 8q=3+7,5q \Rightarrow 0,5q=3$ (keer 2) $\Rightarrow q=6$.



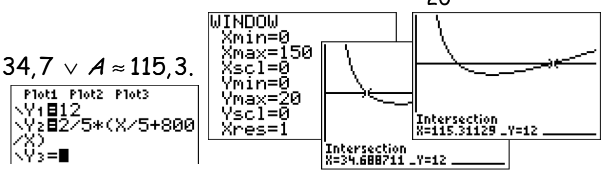
52b $q=10$ en $L=150 \Rightarrow 150\frac{40\cdot p\cdot 10}{2p+10} \Rightarrow \frac{150}{1}=\frac{400p}{2p+10} \Rightarrow 400p=300p+1500 \Rightarrow 100q=1500 \Rightarrow p=15$.

52c $p=15 \Rightarrow L=\frac{40\cdot 15\cdot q}{2\cdot 15+q}=\frac{600q}{30+q}$ (voor grote waarden van q) $\approx\frac{600q}{q}=600$. Dus de grenswaarde is 600.

52d $L=\frac{40pq}{2p+q}$ (voor grote waarden van p en q vast) $\approx\frac{40pq}{2p}=20q$. Dus de grenswaarde is $20q=260 \Rightarrow q=\frac{260}{20}=13$.

53a $F=12,\ n=5$ en $L=8 \Rightarrow 12=\frac{2}{5}\left(\frac{A}{5}+\frac{100\cdot 8}{A}\right)$ (intersect) $\Rightarrow A\approx 34,7 \vee A\approx 115,3$.

De tekst bestaat uit 35 of uit 115 woorden.



53b $F = 12{,}8;\ A = 600$ en $L = 48 \Rightarrow 12{,}8 = \frac{2}{5}\left(\frac{600}{n} + \frac{100 \cdot 48}{600}\right)$ (algebraïsch!!!)
$12{,}8 = \frac{2}{5}\left(\frac{600}{n} + 8\right) \Rightarrow 32 = \frac{600}{n} + 8 \Rightarrow 24 = \frac{600}{n} \Rightarrow n = \frac{600}{24} = 25.$

53c $A = 1500$ en $L = 120 \Rightarrow F = \frac{2}{5}\left(\frac{1500}{n} + \frac{100 \cdot 120}{1500}\right) = \frac{2}{5}\left(\frac{1500}{n} + \frac{12000}{1500}\right) = \frac{2}{5}\left(\frac{1500}{n} + 8\right) = \frac{600}{n} + 3{,}2.$

```
12000/1500
                8
1500/5*2
              600
8/5*2
              3.2
```

53d Een zin bestaat uit minstens 3 woorden $\Rightarrow$ het aantal zinnen n hoogstens $\frac{1500}{3} = 500.$
$n = 500 \Rightarrow F = \frac{600}{500} + 3{,}2 = 4{,}4$ en $n = 30$ (30 zinnen van gemiddeld 50 woorden) $\Rightarrow F = \frac{600}{50} + 3{,}2 = 15{,}2.$
Dus F ligt tussen 4,4 en 15,2.

```
600/500+3.2
              4.4
600/50+3.2
             15.2
```

54a $v = 50 \Rightarrow C = \frac{45g}{4 \cdot 50} - 1{,}25 = \frac{45g}{200} - 1{,}25 = 0{,}225g - 1{,}25.$

```
45/200
             .225
```

54b $g = \frac{1}{2}v \Rightarrow C = \frac{45 \cdot \frac{1}{2}v}{4 \cdot v} - 1{,}25 = \frac{22{,}5v}{4v} - 1{,}25 = 5{,}625 - 1{,}25 = 4{,}375 \approx 4{,}4.$

```
22.5/4
            5.625
Ans-1.25
            4.375
```

54c $v = 18$ en $C = 7{,}5 \Rightarrow 7{,}5 = \frac{45g}{4 \cdot 18} - 1{,}25 \Rightarrow \frac{8{,}75}{1} = \frac{45g}{72} \Rightarrow 45g = 8{,}75 \cdot 72 \Rightarrow g = 14.$
(13 of 15 vragen goed geeft geen 7,5 $\Rightarrow$) Florien had 14 vragen goed.

```
8.75*72/45
               14
45*15/72-1.25
            8.125
45*13/72-1.25
            6.875
```

54d $g = 11$ en $C = 7 \Rightarrow 7 = \frac{45 \cdot 11}{4v} - 1{,}25 \Rightarrow \frac{8{,}25}{1} = \frac{495}{4v} \Rightarrow 8{,}25 \cdot 4v = 495 \Rightarrow v = 15.$
(een toets van 14 of 16 vragen geeft geen 7 $\Rightarrow$) De toets bestond uit 15 vragen.

```
495/(8.25*4)
               15
495/(4*14)-1.25
      7.589285714
495/(4*16)-1.25
         6.484375
```

54e $g = v - 6$ en $C = 7{,}3 \Rightarrow 7{,}3 = \frac{45 \cdot (v-6)}{4v} - 1{,}25 \Rightarrow \frac{8{,}55}{1} = \frac{45 \cdot (v-6)}{4v} \Rightarrow 8{,}55 \cdot 4v = 45(v-6) \Rightarrow$
$34{,}2v = 45v - 270 \Rightarrow -10{,}8v = -270 \Rightarrow v = 25.$
(een toets van 24 of 26 vragen geeft geen 7,3 $\Rightarrow$) De toets bestond uit 25 vragen.

```
8.55*4
             34.2
270/10.8
               25
```

```
45(24-6)/(4*24)-
1.25
           7.1875
45(26-6)/(4*26)-
1.25  7.403846154
```

55a $DL = 6 \cdot 10 = 60.$

55b $DL = 5 \cdot 10 + 2 = 52$ en $DLE = 48 \Rightarrow LA = 100 \cdot \left(1 - \frac{48}{52}\right) \approx 8.$

```
100*(1-48/52)
      7.692307692
```

55c $DL = 5 \cdot 10 + 7 = 57$ en $LA = 3 \Rightarrow 3 = 100 \cdot \left(1 - \frac{DLE}{57}\right) \Rightarrow 0{,}03 = 1 - \frac{DLE}{57} \Rightarrow -0{,}97 = -\frac{DLE}{57} \Rightarrow DLE \approx 55.$

```
-0.97*-57
            55.29
```

55d LA maximaal $\Rightarrow DLE = 0 \Rightarrow LA = 100 \cdot \left(1 - \frac{0}{DL}\right) = 100 \cdot 1 = 100.$

55e $DLE = 42$ en $LA = 25 \Rightarrow 25 = 100 \cdot \left(1 - \frac{42}{DL}\right) \Rightarrow 0{,}25 = 1 - \frac{42}{DL} \Rightarrow -0{,}75 = -\frac{42}{DL} \Rightarrow DL = \frac{-42}{-0{,}75} = 56.$
$DL = 56 = 5 \cdot 10 + 6 \Rightarrow$ hierbij hoort eind (sept-okt-nov-dec-jan-feb) februari in groep $3 + 5 = 8.$

```
-42/-0.75
               56
```

55f $L = 100 \cdot \frac{48-36}{7} = 100 \cdot \frac{12}{7} \approx 171.$ (de maanden juli en augustus tellen niet mee wegens vakantie)

```
100*12/7
      171.4285714
```

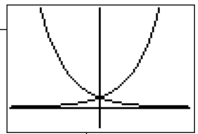
55g $150 = 100 \cdot \frac{48-42}{m} \Rightarrow 1{,}5 = \frac{6}{m} \Rightarrow m = \frac{6}{1{,}5} = 4.$ (dus 4 schoolmaanden na maart $\Rightarrow$ april-mei-juni-~~juli-aug~~-september)
Dus eind september in groep 8.

55h Dan is er tussen twee tests minder geleerd dan op grond van het genote onderwijs mag worden aangenomen.

56a Zie de plot hiernaast. Ze zijn elkaars spiegelbeeld t.o.v. de y-as.
56b De lijn $y = 0$ (de x-as) is asymptoot van beide grafieken.
56c $B_f = B_g = \langle 0, \rightarrow \rangle.$

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

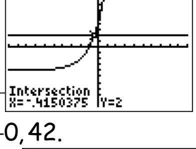
```
WINDOW
 Xmin=-5
 Xmax=5
 Xscl=0
 Ymin=-2
 Ymax=10
 Yscl=0
 Xres=1
```



57a $y = 2^x \xrightarrow{\text{transl. } (0,3)} y = 2^x + 3.$
57c $y = 2^x \xrightarrow{\text{verm. t.o.v. } x\text{-as met } 3} y = 3 \cdot 2^x.$
57b $y = 2^x \xrightarrow{\text{transl. } (5,0)} y = 2^{x-5}.$

```
Plot1 Plot2 Plot3
\Y1=2^(X+3)-4
\Y2=2
\Y3=
```

```
ZOOM MEMORY
1:ZBox
2:Zoom In
3:Zoom Out
4:ZDecimal
5:ZSquare
6:ZStandard
7↓ZTrig
```

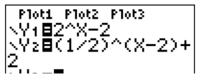


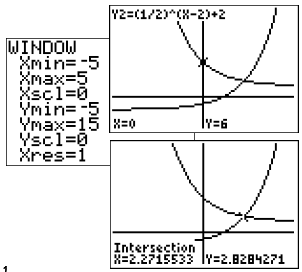
58a $y = 2^x \xrightarrow{\text{transl. } (-3,-4)} f(x) = 2^{x+3} - 4.$
58b H.A.: $y = -4$ (neem x groot negatief). $B_f = \langle -4, \rightarrow \rangle.$
58c $f(x) = 2^{x+3} - 4 = 2$ (intersect) $\Rightarrow x \approx -0{,}42;\ \ f(x) \le 2$ (zie plot) $\Rightarrow x \le -0{,}42.$
58b $f(3) = 2^6 - 4 = 60;\ x \le 3$ (zie grafiek; let op het bereik!!!) $\Rightarrow -4 < f(x) \le 60.$

```
Y1(3)
               60
```

59a $y = 3^x \xrightarrow{\text{transl. } (1,5)} f(x) = 3^{x-1} + 5$ met als H.A.: $y = 5.$
59b $y = 3^x \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 5} y = 5 \cdot 3^x \xrightarrow{\text{transl. } (-1,0)} g(x) = 5 \cdot 3^{x+1}$ met als H.A.: $y = 0$ (de x-as).
59c $y = 3^x \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 4} y = 4 \cdot 3^x \xrightarrow{\text{transl. } (0,-7)} h(x) = 4 \cdot 3^x - 7$ met als H.A.: $y = -7.$

60a $y = 2^x \xrightarrow{\text{transl. } (0,-2)} f(x) = 2^x - 2$ en $y = \left(\frac{1}{2}\right)^x \xrightarrow{\text{transl. } (2,2)} g(x) = \left(\frac{1}{2}\right)^{x-2} + 2.$





60b $B_f = \langle -2, \rightarrow \rangle;\ B_g = \langle 2, \rightarrow \rangle.$

60c $g(4) = \left(\frac{1}{2}\right)^2 + 2 = 2{,}25;\ x \geq 4$ (zie plot en bereik) $\Rightarrow 2 < g(x) \leq 2{,}25.$

60d $f(x) = g(x)$ (intersect) $\Rightarrow x \approx 2{,}27;\ f(x) \leq g(x)$ (zie plot) $\Rightarrow x \leq 2{,}27.$

61 $y_1 = x^{-3}$ en $y_6 = \frac{1}{x^3}$ komen op hetzelfde neer, zo ook $y_2 = 3x^{-1}$ en $y_4 = \frac{3}{x}$ als $y_3 = x^{\frac{1}{3}}$ en $y_5 = \sqrt[3]{x}.$
(je kunt dit bijvoorbeeld met behulp van tabellen op de GR nagaan)

62a $x^5 \cdot \sqrt{x} = x^5 \cdot x^{\frac{1}{2}} = x^{5+\frac{1}{2}} = x^{5\frac{1}{2}}.$

62b $\frac{\sqrt{x}}{x^3} = \frac{x^{\frac{1}{2}}}{x^3} = x^{\frac{1}{2}-3} = x^{-2\frac{1}{2}}.$

62c $\frac{1}{x \cdot \sqrt{x}} = \frac{1}{x^1 \cdot x^{\frac{1}{2}}} = \frac{1}{x^{1+\frac{1}{2}}} = \frac{1}{x^{1\frac{1}{2}}} = x^{-1\frac{1}{2}}.$

62d $x^3 \cdot x^{2{,}4} = x^{3+2{,}4} = x^{5{,}4}.$

62e $\frac{x^4}{\sqrt[5]{x^2}} = \frac{x^4}{x^{\frac{2}{5}}} = x^{4-\frac{2}{5}} = x^{3\frac{3}{5}}.$

62f $x^5 \cdot x^{-\frac{1}{5}} \cdot x = x^{5-\frac{1}{5}+1} = x^{5\frac{4}{5}}.$

63a $y = \frac{5}{x^4} = 5 \cdot \frac{1}{x^4} = 5x^{-4}.$

63b $y = 3x^2 \cdot \sqrt{x} = 3x^2 \cdot x^{\frac{1}{2}} = 3x^{2+\frac{1}{2}} = 3x^{2\frac{1}{2}}.$

63c $y = \frac{1}{5x} = \frac{1}{5} \cdot \frac{1}{x} = \frac{1}{5}x^{-1}.$

63d $y = 5x \cdot \sqrt[4]{x} = 5x \cdot x^{\frac{1}{4}} = 5x^{1+\frac{1}{4}} = 5x^{1\frac{1}{4}}.$

63e $y = \frac{3 \cdot \sqrt{x}}{x^2} = 3 \cdot \frac{\sqrt{x}}{x^2} = 3 \cdot \frac{x^{\frac{1}{2}}}{x^2} = 3 \cdot x^{\frac{1}{2}-2} = 3x^{-1\frac{1}{2}}.$

63f $y = 8\sqrt{x} = 8x^{\frac{1}{2}}.$

63g $y = \left(3x^2\right)^3 \cdot x^5 = 27x^6 \cdot x^5 = 27x^{6+5} = 27x^{11}.$

63h $y = 28 \cdot \frac{1}{4x} = \frac{28}{4x} = \frac{7}{x} = 7x^{-1}.$

63i $y = 6x \cdot \frac{1}{3}\sqrt{x} = 6x^1 \cdot \frac{1}{3}x^{\frac{1}{2}} = 2x^{1+\frac{1}{2}} = 2x^{1\frac{1}{2}}.$

64a $N = 80 \cdot 2^{2t-4} = 80 \cdot 2^{2t} \cdot 2^{-4} = 80 \cdot \left(2^2\right)^t \cdot \frac{1}{2^4} = 80 \cdot \left(2^2\right)^t \cdot \frac{1}{16} = 5 \cdot 4^t.$

64b $N = 2500 \cdot 5^{-t-2} = 2500 \cdot 5^{-t} \cdot 5^{-2} = 2500 \cdot \left(5^{-1}\right)^t \cdot \frac{1}{5^2} = 2500 \cdot \left(\frac{1}{5}\right)^t \cdot \frac{1}{25} = 100 \cdot \left(\frac{1}{5}\right)^t.$

64c $N = \frac{100}{2^{2t}} = 100 \cdot \frac{1}{2^{2t}} = 100 \cdot 2^{-2t} = 100 \cdot \left(2^{-2}\right)^t = 100 \cdot \left(\frac{1}{4}\right)^t.$

65a $32 = 2^5.$

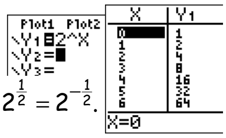
65b $\frac{1}{2} = \frac{1}{2^1} = 2^{-1}.$

65c $\sqrt[4]{2} = 2^{\frac{1}{4}}.$

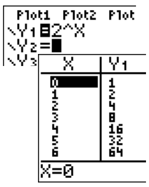
65d $16 \cdot \sqrt{2} = 2^4 \cdot 2^{\frac{1}{2}} = 2^{4\frac{1}{2}}.$

65e $1 = 2^0.$

65f $\frac{1}{2} \cdot \sqrt{2} = \frac{1}{2^1} \cdot 2^{\frac{1}{2}} = 2^{-1} \cdot 2^{\frac{1}{2}} = 2^{-\frac{1}{2}}.$

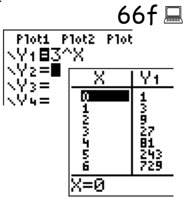


66a $2^{x+1} = 64$
$2^{x+1} = 2^6$
$x + 1 = 6$
$x = 5.$

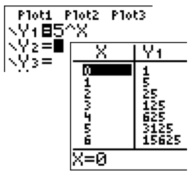


66b $2^{x-2} = \frac{1}{8}$
$2^{x-2} = \frac{1}{2^3}$
$2^{x-2} = 2^{-3}$
$x - 2 = -3$
$x = -1.$

66c $3^{2x+1} = 27 \cdot \sqrt{3}$
$3^{2x+1} = 3^3 \cdot 3^{\frac{1}{2}}$
$3^{2x+1} = 3^{3\frac{1}{2}}$
$2x + 1 = 3\frac{1}{2}$
$2x = 2\frac{1}{2}$
$x = 1\frac{1}{4}.$



66d $5^{-x+6} = 625$
$5^{-x+6} = 5^4$
$-x + 6 = 4$
$-x = -2$
$x = 2.$



66e $3^x - 2 = 25$
$3^x = 27$
$3^x = 3^3$
$x = 3.$

66f $5 \cdot 2^x + 11 = 91$
$5 \cdot 2^x = 80$
$2^x = 16$
$2^x = 2^4$
$x = 4.$

66g $2^x = 1$
$2^x = 2^0$
$x = 0.$

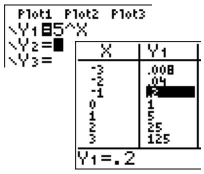
66h $2^{x-3} = \left(\frac{1}{2}\right)^{x-5}$
$2^{x-3} = \left(2^{-1}\right)^{x-5}$
$2^{x-3} = 2^{-x+5}$
$x - 3 = -x + 5$
$2x = 8$
$x = 4.$

66i $2^{x+3} = 8^x$
$2^{x+3} = \left(2^3\right)^x$
$2^{x+3} = 2^{3x}$
$x + 3 = 3x$
$-2x = -1$
$x = \frac{1}{2}.$

67a $2^{3x+5} = 16 \cdot \sqrt{2}$
$2^{3x+5} = 2^4 \cdot 2^{\frac{1}{2}}$
$2^{3x+5} = 2^{4\frac{1}{2}}$
$3x + 5 = 4\frac{1}{2}$
$3x = -\frac{1}{2}$
$x = -\frac{1}{6}.$

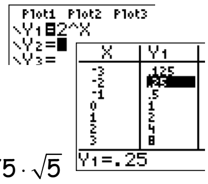
67b $3^{4x} = \frac{1}{81}$
$3^{4x} = \frac{1}{3^4}$
$3^{4x} = 3^{-4}$
$4x = -4$
$x = -1.$

67c $3 \cdot 5^{2x-1} = 0{,}6$
$5^{2x-1} = 0{,}2$
$5^{2x-1} = \frac{1}{5}$
$5^{2x-1} = 5^{-1}$
$2x - 1 = -1$
$2x = 0$
$x = 0.$



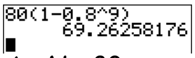
67d $9^{3x-3} = 3^{x+4}$
$\left(3^2\right)^{3x-3} = 3^{x+4}$
$3^{6x-6} = 3^{x+4}$
$6x - 6 = x + 4$
$5x = 10$
$x = 2.$

67e $3 \cdot 2^{x-1} - 1 = -0{,}25$
$3 \cdot 2^{x-1} = 0{,}75$
$2^{x-1} = 0{,}25$
$2^{x-1} = 2^{-2}$
$x - 1 = -2$
$x = -1.$



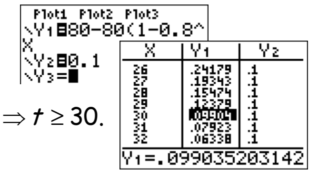
67f $3 \cdot 5^{2x+1} = 75 \cdot \sqrt{5}$
$5^{2x+1} = 25 \cdot \sqrt{5}$
$5^{2x+1} = 5^2 \cdot 5^{\frac{1}{2}}$
$5^{2x+1} = 5^{2\frac{1}{2}}$
$2x + 1 = 2\frac{1}{2}$
$2x = 1\frac{1}{2}$
$x = \frac{3}{4}.$

68a $N = 80(1 - 0{,}8^9) \approx 69.$



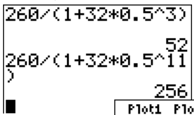
68b $N = 80 - 80 \cdot 0{,}8^t \Rightarrow$ H.A.: $N = 80.$

68c $80 - N < 0{,}1 \Rightarrow 80 - 80(1 - 0{,}8^t) < 0{,}1$ (TABLE of intersect) $\Rightarrow t \geq 30.$



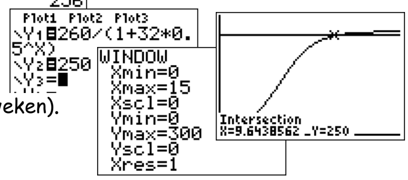
69a Als t toeneemt, dan neemt $32 \cdot 0{,}5^t$ **af**, dus $1 + 32 \cdot 0{,}5^t$ neemt **af**, dus $\frac{260}{1 + 32 \cdot 0{,}5^t}$ neemt **toe**.

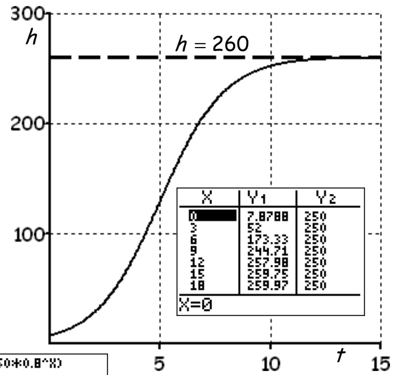
69b $t = 3 \Rightarrow h = \frac{260}{1 + 32 \cdot 0{,}5^3} = 52$ (cm).
$t = 11 \Rightarrow h = \frac{260}{1 + 32 \cdot 0{,}5^{11}} = 256$ (cm).



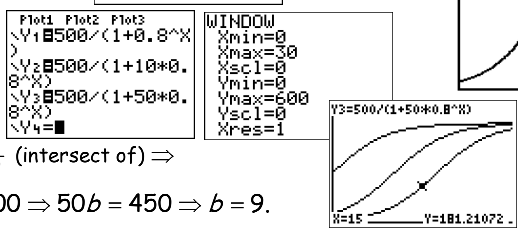
69c Gebruik een plot (eventueel TABLE) $\Rightarrow$ schets.

69d $h = \frac{260}{1 + 32 \cdot 0{,}5^t} > 250$ (intersect) $\Rightarrow t > 9{,}64$ (weken).
Dus vanaf $t = 9{,}7$.

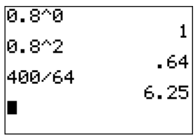




70a Neem bijvoorbeeld $b = 1$, $b = 10$ en $b = 50$.
Zie de plot hiernaast.
Hoe groter b, hoe kleiner de beginwaarde.

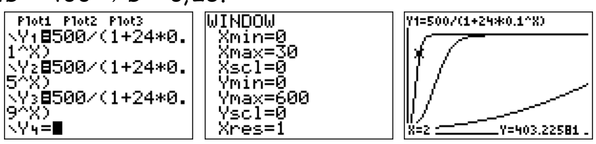


70b $N = \frac{500}{1 + b \cdot 0{,}8^t}$ door $(0, 50) \Rightarrow 50 = \frac{500}{1 + b \cdot 0{,}8^0}$ (intersect of) $\Rightarrow$
$\frac{50}{1} = \frac{500}{1 + b} \Rightarrow 50(1 + b) = 500 \Rightarrow 50 + 50b = 500 \Rightarrow 50b = 450 \Rightarrow b = 9.$



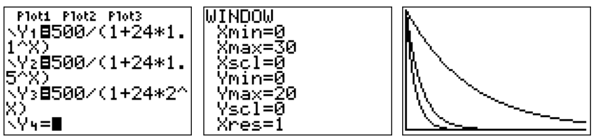
70c $N = \frac{500}{1 + b \cdot 0{,}8^t}$ door $(2, 100) \Rightarrow 100 = \frac{500}{1 + b \cdot 0{,}8^2}$ (intersect of) $\Rightarrow$
$\frac{100}{1} = \frac{500}{1 + 0{,}64} \Rightarrow 100(1 + 0{,}64b) = 500 \Rightarrow 100 + 64b = 500 \Rightarrow 64b = 400 \Rightarrow b = 6{,}25.$

70d Zie de plot met $g = 0{,}1$; $g = 0{,}5$ en $g = 0{,}9$ hiernaast.
Hoe kleiner b, hoe sneller N het verzadigingsniveau bereikt.



70e $N = \frac{500}{1 + 24 \cdot g^t}$ door $(1, 125) \Rightarrow 125 = \frac{500}{1 + 24 \cdot g^1}$ (intersect of) $\Rightarrow$
$\frac{125}{1} = \frac{500}{1 + 24 \cdot g} \Rightarrow 125(1 + 24g) = 500 \Rightarrow 1 + 24g = 4 \Rightarrow 24g = 3 \Rightarrow g = \frac{1}{8} = 0{,}125.$

70f Neem bijvoorbeeld $g = 1{,}1$; $g = 1{,}5$ en $g = 2$.
Zie de plot hiernaast.
De grafieken zijn nu dalend met H.A.: $y = 0$ (de x-as).

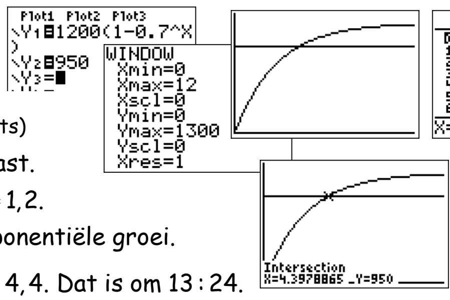


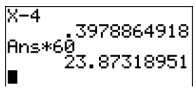
71a De (horizontale) asymptoot is $N = 1200$.
Er zitten 1200 leerlingen op school.

71b Maak een schets van de plot hiernaast.
(stippel ook de horizontale asymptoot in de schets)

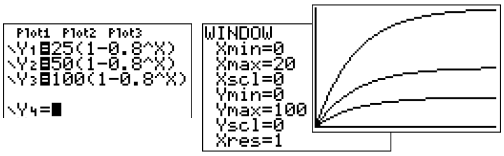
71c Zie de waarden van N in de tabel hiernaast.
$\frac{360}{0}$ kan niet; $\frac{612}{360} \approx 1{,}7$; $\frac{788}{612} \approx 1{,}3$; $\frac{912}{788} \approx 1{,}2$.
De quotiënten zijn niet gelijk $\Rightarrow$ geen exponentiële groei.

71d $N = 1200(1 - 0{,}7^t) = 950$ (intersect) $\Rightarrow t \approx 4{,}4$. Dat is om 13 : 24.

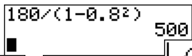




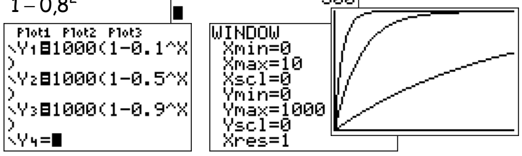
72a Neem bijvoorbeeld $a = 25$, $a = 50$ en $a = 100$.
Zie de plot hiernaast.
a heeft invloed op de waarde van de asymptoot.
Bij $a = 25$ is $N = 25$ de (horizontale) asymptoot.



72b $N = a(1-0{,}8^t)$ door $(2, 180) \Rightarrow 180 = a(1-0{,}8^2) \Rightarrow a = \dfrac{180}{1-0{,}8^2} = 500.$

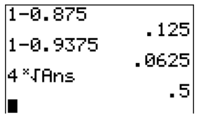


72c Neem bijvoorbeeld $g = 0{,}1$; $g = 0{,}5$ en $g = 0{,}9$.
Zie de plot hiernaast.
g heeft invloed op hoe snel N de asymptoot bereikt.
Hoe kleiner g, hoe sneller de grafiek stijgt.



72d $N = 1000(1-g^t)$ door $(1, 875) \Rightarrow 875 = 1000(1-g^1) \Rightarrow 0{,}875 = 1-g \Rightarrow g = 0{,}125.$

72e $N = 1000(1-g^t)$ door $(4; 937{,}5) \Rightarrow 937{,}5 = 1000(1-g^4)$ (intersect of) $\Rightarrow$
$0{,}9375 = 1-g^4 \Rightarrow g^4 = 0{,}0625 \Rightarrow g = \sqrt[4]{0{,}0625} = 0{,}5.$



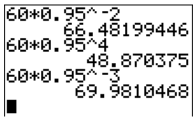
73a Groeiproces I. 73c Groeiproces II. 73e Groeiproces IV.
73b Groeiproces IV. 73d Groeiproces III. 73f Groeiproces I.

74a $N = 1{,}5 \cdot 60 \cdot 0{,}95^t = 90 \cdot 0{,}95^t.$

74b $N = 60 \cdot 0{,}95^{t-2} = 60 \cdot 0{,}95^t \cdot 0{,}95^{-2} \approx 66{,}5 \cdot 0{,}95^t.$

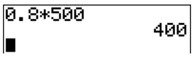
74c $N = 60 \cdot 0{,}95^{t+4} = 60 \cdot 0{,}95^t \cdot 0{,}95^4 \approx 48{,}9 \cdot 0{,}95^t.$

74d $N = 60 \cdot 0{,}95^{t-3} + 10 = 10 + 60 \cdot 0{,}95^t \cdot 0{,}95^{-3} \approx 10 + 70{,}0 \cdot 0{,}95^t.$



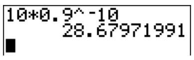
75a De grenswaarde is 500 (vul in de formule grote waarden voor t in).

75b De grenswaarde wordt $0{,}8 \cdot 500 = 400.$

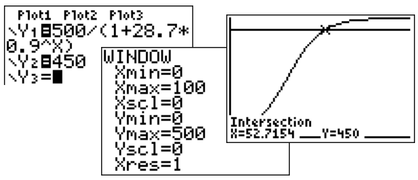


75c $N = 0{,}8 \cdot \dfrac{500}{1+10 \cdot 0{,}9^t} = \dfrac{400}{1+10 \cdot 0{,}9^t}.$

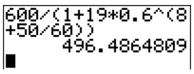
75d $N = \dfrac{500}{1+10 \cdot 0{,}9^{t-10}} = \dfrac{500}{1+10 \cdot 0{,}9^t \cdot 0{,}9^{-10}} \approx \dfrac{500}{1+28{,}7 \cdot 0{,}9^t}.$



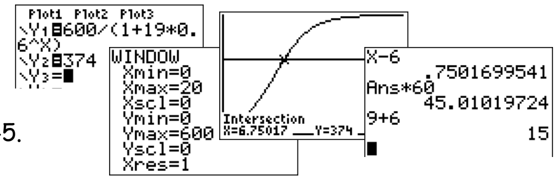
75e $N = \dfrac{500}{1+28{,}7 \cdot 0{,}9^t} = 450$ (intersect) $\Rightarrow t = 52{,}7$ (weken).



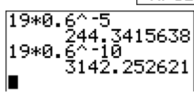
76a $t = 8\frac{50}{60} \Rightarrow N_{\mathrm{I}} = \dfrac{600}{1+19 \cdot 0{,}6^{8\frac{50}{60}}} \approx 496.$



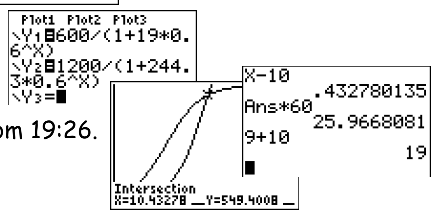
76b $N_{\mathrm{I}} = \dfrac{600}{1+19 \cdot 0{,}6^t} = 374$ (intersect) $\Rightarrow t \approx 6{,}75$. Dat is om 15:45.



76c $N_{\mathrm{II}} = \dfrac{600}{1+19 \cdot 0{,}6^{t-5}} = \dfrac{600}{1+19 \cdot 0{,}6^t \cdot 0{,}6^{-5}} \approx \dfrac{600}{1+244{,}3 \cdot 0{,}6^t}.$
$N_{\mathrm{III}} = \dfrac{600}{1+19 \cdot 0{,}6^{t-10}} = \dfrac{600}{1+19 \cdot 0{,}6^t \cdot 0{,}6^{-10}} \approx \dfrac{600}{1+3142{,}3 \cdot 0{,}6^t}.$



76d $N_{\mathrm{I}} = 2 \cdot N_{\mathrm{II}} \Rightarrow \dfrac{600}{1+19 \cdot 0{,}6^t} = 2 \cdot \dfrac{600}{1+244{,}3 \cdot 0{,}6^t}$ (intersect) $\Rightarrow t \approx 10{,}43$. Dat is om 19:26.



Diagnostische toets

D1a $y = 4x^3 \xrightarrow{\text{translatie } (-2,0)} f(x) = 4(x+2)^3$.

D1b $y = 0{,}5x^4 \xrightarrow{\text{translatie } (2,6)} g(x) = 0{,}5(x-2)^4 + 6$.

D1c $y = -2x^6 \xrightarrow{\text{translatie } (-4,-1)} h(x) = -2(x+4)^6 - 1$.

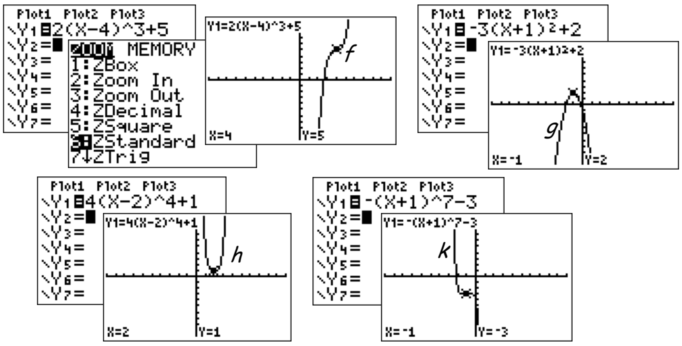
D1d $y = 0{,}1x^6 \xrightarrow{\text{translatie } (0,10)} j(x) = 0{,}1x^6 + 10$.

D2a $f(x) = 2(x-4)^3 + 5 \Rightarrow$ punt van symm. $(4, 5)$.
(maak een schets van de plot)

D2b $g(x) = -3(x+1)^2 + 2 \Rightarrow$ top $(-1, 2)$.
(maak een schets van de plot)

D2c $h(x) = 4(x-2)^4 + 1 \Rightarrow$ top $(2, 1)$.
(maak een schets van de plot)

D2d $k(x) = -(x+1)^7 - 3 \Rightarrow$ punt van symm. $(-1, -3)$.
(maak een schets van de plot)

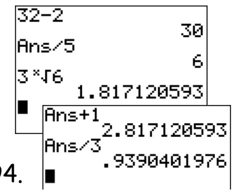


D3a $y = -0{,}15x^2 \xrightarrow{\text{transl. } (5,-3)} f(x) = -0{,}15(x-5)^2 - 3$ met top $(5, -3)$.

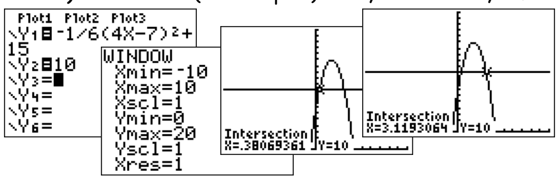
D3b $y = 4(x-5)^3 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } -2} g(x) = -2 \cdot (4(x-5)^3) = -8(x-5)^3$ met punt van symmetrie $(5, 0)$.

D3c $y = 2\frac{1}{2}(x+3)^4 - 2 \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 3} h(x) = 3 \cdot (2\frac{1}{2}(x+3)^4 - 2) = 7\frac{1}{2}(x+3)^4 - 6$ met top $(0, -3)$.

D4a
$5(3x-1)^3 + 2 = 32$
$5(3x-1)^3 = 30$
$(3x-1)^3 = 6$
$3x - 1 = \sqrt[3]{6}$
$3x = 1 + \sqrt[3]{6}$
$x = \frac{1+\sqrt[3]{6}}{3} \approx 0{,}94$.



D4b $-\frac{1}{6}(4x-7)^2 + 15 = 10$ (intersect) $\Rightarrow x \approx 0{,}38 \vee x \approx 3{,}12$.
$-\frac{1}{6}(4x-7)^2 + 15 \geq 10$ (zie een plot) $\Rightarrow 0{,}38 \leq x \leq 3{,}12$.

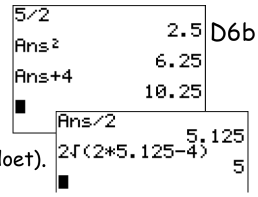


D5a $x \geq 0$. Dus $D_f = [0, \rightarrow\rangle$; $B_f = [-1, \rightarrow\rangle$ en het beginpunt is $(0, -1)$.

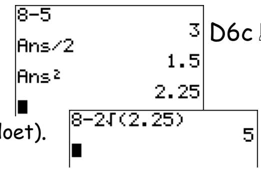
D5b $2x - 5 \geq 0 \Rightarrow 2x \geq 5 \Rightarrow x \geq 2\frac{1}{2}$. Dus $D_g = [2\frac{1}{2}, \rightarrow\rangle$; $B_g = [6, \rightarrow\rangle$ en het beginpunt is $(2\frac{1}{2}, 6)$.

D5c $3 - 2x \geq 0 \Rightarrow -2x \geq -3 \Rightarrow x \leq 1\frac{1}{2}$. Dus $D_f = \langle \leftarrow, 1\frac{1}{2}]$; $B_f = [4, \rightarrow\rangle$ en het beginpunt is $(1\frac{1}{2}, 4)$.

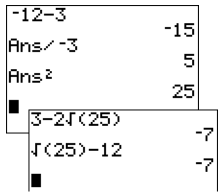
D6a
$2\sqrt{2x-4} = 5$
$\sqrt{2x-4} = 2{,}5$
$2x - 4 = 6{,}25$
$2x = 10{,}25$
$x = 5{,}125$ (voldoet).



D6b
$5 = 8 - 2\sqrt{x}$
$2\sqrt{x} = 3$
$\sqrt{x} = 1{,}5$
$x = 2{,}25$ (voldoet).

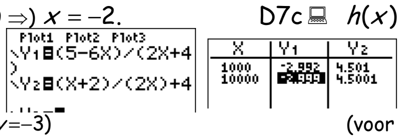


D6c
$3 - 2\sqrt{x} = \sqrt{x} - 12$
$-3\sqrt{x} = -15$
$\sqrt{x} = 5$
$x = 25$ (voldoet).



D7a $y = \frac{1}{x} \xrightarrow{\text{transl. } (-2,-3)} f(x) = \frac{1}{x+2} - 3 \Rightarrow$ V.A.: (noemer $= 0 \Rightarrow$) $x = -2$ en H.A.: $y = -3$.

D7b $g(x) = \frac{5-6x}{2x+4}$ heeft V.A.: (noemer $= 0 \Rightarrow$) $x = -2$.
$\left.\begin{array}{l} g(1000) \approx -2{,}992 \\ g(10\,000) \approx -2{,}999 \end{array}\right\} \Rightarrow$ H.A.: $y = -3$
(of voor grote x is $g(x) \approx \frac{-6x}{2x} = -3 \Rightarrow$ H.A.: $y = -3$)



D7c $h(x) = \frac{x+2}{2x} + 4$ heeft V.A.: (noemer $= 0 \Rightarrow$) $x = 0$.
$\left.\begin{array}{l} h(1000) \approx 4{,}501 \\ h(10\,000) \approx 4{,}5001 \end{array}\right\} \Rightarrow$ H.A.: $y = 4{,}5$.
(voor grote x is $g(x) \approx \frac{x}{2x} + 4 = \frac{1}{2} + 4 \Rightarrow$ H.A.: $y = 4\frac{1}{2}$)

D8a
$3 - \frac{2x}{x+1} = 5$
$\frac{-2x}{x+1} = \frac{2}{1}$
$2 \cdot (x+1) = -2x$
$2x + 2 = -2x$
$4x = -2$
$x = -\frac{2}{4} = -\frac{1}{2}$.

D8b
$\frac{2x-7}{x+7} = 0$
(noemer $= 0 \Rightarrow$)
$2x - 7 = 0$
$2x = 7$
$x = 3\frac{1}{2}$.

D8c
$6 + \frac{3x}{x-1} = 15$
$\frac{3x}{x-1} = \frac{9}{1}$
$9 \cdot (x-1) = 3x$
$9x - 9 = 3x$
$6x = 9$
$x = \frac{9}{6} = 1\frac{1}{2}$.

D9a $p = 16$ en $A = 32 \Rightarrow 32 = \frac{10 \cdot 16 \cdot q}{5 \cdot 16 + q} \Rightarrow \frac{32}{1} = \frac{160q}{80 + q} \Rightarrow 32(80 + q) = 160q \Rightarrow 80 + q = 5q \Rightarrow -4q = -80 \Rightarrow q = 20.$

D9b $q = 40$ en $A = 48 \Rightarrow 48 = \frac{400p}{5p + 40} \Rightarrow 48(5p + 40) = 400p \Rightarrow 240p + 1920 = 400p \Rightarrow -160p = 1920 \Rightarrow p = 12.$

D9c $q = 30 \Rightarrow A = \frac{300p}{5p + 30}$ (is voor grote p) $\approx \frac{300p}{5p} = 60$. Dus de grenswaarde $G = 60$.

D10a $y = 3^x \xrightarrow{\text{transl. } (2,1)} f(x) = 3^{x-2} + 1$ met H.A.: $y = 1$.

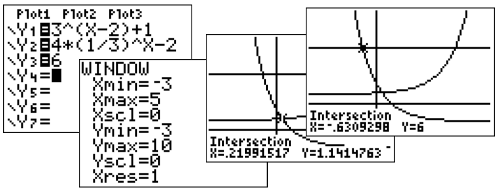
$y = \left(\frac{1}{3}\right)^x \xrightarrow{\text{verm. t.o.v. de } x\text{-as met } 4} y(x) = 4 \cdot \left(\frac{1}{3}\right)^x \xrightarrow{\text{transl. } (0,-2)} g(x) = 4 \cdot \left(\frac{1}{3}\right)^x - 2$ (met H.A.: $y = -2$).

D10b $B_f = \langle 1, \rightarrow \rangle$ en $B_g = \langle -2, \rightarrow \rangle$.

D10c $f(x) = g(x)$ (intersect) $\Rightarrow x \approx 0{,}22;\ f(x) \geq g(x)$ (zie plot) $\Rightarrow x \geq 0{,}22.$

D10d $g(x) = 6$ (intersect) $\Rightarrow x \approx -0{,}63;\ g(x) \leq 6$ (zie plot) $\Rightarrow x \geq -0{,}63.$

D10e $f(5) = 3^3 + 1 = 27 + 1 = 28;\ x \leq 5$ (zie plot en bereik) $\Rightarrow 1 < f(x) \leq 28.$

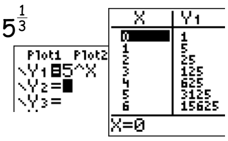


D11a $y = \frac{6}{x^3} = 6 \cdot \frac{1}{x^3} = 6 \cdot x^{-3}.$

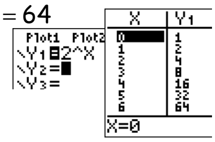
D11b $y = 5x^2 \cdot \sqrt[3]{x} = 5x^2 \cdot x^{\frac{1}{3}} = 5 \cdot x^{2 + \frac{1}{3}} = 5x^{2\frac{1}{3}}.$

D11c $y = \left(3x^2\right)^3 \cdot \frac{2}{9x} = 27x^6 \cdot \frac{2}{9} \cdot \frac{1}{x} = 27x^6 \cdot \frac{2}{9} \cdot x^{-1} = 6 \cdot x^{6 + -1} = 6x^5.$

D12a
$5^{x-1} = 125 \cdot \sqrt[3]{5}$
$5^{x-1} = 5^3 \cdot 5^{\frac{1}{3}}$
$5^{x-1} = 5^{3\frac{1}{3}}$
$x - 1 = 3\frac{1}{3}$
$x = 4\frac{1}{3}.$

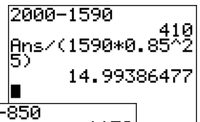


D12b
$2 \cdot 4^{2x-1} - 3 = 61$
$2 \cdot \left(2^2\right)^{2x-1} = 64$
$2^{4x-2} = 32$
$2^{4x-2} = 2^5$
$4x - 2 = 5$
$4x = 7$
$x = \frac{7}{4}.$

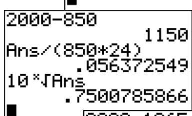


D12c
$2^{3x+1} + 6 = 6\frac{1}{8}$
$2^{3x+1} = \frac{1}{8}$
$2^{3x+1} = \frac{1}{2^3}$
$2^{3x+1} = 2^{-3}$
$3x + 1 = -3$
$3x = -4$
$x = -\frac{4}{3}.$

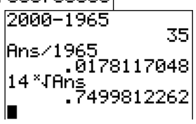
D13a $N = \frac{2000}{1 + b \cdot 0{,}85^t}$ door $(25, 1590) \Rightarrow 1590 = \frac{2000}{1 + b \cdot 0{,}85^{25}}$ (intersect of) $\Rightarrow \frac{1590}{1} = \frac{2000}{1 + 0{,}85^{25}b} \Rightarrow$
$1590(1 + 0{,}85^{25}b) = 2000 \Rightarrow 1590 + 1590 \cdot 0{,}85^{25}b = 2000 \Rightarrow 1590 \cdot 0{,}85^{25}b = 410 \Rightarrow b \approx 15.$



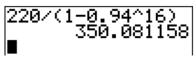
D13b $N = \frac{2000}{1 + 24 \cdot g^t}$ door $(10, 850) \Rightarrow \frac{850}{1} = \frac{2000}{1 + 24g^{10}}$ (intersect of) $\Rightarrow 850(1 + 24g^{10}) = 2000 \Rightarrow$
$850 + 850 \cdot 24g^{10} = 2000 \Rightarrow 850 \cdot 24g^{10} = 1150 \Rightarrow g^{10} = \frac{1150}{850 \cdot 24} \Rightarrow g \approx 0{,}75.$



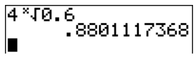
D13c $N = \frac{2000}{1 + \frac{1}{g} \cdot g^t} = \frac{2000}{1 + g^{t-1}}$ door $(15, 1965) \Rightarrow \frac{1965}{1} = \frac{2000}{1 + g^{14}}$ (intersect of) $\Rightarrow$
$1965(1 + g^{14}) = 2000 \Rightarrow 1965 + 1965 \cdot g^{14} = 2000 \Rightarrow 1965 \cdot g^{14} = 35 \Rightarrow g^{14} = \frac{35}{1965} \Rightarrow g \approx 0{,}75.$



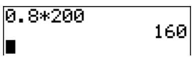
D14a $N = a(1 - 0{,}94^t)$ door $(16, 220) \Rightarrow 220 = a(1 - 0{,}94^{16}) \Rightarrow a = \frac{220}{1 - 0{,}94^{16}} \approx 350.$



D14b $N = 500(1 - g^t)$ door $(4, 200) \Rightarrow 200 = 500(1 - g^4) \Rightarrow 1 - g^4 = \frac{200}{500} = 0{,}4 \Rightarrow -g^4 = -0{,}6 \Rightarrow g^4 = 0{,}6 \Rightarrow g \approx 0{,}88.$

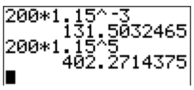


D15a $N = 0{,}8 \cdot 200 \cdot 1{,}15^t = 160 \cdot 1{,}15^t.$



D15b $N = 200 \cdot 1{,}15^{t-3} = 200 \cdot 1{,}15^t \cdot 1{,}15^{-3} \approx 131{,}5 \cdot 1{,}15^t.$

D15c $N = 200 \cdot 1{,}15^{t+5} = 200 \cdot 1{,}15^t \cdot 1{,}15^5 \approx 402{,}3 \cdot 1{,}15^t.$



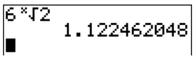
Gemengde opgaven 11. Allerlei functies

G19a $5x^6 - 1 = 9$

$5x^6 = 10$

$x^6 = 2$

$x = \sqrt[6]{2} \approx 1{,}12 \vee x = -\sqrt[6]{2} \approx -1{,}12.$



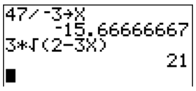
G19b $3 \cdot \sqrt{2-3x} = 21$

$\sqrt{2-3x} = 7$ (kwadrateren)

$2 - 3x = 49$

$-3x = 47$

$x = \frac{47}{-3} = -15\frac{2}{3}$ (voldoet).



G19c $\frac{x+2}{x-1} = \frac{3}{1}$

$x + 2 = 3(x-1)$

$x + 2 = 3x - 3$

$-2x = -5$

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

G19d $2x^3 + 15 = 69$

$2x^3 = 54$

$x^3 = 27 = 3^3$

$x = 3.$

G19e $\frac{2x-1}{x+2} = 0$

(teller=0⇒)

$2x - 1 = 0$

$2x = 1$

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

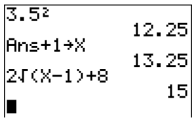
G19f $2 \cdot \sqrt{x-1} + 8 = 15$

$2 \cdot \sqrt{x-1} = 7$

$\sqrt{x-1} = 3{,}5$ (kwadrateren)

$x - 1 = 12{,}25$

$x = 13{,}25$ (voldoet).

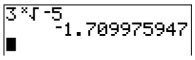


G19g $8x^3 + 34 = -6$

$8x^3 = -40$

$x^3 = -5$

$x = \sqrt[3]{-5} \approx -1{,}71.$



G19h $\frac{4}{x} = \frac{12}{x+1}$

$4(x+1) = 12x$

$4x + 4 = 12x$

$-8x = -4$

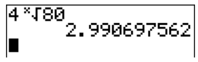
$x = \frac{-4}{-8} = \frac{1}{2}.$

G19i $0{,}1x^4 + 5 = 13$

$0{,}1x^4 = 8$ (keer 10)

$x^4 = 80$

$x = \sqrt[4]{80} \approx 2{,}99 \vee x = -\sqrt[4]{80} \approx -2{,}99.$



G19j $\frac{2x}{x-1} - 2 = 4$

$\frac{2x}{x-1} = \frac{6}{1}$

$6(x-1) = 2x$

$6x - 6 = 2x$

$4x = 6$

$x = \frac{6}{4} = 1\frac{1}{2}.$

G20a Zie de grafieken hiernaast. (gebruik TABLE)

G20b $6 - 2x \geq 0 \Rightarrow -2x \geq -6 \Rightarrow x \leq 3 \Rightarrow D_f = \langle \leftarrow, 3].$

Het beginpunt $(3, -3)$ van de grafiek is het laagste punt $\Rightarrow B_f = [-3, \rightarrow\rangle.$

G20c $f(x) = g(x)$ (intersect) $\Rightarrow x \approx -3{,}0.$

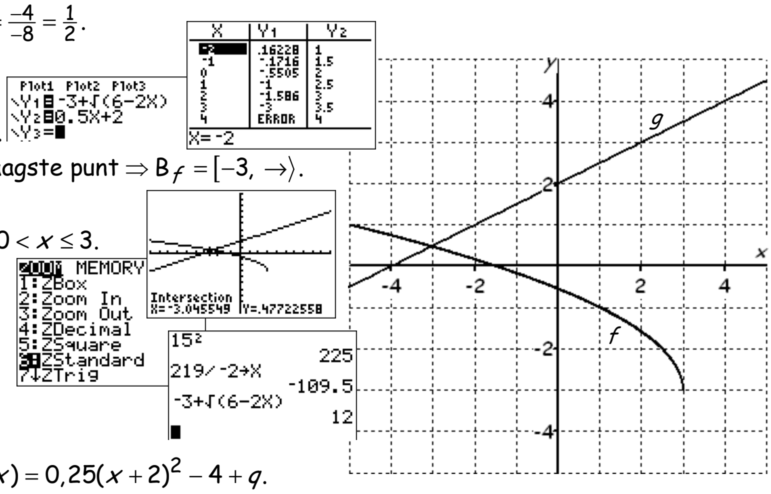
$f(x) < g(x)$ (zie grafiek en gebruik domein) $\Rightarrow -3{,}0 < x \leq 3.$

G20d $f(x) = 12 \Rightarrow -3 + \sqrt{6-2x} = 12$

$\sqrt{6-2x} = 15$ (kwadrateren)

$6 - 2x = 225$

$-2x = 219 \Rightarrow x = \frac{219}{-2} = -109\frac{1}{2}$ (voldoet).



G21a $f(x) = 0{,}25(x+2)^2 - 4 \xrightarrow{\text{translatie } (0, q)} g(x) = 0{,}25(x+2)^2 - 4 + q.$

$g(0) = 0 \Rightarrow 0{,}25(0+2)^2 - 4 + q = 0 \Rightarrow q = -0{,}25 \cdot 2^2 + 4 = -1 + 4 = 3.$

G21b $f(x) = 0{,}25(x+2)^2 - 4 \xrightarrow{\text{translatie } (p, 0)} h(x) = 0{,}25((x-p)+2)^2 - 4.$

$h(0) = 0 \Rightarrow 0{,}25((0-p)+2)^2 - 4 = 0 \Rightarrow 0{,}25(-p+2)^2 = 4$ (keer 4) $\Rightarrow (-p+2)^2 = 16 \Rightarrow -p + 2 = -4 \vee -p + 2 = 4 \Rightarrow$

$-p = -2 - 4 = -6 \vee -p = -2 + 4 = 2 \Rightarrow p = 6 \vee p = -2.$

G21c $f(x) = 0{,}25(x+2)^2 - 4 \xrightarrow[\text{de } x\text{-as met factor } a]{\text{vermenigvuldiging t.o.v.}} k(x) = a \cdot (0{,}25(x+2)^2 - 4).$

De grafiek van $k(x) = a \cdot (0{,}25(x+2)^2 - 4) = 0{,}25a(x+2)^2 - 4a$ is een parabool met top $(-2, -4a)$.

Nu moet gelden $-4a = 6 \Rightarrow a = \frac{6}{-4} = -\frac{3}{2} = -1\frac{1}{2}$. (6 moet een maximum zijn $\Rightarrow 0{,}25a < 0 \Rightarrow a < 0$)

G21d De grafiek van $f(x) = 0{,}25(x+2)^2 - 4$ is een parabool met top $(-2, -4)$.

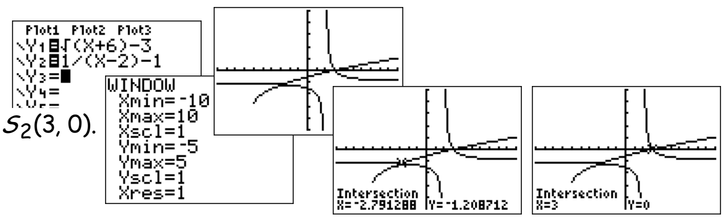
$f(0) = 0{,}25(0+2)^2 - 4 = 0{,}25 \cdot 2^2 - 4 = 1 - 4 = -3 \Rightarrow$ snijpunt met de y-as in $(0, -3)$.

$$\left.\begin{array}{l} m(-2) = f(-2) \Rightarrow a \cdot (-2)^4 + b = -4 \Rightarrow 16a + b = -4 \\ m(0) = f(0) \Rightarrow a \cdot 0^4 + b = -3 \Rightarrow \boxed{b = -3} \end{array}\right\} \Rightarrow 16a - 3 = -4 \Rightarrow 16a = -1 \Rightarrow \boxed{a = -\frac{1}{16}}.$$

G22a Maak een schets van de plot hiernaast.
(beginvoorwaarde bij f: $x + 6 \geq 0 \Rightarrow x \geq -6$
en beginvoorwaarde bij g: $x \neq 2 \Rightarrow$ V.A.: $x = 2$)

G22b $f(x) = g(x)$ (intersect) $\Rightarrow S_1(-2{,}791;\ -1{,}209)$ en $S_2(3, 0)$.

G22c $f(x) \leq g(x) \Rightarrow -6 \leq x \leq -2{,}791$ en $2 < x \leq 3$.
(zie G22b, een plot en de beginvoorwaarden)



G22d $f(x)=1 \Rightarrow \sqrt{x+6}-3=1 \Rightarrow \sqrt{x+6}=4$ (kwadrateren) $\Rightarrow x+6=16 \Rightarrow x=10$ (voldoet).

```
√(10+6)-3
                1
```

G22e $g(x)=5 \Rightarrow \frac{1}{x-2}-1=5 \Rightarrow \frac{1}{x-2}=\frac{6}{1} \Rightarrow 6(x-2)=1 \Rightarrow x-2=\frac{1}{6} \Rightarrow x=2\frac{1}{6}$.

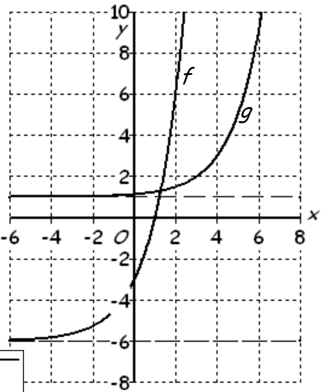
G23a
$30-3^{3x+1}=3$
$-3^{3x+1}=-27$
$3^{3x+1}=27=3^3$
$3x+1=3$
$3x=2$
$x=\frac{2}{3}=\frac{2}{3}$.

G23b
$2^{3x-2}=32=2^5$
$3x-2=5$
$3x=7$
$x=\frac{7}{3}$.

G23c
$2\cdot 3^{x-1}+5=59$
$2\cdot 3^{x-1}=54$
$3^{x-1}=27=3^3$
$x-1=3$
$x=4$.

G23d
$4^{3x+1}=\frac{1}{8}\sqrt{2}$
$(2^2)^{3x+1}=2^{-3}\cdot 2^{\frac{1}{2}}=2^{-2\frac{1}{2}}$
$2^{6x+2}=2^{-2\frac{1}{2}}$
$6x+2=-2\frac{1}{2}$
$6x=-4\frac{1}{2}=-\frac{9}{2}$
$x=-\frac{9}{12}=-\frac{3}{4}$.

G24a $y=2^x \xrightarrow[\text{de } x\text{-as met factor 3}]{\text{vermenigvuldiging t.o.v.}} y=3\cdot 2^x \xrightarrow{\text{translatie } (0,-6)} f(x)=3\cdot 2^x-6$.
$y=2^x \xrightarrow{\text{translatie } (3,1)} g(x)=2^{x-3}+1$.




```
Plot1 Plot2 Plot3
\Y1■3*2^X-6
\Y2■2^(X-3)+1
\Y3=■
```

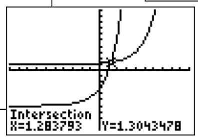
X	Y1	Y2
-3	-5.625	1.0156
-2	-5.25	1.0313
-1	-4.5	1.0625
0	-3	1.125
1	0	1.25
2	6	1.5
3	18	2

X=-3

G24b Zie de grafieken hiernaast. (gebruik TABLE)
(de grafiek van f heeft H.A.: $y=-6$ en de grafiek van g heeft H.A.: $y=1$)

G24c $f(x)=g(x)$ (intersect) $\Rightarrow S(1{,}28;\,1{,}30)$.

```
ZOOM MEMORY
1:ZBox
2:Zoom In
3:Zoom Out
4:ZDecimal
5:ZSquare
6:ZStandard
7↓ZTrig
```



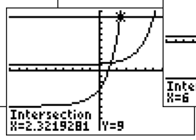
G24d $f(x)=-4\frac{1}{2} \Rightarrow 3\cdot 2^x-6=-4\frac{1}{2} \Rightarrow$
$3\cdot 2^x=1\frac{1}{2} \Rightarrow 2^x=\frac{1}{2}=2^{-1} \Rightarrow x=-1$.

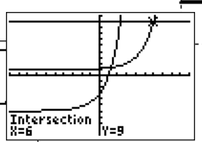
G24e $x=0 \Rightarrow g(0)=2^{0-3}+1=2^{-3}+1=\frac{1}{8}+1=1\frac{1}{8}$.
$x \ge 0$ (zie grafiek) $\Rightarrow g(x) \ge 1\frac{1}{8}$.

G24f $f(x)=9$ (intersect) $\Rightarrow x \approx 2{,}32$ en
$g(x)=9$ (intersect) $\Rightarrow x=6$.
Dus $AB \approx 6-2{,}32=3{,}68$.

```
Plot1 Plot2 Plot3
\Y1■3*2^X-6
\Y2■2^(X-3)+1
\Y3■9
\Y4=■
```

```
ZOOM MEMORY
1:ZBox
2:Zoom In
3:Zoom Out
4:ZDecimal
5:ZSquare
6:ZStandard
7↓ZTrig
```





G25a Op 1-1-1950 is $t=0$ en $N \approx 18\,571$ (TABLE).
Op 1-1-1960 is $t=10$ en $N \approx 31161$ (TABLE).
Op 1-1-1970 is $t=20$ en $N \approx 44\,166$ (TABLE).
De toename tussen 1-1-1950 en 1-1-1960 is $31161-18\,571=12\,590$.
De toename tussen 1-1-1960 en 1-1-1970 is $44\,166-31161=13\,005$.

```
Plot1 Plot2 Plot3
\Y1■65000/(1+2.5
*0.92^X)
\Y2=■
```

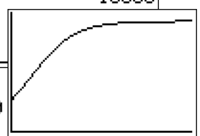
X	Y1
0	18571
10	31161
20	44166
30	53846
40	59687
50	62580
60	63926

X=0

X	Y1
70	64529
80	64795
90	64911
100	64961
110	64983
120	64993
130	64997

X=130

```
31161-18571
             12590
44166-31161
             13005
```



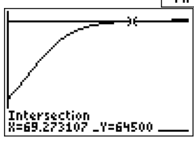
```
WINDOW
 Xmin=0
 Xmax=100
 Xscl=0
 Ymin=0
 Ymax=70000
 Yscl=0
 Xres=1
```

G25b Maak een schets van de plot hiernaast. (stippel ook de horizontale asymptoot $N=65000$)

G25c Op 1-1-2010 is $t=60$ en $N \approx 63\,926$ (TABLE).
Voor grote t is $N=\frac{65000}{1+2{,}5\cdot 0{,}92^t} \approx \frac{65000}{1+0}=65\,000$ (de grenswaarde).
Dus vanaf 2010 zal het aantal inwoners niet meer flink toenemen.

G25d $N=\frac{65000}{1+2{,}5\cdot 0{,}92^t}=64\,500$ (intersect of) $\Rightarrow t \approx 69{,}27$.
Hierbij hoort april (3 volle maanden zijn geweest) 2019.

```
Plot1 Plot2 Plot3
\Y1■65000/(1+2.5
*0.92^X)
\Y2■65000-500
\Y3=■
```




```
X-69
          .2731072203
Ans*12
          3.277286643
1950+69
                 2019
```

G25e $N=\frac{65000}{1+2{,}5\cdot 0{,}92^{t-10}}=\frac{65000}{1+2{,}5\cdot 0{,}92^t\cdot 0{,}92^{-10}} \approx \frac{65000}{1+5{,}8\cdot 0{,}92^t}$.

```
2.5*0.92^-10
          5.755217423
```

G26a $d=8 \Rightarrow P=0{,}48v^3\cdot 8^2=30{,}72v^3$.

```
0.48*8²
               30.72
```

G26b $P=20\,000 \Rightarrow 30{,}72v^3=20\,000 \Rightarrow v^3=\frac{20000}{30{,}72} \Rightarrow v \approx 8{,}7$ (m/s).

```
20000/30.72
          651.0416667
3ˣ√Ans
          8.667015929
```

G26c $P_{\text{maandag}}=30{,}72\cdot v^3 \Rightarrow P_{\text{dinsdag}}=30{,}72\cdot(2v)^3=30{,}72\cdot 2^3\cdot v^3=2^3\cdot\left(30{,}72\cdot v^3\right)=8\cdot P_{\text{maandag}}$.

G26d $v=12 \Rightarrow P=0{,}48\cdot 12^3d^2=829{,}44d^2$.

```
0.48*12^3
              829.44
```

G26e $P=50\,000 \Rightarrow 829{,}44d^2=50\,000 \Rightarrow d^2=\frac{50000}{829{,}44} \Rightarrow d \approx 7{,}8$ (m).

```
50000/829.44
          60.2816358
√(Ans)
          7.764124922
```

G26f $P_{\text{I}}=829{,}44\cdot d^2 \Rightarrow P_{\text{II}}=829{,}44\cdot(2d)^2=829{,}44\cdot 2^2\cdot d^2=2^2\cdot\left(829{,}44\cdot d^2\right)=4\cdot P_{\text{I}}$. Dus 4 keer zoveel vermogen.

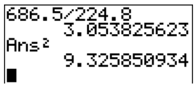
G27a $t=8\cdot 60+25=505 \Rightarrow P_{\text{vrouw}}-P_{\text{man}}=\frac{1197450}{505}-1176-\left(\frac{1077300}{505}-1234{,}9\right) \approx 296{,}8$ (punten).

```
1197450/505-1176
-(1077300/505-12
34.9
          296.8207921
```

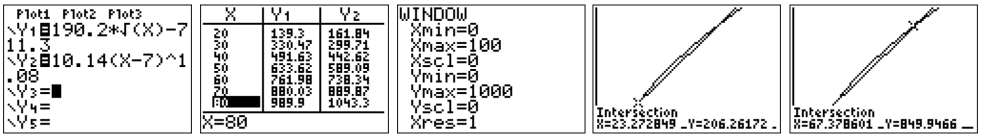
G27b $\frac{111960}{t}-1\,433{,}5=880{,}2 \Rightarrow \frac{111960}{t}=2\,213{,}7 \Rightarrow t=\frac{111960}{2\,213{,}7} \approx 48{,}39$ (sec).

```
880.2+1433.5
               2313.7
111960/Ans
          48.39002464
```

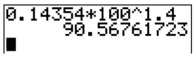
G27c $224{,}8 \cdot \sqrt{r} - 686{,}5 = 0 \Rightarrow 224{,}8 \cdot \sqrt{r} = 686{,}5 \Rightarrow \sqrt{r} = \frac{686{,}5}{224{,}8}$ (kwadrateren) $\Rightarrow r \approx 9{,}33$ (m).
Voor een negatief aantal punten moet ze de discus minder dan 9,33 meter wepen.



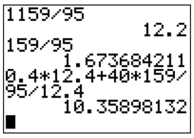
G27d $190{,}2 \cdot \sqrt{r} - 711{,}3 > 10{,}14(r-7)^{1{,}08}$ (intersect en een plot) $\Rightarrow 23{,}27 < r < 67{,}38$ (m).



G27e $P = 0{,}14354 \cdot (100(r-2{,}2))^{1{,}4} = 0{,}14354 \cdot 100^{1{,}4} \cdot (r-2{,}2)^{1{,}4}$. Dus $a = 0{,}14354 \cdot 100^{1{,}4} \approx 90{,}57$.

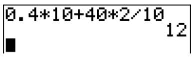


G28a $w = \frac{1178}{95} = 12{,}4$ en $l = \frac{159}{95} \approx 1{,}67 \Rightarrow F = 0{,}4 \cdot 12{,}4 + 40 \cdot \frac{\frac{159}{95}}{12{,}4} \approx 10{,}4$.

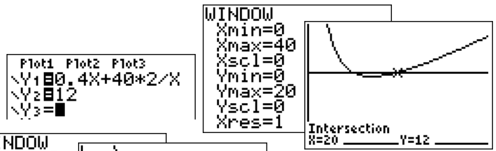


G28b De kleinste waarde 5,3 en de grootste waarde 11,3 kloppen met de boxplot.
De mediaan (het gemiddelde van het 6e en 7e getal) is volgens de boxplot 8,3. Dit klopt ook.
We missen in de staart nog een getal.
Het derde kwartiel (het gemiddelde van het 9e en 10e getal) moet volgens de boxplot 9,3 zijn. Dat zit ook goed.
Dus voor de laatste F-waarde moet gelden: $9{,}3 \le F \le 11{,}3$.

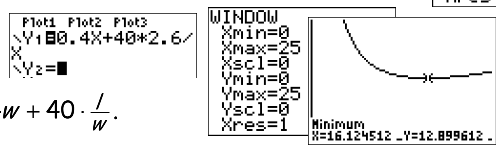
G28c $l = 2$ en $w = 10 \Rightarrow F = 0{,}4 \cdot 10 + 40 \cdot \frac{2}{10} = 4 + 8 = 12$.



$l = 2$, $w > 10$ en $F = 12 \Rightarrow 12 = 0{,}4 \cdot w + 40 \cdot \frac{2}{w}$ (intersect) $\Rightarrow w = 20$.

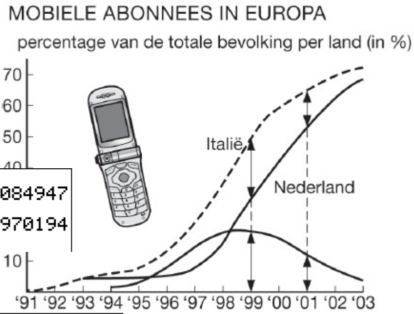


G28d $l = 2{,}6 \Rightarrow F = 0{,}4 \cdot w + 40 \cdot \frac{2{,}6}{w}$.
De optie minimum geeft: $w \approx 16{,}1$ (met $F_{min} \approx 12{,}9$).



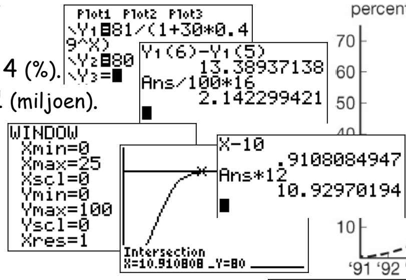
G28e $F = 0{,}4\left(k + l + 100 \cdot \frac{l}{k+l}\right) = 0{,}4\left(w + 100 \cdot \frac{l}{w}\right) = 0{,}4w + 40 \cdot \frac{l}{w}$.

G29a Zie de figuur hiernaast (met toelichting in de figuur).

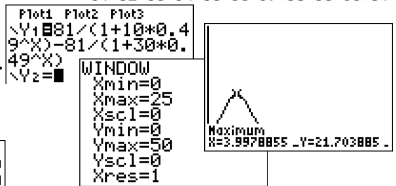


G29b Op 1-1-2000 is $t = 5$ en op 1-1-2001 is $t = 6$.
Toename van het percentage: $P_N(6) - P_N(5) = 13{,}4$ (%).
Toename van het aantal abonnees: $0{,}134 \cdot 16 \approx 2{,}1$ (miljoen).
Dat is meer dan 2 miljoen.

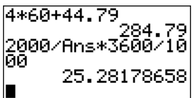
G29c $P_N = \frac{81}{1 + 30 \cdot 0{,}49^t} = 80$ (intersect) $\Rightarrow t \approx 10{,}91$ (jaar).
Dat is 10 jaar en bijna 11 maanden na 1-1-1995.
Dus in november 2005.



G29d $P_I - P_N = \frac{81}{1 + 10 \cdot 0{,}49^t} - \frac{81}{1 + 30 \cdot 0{,}49^t}$.
Optie maximum $\Rightarrow$ maximale verschil in percentages is 21,7 (% bij $t \approx 4{,}0$).



G30a 4 : 44,79 is $4 \times 60 + 44{,}79 = 284{,}79$ seconden.
De gemiddelde snelheid is $\frac{2000}{284{,}79}$ m/s.
De gemiddelde snelheid is $\frac{2000}{284{,}79} \times 3{,}6 \approx 25{,}28$ km/uur.



G30b $a = 3 \Rightarrow v = \frac{200 \cdot 3}{44 \cdot 3^2 + 1} - 0{,}07 \cdot 3 + 23 \approx 24{,}3$ (km/uur).
Het verschil met de tabel is (ongeveer) 0,2 km/uur.

G30c $v = \frac{200a}{44a^2+1} - 0{,}07a + 23 = 30$ (intersect) $\Rightarrow a \approx 0{,}608$ (km).
Dus bij een afstand van (ongeveer) 608 meter.

G30d $v = \frac{200a}{44a^2+1} - 0{,}07a + 23$ (optie maximum) $\Rightarrow a \approx 0{,}151$ (km en $v_{max} \approx 38{,}1$ km/uur).
Dus bij een afstand van (afgerond) 151 meter.