

1a $\Delta x = 6 - 2 = 4$ (km) en $\Delta y = 9,6 - 5 = 4,6$ (€).

1b $\frac{4,6}{4} = 1,15$ (€ / km) = $\frac{\Delta y}{\Delta x}$.

2a $P = aq + b$ met $a = \frac{\Delta P}{\Delta q} = \frac{125 - 57}{17 - 13} = \frac{68}{4} = 17$.

$$\left. \begin{array}{l} P = 17q + b \\ q = 13 \Rightarrow P = 57 \end{array} \right\} \Rightarrow 57 = 17 \cdot 13 + b$$

$$57 - 17 \cdot 13 = b = -164.$$

Dus $P = 17q - 164$.

3ab $K = 1,4q + 864$ en $R = 2,6q$. (volgt direct uit de gegevens)

3c $K = R$
 $1,4q + 864 = 2,6q$
 $-1,2q = -864$
 $q = 720$ (vazen).

4a $n = aT + b$ met $a = \frac{\Delta n}{\Delta T} = \frac{32 - 24}{24 - 19} = \frac{8}{5} = 1,6$.

$$\left. \begin{array}{l} n = 1,6T + b \\ T = 24 \Rightarrow n = 32 \end{array} \right\} \Rightarrow 32 = 1,6 \cdot 24 + b$$

$$32 - 1,6 \cdot 24 = b = -6,4.$$

Dus $n = 1,6T - 6,4$.

1c $5 - 2 \cdot 1,15 = 5 - 2,30 = 2,70$ (€).

1d Uit 1b en 1c volgt: $y = 1,15x + 2,70$.

2b $A = at + b$ met $a = \frac{\Delta A}{\Delta t} = \frac{300 - 360}{61 - 55} = \frac{-60}{6} = -10$.

$$\left. \begin{array}{l} A = -10t + b \\ t = 61 \Rightarrow A = 300 \end{array} \right\} \Rightarrow 300 = -10 \cdot 61 + b$$

$$300 + 10 \cdot 61 = b = 910.$$

Dus $A = -10t + 910$.

3d $W = R - K = 900$

$$2,6q - (1,4q + 864) = 900$$

$$1,2q - 864 = 900$$

$$1,2q = 1764$$

$$q = 1470$$
 (vazen).

4b $n = 1,6T - 6,4$

$$n + 6,4 = 1,6T$$

$$T = \frac{n + 6,4}{1,6} = \frac{1}{1,6}n + \frac{6,4}{1,6} = 0,625n + 4.$$

4c $n = \frac{88}{4} = 22 \Rightarrow T = 0,625 \cdot 22 + 4 = 17,75 \approx 18$ (°C).

5a $a = 150$ (per vrachtauto) $\Rightarrow K = 200$ (€ / TEU). Dus de totale kosten zijn $10 \cdot 200 = 2000$ euro.

5b 300 TEU per trein voor 69000 euro $\Rightarrow K = \frac{69000}{300} = 230$ (€ / TEU) $\Rightarrow a = 365$ (km).

5c Vrachtauto: lijn door (0, 50) en (50, 100) $\Rightarrow \frac{\Delta K}{\Delta a} = \frac{50}{50} = 1$ en $K = a + 50$.

Trein: lijn door (50, 150) en (250, 200) $\Rightarrow \frac{\Delta K}{\Delta a} = \frac{50}{200} = \frac{1}{4} = 0,25$ en $K = 0,25a + b$ door (250, 200) $\Rightarrow b = 137,5$.

Schip: lijn door (0, 150) en (250, 200) $\Rightarrow \frac{\Delta K}{\Delta a} = \frac{50}{250} = \frac{1}{5} = 0,2$ en $K = 0,2a + 150$.

5d $a + 50 = 0,25a + 137,5$ $0,25a + 137,5 = 0,2a + 150$

$$0,75a = 87,5$$

$$a = \frac{87,5}{0,75} \approx 116,67$$

$$0,05a = 12,5$$

$$a = \frac{12,5}{0,05} = 250$$

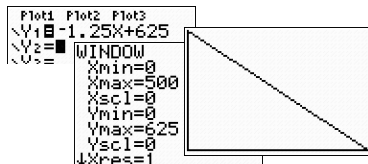
Nu aflezen in de grafiek: voor afstanden tussen 117 en 250 km is vervoer per trein het voordeligst.

6a $30x + 24y = 15000$
 (x keer € 30 en y keer € 24 levert € 15000 op)

$$24y = -30x + 15000$$

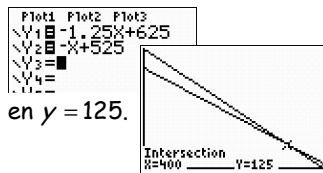
$$y = -\frac{30x}{24} + \frac{15000}{24}$$

$$y = -1,25x + 625.$$



6b $x + y = 525$
 (er worden 525 kaarten verkocht)

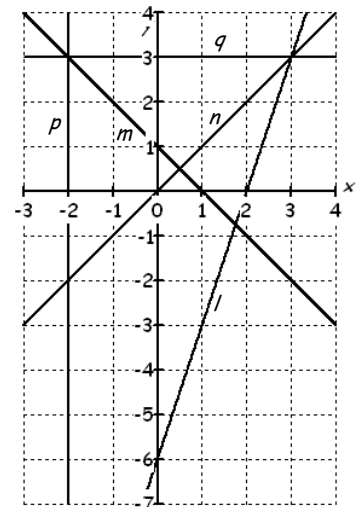
$y = -x + 525$. (zie de plot hiernaast)



6c $-1,25x + 625 = -x + 525$ (intersect) $\Rightarrow x = 400$ en $y = 125$.
 Er waren dus 125 pashouders aanwezig.

7ab

| | | |
|---|-----------------------------------|---|
| $l: 3x - y = 6$ | $m: x + y = 1$ | $n: x - y = 0$ |
| $x = 0 \Rightarrow -y = 6 \Rightarrow y = -6$ | $x = 0 \Rightarrow y = 1$ | $x = 0 \Rightarrow y = 0$ |
| $y = 0 \Rightarrow 3x = 6 \Rightarrow x = 2$ | $y = 0 \Rightarrow x = 1$ | $y = 1 \Rightarrow x - 1 = 0 \Rightarrow x = 1$ |
| $rc_l = 3$ ($y = 3x + \dots$) | $rc_m = -1$ ($y = -x + \dots$) | $rc_n = 1$ ($y = x + \dots$) |
| $p: y = 3$ (een horizontale lijn) | $q: x = -2$ (een verticale lijn) | |
| $x = 0 \Rightarrow y = 3$ | $y = 0 \Rightarrow x = -2$ | |
| $x = 1 \Rightarrow y = 3$ | $y = 1 \Rightarrow x = -2$ | |
| $rc_p = 0$ ($y = 0x + \dots$) | rc_q bestaat niet ($y = ???$) | |



8a $3x - 4y = 12$
 $-4y = -3x + 12$
 $y = \frac{3}{4}x - 3$.

8b $2x + 6 = 3y - 12$
 $-3y = -2x - 18$
 $y = \frac{2}{3}x + 6$.

8c $2x + 3y = y - 20$
 $2y = -2x - 20$
 $y = -x - 10$.

8d $2,5x - 3 = -6y + 30$
 $6y = -2,5x + 33$
 $y = -\frac{5}{12}x + 5\frac{1}{2}$.

9a Stel x = het aantal stoelen en y = het aantal tafels $\Rightarrow 350x + 850y = 22\,000$.

9b Stel x = de prijs van 100 gram cashewnoten en y = de prijs van 100 gram studentenhaver $\Rightarrow 4x + 7y = 8,40$.

9c Stel x = het aantal ha groenten en y = het aantal ha graan $\Rightarrow 10\,000x + 5\,000y = 250\,000$.

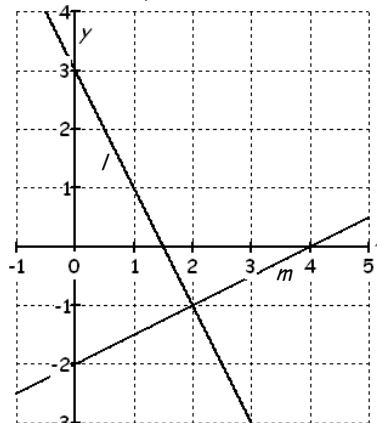
10a Stel x = het aantal abrikozenvlaaien en y = het aantal rijstevlaaien $\Rightarrow 12x + 15y = 645$.

10b Bijv.: $x = 0$ en $y = 43$
of $x = 5$ en $y = 39$
of $x = 10$ en $y = 35$.

11a $l: 2x + y = 3$
 $x = 0 \Rightarrow y = 3$
 $x = 1 \Rightarrow 2 + y = 3 \Rightarrow y = 1$.

$m: x - 2y = 4$
 $x = 0 \Rightarrow -2y = 4 \Rightarrow y = -2$
 $y = 0 \Rightarrow x = 4$.

11b Aflezen in de figuur: $(2, -1)$.
(of eerst y vrijmaken en dan algebraïsch oplossen)



12a \square $-2x + y = 7 \Rightarrow y = 2x + 7$.
 $y = 2x + 7$ (invullen) in $3x + y = 29$
 $3x + 2x + 7 = 29$
 $5x = 22$
 $x = 4,4$ in $y = 2x + 7$
 $y = 2 \cdot 4,4 + 7 = 15,8$.

12b \square $x - 5y = -15 \Rightarrow x = 5y - 15$.
 $x = 5y - 15$ in $x + y = 27$
 $5y - 15 + y = 27$
 $6y = 42$
 $y = 7$ in $x = 5y - 15$
 $x = 5 \cdot 7 - 15 = 20$.

12c \square $2x - y = 3 \Rightarrow y = 2x - 3$.
 $y = 2x - 3$ in $-3x + 5y = 13$
 $-3x + 10x - 15 = 13$
 $7x = 28$
 $x = 4$ in $y = 2x - 3$
 $y = 2 \cdot 4 - 3 = 5$.

13a \square $a - b = 720 \Rightarrow a = b + 720$.
 $a = b + 720$ in $a - 0,18b = 1130$
 $b + 720 - 0,18b = 1130$
 $0,82b = 410$
 $b = 500$ in $a = b + 720$
 $a = 500 + 720 = 1220$.

13b \square $3p + q = 18 \Rightarrow q = 18 - 3p$.
 $q = 18 - 3p$ in $2p - 3q = 19$
 $2p - 54 + 9p = 19$
 $11p = 73$
 $p = \frac{73}{11}$ in $q = 18 - 3p$
 $q = 18 - 3 \cdot \frac{73}{11} = -\frac{21}{11}$.

14 $x + 4y = 38 \Rightarrow x = 38 - 4y$.
 $x = 38 - 4y$ in $3x - 2y = -12$
 $114 - 12y - 2y = -12$
 $-14y = -126$
 $y = 9$ in $x = 38 - 4y$
 $x = 38 - 4 \cdot 9 = 2$.

15a $x + y = 5\,000$. (totaal 5000 kg)
15b $5\,000 \cdot 12,80 = 64\,000$.

15 $x + y = 5\,000 \Rightarrow y = 5\,000 - x$.
 $y = 5\,000 - x$ in $12x + 16y = 64\,000$
 $12x + 80\,000 - 16x = 64\,000$
 $-4x = -16\,000$
 $x = 4\,000$ in $y = 5\,000 - x$
 $y = 5\,000 - 4\,000 = 1\,000$.

16 Stel respectievelijk A en B euro.
 $A + B = 150\,000 \Rightarrow B = 150\,000 - A$.
 $B = 150\,000 - A$ in $0,06A + 0,08B = 11\,000$
 $0,06A + 12\,000 - 0,08A = 11\,000$
 $-0,02A = -1\,000 \Rightarrow A = 50\,000$.

17a $L = 207 - 0,85 \cdot 170 - 1,02 \cdot 18 = 44,14 \approx 44$.

17b $99 = 207 - 0,85 \cdot 120 - 1,02W$
 $1,02W = 6$
 $W \approx 5,9$.

17c Bij een moeilijk boek zullen S en W groot zijn.
Hoe groter S en W , hoe lager (de leesbaarheidsfactor) L is.

18a \square $a = 5b + 8 \Rightarrow 5b = a - 8 \Rightarrow b = \frac{1}{5}a - \frac{8}{5}$.
 $b = \frac{1}{5}a - \frac{8}{5}$ in $K = 14\frac{1}{4}b + 518\frac{1}{4} \Rightarrow$
 $K = 14\frac{1}{4}(\frac{1}{5}a - \frac{8}{5}) + 518\frac{1}{4} = 2,85a + 495,45$.

18b \square $2b = 6 - 8c \Rightarrow b = 3 - 4c$.
 $b = 3 - 4c$ in $K = 14\frac{1}{4}b + 518\frac{1}{4} \Rightarrow$
 $K = 14\frac{1}{4}(3 - 4c) + 518\frac{1}{4} = -57c + 561$.

19a \square $t = -\frac{1}{2}p + 6 \Rightarrow \frac{1}{2}p = 6 - t \Rightarrow p = 12 - 2t$.
 $p = 12 - 2t$ in $A = 2t + 5p + 9 \Rightarrow$
 $A = 2t + 5(12 - 2t) + 9 = -8t + 69$.

19c \square $p = -3q + 6$ en $2q = -r + 8 \Rightarrow r = 8 - 2q$.
beide invullen in $K = 5p + 3q + 5r + 100 \Rightarrow$
 $K = 5(-3q + 6) + 3q + 5(8 - 2q) + 100 = -22q + 170$.

19b \square $y = 2x + 6 \Rightarrow 2x = y - 6 \Rightarrow x = \frac{1}{2}y - 3$.
 $x = \frac{1}{2}y - 3$ in $A = 6xy + 20 \Rightarrow$
 $A = 6y(\frac{1}{2}y - 3) + 20 = 3y^2 - 18y + 20$.

19d \square $x + y + z = 50 \Rightarrow z = 50 - x - y$.
 $z = 50 - x - y$ in $W = 18 - 0,02x - 0,6y - 0,5z \Rightarrow$
 $W = 18 - 0,02x - 0,6y - 0,5(50 - x - y) = -7 + 0,48x - 0,1y$.

20a $A = 10p$ in $q = -10p + 0,3A + 150$ geeft $q = -10p + 0,3 \cdot 10p + 150 = -7p + 150$. 20c $q = 119$ én $p = 8,5$ in $q = -10p + 0,3A + 150$ geeft $119 = -10 \cdot 8,5 + 0,3A + 150$
 $-0,3A = -54$
 $A = 180$

20b $A = 30 + 5p$ in $q = -10p + 0,3A + 150$ geeft $q = -10p + 0,3 \cdot (30 + 5p) + 150 = -8,5p + 159$.

21a $l = 50 \Rightarrow BMR = 66 + 13,7g + 5h - 6,8 \cdot 50 = 13,7g + 5h - 274$.

21b $l = 28, g = 68$ en $BMR = 1700 \Rightarrow 1700 = 66 + 13,7 \cdot 68 + 5h - 6,8 \cdot 28 \Rightarrow 892,8 = 5h \Rightarrow h \approx 179$ (cm).

21c $l = 40$ en $g = h - 100 \Rightarrow BMR = 66 + 13,7 \cdot (h - 100) + 5h - 6,8 \cdot 40 = 18,7h - 1576$.

22 $y = 80$ en $z = 10x - 20 \Rightarrow P = \frac{80x}{10} (2 - \frac{10x - 20}{5}) = 8x(2 - (2x - 4)) = 8x(2 - 2x + 4) = 8x(6 - 2x) = -16x^2 + 48x$.

23a $R = pq = (-0,002q + 4)q = -0,002q^2 + 4q$.

23b $\frac{dR}{dq} = 0 \Rightarrow -0,004q + 4 = 0 \Rightarrow -0,004q = -4 \Rightarrow q = 1000$.
De maximale opbrengst is $R_{\max} = R(1000) = 2000$ euro.

23c $W = R - K = -0,002q^2 + 4q - (0,60q + 200) = -0,002q^2 + 3,4q - 200$.

23d $\frac{dW}{dq} = 0 \Rightarrow -0,004q + 3,4 = 0 \Rightarrow -0,004q = -3,4 \Rightarrow q = 850$.
De prijs is dan $p(850) = 2,30$ euro.

24a $20x^2 - 160x + 300 = 0$
 $x^2 - 8x + 15 = 0$
 $(x - 3)(x - 5) = 0$
 $x = 3 \vee x = 5$.

24c $q(4 - 0,2q) = 15$
 $4q - 0,2q^2 = 15$
 $-0,2q^2 + 4q - 15 = 0$
 $q^2 - 20q + 75 = 0$
 $(q - 5)(q - 15) = 0$
 $q = 5 \vee q = 15$.

24d $q(-0,01q + 40) = 0$
 $q = 0 \vee -0,01q = -40$
 $q = 0 \vee q = \frac{-40}{-0,01} = 4000$.

24b $0,02x^2 - 8x = 0$
 $x^2 - 400x = 0$
 $x(x - 400) = 0$
 $x = 0 \vee x = 400$.

25a $R = -0,002q^2 + 24q = 0$ (de grafiek van R is een bergparabool)
 $q(-0,002q + 24) = 0$
 $q = 0 \vee -0,002q = -24$
 $q = 0 \vee q = 12000$.

25cd $R = -0,002q^2 + 24q = 64000$
 $-0,002q^2 + 24q - 64000 = 0$
 $q^2 - 12000q + 32000000 = 0$
 $(q - 4000)(q - 8000) = 0$
 $q = 4000 \vee q = 8000$.
Dus bij aantallen tussen 4000 en 8000.

25b $\frac{dR}{dq} = 0 \Rightarrow -0,004q + 24 = 0 \Rightarrow -0,004q = -24 \Rightarrow q = 6000$.
De maximale opbrengst is $R_{\max} = R(6000) = 72000$ euro.

26a $p = aq + b$ met $a = \frac{\Delta p}{\Delta q} = \frac{20 - 28}{1200 - 400} = \frac{-8}{800} = -0,01$.
 $p = -0,01q + b$
 $q = 400 \Rightarrow p = 28$
 $28 + 4 = b = 32$.
Dus $p = -0,01q + 32$ en $R = pq = -0,01q^2 + 32q$.

26c $K = 16q + 1500$.
 $W = R - K = -0,01q^2 + 32q - 16q - 1500$
 $W = -0,01q^2 + 16q - 1500$.
 $\frac{dW}{dq} = -0,02q + 16$
 $\frac{dW}{dq} = 0 \Rightarrow -0,02q = -16 \Rightarrow q = 800$.
 $W_{\max} = W(800) = 4900$ (€) en $p = p(800) = 24$ (€).

26b $R = -0,01q^2 + 32q = 24000$ ($\times -100$ en op 0 herleiden)
 $q^2 - 3200q + 2400000 = 0$
 $(q - 1200)(q - 2000) = 0$
 $q = 1200 \vee q = 2000$.
 $q = 1200 \Rightarrow p = -12 + 32 = 20$ (€).
 $q = 2000 \Rightarrow p = -20 + 32 = 12$ (€).

26d $W = -0,01q^2 + 16q - 1500$ geeft $W_{\max} = 4900$ (€).
Zonder vaste kosten $W_{\max} = 6400$ (€).
De vaste kosten zijn nu 400 (€).

27a $h = -0,18x^2 + 0,96 = 0$
 $-0,18x^2 = -0,96$
 $x^2 = \frac{16}{3}$
 $x_A = -\sqrt{\frac{16}{3}} \vee x_B = \sqrt{\frac{16}{3}}$ ($\times 100$ feet).
 $AB = \sqrt{\frac{16}{3}} \times 100 \times 2 \times 0,314 \approx 145$ meter.

27b $PQ = 380$ feet $\Rightarrow x_Q = 1,9$ ($\times 100$ feet).
 $h_Q = -0,18 \cdot 1,9^2 + 0,96 = 0,3102$ ($\times 100$ feet).
 $h_T = -0,18 \cdot 0^2 + 0,96 = 0,96$ ($\times 100$ feet).
 $h_T = h_Q = 0,96 - 0,3102 = 0,6498$ ($\times 100$ feet).
Dus het water staat $0,6498 \cdot 100 \approx 65$ feet onder T.

27c $h_{\text{wateroppervlak}} = h_T - 0,7 = 0,96 - 0,7 = 0,26$ ($\times 100$ feet).

$$h = -0,18 \cdot x^2 + 0,96 = 0,26 \Rightarrow -0,18 \cdot x^2 = -0,7 \Rightarrow x^2 = \frac{-0,7}{-0,18} = \frac{70}{18} = \frac{35}{9} \Rightarrow x = \pm \sqrt{\frac{35}{9}}$$
 ($\times 100$ feet).

De breedte van het wateroppervlak is $\sqrt{\frac{35}{9}} \cdot 100 \cdot 2 \cdot 0,314 \approx 123,8$ meter.

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-0.7/-0.18*Frac
35/9
sqrt(Ans)*100*2*0.3
14
123.8432701

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28a $x^2 = 16 \Rightarrow x = 4 \vee x = -4$, dus $(2x - 1)^2 = 16 \Rightarrow 2x - 1 = 4 \vee 2x - 1 = -4$.

28b $(2x - 1)^2 = 16 \Rightarrow 2x - 1 = 4 \vee 2x - 1 = -4 \Rightarrow 2x = 5 \vee 2x = -3 \Rightarrow x = \frac{5}{2} \vee x = -\frac{3}{2}$.

28c Een kwadraat kan nooit negatief zijn (of de wortel uit een negatief getal bestaat niet).

29a $(x - 3)(2x + 1) = (x - 3)(x + 5)$
 $2x^2 + x - 6x - 3 = x^2 + 5x - 3x - 15$
 $x^2 - 7x + 12 = 0$
 $(x - 3)(x - 4) = 0$
 $x = 3 \vee x = 4$.

29bc $2x + 1 = x + 5$
 $x = 4$.
 Leonard krijgt de oplossing $x = 4$, maar is $x = 3$ kwijt.
 Het is niet toegestaan door letters (bijvoorbeeld $x - 3$) te delen.
 (je mag wel delen als je vóór het delen door $x - 3$ eerst $x - 3 = 0$ stelt)

30a $(3x - 2)^2 = 49$
 $3x - 2 = 7 \vee 3x - 2 = -7$
 $3x = 9 \vee 3x = -5$
 $x = 3 \vee x = -\frac{5}{3}$.

30c $(x - 3)^2 = (2x - 7)^2$
 $x - 3 = 2x - 7 \vee x - 3 = -(2x - 7)$
 $-x = -4 \vee 3x = 10$
 $x = 4 \vee x = \frac{10}{3}$.

30b $(3x - 1)(5x - 3) = (3x - 1)(6x + 5)$
 $3x - 1 = 0 \vee 5x - 3 = 6x + 5$
 $3x = 1 \vee -x = 8$
 $x = \frac{1}{3} \vee x = -8$.

30d $(x^2 - 1)(4x - 3) - 5(x^2 - 1) = 0$
 $(x^2 - 1)(4x - 3) = 5(x^2 - 1)$
 $x^2 - 1 = 0 \vee 4x - 3 = 5$
 $x^2 = 1 \vee 4x = 8$
 $x = 1 \vee x = -1 \vee x = 2$.

31a $(x + 2)(x^2 + 2x + 1) = x + 2$
 $x + 2 = 0 \vee x^2 + 2x + 1 = 1$
 $x = -2 \vee x^2 + 2x = 0$
 $x = -2 \vee x(x + 2) = 0$
 $x = -2 \vee x = 0 \vee x = -2$.

31e $7(x - 3)^2 = (x + 1)(x - 3)^2$
 $(x - 3)^2 = 0 \vee x + 1 = 7$
 $x - 3 = 0 \vee x = 6$
 $x = 3 \vee x = 6$.

31b $5 \cdot \sqrt{x^2 - 3} = (2x - 1) \cdot \sqrt{x^2 - 3}$
 $\sqrt{x^2 - 3} = 0 \vee 2x - 1 = 5$
 $x^2 - 3 = 0 \vee 2x = 6$
 $x^2 = 3 \vee x = 3$
 $x = -\sqrt{3} \vee x = \sqrt{3} \vee x = 3$
 $x \approx -1,73 \vee x \approx 1,73 \vee x = 3$.

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sqrt(3)
1.732050808

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31g

31f $(2x - 1)^2 \cdot \sqrt{2x - 1} = 25 \cdot \sqrt{2x - 1}$
 $\sqrt{2x - 1} = 0 \vee (2x - 1)^2 = 25$
 $2x - 1 = 0 \vee 2x - 1 = -5 \vee 2x - 1 = 5$
 $2x = 1 \vee 2x = -4 \vee 2x = 6$
 $x = \frac{1}{2} \vee x = -2 \vee x = 3$.

31c $(x - 1)(x + 3) = (x - 1)(x^2 + 6x + 3)$
 $x - 1 = 0 \vee x^2 + 6x + 3 = x + 3$
 $x = 1 \vee x^2 + 5x = 0$
 $x = 1 \vee x(x + 5) = 0$
 $x = 1 \vee x = 0 \vee x = -5$.

$(x^2 - 5)^3 = 9(x^2 - 5)$
 $x^2 - 5 = 0 \vee (x^2 - 5)^2 = 9$
 $x^2 = 5 \vee x^2 - 5 = -3 \vee x^2 - 5 = 3$
 $x = -\sqrt{5} \vee x = \sqrt{5} \vee x^2 = 2 \vee x^2 = 8$
 $x = -\sqrt{5} \vee x = \sqrt{5} \vee x = -\sqrt{2} \vee x = \sqrt{2} \vee x = -\sqrt{8} \vee x = \sqrt{8}$
 $x \approx -2,24 \vee x \approx 2,24 \vee x \approx -1,41 \vee x \approx 1,41 \vee x \approx -2,83 \vee x \approx 2,83$.

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sqrt(5)
2.236067977
sqrt(2)
1.414213562
sqrt(8)
2.828427125

```

31d $5(3x - 5) = (x - 1)(3x - 5)$
 $3x - 5 = 0 \vee x - 1 = 5$
 $3x = 5 \vee x = 6$
 $x = \frac{5}{3} \vee x = 6$.

31h $(2x - 1)(x^2 - 36) = (x^2 - 36)(x + 7)$
 $x^2 - 36 = 0 \vee 2x - 1 = x + 7$
 $x^2 = 36 \vee x = 8$
 $x = -6 \vee x = 6 \vee x = 8$.

32a $(5x^2 - 30)(3x + 1) = 0$
 $5x^2 - 30 = 0 \vee 3x + 1 = 0$
 $5x^2 = 30 \vee 3x = -1$
 $x^2 = 6 \vee x = -\frac{1}{3}$
 $x = -\sqrt{6} \vee x = \sqrt{6} \vee x = -\frac{1}{3}$
 $x \approx -2,45 \vee x \approx 2,45 \vee x \approx -0,33$.

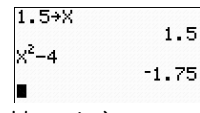
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sqrt(6)
2.449489743
1/3
.3333333333

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32b $(5x^2 - 125)(3x + 1) = (5x^2 - 125)(x^2 + 1)$
 $5x^2 - 125 = 0 \vee x^2 + 1 = 3x + 1$
 $5x^2 = 125 \vee x^2 - 3x = 0$
 $x^2 = 25 \vee x(x - 3) = 0$
 $x = -5 \vee x = 5 \vee x = 0 \vee x = 3$.

32c $3x \cdot \sqrt{x^2 - 4} = (x + 3) \cdot \sqrt{x^2 - 4}$
 $\sqrt{x^2 - 4} = 0 \vee 3x = x + 3$
 $x^2 - 4 = 0 \vee 2x = 3$
 $x^2 = 4 \vee x = \frac{3}{2}$
 $x = -2 \vee x = 2 \vee x = \frac{3}{2}$ (voldoet niet).



32e $6(5x - 3) - (2x - 3)(x + 6) = 0$
 $30x - 18 - (2x^2 + 12x - 3x - 18) = 0$
 $-2x^2 + 21x = 0$
 $x(-2x + 21) = 0$
 $x = 0 \vee -2x = -21$
 $x = 0 \vee x = \frac{21}{2} = 10\frac{1}{2}$.

32d $5 \cdot \sqrt{x^2 - 4} - x \cdot \sqrt{x^2 - 4} = 0$
 $5 \cdot \sqrt{x^2 - 4} = x \cdot \sqrt{x^2 - 4}$
 $\sqrt{x^2 - 4} = 0 \vee x = 5$
 $x^2 - 4 = 0 \vee x = 5$
 $x^2 = 4 \vee x = 5$
 $x = -2 \vee x = 2 \vee x = 5$.

32f $(x + 2)(x + 3) = (x + 4)(x + 5)$
 $x^2 + 3x + 2x + 6 = x^2 + 5x + 4x + 20$
 $-4x = 14$
 $x = \frac{14}{-4} = -\frac{7}{2} = -3\frac{1}{2}$.

33a $q = 0,6(a - 3)^2$ invullen in $K = 0,2q + 25$
 $K = 0,2 \cdot 0,6(a - 3)^2 + 25$
 $K = 0,12(a - 3)^2 + 25$.

33b $K = 0,12(a - 3)^2 + 25 = 37$
 $0,12(a - 3)^2 = 12$
 $(a - 3)^2 = 100$
 $a - 3 = -10 \vee a - 3 = 10$
 $a = -7 \vee a = 13$.

34 (3, 5) op de grafiek van $y = ax^2 + bx + 8 \Rightarrow a \cdot 3^2 + b \cdot 3 + 8 = 5 \Rightarrow 9a + 3b + 8 = 5$.

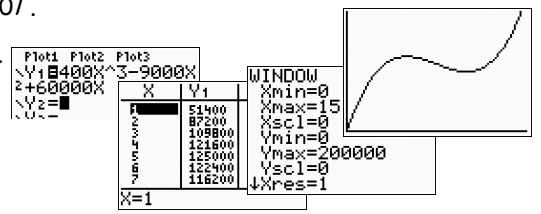
35 (-2, -24) op de grafiek van $y = ax^2 + bx \Rightarrow 4a - 2b = -24$ ofwel $2a - b = -12$.
 (1, 3) op de grafiek van $y = ax^2 + bx \Rightarrow a + b = 3$.
 $a + b = 3 \Rightarrow b = 3 - a$ invullen in $2a - b = -12$ geeft
 $2a - (3 - a) = -12$
 $2a - 3 + a = -12$
 $3a = -9 \Rightarrow a = -3$ invullen in $a + b = 3$ geeft $-3 + b = 3 \Rightarrow b = 6$.

36 (0, 0) op de grafiek van $y = ax^2 + bx + c \Rightarrow c = 0$,
 (1, 300) op de grafiek van $y = ax^2 + bx + c \Rightarrow a + b + c = 300$ en
 (2, 500) op de grafiek van $y = ax^2 + bx + c \Rightarrow 4a + 2b + c = 500$.
 $c = 0$ invullen in $a + b + c = 300$ en $4a + 2b + c = 500$ geeft $a + b = 300$ en $4a + 2b = 500$.
 $a + b = 300 \Rightarrow b = 300 - a$ invullen in $4a + 2b = 500$ geeft
 $4a + 2(300 - a) = 500$
 $4a + 600 - 2a = 500$
 $2a = -100 \Rightarrow a = -50$ invullen in $a + b = 300$ geeft $-50 + b = 300 \Rightarrow b = 350$. Dus $a = -50$, $b = 350$ en $c = 0$.

37a $T = 2,5 \Rightarrow A = 40\,000 \Rightarrow 6,25a + 2,5b + 60\,000 = 40\,000$ ofwel $6,25a + 2,5b = -20\,000$ of $25a + 10b = -80\,000$ en
 $T = 5 \Rightarrow A = 25\,000 \Rightarrow 25a + 5b + 60\,000 = 25\,000$ ofwel $25a + 5b = -35\,000$ ofwel $5a + b = -7\,000$.
 $5a + b = -7\,000 \Rightarrow b = -7\,000 - 5a$ invullen in $25a + 10b = -80\,000$ geeft
 $25a + 10(-7\,000 - 5a) = -80\,000$
 $25a - 70\,000 - 50a = -80\,000$
 $-25a = -10\,000 \Rightarrow a = 400$ invullen in $5a + b = -7\,000$ geeft $2\,000 + b = -7\,000 \Rightarrow b = -9\,000$.

37b $A = 400T^2 - 9000T + 60\,000$.
 $R = T \cdot A = T \cdot (400T^2 - 9000T + 60\,000) = 400T^3 - 9000T^2 + 60\,000T$.

37c $R = 400T^3 - 9000T^2 + 60\,000T \Rightarrow \frac{dR}{dT} = 1200T^2 - 18000T + 60\,000$.
 $\frac{dR}{dT} = 0 \Rightarrow 1200T^2 - 18000T + 60\,000 = 0$
 $T^2 - 15T + 50 = 0$
 $(T - 5)(T - 10) = 0 \Rightarrow T = 5 \vee T = 10$.
 R is maximaal (zie een plot) bij een toltarief van 5 euro.



38a Je krijgt $\frac{A}{B} = C \Rightarrow A = BC$.

38b Je krijgt $\frac{A}{B} = 0 \Rightarrow A = 0$.

$$39a \quad \frac{20}{x-3} = 2 \\ 2(x-3) = 20 \\ x-3 = 10 \\ x = 13.$$

$$39c \quad \frac{5}{x^2} - \frac{20}{x^3} = 0 \\ \frac{5x-20}{x^3} = 0 \text{ (teller = 0)} \\ 5x = 20 \\ x = 4.$$

$$39e \quad \frac{3(2x-5) - (x+3)(x-5)}{x+7} = 0 \text{ (teller = 0)} \\ 6x - 15 - (x^2 - 5x + 3x - 15) = 0 \\ -x^2 + 8x = 0 \\ x(-x+8) = 0 \Rightarrow x = 0 \vee x = 8.$$

$$39b \quad \frac{800}{x-3} - 300 = 100 \\ \frac{800}{x-3} = 400 \\ 400(x-3) = 800 \\ x-3 = 2 \\ x = 5.$$

$$39d \quad \frac{-0,03x^2 + 18x}{x+7} = 0 \text{ (teller = 0)} \\ -0,03x^2 + 18x = 0 \\ x(-0,03x + 18) = 0 \\ x = 0 \vee -0,03x = -18 \\ x = 0 \vee x = 600.$$

$$39f \quad \frac{x}{x-10} = \frac{5}{x} \\ x^2 = 5(x-10) \\ x^2 - 5x + 50 = 0 \\ D = (-5)^2 - 4 \cdot 1 \cdot 50 < 0 \Rightarrow \text{geen oplossing.}$$

$$40a \quad \frac{500}{a} - 70 = \frac{500}{a} - \frac{70}{1} = \frac{500-70a}{a}.$$

$$40d \quad \frac{0,5}{x+3} - 0,2x = \frac{0,5}{x+3} - \frac{0,2x}{1} = \frac{0,5-0,2x(x+3)}{x+3} = \frac{-0,2x^2-0,6x+0,5}{x+3}.$$

$$40b \quad \frac{100}{a} + \frac{200}{b} = \frac{100b+200a}{ab}.$$

$$40e \quad 80 + \frac{50}{3x-10} = \frac{80}{1} + \frac{50}{3x-10} = \frac{80(3x-10)+50}{3x-10} = \frac{240x-750}{3x-10}.$$

$$40c \quad 5 + \frac{3}{x-2} = \frac{5}{1} + \frac{3}{x-2} = \frac{5(x-2)+3}{x-2} = \frac{5x-10+3}{x-2} = \frac{5x-7}{x-2}.$$

$$40f \quad \frac{380}{x^2} - \frac{40}{x} = \frac{380-40x}{x^2}.$$

$$41a \quad \frac{3}{x} \cdot \frac{5}{y} = \frac{15}{xy}.$$

$$41d \quad \frac{350}{x} \left(1 - \frac{2}{x}\right) = \frac{350}{x} - \frac{700}{x^2} = \frac{350x-700}{x^2}.$$

$$41b \quad \frac{3}{2x} \cdot \frac{x^3}{5y} = \frac{3x^3}{10xy} = \frac{3x^2}{10y}.$$

$$41e \quad \frac{150}{x} : \frac{x-4}{x} = \frac{150}{x} \cdot \frac{x}{x-4} = \frac{150x}{x(x-4)} = \frac{150}{x-4}.$$

$$41c \quad \frac{6000}{\left(\frac{2}{x-4}\right)} = \frac{6000}{\left(\frac{2}{x-4}\right)} \cdot \frac{x-4}{x-4} = \frac{6000(x-4)}{2} = 3000x - 12000.$$

$$41f \quad 8x \left(3 + \frac{5}{x^2}\right) = 24x + \frac{40x}{x^2} = \frac{24x}{1} + \frac{40}{x} = \frac{24x^2+40}{x}.$$

$$42 \quad \frac{15}{\left(\frac{5}{3}\right)} = \frac{15}{\left(\frac{5}{3}\right)} \cdot \frac{3}{3} = \frac{45}{5} = 9 \\ \frac{\left(\frac{15}{5}\right)}{3} = \frac{3}{3} \cdot \frac{5}{5} = \frac{15}{15} = 1$$

$$\text{of} \quad \frac{15}{\left(\frac{5}{3}\right)} = 15 \cdot \frac{3}{5} = \frac{45}{5} = 9.$$

$$\text{of} \quad \frac{\left(\frac{15}{5}\right)}{3} = \frac{\left(\frac{15}{5}\right)}{3} \cdot \frac{5}{5} = \frac{15}{15} = 1$$

$$\text{of} \quad \frac{\left(\frac{15}{5}\right)}{3} = \frac{15}{5} \cdot \frac{1}{3} = \frac{15}{15} = 1.$$

$$43a \quad \frac{15 + \frac{3}{x}}{x} = \frac{15 + \frac{3}{x}}{x} \cdot \frac{x}{x} = \frac{15x+3}{x^2}.$$

$$43d \quad \frac{50}{\left(\frac{10}{x}\right)} = \frac{50}{\left(\frac{10}{x}\right)} \cdot \frac{x}{x} = \frac{50x}{10} = 5x.$$

$$43e \quad x + 25 \cdot \frac{\left(\frac{100}{x}\right)}{5} = x + 5 \cdot \frac{100}{x} = x + \frac{500}{x}.$$

$$43b \quad \frac{20a}{b + \frac{a^2}{2b}} = \frac{20a}{b + \frac{a^2}{2b}} \cdot \frac{2b}{2b} = \frac{40ab}{2b^2 + a^2}.$$

$$43c \quad \frac{\left(\frac{50}{x}\right)}{10} = \frac{\left(\frac{50}{x}\right)}{10} \cdot \frac{x}{x} = \frac{50}{10x} = \frac{5}{x}.$$

$$43f \quad \frac{3 + \frac{2}{x}}{7 - \frac{1}{x}} = \frac{3 + \frac{2}{x}}{7 - \frac{1}{x}} \cdot \frac{x}{x} = \frac{3x+2}{7x-1}.$$

$$44a \quad A = 18 \cdot \frac{\left(\frac{500}{x}\right)}{10} + 25x = 9 \cdot \frac{\left(\frac{500}{x}\right)}{5} \cdot \frac{x}{x} + 25x = 9 \cdot \frac{500}{5x} + 25x = 9 \cdot \frac{100}{x} + 25x = \frac{900}{x} + 25x.$$

$$44b \quad T = \frac{50a}{\frac{a^2}{5b} + 2b} = \frac{50a}{\frac{a^2}{5b} + 2b} \cdot \frac{5b}{5b} = \frac{250ab}{a^2 + 10b^2}.$$

$$44c \quad L = \left(21 + \frac{180}{\frac{a}{b}}\right) \cdot a = \left(21 + \frac{9}{\frac{a}{b}} \cdot \frac{b}{b}\right) \cdot a = \left(21 + \frac{9b}{a}\right) \cdot a = 21a + 9b.$$

$$45a \quad A = \frac{5x^2+4x+3}{x} = \frac{5x^2}{x} + \frac{4x}{x} + \frac{3}{x} = 5x + 4 + \frac{3}{x}.$$

$$45c \quad y = \frac{5a^2+10a}{2a^2} = \frac{5a^2}{2a^2} + \frac{10a}{2a^2} = \frac{5}{2} + \frac{5}{a}.$$

$$45b \quad T = \frac{3x^2+6x+180}{3x} = \frac{3x^2}{3x} + \frac{6x}{3x} + \frac{180}{3x} = x + 2 + \frac{60}{x}.$$

$$45d \quad K = \frac{q^2+3q+18}{q} = \frac{q^2}{q} + \frac{3q}{q} + \frac{18}{q} = q + 3 + \frac{18}{q}.$$

$$46a \quad C = \frac{A}{B+3} \Rightarrow B+3 = \frac{A}{C} \Rightarrow B = \frac{A}{C} - 3.$$

$$46b \quad C = 5 + \frac{A}{B} \Rightarrow C - 5 = \frac{A}{B} \Rightarrow B = \frac{A}{C-5}.$$

$$47a \quad K = 5 + \frac{8}{q} \Rightarrow K - 5 = \frac{8}{q} \Rightarrow q = \frac{8}{K-5}.$$

$$47d \quad P = 18 - \frac{5}{q-2} \Rightarrow P - 18 = \frac{-5}{q-2} \Rightarrow q-2 = \frac{-5}{P-18} \Rightarrow q = 2 - \frac{5}{P-18}.$$

$$47b \quad K = \frac{8}{q-1} \Rightarrow q-1 = \frac{8}{K} \Rightarrow q = \frac{8}{K} + 1.$$

$$47e \quad P = \frac{7}{3q-2} \Rightarrow 3q-2 = \frac{7}{P} \Rightarrow 3q = \frac{7}{P} + 2 \left(\times \frac{1}{3}\right) \Rightarrow q = \frac{7}{3P} + \frac{2}{3}.$$

$$47c \quad K = \frac{q+3}{2q-1} \Rightarrow K(2q-1) = q+3 \Rightarrow \\ 2Kq - K = q+3 \Rightarrow 2Kq - q = K+3 \Rightarrow \\ q(2K-1) = K+3 \Rightarrow q = \frac{K+3}{2K-1}.$$

$$47f \quad A = \frac{q}{q+4} \Rightarrow A(q+4) = q \Rightarrow \\ Aq + 4A = q \Rightarrow Aq - q = -4A \Rightarrow \\ q(A-1) = -4A \Rightarrow q = -\frac{4A}{A-1}.$$

48a $T = \frac{a}{a-6} \Rightarrow aT - 6T = a \Rightarrow aT - a = 6T \Rightarrow a(T-1) = 6T \Rightarrow a = \frac{6T}{T-1}$.

48b $L = 320 - \frac{18}{q-1} \Rightarrow L - 320 = \frac{-18}{q-1} \Rightarrow q-1 = \frac{-18}{L-320} \Rightarrow q = 1 - \frac{18}{L-320}$.

48c $\frac{3x}{x+y} = 5 - x \Rightarrow \frac{3x}{5-x} = x + y \Rightarrow y = \frac{3x}{5-x} - x$.

49a $\frac{1}{T} = 5 + \frac{3}{A} \Rightarrow \frac{1}{T} - \frac{5}{1} = \frac{3}{A} \Rightarrow \frac{1-5T}{T} = \frac{3}{A} \Rightarrow \frac{T}{1-5T} = \frac{A}{3} \text{ (}\times 3\text{)} \Rightarrow A = \frac{3T}{1-5T}$.

49b $\frac{1}{T} = 5 + \frac{3}{A} \Rightarrow \frac{1}{T} = \frac{5}{1} + \frac{3}{A} \Rightarrow \frac{1}{T} = \frac{5A+3}{A} \Rightarrow \frac{T}{1} = T = \frac{A}{5A+3}$.

50a $y = 15$ en $z = \frac{1}{2}x + 4$ invullen in $K = \frac{xy}{120} \left(4 - \frac{z}{4}\right)$ geeft

$K = \frac{15x}{120} \left(4 - \frac{\frac{1}{2}x + 4}{4}\right) = \frac{1}{8}x \left(4 - \left(\frac{1}{8}x + 1\right)\right) = \frac{1}{8}x \left(3 - \frac{1}{8}x\right) = -\frac{1}{64}x^2 + \frac{3}{8}x$. Dus $a = -\frac{1}{64}$ en $b = \frac{3}{8}$.

50b $xy = 120 \Rightarrow y = \frac{120}{x}$ invullen in $K = \frac{50}{x} + 8x + \frac{6}{y} + \frac{1}{15}y$ geeft

$K = \frac{50}{x} + 8x + \frac{6}{\left(\frac{120}{x}\right)} + \frac{1}{15} \cdot \frac{120}{x} = \frac{50}{x} + 8x + 6 \cdot \frac{x}{120} + \frac{8}{x} = \frac{58}{x} + 8\frac{1}{20}x$. Dus $a = 58$ en $b = 8\frac{1}{6}$.

51 $5\sqrt{x} = y \Rightarrow \sqrt{x} = \frac{y}{5} \Rightarrow x = \left(\frac{y}{5}\right)^2 = \frac{y^2}{25}$.

$\sqrt{x-5} = y \Rightarrow x-5 = y^2 \Rightarrow x = y^2 + 5$.

$5 \cdot \sqrt{x-5} = y \Rightarrow \sqrt{x-5} = \frac{y}{5} \Rightarrow x-5 = \left(\frac{y}{5}\right)^2 \Rightarrow x = \frac{y^2}{25} + 5$.

52a $y = \sqrt{16x} = \sqrt{16} \cdot \sqrt{x} = 4 \cdot \sqrt{x}$.

52b $y = \sqrt{20x} = \sqrt{20} \cdot \sqrt{x} \approx 4,47 \cdot \sqrt{x}$.

52c $y = 3 \cdot \sqrt{7x} = 3 \cdot \sqrt{7} \cdot \sqrt{x} \approx 7,94 \cdot \sqrt{x}$.

| | |
|--------|-------------|
| f(16) | 4 |
| f(20) | 4.472135955 |
| 3*f(7) | 7.937253933 |

53a $A = \sqrt{t-3} \Rightarrow t-3 = A^2 \Rightarrow t = A^2 + 3$.

53b $S = 2 \cdot \sqrt{\frac{1}{2}t + 4} \Rightarrow \sqrt{\frac{1}{2}t + 4} = \frac{1}{2}S \Rightarrow \frac{1}{2}t + 4 = \frac{1}{4}S^2 \Rightarrow \frac{1}{2}t = \frac{1}{4}S^2 - 4 \Rightarrow t = \frac{1}{2}S^2 - 8$.

53c $y = 3 - \frac{2}{\sqrt{t}} \Rightarrow \frac{2}{\sqrt{t}} = 3 - y \Rightarrow \frac{2}{3-y} = \sqrt{t} \Rightarrow t = \left(\frac{2}{3-y}\right)^2 = \frac{4}{(3-y)^2}$.

54a $z = 6 \cdot \sqrt{8 - \frac{1}{2}y} \Rightarrow \sqrt{8 - \frac{1}{2}y} = \frac{1}{6}z \Rightarrow 8 - \frac{1}{2}y = \frac{1}{36}z^2 \Rightarrow -\frac{1}{2}y = \frac{1}{36}z^2 - 8 \Rightarrow y = -\frac{1}{18}z^2 + 16$. Dus $a = -\frac{1}{18}$ en $b = 16$.

54b $A = 8 - \frac{20}{\sqrt{s}} \Rightarrow \frac{20}{\sqrt{s}} = 8 - A \Rightarrow \frac{20}{8-A} = \sqrt{s} \Rightarrow s = \frac{400}{(8-A)^2}$.

54c $\sqrt{At} = A + 2 \Rightarrow At = (A + 2)^2 = (A + 2)(A + 2) = A^2 + 4A + 4 \Rightarrow t = \frac{A^2 + 4A + 4}{A} = \frac{A^2}{A} + \frac{4A}{A} + \frac{4}{A} = A + 4 + \frac{4}{A}$.

55a $\frac{\Delta N}{\Delta t} = \frac{90-50}{12-8} = \frac{40}{4} = 10$ (dit is de toename van N per tijdseenheid).

55b $g^{12-8} = \frac{90}{50} \Rightarrow g^4 = \frac{9}{5} = 1,8 \Rightarrow g = 1,8^{\frac{1}{4}} \approx 1,16$ (dit is de groeifactor per tijdseenheid).

56a $N_1 = at + b$ met $a = \frac{\Delta N}{\Delta t} = \frac{942-750}{20-12} = \frac{192}{8} = 24$.

$N_1 = 24t + b$
 $t = 12 \Rightarrow N_1 = 750 \Rightarrow 750 = 24 \cdot 12 + b \Rightarrow b = 750 - 24 \cdot 12 = 462$.

Dus $N_1 = 24t + 462$.

$N_2 = b \cdot g^t$ met $g^{20-12} = g^8 = \frac{942}{750} = 1,256 \Rightarrow g = 1,256^{\frac{1}{8}} = 1,0289...$

$N_2 = b \cdot 1,0289...^t$
 $t = 12 \Rightarrow N_2 = 750 \Rightarrow 750 = b \cdot 1,0289...^{12} \Rightarrow b = \frac{750}{1,0289...^{12}} \approx 533$.

Dus $N_2 \approx 533 \cdot 1,029^t$.

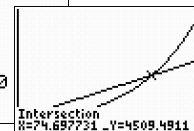
56b $N_2 = 2N_1$

$533 \cdot 1,029^t = 2(24t + 462)$ (intersect) $\Rightarrow t \approx 74,7$.

| | |
|---------------------|-----|
| $(942-750)/(20-12)$ | 24 |
| $750-24*12$ | 462 |

| | |
|-----------------------|-------------|
| $942/750$ | 1.256 |
| $\text{Ans}^{(1/8)}$ | 1.028901274 |
| $750/\text{Ans}^{12}$ | 532.8154436 |

| | |
|------------|--|
| WINDOW | |
| Xmin=0 | |
| Xmax=100 | |
| Xscl=0 | |
| Ymin=0 | |
| Ymax=10000 | |
| Yscl=0 | |
| Xres=1 | |



| | | |
|------------------------------|-------|-------|
| Plot1 | Plot2 | Plot3 |
| $Y_1 = 533 \cdot 1.029^{XX}$ | | |
| $Y_2 = 2(24X + 462)$ | | |
| $Y_3 =$ | | |
| $Y_4 =$ | | |

57a $N_1 = at + b$ met $a = \frac{\Delta N}{\Delta t} = \frac{1820 - 2180}{10 - 6} = \frac{-360}{4} = -90$.

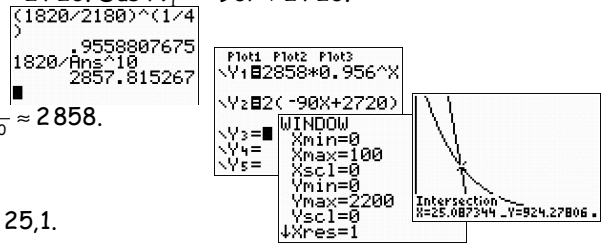
$N_1 = -90t + b$
 $t = 10 \Rightarrow N_1 = 1820 \Rightarrow 1820 = -90 \cdot 10 + b \Rightarrow b = 1820 + 900 = 2720$. Dus $N_1 = -90t + 2720$.

$N_2 = b \cdot g^t$ met $g^{10-6} = g^4 = \frac{1820}{2180} \Rightarrow g = \left(\frac{1820}{2180}\right)^{\frac{1}{4}} = 0,9558\dots$

$N_2 = b \cdot 0,9558\dots^t$
 $t = 10 \Rightarrow N_2 = 1820 \Rightarrow 1820 = b \cdot 0,9558\dots^{10} \Rightarrow b = \frac{1820}{0,9558\dots^{10}} \approx 2858$.

Dus $N_2 \approx 2858 \cdot 0,956^t$.

57b $N_2 = 2N_1 \Rightarrow 2858 \cdot 0,956^t = 2(-90t + 2720)$ (intersect) $\Rightarrow t \approx 25,1$.



58a $\frac{1}{x^3} = x^{-3}$.

58c $\sqrt{x} = x^{\frac{1}{2}}$.

58e $x^6 : x^2 = x^4$.

58b $\sqrt[4]{x^3} = x^{\frac{3}{4}}$.

58d $x^3 \cdot x^5 = x^8$.

58f $x^3 \cdot \sqrt{x} = x^3 \cdot x^{\frac{1}{2}} = x^{3\frac{1}{2}}$.

59a $y = 5x^4 \cdot \sqrt{x} = 5x^4 \cdot x^{\frac{1}{2}} = 5x^{4\frac{1}{2}}$.

59c $y = (3x^{-1,8})^4 \cdot 2x^{3,6} = 81x^{-7,2} \cdot 2x^{3,6} = 162x^{-3,6}$.

59b $y = \frac{5}{x} \cdot x^{1,3} = 5x^{-1} \cdot x^{1,3} = 5x^{0,3}$.

60a $N = 25 \cdot 1,4^{3t-2} = 25 \cdot 1,4^{3t} \cdot 1,4^{-2} = 25 \cdot 1,4^{-2} \cdot (1,4^3)^t \approx 12,76 \cdot 2,74^t$.

60b $N = 180 \cdot 0,8^{5-t} = 180 \cdot 0,8^5 \cdot 0,8^{-t} = 180 \cdot 0,8^5 \cdot (0,8^{-1})^t \approx 58,98 \cdot 1,25^t$.

60c $N = 92,6 \cdot 1,7^{-1,2t+0,5} = 92,6 \cdot 1,7^{-1,2t} \cdot 1,7^{0,5} = 92,6 \cdot 1,7^{0,5} \cdot (1,7^{-1,2})^t \approx 120,74 \cdot 0,53^t$.

61a $y = 18 \cdot (2x^2)^{0,3} \cdot (5z)^{0,6} = 18 \cdot 2^{0,3} \cdot x^{0,6} \cdot 5^{0,6} \cdot z^{0,6} \approx 58,21x^{0,6}z^{0,6}$.

61b $N = 18 - 5(6 - 1,5^{4t}) = 18 - 30 + 5 \cdot 1,5^{4t} = -12 + 5 \cdot (1,5^4)^t \approx -12 + 5 \cdot 5,06^t$.

61c $T = 27 \cdot 0,4^t (3 - 0,4^{2t}) = 81 \cdot 0,4^t - 27 \cdot 0,4^{3t} = 81 \cdot 0,4^t - 27 \cdot (0,4^3)^t = 81 \cdot 0,4^t - 27 \cdot 0,064^t$.

62a $L = 0,006 \cdot (5t)^{0,35} \cdot (5 \cdot \frac{1}{3}t^3)^{0,18} = 0,006 \cdot 5^{0,35} \cdot t^{0,35} \cdot 5^{0,18} \cdot (\frac{1}{3})^{0,18} \cdot t^{0,54} \approx 0,01 \cdot t^{0,89}$.

62b $y = 0,012 \cdot (3 \cdot \frac{1}{2}z^{-0,4})^{1,6} \cdot (\frac{1}{5}z)^{2,3} = 0,012 \cdot (\frac{3}{2})^{1,6} z^{-0,64} \cdot (\frac{1}{5})^{2,3} z^{2,3} \approx 0,01 \cdot z^{1,66}$.

62c $y = \frac{500}{(4 \cdot \sqrt{20+a^2})^4} = \frac{500}{(4 \cdot (20+a^2)^{\frac{1}{2}})^4} = \frac{500}{4^4 \cdot (20+a^2)^2} = \frac{1,95}{(20+a^2)^2} \approx 1,95(20+a^2)^{-2}$.

63a $x^5 = 18 \Rightarrow x = \sqrt[5]{18}$.

63b $\sqrt[3]{x} = 4 \Rightarrow x = 4^3 = 64$.

64a $5x^{-1,2} = 20$

64b $3 + 0,18x^{1,7} = 25$

64c $5 \cdot \sqrt[4]{x} - 7 = 43$

64d $3x^6 = 57$

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

$0,18x^{1,7} = 22$

$5 \cdot \sqrt[4]{x} = 50$

$x^6 = 19$

$x = 4^{-\frac{1}{1,2}} \approx 0,31$

$x^{1,7} = \frac{22}{0,18}$

$\sqrt[4]{x} = 10$

$x = 19^{\frac{1}{6}} \approx 1,63$

$x = \left(\frac{22}{0,18}\right)^{\frac{1}{1,7}} \approx 16,89$

$x = 10^4 = 10000$

$x = 19^{\frac{1}{6}} \approx 1,63$

65a $y = 3x^{2,6} \Rightarrow x^{2,6} = \frac{1}{3}y \Rightarrow x = \left(\frac{1}{3}y\right)^{\frac{1}{2,6}} = \left(\frac{1}{3}\right)^{\frac{1}{2,6}} \cdot y^{\frac{1}{2,6}} \approx 0,66 \cdot y^{0,38}$.

65b $y = 0,18 \cdot (3x)^{-1,4} \Rightarrow (3x)^{-1,4} = \frac{1}{0,18}y \Rightarrow 3x = \left(\frac{1}{0,18}y\right)^{\frac{1}{-1,4}} \Rightarrow x = \frac{1}{3} \cdot \left(\frac{1}{0,18}\right)^{\frac{1}{-1,4}} \cdot y^{\frac{1}{-1,4}} \approx 0,10 \cdot y^{-0,71}$.

65c $y = 7 \cdot \sqrt[5]{3x} \Rightarrow \sqrt[5]{3x} = \frac{1}{7}y \Rightarrow 3x = \left(\frac{1}{7}y\right)^5 \Rightarrow x = \frac{1}{3} \cdot \left(\frac{1}{7}\right)^5 \cdot y^5 \approx 0,00 \cdot y^5$.

65d $y = 1,9 \cdot (2x)^{3,6} \cdot (3x)^{-1,7} = 1,9 \cdot 2^{3,6} x^{3,6} \cdot 3^{-1,7} x^{-1,7} \Rightarrow x^{1,9} = \frac{1}{1,9 \cdot 2^{3,6} \cdot 3^{-1,7}} y \Rightarrow x = \left(\frac{1}{1,9 \cdot 2^{3,6} \cdot 3^{-1,7}} y\right)^{\frac{1}{1,9}} \approx 0,51 \cdot y^{0,53}$.

66a $p = 2,5q^{3,6} \Rightarrow q^{3,6} = \frac{1}{2,5}p \Rightarrow q = \left(\frac{1}{2,5}p\right)^{\frac{1}{3,6}} = \left(\frac{1}{2,5}\right)^{\frac{1}{3,6}} \cdot p^{\frac{1}{3,6}} \approx 0,78 \cdot p^{0,28}$

66b $L = \frac{1}{6} \cdot \sqrt[3]{A} - 7 \Rightarrow \frac{1}{6} \cdot \sqrt[3]{A} = L + 7 \Rightarrow \sqrt[3]{A} = 6L + 42 \Rightarrow A = (6L + 42)^3$

66c $O = 8a^2 \Rightarrow a^2 = \frac{1}{8}O \Rightarrow a = \left(\frac{1}{8}O\right)^{\frac{1}{2}}$ in $K = 4a^3$ geeft $K = 4 \cdot \left(\left(\frac{1}{8}O\right)^{\frac{1}{2}}\right)^3 = 4 \cdot \left(\frac{1}{8}\right)^{1,5} \cdot O^{1,5} \approx 0,18 \cdot O^{1,5}$
 $K = 4 \cdot \left(\frac{1}{8}\right)^{1,5} \cdot O^{1,5} \Rightarrow O^{1,5} = \frac{1}{4} \cdot \left(\frac{1}{8}\right)^{\frac{1}{1,5}} \cdot K \Rightarrow O = \left(\frac{1}{4} \cdot \left(\frac{1}{8}\right)^{\frac{1}{1,5}} \cdot K\right)^{\frac{1}{1,5}} = \left(\frac{1}{4} \cdot \left(\frac{1}{8}\right)^{\frac{1}{1,5}}\right)^{\frac{1}{1,5}} \cdot K^{\frac{1}{1,5}} \approx 0,16K^{0,67}$

67a ${}^3\log(81) = {}^3\log(3^4) = 4$

67c ${}^2\log\left(\frac{1}{2}\right) = {}^2\log(2^{-1}) = -1$

67e ${}^6\log(1) = {}^6\log(6^0) = 0$

67b ${}^5\log(5) = {}^5\log(5^1) = 1$

67d ${}^{10}\log(1000) = {}^{10}\log(10^3) = 3$

67f ${}^3\log(3^{1,9}) = 1,9$

${}^g\log(x) = y$ betekent $g^y = x$
dus ${}^g\log(g^y) = y$

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

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

${}^g\log(a^b) = b \cdot {}^g\log(a)$

68a $\log(N) = 1,17 + 0,3t \Rightarrow N = 10^{1,17+0,3t} = 10^{1,17} \cdot 10^{0,3t} = 10^{1,17} \cdot (10^{0,3})^t \approx 15 \cdot 2,00^t$

68b $\log(a) = 2,16 + 1,3 \cdot \log(b) \Rightarrow a = 10^{2,16+1,3 \cdot \log(b)} = 10^{2,16} \cdot 10^{1,3 \cdot \log(b)} = 10^{2,16} \cdot 10^{\log(b^{1,3})} \approx 145 \cdot b^{1,3}$

68c ${}^2\log(p) = 1,18 - 0,8 \cdot {}^2\log(q) \Rightarrow p = 2^{1,18-0,8 \cdot {}^2\log(q)} = 2^{1,18} \cdot 2^{-0,8 \cdot {}^2\log(q)} = 2^{1,18} \cdot 2^{2 \cdot \log(q^{-0,8})} \approx 2,27 \cdot q^{-0,8}$

68d $N = \log(3L + 6) \Rightarrow \log(3L + 6) = N \Rightarrow 3L + 6 = 10^N \Rightarrow 3L = 10^N - 6 \Rightarrow L = \frac{1}{3} \cdot 10^N - 2$

69a $0,5k = \log(2T + 5) - 1,8$
 $\log(2T + 5) = 0,5k + 1,8$
 $2T + 5 = 10^{0,5k+1,8}$
 $2T = 10^{0,5k} \cdot 10^{1,8} - 5$
 $T = \frac{1}{2} \cdot 10^{1,8} \cdot (10^{0,5})^k - \frac{5}{2}$
 $T \approx -2,5 + 31,55 \cdot 3,16^k$

69b $3 \cdot \log(M) = 1,6 + \log(4,5 - 1)$
 $\log(4,5 - 1) = 3 \cdot \log(M) - 1,6$
 $4,5 - 1 = 10^{3 \cdot \log(M) - 1,6}$
 $4,5 = 10^{\log(M^3)} \cdot 10^{-1,6} + 1$
 $S = \frac{1}{4} \cdot 10^{-1,6} \cdot M^3 + \frac{1}{4}$
 $S \approx 0,25 + 0,01M^3$

70a $g = 185 \text{ (cm)} \Rightarrow S = 290 \cdot \log(185 + 100) - 550 \approx 162 \text{ (cm)}$

70b $S = 210 \text{ (cm)}$
 $210 = 290 \cdot \log(g + 100) - 550$
 $290 \cdot \log(g + 100) = 760$
 $\log(g + 100) = \frac{760}{290}$
 $g + 100 = 10^{\frac{760}{290}}$
 $g = 10^{\frac{760}{290}} - 100 \approx 318 \text{ (cm)}$

70c $S = 290 \cdot \log(g + 100) - 550$
 $290 \cdot \log(g + 100) = S + 550$
 $\log(g + 100) = \frac{1}{290} \cdot S + \frac{550}{290}$
 $g + 100 = 10^{\frac{1}{290} \cdot S + \frac{550}{290}} = 10^{\frac{1}{290} \cdot S} \cdot 10^{\frac{550}{290}}$
 $g = 10^{\frac{1}{290} \cdot S} \cdot (10^{\frac{550}{290}})^S - 100 \approx 78,8 \cdot 1,008^S - 100$

71a $D = 50 \text{ (cm)} \Rightarrow \log(N) = 5,3 - 1,7 \cdot \log(50) \Rightarrow N = 10^{5,3-1,7 \cdot \log(50)} \approx 258 \text{ (bomen/ha)}$

71b $N = \frac{2000}{8} = 250 \text{ (bomen/ha)}$
 $\log(250) = 5,3 - 1,7 \cdot \log(D)$ (intersect/of)
 $1,7 \cdot \log(D) = 5,3 - \log(250)$
 $\log(D) = \frac{5,3 - \log(250)}{1,7} = 1,707\dots$
 $D = 10^{1,707\dots} \approx 51 \text{ (cm)}$

71c $\log(N) = 5,3 - 1,7 \cdot \log(D)$
 $1,7 \cdot \log(D) = 5,3 - \log(N)$
 $\log(D) = \frac{5,3}{1,7} - \frac{1}{1,7} \cdot \log(N)$
 $D = 10^{\frac{5,3}{1,7} - \frac{1}{1,7} \cdot \log(N)} = 10^{\frac{5,3}{1,7}} \cdot 10^{-\frac{1}{1,7} \cdot \log(N)}$
 $= 10^{\frac{5,3}{1,7}} \cdot 10^{\log(N^{-\frac{1}{1,7}})} \approx 1310 \cdot N^{-\frac{1}{1,7}} \approx 1310 \cdot N^{-0,59}$

72a $p = 350\,000 \Rightarrow v = 0,86 \cdot \log(350\,000) + 0,04 \approx 4,81 \text{ (feet/sec)}$
 Dit is een snelheid van (ongeveer) 5,4 km/uur.

72b $v = \frac{6 \cdot 1000}{3600 \cdot 0,314} \approx 5,31 \text{ (feet)} \Rightarrow \frac{6 \cdot 1000}{3600 \cdot 0,314} = 0,86 \cdot \log(p) + 0,04$ (intersect of)
 $\log(p) = \left(\frac{6 \cdot 1000}{3600 \cdot 0,314} - 0,04\right) : 0,86 \Rightarrow p = 10^{\text{Ans}} \approx 1335\,000$. Dit is ongeveer 11,2% meer.

72c $v = 0,86 \cdot \log(p) + 0,04 \Rightarrow 0,86 \cdot \log(p) = v - 0,04 \Rightarrow \log(p) = \frac{1}{0,86}v - \frac{0,04}{0,86} \Rightarrow$
 $p = 10^{\frac{1}{0,86}v - \frac{0,04}{0,86}} = 10^{\frac{1}{0,86}v} \cdot 10^{-\frac{0,04}{0,86}} = 10^{-\frac{0,04}{0,86}} \cdot (10^{\frac{1}{0,86}})^v \approx 0,9 \cdot 14,5^v$

$10^{(-0,04/0,86)}$
 $10^{(1/0,86)}$
 8984385372
 14.54757811

REKENREGELS:
 ${}^g \log(ab) = {}^g \log(a) + {}^g \log(b)$
 ${}^g \log\left(\frac{a}{b}\right) = {}^g \log(a) - {}^g \log(b)$
 ${}^g \log(a^b) = b \cdot {}^g \log(a)$

73a $3^x = 200$ (${}^3 \log \dots$ nemen) $\Rightarrow x = {}^3 \log(200) = \frac{\log(200)}{\log(3)} \approx 4,82$.

$\frac{\log(200)}{\log(3)}$
 4.822736302

73b $3^x = 200$ ($\log \dots$ nemen) $\Rightarrow \log(3^x) = \log(200) \Rightarrow x \cdot \log(3) = \log(200) \Rightarrow x = \frac{\log(200)}{\log(3)} \approx 4,82$.

74a $1,2^x = 13$ ($\log \dots$ nemen) $\Rightarrow \log(1,2^x) = \log(13) \Rightarrow x \cdot \log(1,2) = \log(13) \Rightarrow x = \frac{\log(13)}{\log(1,2)} \approx 14,07$.

$\frac{\log(13)}{\log(1,2)}$
 14.06827258

74b $x^{1,2} = 13 \Rightarrow x = 13^{\frac{1}{1,2}} \approx 8,48$.

$13^{(1/1,2)}$
 8.477857782

$\frac{\log(13)}{\log(1,2)}$
 14.06827258

74c $3 \cdot 1,5^x + 1 = 19 \Rightarrow 3 \cdot 1,5^x = 18 \Rightarrow 1,5^x = 6$ ($\log \dots$ nemen) $\Rightarrow \log(1,5^x) = \log(6) \Rightarrow x \cdot \log(1,5) = \log(6) \Rightarrow x = \frac{\log(6)}{\log(1,5)} \approx 4,42$.

74d $5 \cdot x^{1,74} + 8 = 29 \Rightarrow 5 \cdot x^{1,74} = 21 \Rightarrow x^{1,74} = 4,2 \Rightarrow x = 4,2^{\frac{1}{1,74}} \approx 2,28$.

$4,2^{(1/1,74)}$
 2.281335966

74e ${}^3 \log(4x) = 1,7$ (${}^3 \dots$ nemen) $\Rightarrow 4x = 3^{1,7} \Rightarrow x = \frac{1}{4} \cdot 3^{1,7} \approx 1,62$.

$\frac{1}{4} \cdot 3^{1,7}$
 1.61825196

74f $2 \cdot 1,7^{3x-1} = 46 \Rightarrow 1,7^{3x-1} = 23$ ($\log \dots$ nemen) $\Rightarrow \log(1,7^{3x-1}) = \log(23) \Rightarrow (3x-1) \cdot \log(1,7) = \log(23) \Rightarrow$
 $3x-1 = \frac{\log(23)}{\log(1,7)} \Rightarrow 3x = \frac{\log(23)}{\log(1,7)} + 1 \Rightarrow x = \left(\frac{\log(23)}{\log(1,7)} + 1\right) \cdot \frac{1}{3} \approx 2,30$.

$\frac{\log(23)}{\log(1,7)}$
 5.909022389
 Ans+1 6.909022389
 Ans/3 2.303007463

75a $y = 3 \cdot 5^x$
 $5^x = \frac{1}{3}y$ ($\log \dots$ nemen)

$\log(5^x) = \log\left(\frac{y}{3}\right)$
 $x \cdot \log(5) = \log(y) - \log(3)$
 $x = \frac{\log(y) - \log(3)}{\log(5)}$
 $x \approx 1,43 \cdot \log(y) - 0,68$

$\frac{1/\log(5)}$
 $\frac{1}{-1,09(3)/\log(5)}$
 1.430676558
 -0.6826861945

75b $y = 7 \cdot 1,6^x$
 $1,6^x = \frac{1}{7}y$ ($\log \dots$ nemen)

$\log(1,6^x) = \log\left(\frac{y}{7}\right)$
 $x \cdot \log(1,6) = \log(y) - \log(7)$
 $x = \frac{\log(y) - \log(7)}{\log(1,6)}$
 $x \approx 4,90 \cdot \log(y) - 4,14$

$\frac{1/\log(1,6)}$
 $\frac{-1/\log(7)/\log(1,6)}$
 4.899079389
 -4.14020239

75c $y = 1,8 \cdot 1,3^{2x-5}$
 $1,3^{2x-5} = \frac{1}{1,8}y$ ($\log \dots$ nemen)

$\log(1,3^{2x-5}) = \log\left(\frac{y}{1,8}\right)$
 $(2x-5) \cdot \log(1,3) = \log(y) - \log(1,8)$
 $2x-5 = \frac{\log(y) - \log(1,8)}{\log(1,3)}$
 $2x = \frac{\log(y) - \log(1,8)}{\log(1,3)} + 5$
 $x = \frac{\log(y) - \log(1,8)}{2 \cdot \log(1,3)} + \frac{5}{2}$
 $x \approx 4,39 \cdot \log(y) + 1,38$

$\frac{1/(2 \cdot \log(1,3))}{5/2 - 1/2 \cdot \log(1,8)/\log(1,3)}$
 $\frac{1/\log(1,3)}{1.379827125}$
 4.388145424
 1.379827125

76a $P = 25 \cdot 3^{2q+4}$ ($\log \dots$ nemen)
 $\log(P) = \log(25 \cdot 3^{2q+4})$
 $\log(P) = \log(25) + \log(3^{2q+4})$
 $\log(P) = \log(25) + (2q+4)\log(3)$
 $2q+4 = \frac{\log(P) - \log(25)}{\log(3)}$
 $2q = \frac{\log(P) - \log(25)}{\log(3)} - 4$
 $q = \frac{1}{2} \cdot \frac{\log(P) - \log(25)}{\log(3)} - 2$
 $q \approx -3,46 + 1,05 \cdot \log(P)$

$\frac{1/2 \cdot \log(25)/\log(3) - 2}{1/2 \cdot 1/\log(3)}$
 $\frac{-3,464973521}{1,047951637}$

76c $P = 27 \cdot q^{1,8}$
 $q^{1,8} = \frac{1}{27}P$
 $q = \left(\frac{1}{27}P\right)^{\frac{1}{1,8}}$
 $q = \left(\frac{1}{27}\right)^{\frac{1}{1,8}} \cdot P^{\frac{1}{1,8}}$
 $q \approx 0,16P^{0,56}$

$(1/27)^{(1/1,8)}$
 $1/1,8 \cdot 1602499523$
 0.5555555556

76b $P \cdot 1,5^{q+2} = 18$ ($\log \dots$ nemen)
 $\log(P \cdot 1,5^{q+2}) = \log(18)$
 $\log(P) + \log(1,5^{q+2}) = \log(18)$
 $\log(P) + (q+2)\log(1,5) = \log(18)$
 $q+2 = \frac{\log(18) - \log(P)}{\log(1,5)}$
 $q = \frac{\log(18) - \log(P)}{\log(1,5)} - 2$
 $q \approx 5,13 - 5,68 \cdot \log(P)$

$\frac{\log(18)/\log(1,5) - 2}{-1 \cdot \log(1,5)}$
 $\frac{5,128533874}{-5,678873587}$

76d $P = 3,5 + 4,2 \log(q)$
 $4,2 \log(q) = P - 3,5$
 $\log(q) = \frac{P - 3,5}{4,2}$ (10^{\dots} nemen)
 $q = 10^{\frac{P - 3,5}{4,2}}$
 $q = 10^{\frac{1}{4,2} \cdot P - \frac{3,5}{4,2}}$
 $q = 10^{\frac{1}{4,2} \cdot P} \cdot 10^{-\frac{3,5}{4,2}}$
 $q \approx 0,15 \cdot 1,73^P$

$10^{(-3,5/4,2)}$
 $10^{(1/4,2)}$
 0.1467799268
 1.730195739

Diagnostische toets

D1 $K = aq + b$ met $a = \frac{\Delta K}{\Delta q} = \frac{1030 - 575}{460 - 200} = \frac{455}{260} = 1,75$.

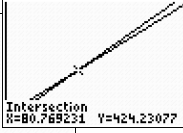
$K = 1,75q + b$
 $q = 200 \Rightarrow K = 575$ $\Rightarrow 575 = 1,75 \cdot 200 + b \Rightarrow 575 - 1,75 \cdot 200 = b = 225$. Dus $K = 1,75q + 225$.

$455/260$
 $575 - 1,75 \cdot 200$
 225

D2a \square $2,12t + 253 = 1,86t + 274$
 $0,26t = 21 \quad | :0,26$
 $t \approx 80,8$
 $K_I > K_{II}$ (zie een plot) $\Rightarrow t \geq 81$ (uur).

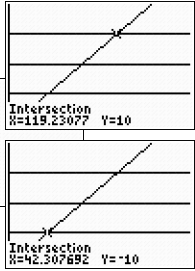
Plot1 Plot2 Plot3
 $\sqrt{V1} = 2,12X + 253$
 $\sqrt{V2} = 1,86X + 274$
 $\sqrt{V3} =$

WINDOW
 $Xmin=0$
 $Xmax=200$
 $Xscl=10$
 $Ymin=250$
 $Ymax=650$
 $Yscl=10$
 $\downarrow Xres=1$



Plot1 Plot2 Plot3
 $\sqrt{V1} = 2,12X + 253$
 $\sqrt{V2} = 1,86X + 274$
 $\sqrt{V3} = Y1 - Y2$
 $\sqrt{V4} = 10$
 $\sqrt{V5} = 10$
 $\sqrt{V6} = 10$
 $\sqrt{V7} =$

WINDOW
 $Xmin=0$
 $Xmax=200$
 $Xscl=10$
 $Ymin=-20$
 $Ymax=20$
 $Yscl=10$
 $\downarrow Xres=1$



D2b \square $K_I - K_{II} = 10$ (intersect of)
 $2,12t + 253 - (1,86t + 274) = 10$
 $0,26t - 21 = 10$
 $0,26t = 31$
 $t \approx 119$
 $-10 < K_I - K_{II} < 10$ (zie een plot) $\Rightarrow 42 < t < 119$ (uur).

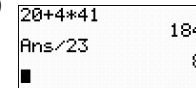
$K_{II} - K_I = 10$ of $K_I - K_{II} = -10$ (intersect of)
 $2,12t + 253 - (1,86t + 274) = -10$
 $0,26t - 21 = -10$
 $0,26t = 11$
 $t \approx 42$.

D3a \square $6x - 5y = 20 \Rightarrow -5y = -6x + 20 \Rightarrow y = 1,2x - 4$.

D3b \square $15x - 4 = 23 - 3y \Rightarrow 3y = -15x + 27 \Rightarrow y = -5x + 9$.

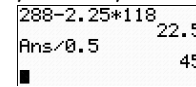
D4a \square $x - 5y = 1 \Rightarrow x = 5y + 1$
 $x = 5y + 1$ in $2x + y = 13$
 $2(5y + 1) + y = 13$
 $11y = 11$
 $y = 1$ in $x = 5y + 1$
 $x = 5 + 1 = 6$.

D4b \square $5x - y = 41 \Rightarrow -y = -5x + 41 \Rightarrow y = 5x - 41$
 $y = 5x - 41$ in $3x + 4y = 20$
 $3x + 4(5x - 41) = 20$
 $23x = 184$
 $x = 8$ in $y = 5x - 41$
 $y = 40 - 41 = -1$.



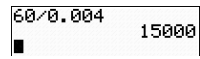
D5a \square $M + C = 118$
 $2,75M + 2,25C = 288$

D5b \square $M + C = 118 \Rightarrow C = 118 - M$ in $2,75M + 2,25C = 288$
 $2,75M + 2,25(118 - M) = 288$
 $0,5M = 22,5 \Rightarrow M = 45$.



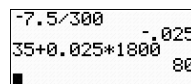
D6 \square $a + 2b - 3c = 36 \Rightarrow -3c = -a - 2b + 36 \Rightarrow c = \frac{1}{3}a + \frac{2}{3}b - 12$
 $P = 20 - 0,3a + 0,8b - 1,5(\frac{1}{3}a + \frac{2}{3}b - 12) = 20 - 0,3a + 0,8b - 0,5a - b + 18 = 38 - 0,8a - 0,2b$.

D7a \square $0,004x^2 - 60x = 0$
 $x(0,004x - 60) = 0$
 $x = 0 \vee 0,004x - 60 = 0$
 $x = 0 \vee 0,004x = 60$
 $x = 0 \vee x = 15000$.

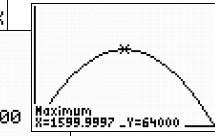


D7b \square $q(-0,25q + 50) = 900$
 $-0,25q^2 + 50q - 900 = 0$
 $q^2 - 200q + 3600 = 0$
 $(q - 180)(q - 20) = 0$
 $q = 280 \vee q = 20$.

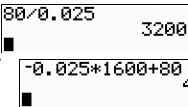
D8a \square $p = aq + b$ met $a = \frac{\Delta p}{\Delta q} = \frac{35 - 42,50}{1800 - 1500} = \frac{-7,50}{300} = -0,025$
 $p = -0,025q + b$
 $q = 1800 \Rightarrow p = 35$
 $35 = -0,025 \cdot 1800 + b$
 $35 + 0,025 \cdot 1800 = b = 80$. Dus $p = -0,025q + 80$.



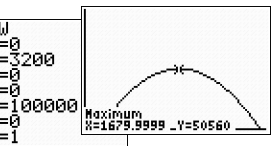
Plot1 Plot2 Plot3
 $\sqrt{V1} = -0,025X^2 + 80X$
 $\sqrt{V2} =$
 $\sqrt{V3} =$



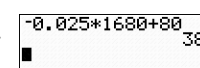
D8b \square $R = p \cdot q = (-0,025q + 80) \cdot q = -0,025q^2 + 80q$
De optie maximum (of met de afgeleide) $\Rightarrow q = 1600$
De prijs is dan $p = -0,025 \cdot 1600 + 80 = 40$ (€).



Plot1 Plot2 Plot3
 $\sqrt{V1} = -0,025X^2 + 80X$
 $\sqrt{V2} = -(20000 - 4X)$
 $\sqrt{V3} =$



D8c \square $W = R - K = -0,025q^2 + 80q - (20000 - 4q)$
De optie maximum geeft $W \max = 50560$ (€) voor $q = 1680$
De prijs is dan $p = -0,025 \cdot 1680 + 80 = 38$ (€).



D9a \square $(4x - 5)^2 = 36$
 $4x - 5 = -6 \vee 4x - 5 = 6$
 $4x = -1 \vee 4x = 11$
 $x = -\frac{1}{4} \vee x = \frac{11}{4}$.

D9c \square $6(4x - 5) = (2x - 3)(4x - 5)$
 $4x - 5 = 0 \vee 2x - 3 = 6$
 $4x = 5 \vee 2x = 9$
 $x = \frac{5}{4} \vee x = \frac{9}{2}$.

D9e \square $(x^2 - 9)(x^2 + 5x + 5) = x^2 - 9$
 $x^2 - 9 = 0 \vee x^2 + 5x + 5 = 1$
 $x^2 = 9 \vee x^2 + 5x + 4 = 0$
 $x = -3 \vee x = 3 \vee (x + 4)(x + 1) = 0$
 $x = -3 \vee x = 3 \vee x = -4 \vee x = -1$.

D9b \square $(4x - 5)^2 = (2x - 3)^2$
 $4x - 5 = -(2x - 3) \vee 4x - 5 = 2x - 3$
 $6x = 8 \vee 2x = 2$
 $x = \frac{8}{6} = \frac{4}{3} \vee x = 1$.

D9d \square $(x^2 - 6)\sqrt{x^2 - 16} = x\sqrt{x^2 - 16}$
 $\sqrt{x^2 - 16} = 0 \vee x^2 - 6 = x$
 $x^2 - 16 = 0 \vee x^2 - x - 6 = 0$
 $x^2 = 16 \vee (x - 3)(x + 2) = 0$
 $x = -4 \vee x = 4 \vee x = 3 \vee x = -2$.

D9f \square $(x^2 - 10)(x - 10)^2 = x^2 - 10$
 $x^2 - 10 = 0 \vee (x - 10)^2 = 1$
 $x^2 = 10 \vee x - 10 = -1 \vee x - 10 = 1$
 $x = -\sqrt{10} \vee x = \sqrt{10} \vee x = 9 \vee x = 11$.

D10 \square $P(2, -2)$ op de grafiek van $y = ax^2 + bx + 5 \Rightarrow -2 = 4a + 2b + 5$ ofwel $4a + 2b = -7$.
 $Q(6, 2)$ op de grafiek van $y = ax^2 + bx + 5 \Rightarrow 2 = 36a + 6b + 5$ ofwel $36a + 6b = -3$.
 $36a + 6b = -3 \Rightarrow 12a + 2b = -1 \Rightarrow 2b = -12a - 1$.
 $2b = -12a - 1$ in $4a + 2b = -7 \Rightarrow 4a - 12a - 1 = -7 \Rightarrow -8a = -6 \Rightarrow a = \frac{3}{4}$ in $2b = -12a - 1 \Rightarrow 2b = -9 - 1 = -10 \Rightarrow b = -5$.

D11a \square $\frac{0,04x^2 - 5x}{x+7} = 0$ (teller = 0) $\frac{4 - \frac{10}{x^2}}{x^2 - x^3} = 0$ D11b \square $\frac{4 - \frac{10}{x^2}}{x^2 - x^3} = 0$ (teller = 0) D11c \square $\frac{90}{x^2 - 4} = 2$ D11d \square $\frac{2x}{x-1} = \frac{x}{x+1}$

$0,04x^2 - 5x = 0$ $\frac{4x - 10}{x^3} = 0$ $45 = x^2 - 4$ $2x(x+1) = x(x-1)$
 $x(0,04x - 5) = 0$ $4x - 10 = 0$ $x^2 = 49$ $2x^2 + 2x = x^2 - x$
 $x = 0 \vee 0,04x = 5$ $4x = 10$ $x^2 = 49$ $x^2 + 3x = 0$
 $x = 0 \vee x = 125$ $4x = 10$ $x = -7 \vee x = 7$ $x(x+3) = 0$
 $x = 0 \vee x = 125$ $x = \frac{10}{4} = 2\frac{1}{2}$ $x = 0 \vee x = -3$

D12a \square $\frac{20}{x} - 5 = \frac{20}{x} - \frac{5}{1} = \frac{20-5x}{x}$ D12c \square $20 + \frac{5}{2x+1} = \frac{20}{1} + \frac{5}{2x+1} = \frac{20(2x+1)+5}{2x+1} = \frac{40x+25}{2x+1}$
D12b \square $\frac{20}{x} \left(5 - \frac{4}{x}\right) = \frac{100}{x} - \frac{80}{x^2} = \frac{100x-80}{x^2}$ D12d \square $\frac{20}{x} : \frac{5}{2x-1} = \frac{20}{x} \cdot \frac{2x-1}{5} = \frac{20(2x-1)}{5x} = \frac{4(2x-1)}{x} = \frac{8x-4}{x}$

D13 \square $K = \frac{20p}{\frac{p^2}{3q} + 2q} = \frac{20p}{\frac{p^2}{3q} + 2q} \cdot \frac{3q}{3q} = \frac{60pq}{p^2 + 6q^2}$

D14a \square $F = 4 + \frac{3}{p-5} \Rightarrow F - 4 = \frac{3}{p-5} \Rightarrow p - 5 = \frac{3}{F-4} \Rightarrow p = \frac{3}{F-4} + 5$

D14b \square $G = \frac{3q-1}{4q+5} \Rightarrow G(4q+5) = 3q-1 \Rightarrow 4Gq+5G = 3q-1 \Rightarrow 5G+1 = 3q-4Gq \Rightarrow 5G+1 = q(3-4G) \Rightarrow q = \frac{5G+1}{3-4G}$

D14c \square $\frac{2a}{a+10} = a + 2b \Rightarrow 2b = \frac{2a}{a+10} - a \Rightarrow b = \frac{a}{a+10} - \frac{1}{2}a$

D14d \square $y = \frac{1}{5} \cdot \sqrt{2x-3} \Rightarrow \sqrt{2x-3} = 5y \Rightarrow 2x-3 = 25y^2 \Rightarrow 2x = 25y^2 + 3 \Rightarrow x = 12\frac{1}{2}y^2 + 1\frac{1}{2}$

D15a \square $N_1 = at + b$ met $a = \frac{\Delta N}{\Delta t} = \frac{265-150}{9-4} = \frac{115}{5} = 23$.
 $N_1 = 23t + b$
 $t = 4 \Rightarrow N_1 = 150$ $\Rightarrow 150 = 23 \cdot 4 + b \Rightarrow b = 150 - 92 = 58$. Dus $N_1 = 23t + 58$.

D15b \square $N_2 = b \cdot g^t$ met $g^{9-4} = g^5 = \frac{265}{150} \Rightarrow g = \left(\frac{265}{150}\right)^{\frac{1}{5}} = 1,1205\dots$
 $N_2 = b \cdot 1,1205\dots^t$
 $t = 4 \Rightarrow N_2 = 150$ $\Rightarrow 150 = b \cdot 1,1205\dots^4 \Rightarrow b = \frac{150}{1,1205\dots^4} \approx 95$. Dus $N_2 \approx 95 \cdot 1,121^t$.

D16a \square $y = 180 \cdot (2x^{-1,3})^3 \cdot \left(\frac{1}{6}x^{2,4}\right)^2 = 180 \cdot 2^3 \cdot x^{-3,9} \cdot \left(\frac{1}{6}\right)^2 \cdot x^{4,8} = 40x^{0,9}$

D16b \square $N = 50 - 4(5 - 1,6^{2t}) = 50 - 20 + 4 \cdot 1,6^{2t} = 30 + 4 \cdot (1,6^2)^t = 30 + 4 \cdot 2,56^t$

D17 \square $N = 200 \cdot 1,85^{3t-4} = 200 \cdot 1,85^{3t} \cdot 1,85^{-4} = 200 \cdot 1,85^{-4} \cdot (1,85^3)^t \approx 17 \cdot 6,33^t$

D18a \square $F = 20 \cdot (5p)^{1,5} = 20 \cdot 5^{1,5} \cdot p^{1,5} \Rightarrow p^{1,5} = \frac{1}{20 \cdot 5^{1,5}} \cdot F \Rightarrow p = \left(\frac{1}{20 \cdot 5^{1,5}} \cdot F\right)^{\frac{1}{1,5}} = \left(\frac{1}{20 \cdot 5^{1,5}}\right)^{\frac{1}{1,5}} \cdot F^{\frac{1}{1,5}} \approx 0,027 \cdot F^{0,667}$

D18b \square $y = 2,5 \cdot \sqrt[5]{x} - 5 \Rightarrow 2,5 \cdot \sqrt[5]{x} = y + 5 \Rightarrow \sqrt[5]{x} = \frac{1}{2,5}y + 2 \Rightarrow x = (0,4y + 2)^5$

D19a \square $\log(N) = 0,76t + 3,6$ (10^{\dots} nemen) $N = 10^{0,76t+3,6}$
 $N = 10^{0,76t} \cdot 10^{3,6}$
 $N = 10^{3,6} \cdot (10^{0,76})^t$
 $N \approx 3981 \cdot 5,75^t$

D19b \square $\log(R) = 3,2 + 1,6 \cdot \log(S)$
 $\log(R) - \log(S^{1,6}) = 3,2$
 $\log\left(\frac{R}{S^{1,6}}\right) = 3,2$ (10^{\dots} nemen)
 $\frac{R}{S^{1,6}} = 10^{3,2} \approx 1585$
 $R \approx 1585 \cdot S^{1,6}$

D19c \square $N = 12,5 \cdot 1,75^t$ (log... nemen)
 $\log(N) = \log(12,5 \cdot 1,75^t)$
 $\log(N) = \log(12,5) + \log(1,75^t)$
 $\log(N) = \log(12,5) + t \cdot \log(1,75)$
 $t \cdot \log(1,75) = \log(N) - \log(12,5)$
 $t = \frac{\log(12,5) - \log(N)}{\log(1,75) + \log(1,75)}$
 $t \approx -4,5 + 4,1 \cdot \log(N)$

Gemengde opgaven 14. Algebraïsche vaardigheden

G11a \square $K_A = \begin{cases} 150 + 3,75a & \text{voor } a \leq 80 \\ 150 + 3,75 \cdot 80 + 0,9(a - 80) & \text{voor } a > 80 \end{cases}$ en $K_B = \begin{cases} 225 + 1,9a & \text{voor } a \leq 200 \\ 225 + 1,9 \cdot 200 + 0,75(a - 200) & \text{voor } a > 200. \end{cases}$
 of $K_A = \begin{cases} 3,75a + 150 & \text{voor } a \leq 80 \\ 0,9a + 378 & \text{voor } a > 80 \end{cases}$ en $K_B = \begin{cases} 1,9a + 225 & \text{voor } a \leq 200 \\ 0,75a + 455 & \text{voor } a > 200. \end{cases}$

G11 \square Er moeten drie snijpunten worden berekend.
 Voor $a \leq 80$ $3,75a + 150 = 1,9a + 225$ (intersect of) $\Rightarrow 1,85a = 75 \Rightarrow a \approx 40,5$.
 Voor $80 < x \leq 200$ $0,9a + 378 = 1,9a + 225$ (intersect of) $\Rightarrow -a = -153 \Rightarrow a = 153$.
 Voor $x > 200$ $0,9a + 378 = 0,75a + 455$ (intersect of) $\Rightarrow 0,15a = 77 \Rightarrow a \approx 513,3$.
 Agterberg is goedkoper dan van Bulten voor $a < 41$ (Agterberg begint goedkoper) en voor $153 < x < 153$.

G11c \square $GK_A = \frac{K_A}{a} = \begin{cases} 3,75 + \frac{150}{a} & \text{voor } a \leq 80 \\ 0,9 + \frac{378}{a} & \text{voor } a > 80 \end{cases}$ en $GK_B = \frac{K_B}{a} = \begin{cases} 1,9 + \frac{225}{a} & \text{voor } a \leq 200 \\ 0,75 + \frac{455}{a} & \text{voor } a > 200. \end{cases}$

G11d \square $a = 80 \Rightarrow GK_A = 3,75 + \frac{150}{80} = 5,625 > 4,50$. Dus $0,9 + \frac{378}{a} = 4,5 \Rightarrow \frac{378}{a} = 3,6 \Rightarrow 3,6a = 378 \Rightarrow a = 105$.
 Dus vanaf 105 km zijn de gemiddelde transportkosten bij Agterberg minder dan 4,50 €/km.

G12a \square $p = aq + b$ met $a = \frac{\Delta p}{\Delta q} = \frac{11,90 - 15,40}{750 - 500} = \frac{-3,50}{250} = -0,014$.
 $p = -0,014q + b$
 $q = 500 \Rightarrow p = 15,40 \Rightarrow 15,4 + 7 = b = 22,4$.
 Dus $p = -0,014q + 22,4$ en $R = pq = -0,014q^2 + 22,4q$.
 G12c \square $R = -0,014q^2 + 22,4q$ (de grafiek is een bergparabool)
 $\frac{dR}{dq} = -0,028q + 22,4 = 0$ geeft $-0,028q = -22,4 \Rightarrow q = 800$.
 $R_{\max} = R(800) = 8960$ (€) en $p = p(800) = 11,20$ (€).

G12b \square $R = -0,014q^2 + 22,4q = 8400$
 $q^2 - 1000q + 600000 = 0$
 $(q - 60)(q - 1000) = 0$
 $q = 600 \vee q = 1000$.
 $q = 600 \Rightarrow p = 14$ (€).
 $q = 1000 \Rightarrow p = 8,40$ (€).
 G12de \square $K = 8q + 2000$.
 $W = R - K = -0,014q^2 + 22,4q - 8q - 2000 = -0,014q^2 + 14,4q - 2000$.
 $\frac{dW}{dq} = -0,028q + 14,4 = 0 \Rightarrow q = \frac{-14,4}{-0,028} \approx 514$ en $W_{\max} = W(514) = 1703$ (€ bij €2000 vaste kosten).
 Als $W_{\max} = 2500 \Rightarrow$ vaste kosten 797 (€) lager, dus de nieuwe vaste kosten zijn 1203 (€).

G13a \square Stel $v =$ het aantal pakken van 5 kg en $t =$ het aantal pakken van 2 kg.
 Je krijgt de vergelijkingen $5v + 2t = 36000$ (in de eerste oplage fout) en $v + t = 8580$.
 $v + t = 8580 \Rightarrow t = 8580 - v$ invullen in $5v + 2t = 36000$ geeft
 $5v + 2(8580 - v) = 36000 \Rightarrow 3v = 18840 \Rightarrow v = 6280$ in $v + t = 8580 \Rightarrow t = 8580 - 6280 = 2300$.

G13b \square Je krijgt de vergelijkingen $5v + 2t = 36000$ en $t = 2v$.
 $t = 2v$ invullen in $5v + 2t = 36000$ geeft $5v + 4v = 36000 \Rightarrow 9v = 36000 \Rightarrow v = 4000$ in $t = 2v \Rightarrow t = 8000$.

G13c \square Je krijgt de vergelijkingen $5v + 2t = 36000$ en $2v + t = 15780$.
 $2v + t = 15780 \Rightarrow t = 15780 - 2v$ invullen in $5v + 2t = 36000$ geeft
 $5v + 2(15780 - 2v) = 36000 \Rightarrow v = 4440$ in $2v + t = 15780 \Rightarrow t = 15780 - 8880 = 6900$.

G13d \square Je krijgt de vergelijkingen $5v + 2t = 36000$ en $7v + 3t = 51040$ (in de eerste oplage fout).
 $5v + 2t = 36000 \Rightarrow 2t = 36000 - 5v \Rightarrow t = 18000 - 2\frac{1}{2}v$ invullen in $7v + 3t = 51040$ geeft
 $7v + 3(18000 - 2\frac{1}{2}v) = 51040 \Rightarrow -\frac{1}{2}v = -2960 \Rightarrow v = 5920$ in $5v + 2t = 36000 \Rightarrow t = \frac{36000 - 5 \cdot 5920}{2} = 3200$.

G14a \square $(4x - 1)^2 = \frac{1}{4}$
 $4x - 1 = -\frac{1}{2} \vee 4x - 1 = \frac{1}{2}$
 $4x = \frac{1}{2} \vee 4x = 1\frac{1}{2}$
 $x = \frac{1}{8} \vee x = \frac{3}{8}$.

G14d \square $\frac{4x-1}{x-4} = \frac{3x-4}{x}$
 $x(4x - 1) = (3x - 4)(x - 4)$
 $4x^2 - x = 3x^2 - 12x - 4x + 16$
 $x^2 + 15x - 16 = 0$
 $(x + 16)(x - 1) = 0$
 $x = -16 \vee x = 1$.

G14f \square $\frac{4x-1}{x-4} = 0$ (teller = 0)
 $4x - 1 = 0$
 $4x = 1$
 $x = \frac{1}{4}$.

G14b \square $(4x - 1)^2 \cdot (4x^2 - 1) = 0$
 $4x - 1 = 0 \vee 4x^2 = 1$
 $4x = 1 \vee x^2 = \frac{1}{4}$
 $x = \frac{1}{4} \vee x = -\frac{1}{2} \vee x = \frac{1}{2}$.

G14e \square $6 \cdot \sqrt{4x-1} = (x-4) \cdot \sqrt{4x-1}$
 $\sqrt{4x-1} = 0 \vee x - 4 = 6$
 $4x - 1 = 0 \vee x = 10$
 $4x = 1 \vee x = 10$
 $x = \frac{1}{4} \vee x = 10$.

G14g \square $4x^{-1,5} + 45 = 301$
 $4x^{-1,5} = 256$
 $x^{-1,5} = 64$
 $x = 64^{-\frac{1}{1,5}} = 0,0625$.

G14c \square $(4x - 1)^2 = (x - 4)^2$
 $4x - 1 = x - 4 \vee 4x - 1 = -(x - 4)$
 $3x = -3 \vee 5x = 5$
 $x = -1 \vee x = 1$.

G14h \square $4 \cdot \sqrt[3]{x} + 5 = 33$
 $4 \cdot \sqrt[3]{x} = 28$
 $\sqrt[3]{x} = 7$
 $x = 7^3 = 343$.

G15a \square (0, 5) op de grafiek van $y = ax^2 + b \Rightarrow b = 5$.

(500, 105) op de grafiek $\Rightarrow 105 = a \cdot 500^2 + 5$ (want $b = 5$) $\Rightarrow a \cdot 250\,000 = 100 \Rightarrow a = \frac{100}{250\,000} = \frac{1}{2500} = 0,0004$.

G15b \square $x = 500 - 200 = 300 \Rightarrow y = 0,0004 \cdot 300^2 + 5 = 36 + 5 = 41$. Dus de hoogte is 41 meter.

G15c \square $0,0004 \cdot x^2 + 5 = 50 \Rightarrow 0,0004 \cdot x^2 = 45 \Rightarrow x^2 = 112\,500 \Rightarrow x = \pm\sqrt{112\,500}$.
De lengte is $2 \cdot \sqrt{112\,500} \approx 671$ meter.

G15d \square (0, 5) op de grafiek van $y = \frac{450x^2}{a-x^2} + b \Rightarrow \frac{0}{a} + b = 5 \Rightarrow b = 5$.

(500, 105) geeft $105 = \frac{450 \cdot 500^2}{a-500^2} + 5 \Rightarrow 100 = \frac{450 \cdot 500^2}{a-500^2} \Rightarrow 100a - 100 \cdot 500^2 = 450 \cdot 500^2 \Rightarrow a = 5,5 \cdot 500^2 = 1\,375\,000$.

G15e \square $x = 300 \Rightarrow y = \frac{450 \cdot 300^2}{1\,375\,000 - 300^2} + 5 \approx 36,5$. Dus de hoogte is (ongeveer) 36,5 meter.

$\frac{450x^2}{1\,375\,000 - x^2} + 5 = 50 \Rightarrow \frac{450x^2}{1\,375\,000 - x^2} = 45 \Rightarrow 450x^2 = 45 \cdot 1\,375\,000 - 45x^2 \Rightarrow x^2 = \frac{45 \cdot 1\,375\,000}{495} \Rightarrow x = \pm\sqrt{\frac{45 \cdot 1\,375\,000}{495}}$
De lengte is $2 \cdot \sqrt{\frac{45 \cdot 1\,375\,000}{495}} \approx 707$ meter.

G15f \square (0, 5) op de grafiek van $y = a(3^{bx} + 3^{-bx}) \Rightarrow a(3^0 + 3^0) = 5 \Rightarrow 2a = 5 \Rightarrow a = 2,5$.

(500, 105) geeft $2,5(3^{500b} + 3^{-500b}) = 105$ (intersect) $\Rightarrow b \approx 0,0068$.

G15g \square $V = 0,0004 \cdot x^2 + 5 - 2,5(3^{0,0068x} + 3^{-0,0068x})$
(optie maximum geeft) $x \approx 370,62$ en $V_{\max} \approx 19,94$.
De best formule geeft hier (ongeveer) 40.

De maximale afwijking is $\frac{V_{\max}}{40} \times 100\% \approx 49,8\%$.

G16a \square $D = 100 + \frac{200}{\frac{a}{2b} + 10} = 100 \cdot \frac{a+20b}{a+20b} + \frac{200}{\frac{a}{2b} + 10} \cdot \frac{2b}{2b} = \frac{100a+2000b}{a+20b} + \frac{400b}{a+20b} = \frac{100a+2400b}{a+20b}$.

G16b \square $A = \frac{6x^2+15}{3x^2} + \frac{x^3+4x}{x^3} = \frac{3(2x^2+5)}{3x^2} + \frac{x^3+4x}{x^3} \cdot \frac{2}{2} = \frac{2x^2+5}{x^2} + \frac{x^3+4x}{2x^3} = \frac{2x^2}{x^2} + \frac{5}{x^2} + \frac{x^3}{2x^3} + \frac{4x}{2x^3} = 2 + \frac{5}{x^2} + \frac{1}{2} + \frac{2}{x^2} = 2\frac{1}{2} + \frac{7}{x^2}$.

G16c \square $E = (10x^{1,2})^2 \cdot (5y^{-1,8})^3 \cdot (\frac{1}{25}x^{-1,1} \cdot y^{3,4})^2 = 10^2 \cdot x^{2,4} \cdot 5^3 \cdot y^{-5,4} \cdot (\frac{1}{25})^2 \cdot x^{-2,2} \cdot y^{6,8} = 20 \cdot x^{0,2} \cdot y^{1,4}$.

G16d \square $N = 2025 \cdot 1,5^{3t-4} + 300 \cdot 1,5^t \cdot (1 - 2,25^t) = 2025 \cdot (1,5^3)^t \cdot 1,5^{-4} + 300 \cdot 1,5^t - 300 \cdot 1,5^t \cdot 2,25^t$
 $= 400 \cdot 3,375^t + 300 \cdot (1,5)^t - 300 \cdot 3,375^t = 100 \cdot 3,375^t + 300 \cdot 1,5^t$.

G17a \square $A = 20 - \frac{5}{2p+3} \Rightarrow \frac{5}{2p+3} = \frac{20-A}{1} \Rightarrow \frac{2p+3}{5} = \frac{1}{20-A} \Rightarrow \frac{2p+3}{1} = \frac{5}{20-A} \Rightarrow$

$2p = \frac{5}{20-A} - 3 = \frac{5}{-A+20} - 3 \cdot \frac{-A+20}{-A+20} = \frac{3A-55}{-A+20} \Rightarrow p = \frac{1}{2} \cdot \frac{3A-55}{-A+20} = \frac{3A-55}{-2A+40}$.

G17b \square $B = \frac{20k-16}{5k-3} \Rightarrow B(5k-3) = 20k-16 \Rightarrow 5Bk-3B-20k = -16 \Rightarrow k(5B-20) = 3B-16 \Rightarrow k = \frac{3B-16}{5B-20}$.

G17c \square $6Z = \frac{2}{5} \cdot \sqrt{2y+80} + 4 \Rightarrow \frac{2}{5} \cdot \sqrt{2y+80} = 6Z-4 \Rightarrow \sqrt{2y+80} = 15Z-10 \Rightarrow 2y+80 = (15Z-10)^2 \Rightarrow$

$2y+80 = (15Z-10)(15Z-10) = 225Z^2 - 150Z - 150Z + 100 = 225Z^2 - 300Z + 100 \Rightarrow$

$2y = 225Z^2 - 300Z + 20 \Rightarrow y = 112,5Z^2 - 150Z + 10$.

G17d \square $5 \cdot \log(N) = 2t + 13 \Rightarrow \log(N) = 0,4t + 2,6 \Rightarrow N = 10^{0,4t+2,6} = 10^{0,4t} \cdot 10^{2,6} = 10^{2,6} \cdot (10^{0,4})^t \approx 398 \cdot 2,51^t$.

G17e \square $4 \cdot \log(S) = 1,8 - 2,4 \cdot \log(T) \Rightarrow \log(S) = 0,45 - 0,6 \cdot \log(T) \Rightarrow$

$S = 10^{0,45-0,6 \cdot \log(T)} = 10^{0,45} \cdot 10^{-0,6 \cdot \log(T)} = 10^{0,45} \cdot 10^{\log(T^{-0,6})} \approx 2,8 \cdot T^{-0,6}$.

G17f \square $N = 0,15 \cdot 6,25^t \Rightarrow 6,25^t = \frac{1}{0,15} N$ (log... nemen) $\Rightarrow \log(6,25^t) = \log(\frac{N}{0,15}) \Rightarrow$

$t \cdot \log(6,25) = \log(N) - \log(0,15) \Rightarrow t = \frac{\log(N)}{\log(6,25)} - \frac{\log(0,15)}{\log(6,25)} \approx 1,0 + 1,3 \log(N)$.

G18a \square Aflezen en meten in figuur G.2 geeft onderstaande tabel.

Je ziet dat de toename van N_{\max} niet steeds hetzelfde is.

| L | 70 | 65 | 60 |
|------------|--------|--------|---------|
| N_{\max} | 270000 | 590000 | 1270000 |

G18b \square $B = 20 \cdot \log(N) + \frac{4}{3} \cdot 72 - 157 = 20 \cdot \log(N) - 61 \Rightarrow 20 \cdot \log(N) = B + 61 \Rightarrow \log(N) = 0,05B + 3,05 \Rightarrow$

$N = 10^{0,05B+3,05} = 10^{0,05B} \cdot 10^{3,05} = 10^{3,05} \cdot (10^{0,05})^B \approx 1122 \cdot 1,122^B$.

G18c \square $45 = 10 \cdot \log(N_{\max}) + L - 79 = 10 \cdot \log(N_{\max}) = 45 - L + 79 \Rightarrow 10 \cdot \log(N_{\max}) = 124 - L \Rightarrow$

$\log(N_{\max}) = 12,4 - 0,1L \Rightarrow N_{\max} = 10^{12,4 - 0,1L} = 10^{12,4} \cdot 10^{-0,1L} = 10^{12,4} \cdot (10^{-0,1})^L \approx 2,512 \cdot 10^{12} \cdot 0,794^L$

$$10^{12,4} = 2,511886432E12$$

$$10^{-0,1} = 0,7943282347$$

G18d \square Maak met de formule boven G18c de tabel hieronder.

| L | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 |
|--------------------------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| $N_{\max} (\times 1000)$ | 1545 | 1227 | 974 | 773 | 614 | 488 | 387 | 307 | 244 | 194 |

| Plot1 | Plot2 | Plot3 |
|------------------|-----------------------------|-------|
| $\sqrt{Y1}$ | $2,512 \cdot 10^{12} \cdot$ | |
| $0,794^X / 1000$ | | |
| $\sqrt{Y2}$ | | |

| X | Y1 | Y2 |
|----|--------|----|
| 62 | 1544,9 | |
| 63 | 1226,6 | |
| 64 | 973,94 | |
| 65 | 773,31 | |
| 66 | 614,01 | |
| 67 | 487,52 | |
| 68 | 387,09 | |
| 69 | 307,35 | |
| 70 | 244,04 | |
| 71 | 193,76 | |

Het wordt aan de lezer overgelaten de schets in het werkboek af te maken.

(rechts van $L = 69$ (dus voor $L < 69$) komt de grafiek van formule(2) boven de grafiek van formule(1))

Bij afname van L geeft formule(2) een hogere waarde van N_{\max} dan formule(1) \Rightarrow vaker lawaai.

G19a \square $W = \frac{90}{1000} = 0,09$ (kg); $S = \frac{200}{10000} = 0,02$ (m²) en $d = 1,25$ (kg/m³) geeft

$0,09 = 0,03 \cdot 1,25 \cdot V^2 \cdot 0,02 \Rightarrow V^2 = \frac{0,09}{0,03 \cdot 1,25 \cdot 0,02} = 120 \Rightarrow V \approx 11$ (m/s).

$$0,09 / (0,03 * 1,25 * 0,02)$$

$$= 120$$

$$0,03 * 0,3125 * 250^2$$

$$= 585,9375$$

G19b \square $S = 511$ (m²); $V = \frac{900 \cdot 1000}{3600} = 250$ (m/s) en $d = 0,3125$ (kg/m³) geeft $vb = \frac{W}{S} = \frac{0,03 \cdot 0,3125 \cdot 250^2 \cdot 511}{511} \approx 586$ (kg/m²).

G19c \square $vb = \frac{W}{S} = \frac{0,0375 \cdot V^2 \cdot S}{S} = 0,0375 \cdot V^2$ (kg/m²). Dus de vleugelbelasting is $1,5^2 = 2,25$ keer zo groot.

$$1,5^2 = 2,25$$

G19d \square $\frac{W}{S} = 5,5 \cdot W^{\frac{1}{3}} \Rightarrow \frac{W}{5,5 \cdot W^{\frac{1}{3}}} = S \Rightarrow S = \frac{1}{5,5} \cdot W^{\frac{2}{3}}$. Dus $a = \frac{1}{5,5} \approx 0,18$ en $b = \frac{2}{3} \approx 0,67$.

$$1 / 5,5 = 0,1818181818$$

$$2 / 3 = 0,6666666667$$

G20a \square $T = ah + b$ met $a = \frac{\Delta T}{\Delta h} = \frac{-50 - 15}{10 - 0} = \frac{-65}{10} = -6,5$ en $b = 15$ (want $h = 0 \Rightarrow T = 15$) $\Rightarrow T = -6,5h + 15$.

$$1 + 15 / 273 = 1,054945055$$

$$-6,5 / 273 = -0,238095238$$

$T = -6,5h + 15$ in $V = 331 \cdot \sqrt{1 + \frac{T}{273}} \Rightarrow V = 331 \cdot \sqrt{1 + \frac{-6,5h + 15}{273}} = 331 \cdot \sqrt{1 + \frac{-6,5}{273}h + \frac{15}{273}} \approx 331 \cdot \sqrt{1,0549 - 0,0238h}$.

G20b \square $270,8 = 0,9 \cdot V \Rightarrow V = \frac{270,8}{0,9} = 331 \cdot \sqrt{1,0549 - 0,0238h} \Rightarrow \sqrt{1,0549 - 0,0238h} = \frac{270,8}{0,9 \cdot 331}$ (kwadrateren) \Rightarrow

$1,0549 - 0,0238h = \left(\frac{270,8}{0,9 \cdot 331}\right)^2 \Rightarrow -0,0238h = \left(\frac{270,8}{0,9 \cdot 331}\right)^2 - 1,0549 \Rightarrow h \approx 9,6$ (km).

$$270,8 / 0,9 / 331 = 0,8263353151$$

$$\text{Ans}^2 = 0,8263353151$$

$$\text{Ans} - 1,0549 = -0,2285646849$$

$$\text{Ans} / -0,0238 = 9,603552033$$