

# UITWERKINGEN VOOR HET VWO A1B1 DEEL1

## Hoofdstuk 6

### VERGELIJKINGEN

#### KERN 1

#### EERSTE GRAADSVERGELIJKINGEN

**1a)**  $1100 + 3 \cdot 1200 + 1100 = 5800 \text{ meter} = 5,8 \text{ kilometer}$

**1b)**  $n \xrightarrow{\text{maal } 1,2} \xrightarrow{\text{plus } 2,2} \text{aantal kilometer}$

**1c)**

$1,5 \times 1,2 + 2,2 = 20,2 \text{ km}$

$1,6 \times 1,2 + 2,2 = 21,4 \text{ km}$

Anders :

$n \xrightarrow{\times 2} \xrightarrow{+2,2} 21,1$

$15,75 \xrightarrow{\div 1,2} 18,9 \xrightarrow{-2,2} 21,1$

De kleinste  $n$  is 16 (nis een geheel getal)

**2a)**  $5x - 18 = 27 \Rightarrow 5x = 27 + 18 \Rightarrow x = \frac{45}{5}$

**2b)**  $4(x + 7) = 8 \Rightarrow x + 7 = \frac{8}{4} \Rightarrow$

$\Rightarrow x = -2 - 7 \Rightarrow x = -9$

**2c)**  $3(x - 1) = 12 \Rightarrow x - 1 = \frac{12}{3} \Rightarrow$

$\Rightarrow x - 1 = 4 \Rightarrow x = 5$

**2d)**  $\frac{1}{2}(x - 3) + 1 = 1\frac{1}{2} \Rightarrow \frac{1}{2}(x - 3) = 1\frac{1}{2} - 1 \Rightarrow$

$\Rightarrow x - 3 = \frac{1}{2} \cdot 2 \Rightarrow x = 4$

**2e)**  $2x + 1 = -5 \Rightarrow 2x = -5 - 1 \Rightarrow$

$x = \frac{-6}{2} \Rightarrow x = -3$

**2f)**  $5 - 3x = 11 \Rightarrow -3x = 11 - 5 \Rightarrow$

$\Rightarrow x = \frac{6}{-3} \Rightarrow x = -2$

**3a)**  $S = 5x + 520$

$x$	0	10	20	30
$S$	520	570	620	670

**3c)**  $800 = 5x + 520 \Rightarrow 800 - 520 = 5x$

$\Rightarrow 5x = 280 \Rightarrow x = \frac{280}{5} = 56 \text{ leden}$

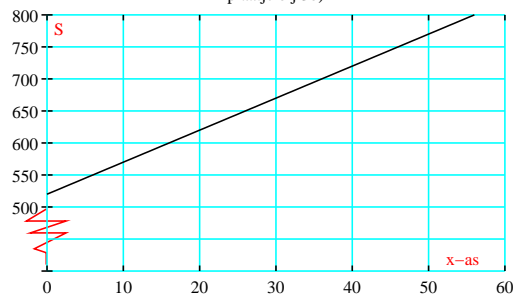
**3d)**  $5x + 520 = 2000 \Rightarrow 5x = 2000 - 520 \Rightarrow$

$\Rightarrow 5x = 1480 \Rightarrow x = \frac{1480}{5} \Rightarrow x = 296$

Dus meer dan 296 leden

$5x + 520 < < < < = > > > > 2000$   
296

plaatje bij 3b)



**4a)** 2 dozen en 2 gewichtjes

**4b)** 1 doos = 2 gewichtjes = 100 gram

**5a)**  $4x - 8 = 3x - 3 \xrightarrow{\text{linksen rechts: } -3x} x - 8 = -3 \Rightarrow x = -3 + 8 \Rightarrow x = 5$

**5b)**  $2 - 5t = -t + 5 \xrightarrow{\text{linksen rechts: } +t} 3 - 4t = 5 \Rightarrow -4t = 5 - 3 \Rightarrow t = \frac{2}{-4} = -\frac{1}{2}$

<sup>1</sup> Deze samenvatting mag niet massaal op kosten van Schaersvoorde worden Uitgeprint!!!



<sup>2</sup> werd gemaakt onder Linux met L<sup>A</sup>T<sub>E</sub>X en L<sup>A</sup>T<sub>E</sub>X

<sup>3</sup> Typ&andere fouten&blunders graag Melden!

$$5c) \frac{1}{4}b + 2 = -b - 8 \xrightarrow{\text{linksenrechts: } +b} 1\frac{1}{4}b + 2 = -8 \xrightarrow{\text{linksenrechts: } -2} 1\frac{1}{4}b = -10 \Rightarrow b = \frac{-10}{1,25} = -8$$

$$5d) 3(s-4) = 6s-9 \xrightarrow{\text{Haakjes wegwerken}} 3s-12 = 6s-9 \xrightarrow{-3s} -12 = 3s-9 \xrightarrow{+9} -3 = 3s \Rightarrow s = -1$$

$$6a) 6x-1 > 3x-7 \xrightarrow{-3x} 3x-1 > -7 \xrightarrow{+1} 3x > -6 \xrightarrow{\div 3} x > -2$$

$$6b) 7-5R \geq -3R+5 \xrightarrow{+3R} 7-2R \geq 5 \xrightarrow{-7} -2R \geq -2 \Rightarrow \xrightarrow{\div(-2)} \Rightarrow \text{delen door negatief getal klapt teken om} \rightarrow R \leq 1$$

$$6c) \frac{1}{2}n-1 < -n+8 \xrightarrow{+n} 1\frac{1}{2}n-1 < 8 \xrightarrow{+1} 1\frac{1}{2}n < 9 \xrightarrow{\div 1\frac{1}{2}} n < 6$$

$$6d) 4(s+2) \leq 6s-9 \xrightarrow{\text{Haakjes wegwerken}} 4s+8 \leq 6s-9 \xrightarrow{-6s} -2s+8 \leq -9 \xrightarrow{-8} -2s \leq -17 \Rightarrow \xrightarrow{\div(-2)} s \geq 8,5$$

$$7a) y = 2x+3 \quad y = -2x+9$$

$$2x+3 = -2x+9 \xrightarrow{+2x} 4x+3 = 9 \xrightarrow{-3} 4x = 6 \xrightarrow{\div 4} x = 1\frac{1}{2} \xrightarrow{\text{Invullen}} y = 2 \cdot 1\frac{1}{2} + 3 \Rightarrow y = 6$$

$$S = (1\frac{1}{2}; 6) \xrightarrow{\text{Kontrole}} y = -2 \cdot 1\frac{1}{2} + 9 = -3 + 9 = 6 \xleftarrow{\text{Klopt!!}}$$

$$7b) y = 0, 3x+5 \quad y = -1, 2x+6, 3$$

$$0, 3x+5 = -1, 2x+6, 3 \xrightarrow{+1, 2x} 1, 5x+5 = 6, 5 \xrightarrow{-5} 1, 5x = 1, 5 \xrightarrow{\div 1,5} x = 1 \xrightarrow{\text{Invullen}} y = 0, 3 \cdot 1 + 5 = 5, 3$$

$$S = (1; 5, 3) \xrightarrow{\text{Kontrole}} y = -1, 2 \cdot 1 + 6, 5 = 5, 3 \xleftarrow{\text{Klopt!!}}$$

$$7c) y = -0, 75x \quad y = 1, 75x+10$$

$$1, 75x+10 = -0, 75x \xrightarrow{+0,75x} 2, 5x+10 = 0 \xrightarrow{-10} 2, 5x = -10 \xrightarrow{\div 2,5} x = -4 \xrightarrow{\text{Invullen}} y = -0, 75 \cdot -4 \Rightarrow$$

$$\Rightarrow y = +3 \quad S = (-4; 3) \xrightarrow{\text{Kontrole}} y = 1, 75 \cdot -4 + 10 = 3 \xleftarrow{\text{Klopt!!}}$$

$$7d) y = 10-3x \quad y = \frac{1}{2}x-4$$

$$10-3x = \frac{1}{2}x-4 \xrightarrow{-\frac{1}{2}x} 10-3\frac{1}{2}x = -4 \xrightarrow{-10} -3\frac{1}{2}x = -14 \xrightarrow{\div -3\frac{1}{2}} x = 4 \xrightarrow{\text{Invullen}} y = 10-3 \cdot 4 = -2$$

$$S = (4; -2) \xrightarrow{\text{Kontrole}} y = \frac{1}{2} \cdot 4 - 4 = -2 \xleftarrow{\text{Klopt!!}}$$

$$8a) 48.000 - 86.000 \cdot 0,15 = Hfl 46.725, -$$

$$8b) W = 48.000 - 0,15k$$

$$8c) 30.000 = 48.000 - 0,15k \Rightarrow 0,15k = 18.000 \Rightarrow k = 120.000 \text{ km}$$

$$9) 59x-50 = 3(2+x)-7$$

9a) ja, dit is een 1<sup>ste</sup> graads vergelijking. Na haakjes wegwerken krijg je:  $5x-25 = 6+3x-7$

9b) ja

9c) De BalansMethode

$$9d) 5x-25 = 6+3x-7 \Rightarrow 5x-25 = 3x-1 \xrightarrow{-3x} 2x-25 = -1 \xrightarrow{+25} 2x = 24 \Rightarrow x = 12$$

$$10a) 3x+7 = 5x+11 \xrightarrow{-5x} -2x+7 = 11 \xrightarrow{-7} -2x = 4 \Rightarrow x = -2$$

$$10b) 7x-4 = 4 \xrightarrow{+4} 7x = 8 \Rightarrow x = \frac{8}{7} \Rightarrow x = 1\frac{1}{7}$$

$$10c) 2(x-4) = -8 \xrightarrow{\text{Haakjes wegwerken}} 2x-8 = -8 \xrightarrow{\div 2} x-6 = 4 \xrightarrow{+6} x = 10$$

$$10e) 4(x+1) = 4(2x-1)-4 \xrightarrow{\text{Haakjes wegwerken}} 4x+4 = 8x-4-4 \Rightarrow$$

$$\xrightarrow{-8x} -4x-4 = -8 \xrightarrow{-4} -4x = -12 \Rightarrow x = 3$$

$$10f) \frac{1}{2}(x-3) = \frac{1}{4}(x-1) + 1 \xrightarrow{\times 4} 2(x-3) = (x-1) + 4 \Rightarrow 2(x-3) = x-1+4 \Rightarrow$$

$$\xrightarrow{\text{Haakjes wegwerken}} 2x-6 = x+3 \Rightarrow 2x = x+9 \xrightarrow{-x} x = 9$$

11)

Model	prijs	Aantal op voorraad
607MW	1240,- ex BTW	11
107ZW	680,- ex BTW	0

11a)  $1240 \cdot 11 + 1240 \cdot 0,175 \cdot 11 = Hfl\ 16.027,-$

11b)  $30.000 - 16.027 = Hfl\ 13.973,-$

$n$  het aantal bestelde cdspelers

$$11 \cdot 1240 + 680 \cdot n = 13973 \Rightarrow 799 \cdot n = 13973 \Rightarrow n = \frac{13973}{799} \simeq 17,5$$

Er kunnen dus nog Maximaal 17 CDspelers van het type 107ZW bijbesteld worden

12a) 1 jan. 1995  $Hfl\ 150.000,-$   $-0,5\%$  rente/maand  $\xrightarrow{0,5\% \text{ van } 150.000 \text{ is}}$   $Hfl\ 750,-$

En elke maand  $\frac{150.000}{300} = Hfl\ 500,-$

$Hfl\ 750,- + Hfl\ 500,- = Hfl\ 1250,-$

12b)  $Hfl\ 500,-$

12c)

$$B = 500 + (150000 - 500(n-1)) \cdot 0,005 \Rightarrow$$

$$B = 500 + (150000 - 500n + 500) \cdot 0,005 \Rightarrow$$

$$B = 500 + (150500 - 500n) \cdot 0,005 \Rightarrow$$

$$B = 500 + 752,5 - 2,5n \Rightarrow$$

$$B = 1252,5 - 2,5n$$

12d)  $1000 = 1252,5 - 2,5n \Rightarrow 2,5n = 252,5 \Rightarrow n = 101$

$$\frac{101}{12} = 8,417$$

$$1995 + 8 = 2003$$

$$n = 1 \rightarrow 1 \text{ feb. } 1995$$

$$n = 97 \rightarrow 1 \text{ feb. } 2003$$

$$n = 101 \rightarrow 1 \text{ juni. } 2003$$

Alle maandelijkse betalingen 2004

## KERN 2

### TWEEDE GRAADSVERGELIJKINGEN

**13a)**  $h = 0,02l \cdot (80 - l) \Rightarrow h = 0,02l \cdot 80 - 0,02l \cdot l \Rightarrow h = 1,6l - 0,02l^2$

**13b)** Met haakjes

**13c)**  $0 = 0,02l \cdot (80 - l) \Rightarrow 0,02l = 0 \vee 80 - l = 0 \Rightarrow l = 0 \vee l = 80 \leftarrow \begin{matrix} \vee \text{ betekent 'of!'} \\ \wedge \text{ betekent 'en!'} \end{matrix}$

**14a)**  $x^2 - 7x = 0 \Rightarrow x(x - 7) = 0 \Rightarrow x = 0 \vee x - 7 = 0 \Rightarrow x = 0 \vee x = 7$

**14b)**  $x^2 + 2x - 15 = 0 \xrightarrow{\downarrow \text{zie voor ontbinding in factoren de tabel} \downarrow} (x - 3)(x + 5) = 0 \Rightarrow x = 3 \vee x = -5$

Produkt		Som		$x^2 + 2x - 15 = 0$
$1 \cdot (-15) = -15$		$1 + (-15) = -14$		fout
$3 \cdot (-5) = -15$		$3 + (-5) = -2$		fout
$-3 \cdot 5 = -15$		$-3 + 5 = 2$		Goed

**14c)**  $15x^2 - 12x = 0 \xrightarrow{\div 3} 5x^2 - 4x = 0 \Rightarrow x(5x - 4) = 0 \Rightarrow x = 0 \vee 5x - 4 = 0 \Rightarrow x = 0 \vee 5x = 4 \Rightarrow x = 0 \vee x = \frac{4}{5} = 0,8$

**14d)**  $x^2 - 7x = 18 \Rightarrow x^2 + 7x - 18 = 0 \xrightarrow{\downarrow \text{Zie Tabel} \downarrow} (x + 2)(x - 9) = 0 \Rightarrow x = -2 \vee x = 9$

Produkt		Som		$x^2 - 7x - 18 = 0$
$1 \cdot (-18) = -18$		$1 + (-18) = -17$		fout
$2 \cdot (-9) = -18$		$2 + (-9) = -7$		Goed

**14e)**  $3x^2 = -15x - 18 \xrightarrow{+(15x+18)} 3x^2 + 15x + 18 = 0 \xrightarrow{\div 3} x^2 + 5x + 6 = 0 \Rightarrow (x + 2)(x + 3) = 0 \Rightarrow x + 2 = 0 \vee x + 3 = 0 \Rightarrow x = -2 \vee x = -3$

Produkt		Som		$x^2 + 5 \cdot x + 6 = 0$
$1 \cdot 6 = 6$		$1 + 6 = 7$		fout
$2 \cdot 3 = 6$		$2 + 3 = 5$		Goed

**14f)**  $x = x^2 - 6 \xrightarrow{-x} 0 = x^2 - x - 6 \xrightarrow{\downarrow \text{Zie Tabel} \downarrow} (x + 2)(x - 3) \Rightarrow x + 2 = 0 \vee x - 3 = 0 \Rightarrow x = -2 \vee x = 3$

Produkt		Som		$x^2 - 1 \cdot x - 6 = 0$
$1 \cdot (-6) = -6$		$1 + (-6) = -5$		fout
$2 \cdot (-3) = -6$		$2 + (-3) = -1$		Goed

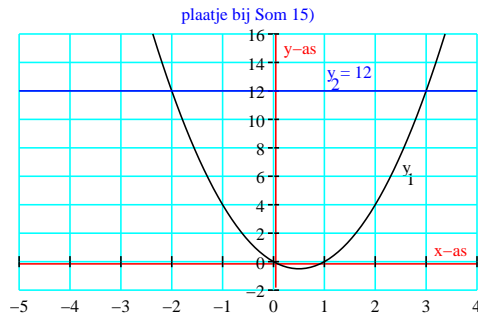
**14g)**  $12x - 24x^2 = 0 \div 12x - 2x^2 = 0 \Rightarrow x(1 - 2x) = 0 \Rightarrow x = 0 \vee 1 - 2x = 0 \Rightarrow x = 0 \vee x = \frac{1}{2}$

**14h)**  $3x^2 + x = x^2 - 3x - 2 \xrightarrow{-x^2} 2x^2 + x = -3x - 2 \xrightarrow{+3x} 2x^2 + 4x = -2 \xrightarrow{+2} 2x^2 + 4x + 2 = 0 \Rightarrow x^2 + 2x + 1 = 0 \Rightarrow (x + 1)(x + 1) = 0 \Rightarrow x = -1$

**15a)**  $y_1 = 2x^2 - 2x \quad y_2 = 12$

$2x^2 - 2x = 0 \xrightarrow{\div 2} x^2 - x = 0 \Rightarrow x(x - 1) = 0 \Rightarrow x = 0 \vee x = 1$

x		-2		-1		$\frac{1}{2}$		0		$\frac{1}{2}$		1		$1\frac{1}{2}$		2		3		4
y <sub>1</sub>		12		4		$1\frac{1}{2}$		0		$-\frac{1}{2}$		0		$1\frac{1}{2}$		4		12		24



15b)  $\xrightarrow{\text{Snijpunten}} y_1 = y_2 \Rightarrow 2x^2 - 2x = 12 \xrightarrow{\div 2} x^2 - x = 6 \xrightarrow{-6} x^2 - x - 6 = 0 \Rightarrow$   
 $\downarrow \text{Zie Tabel} \downarrow (x+2)(x-3) = 0 \Rightarrow x+2=0 \vee x-3=0 \Rightarrow x = -2 \vee x = 3$

Produkt	Som	$x^2 - 1 \cdot x - 6 = 0$
$1 \cdot (-6) = -6$	$1 + (-6) = -5$	fout
$2 \cdot (-3) = -6$	$2 + (-3) = -1$	Goed

15c)  $-2 \leq x \leq 3$



16)  $x^2 + 6x - 12 = 0$

16a) Neen

16b) Deze vergelijking is *niet* op te lossen met de “Produkt – Som methode”

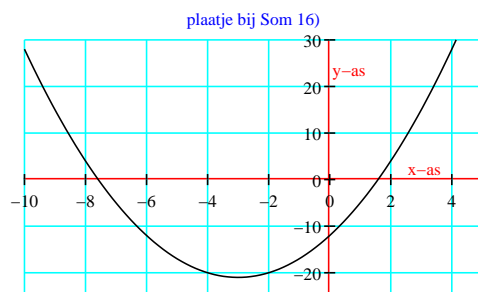
Produkt	Som
$1 \cdot (-12) = -12$	$1 + (-12) = -11$
$2 \cdot (-6) = -12$	$2 + (-6) = -4$
$3 \cdot (-4) = -12$	$3 + (-4) = -1$
$4 \cdot (-3) = -12$	$4 + (-3) = 1$
$6 \cdot (-2) = -12$	$6 + (-2) = 4$
$12 \cdot (-1) = -12$	$12 + (-1) = 11$

16c)

x	-10	-9	-8	-7	-6	-3	0	1	2	3
$y = x^2 + 6x - 12$	28	15	4	-5	-12	-21	-12	-5	4	15

(2; 4)(-8; 4) zijn twee punten op dezelfde hoogte (4)  $\xrightarrow{\text{Symmetrieas ligt daar precies tussen in}} \frac{2+(-8)}{2} = -3$

16d)  $x^2 + 6x - 12 = 0 \leftarrow \text{Heeft Wel een Oplossing}$



17a)  $x^2 + 6x - 12 = 0$

$\xrightarrow{\text{Algemene Formule: } ax^2 + bx + c}$

$$\left. \begin{array}{l} a = 1 \\ b = 6 \\ c = -12 \end{array} \right\} \Rightarrow D = 36 - 4 \cdot 1 \cdot (-12) \Rightarrow D = 36 + 48 \Rightarrow D = 84$$

$$\left\{ \begin{array}{l} \frac{\sqrt{D}}{2a} = \frac{\sqrt{84}}{2} = \frac{\sqrt{4 \cdot 21}}{2} = \frac{\sqrt{4} \cdot \sqrt{21}}{2} = \frac{2 \cdot \sqrt{21}}{2} = \sqrt{21} \\ -\frac{b}{2a} = -\frac{-6}{2} = -3 \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = -3 - \sqrt{21} \simeq -7,58 \\ x_2 = -3 + \sqrt{21} \simeq 1,58 \end{array} \right.$$

$$\mathbf{17b)} \quad 2x^2 + 1 - 3x = 0 \Rightarrow 2x^2 - 3x + 1 = 0 \rightarrow \left. \begin{array}{l} a = 2 \\ b = -3 \\ c = 1 \end{array} \right\} \Rightarrow D = (-3)^2 - 4 \cdot 2 \cdot 1 = 9 - 8 = 1$$

$$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{-3}{4} = \frac{3}{4} \\ \frac{\sqrt{D}}{2a} = \frac{1}{4} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = \frac{3}{4} - \frac{1}{4} = \frac{1}{2} \\ x_2 = \frac{3}{4} + \frac{1}{4} = 1 \end{array} \right.$$

$$\mathbf{17c)} \quad -x^2 + 2x - 8 = 0 \rightarrow \left. \begin{array}{l} a = -1 \\ b = 2 \\ c = -8 \end{array} \right\} \Rightarrow D = (2)^2 - 4 \cdot (-1) \cdot (-8) = 4 - 32 = -28 < 0 \leftarrow \text{er zijn geen Oplossingen}$$

$$\mathbf{17d)} \quad x(x+1) + 5 = 0 \Rightarrow$$

$$\Rightarrow x^2 + x + 5 = 0 \rightarrow \left. \begin{array}{l} a = 1 \\ b = 1 \\ c = 5 \end{array} \right\} \Rightarrow D = (1)^2 - 4 \cdot 1 \cdot 5 = 1 - 20 = -19 < 0 \leftarrow \text{er zijn geen Oplossingen}$$

$$\mathbf{17e)} \quad 4x^2 - 2 = 5x \Rightarrow 4x^2 - 5x - 2 = 0 \Rightarrow \left. \begin{array}{l} a = 4 \\ b = -5 \\ c = -2 \end{array} \right\} \Rightarrow D = (-5)^2 - 4 \cdot 4 \cdot (-2) = 25 + 32 = 57$$

$$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{-5}{8} = \frac{5}{8} \\ \frac{\sqrt{D}}{2a} = \frac{\sqrt{57}}{8} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = \frac{5}{8} - \frac{1}{8}\sqrt{57} \simeq -0,32 \\ x_2 = \frac{5}{8} + \frac{1}{8}\sqrt{57} \simeq 1,57 \end{array} \right.$$

$$\mathbf{17f)} \quad 0,1x^2 - 0,5x = 1 \Rightarrow$$

$$\Rightarrow 0,1x^2 - 0,5x - 1 = 0 \Rightarrow \left. \begin{array}{l} a = 0,1 \\ b = -0,5 \\ c = -1 \end{array} \right\} \Rightarrow D = (-0,5)^2 - 4 \cdot 0,1 \cdot (-1) = 0,65$$

$$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{-0,5}{0,2} = \frac{0,5}{0,2} = \frac{5}{2} = 2\frac{1}{2} \\ \frac{\sqrt{D}}{2a} = \frac{\sqrt{0,65}}{0,2} = \frac{\sqrt{\frac{45}{100}}}{0,2} = \frac{\sqrt{45}}{\sqrt{100}} = \frac{\sqrt{45}}{10} = \frac{\sqrt{9 \cdot 5}}{10} = \frac{3\sqrt{5}}{10} = \frac{3}{2}\sqrt{\frac{5}{10}} = \frac{3}{2}\sqrt{\frac{1}{2}} = \frac{3}{2} \cdot \frac{1}{\sqrt{2}} = \frac{3}{2} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{2}}{2} = \frac{3}{2}\sqrt{2} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = 2\frac{1}{2} - \frac{3}{2}\sqrt{2} \simeq -1,53 \\ x_2 = 2\frac{1}{2} + \frac{3}{2}\sqrt{2} \simeq 6,53 \end{array} \right.$$

$$\mathbf{17g)} \quad 3000 - 100x^2 = 1300x \xrightarrow{\div 100} 30 - x^2 = 13x \Rightarrow -x^2 - 13x + 30 = 0 \Rightarrow$$

$$\Rightarrow x^2 + 13x - 30 = 0 \Rightarrow \left. \begin{array}{l} a = 1 \\ b = 13 \\ c = -30 \end{array} \right\} \Rightarrow D = (13)^2 - 4 \cdot 1 \cdot (-30) = 289$$

$$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{13}{2} = -6\frac{1}{2} \\ \frac{\sqrt{D}}{2a} = \frac{17}{2} = 8\frac{1}{2} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = -6\frac{1}{2} - 8\frac{1}{2} = -15 \\ x_2 = -6\frac{1}{2} + 8\frac{1}{2} = 2 \end{array} \right.$$

$$\mathbf{17h)} \quad x^2 = x - 2 \Rightarrow x^2 - x + 2 = 0 \Rightarrow \left. \begin{array}{l} a = 1 \\ b = -1 \\ c = 2 \end{array} \right\} \Rightarrow D = (-1)^2 - 4 \cdot 1 \cdot 2 = 1 - 8 = -7 < 0 \leftarrow \text{er zijn geen Oplossingen}$$

$$\mathbf{18a)} \quad x^2 + 2x + p = 0$$

$$\left\{ \begin{array}{l} p = 0 \Rightarrow x^2 + 2x = 0 \Rightarrow x(x+2) = 0 \Rightarrow x = 0 \vee x = -2 \Rightarrow \left\{ \begin{array}{l} a = 1 \\ b = 1 \\ c = 0 \end{array} \right\} \Rightarrow D = 2^2 - 4 \cdot 1 \cdot 0 = 4 \end{array} \right.$$

$$\left\{ \begin{array}{l} p = 1 \Rightarrow x^2 + 2x + 1 = 0 \Rightarrow (x+1)(x+1) \Rightarrow x = -1 \Rightarrow \left\{ \begin{array}{l} a = 1 \\ b = 2 \\ c = 1 \end{array} \right\} \Rightarrow D = 2^2 - 4 \cdot 1 \cdot 1 = 0 \end{array} \right.$$

$$\left\{ \begin{array}{l} p = 2 \Rightarrow x^2 + 2x + 2 = 0 \Rightarrow \left\{ \begin{array}{l} a = 1 \\ b = 2 \\ c = 2 \end{array} \right\} \Rightarrow D = 2^2 - 4 \cdot 1 \cdot 2 = -2 < 0 \leftarrow \text{er zijn geen Oplossingen} \end{array} \right.$$

**18b&c)**

$$p = 0 \rightarrow D = 4 \Rightarrow D > 0 \rightarrow \text{twee oplossingen}$$

$$p = 1 \rightarrow D = 0 \rightarrow \text{enkele oplossing}$$

$$p = 2 \rightarrow D = -4 \Rightarrow D < 0 \rightarrow \text{geen oplossing}$$

**19a&b)**  $1500x^2 - 4500x + 3000 = 0 \xrightarrow{\div 100} 15x^2 - 45x + 30 = 0 \xrightarrow{\div 15} x^2 - 3x + 2 = 0 \Rightarrow$   
 $\Rightarrow (x-2)(x-1) = 0 \Rightarrow x = 2 \vee x = 1$

**19c)**  $\left. \begin{array}{l} a = 1 \\ b = -3 \\ c = 2 \end{array} \right\} \Rightarrow D = (-3)^2 - 4 \cdot 1 \cdot 2 = 1$

$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{-3}{2} = 1\frac{1}{2} \\ \frac{\sqrt{D}}{2a} = \frac{1}{2} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = 1\frac{1}{2} - \frac{1}{2} = 1 \\ x_2 = 1\frac{1}{2} + \frac{1}{2} = 2 \end{array} \right.$

**19d)** Produkt-som

**20a)**  $3x^2 + 7 = 5x + 11 \Rightarrow 3x^2 - 5x + 7 = 11 \Rightarrow$   
 $\Rightarrow 3x^2 - 5x - 4 = 0 \rightarrow \left. \begin{array}{l} a = 3 \\ b = -5 \\ c = -4 \end{array} \right\} \Rightarrow D = (-5)^2 - 4 \cdot 3 \cdot -4 = 25 + 48 = 73$

$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{-5}{2} = \frac{5}{2} \\ \frac{\sqrt{D}}{2a} = \frac{\sqrt{73}}{6} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = \frac{5}{2} - \frac{1}{6}\sqrt{73} \simeq -0,59 \\ x_2 = \frac{5}{2} + \frac{1}{6}\sqrt{73} \simeq 2,26 \end{array} \right.$

**20b)**  $x(x-6) = 27 \Rightarrow x^2 - 6x - 27 = 0 \xrightarrow{\text{Zie Tabel}} (x+3)(x-9) = 0 \Rightarrow x+3 = 0 \vee x-9 = 0 \Rightarrow$   
 $\Rightarrow x = -3 \vee x = 9$

Produkt	Som	$x^2 - 6 \cdot x - 27 = 0$
$1 \cdot (-27) = -27$	$1 + (-27) = -26$	<i>fout</i>
$3 \cdot (-9) = -27$	$3 + (-9) = -6$	<i>Goed</i>

**20c)**  $4x^2 = 25x^2 - 63x \Rightarrow 21x^2 - 63x = 0 \Rightarrow 7x^2 - 21x = 0 \Rightarrow x^2 - 3x = 0 \Rightarrow x(x-3) = 0 \Rightarrow$   
 $\Rightarrow x = 0 \vee x = 3$

**20d)**  $(x-3)^2 = 9 \Rightarrow (x-3) = 3 \vee (x-3) = -3 \Rightarrow x = 6 \vee x = 0$

**20e)**  $x^2 + 3x - 4 = 0 \Rightarrow (x+4)(x-1) = 0 \Rightarrow (x+4) = 0 \vee (x-1) = 0 \Rightarrow x = -4 \vee x = 1$

**20f)**  $x^2 + 3x + 4 = 0 \rightarrow \left\{ \begin{array}{l} a = 1 \\ b = 3 \\ c = 4 \end{array} \right\} \Rightarrow D = 3^2 - 4 \cdot 1 \cdot 4 = 9 - 16 = -7 \Rightarrow D < 0 \leftarrow \text{Geen oplossingen}$

**20g)**  $x^2 + 5x + 8 = x + 8 \Rightarrow x^2 + 4x = 0 \Rightarrow x(x+4) = 0 \Rightarrow x = 0 \vee x = -4$

**20h)**  $x^2 - 5 = 0 \Rightarrow x^2 = 5 \Rightarrow x = \sqrt{5} \vee x = -\sqrt{5} \Rightarrow x \simeq 2,24 \vee x \simeq -2,24$

**21)**  $h = v \cdot t - 5t^2$  waarbij  $h$  in meters,  $t$  in seconden

**21a)**

$\left. \begin{array}{l} h = 15 \\ v = 20 \end{array} \right\} \Rightarrow 15 = 20t - 5t^2 \xrightarrow{\div 5} 3 = 4t - t^2 \Rightarrow t^2 - 4t + 3 = 0 \Rightarrow (t-1)(t-3) = 0 \Rightarrow t = 1 \vee t = 3$

**21b)**

$\left. \begin{array}{l} h = 5 \\ v = 20 \end{array} \right\} \Rightarrow 5 = 20t - 5t^2 \Rightarrow 1 = 4t - t^2 \Rightarrow t^2 - 4t + 1 = 0 \rightarrow \left\{ \begin{array}{l} a = 1 \\ b = -4 \\ c = 1 \end{array} \right\} \Rightarrow$

$\Rightarrow D = (-4)^2 - 4 \cdot 1 \cdot 1 = 16 - 4 = 12$

$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{-4}{2} = 2 \\ \frac{\sqrt{D}}{2a} = \frac{\sqrt{12}}{2} = \frac{\sqrt{4 \cdot 3}}{2} = \frac{\sqrt{4} \cdot \sqrt{3}}{2} = \sqrt{3} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = 2 - \sqrt{3} \simeq 0,27 \\ x_2 = 2 + \sqrt{3} \simeq 3,73 \end{array} \right.$

**21c)**  $t = 2 \xleftarrow{\text{Is de Symmetrieas}} h = 20 \cdot 2 - 5 \cdot 2^2 \Rightarrow h = 40 - 20 = 20 \text{ meter}$

**21d)**  $45 = vt - 5t^2 \Rightarrow 5t^2 - vt + 45 = 0 \xrightarrow{D=b^2-4ac=0} D = 0 \Rightarrow (-v)^2 - 4 \cdot 5 \cdot 45 = 0 \Rightarrow$   
 $\Rightarrow v^2 = 900 \Rightarrow v = 30$

## KERN 3

### ANDERE TYPEN VERGELIJKINGEN

22a)  $r \xrightarrow{\star\star^2} \xrightarrow{\times 6} A$

22b)  $300 = 6 \cdot r^2$

22c)  $r^2 = \frac{300}{6} \Rightarrow r = \sqrt{\frac{300}{6}} \vee r = -\sqrt{\frac{300}{6}} \Rightarrow r \simeq 7,07 \vee r \simeq -7,07 \leftarrow \text{Vervalt} \leftarrow \text{negatieve lengte bestaat niet}$

23a)  $3^x = 5 \Rightarrow x = {}^3\log 5 \Rightarrow x = \frac{\log 5}{\log 3} \simeq 1,46$

23b)  ${}^2\log x = 1024 \Rightarrow x = 2^{1024} \simeq 1,38 \times 10^{308}$

23c)  $x^2 = 0,04 \Rightarrow x = \sqrt{0,04} \vee x = -\sqrt{0,04} \Rightarrow x = +0,2 \vee x = -0,2$

23d)  $\sqrt{x} = 3 \Rightarrow x = 9$

23e)  $8^x = \sqrt{8} - 8^{\frac{1}{2}} \Rightarrow x = \frac{1}{2}$

24a) 2% lekt weg  $\xrightarrow{98\% \text{ blijft over}} g = 0,98$

$H = 500 \cdot 0,98^t$

24b)  $250 = 500 \cdot 0,98^t \Rightarrow \frac{250}{500} = 0,98^t \Rightarrow t = {}^{0,98}\log 0,5 = \frac{\log 0,5}{\log 0,98} \simeq 34,31 \text{ uren} \Rightarrow$

$\xrightarrow{\text{ofwel}} 34,31 \cdot 60 \simeq 2059 \text{ minuten}$

25a)  $g_{45 \text{ minuten}} = 2 \xrightarrow{45 \text{ min} = \frac{3}{4} \text{ uur}} g_{\text{uur}} = 2^{\frac{4}{3}} \simeq 2,52$

25b)  $g_{3,5 \text{ jaar}} = \frac{1}{2} \Rightarrow g_{\text{jaar}} = \left(\frac{1}{2}\right)^{\frac{1}{3,5}} \simeq 0,82 \xrightarrow{\text{dus een Afname van}} 1 - 0,86 \simeq 18\%$

26a)  $(2x-1)^8 + 7 = 8 \xrightarrow{\text{In Haakjes eerst}} x \xrightarrow{\times 2} \star\star \xrightarrow{-1} \star\star \xrightarrow{\star\star^8} \star\star \xrightarrow{+7} 8$

$1 \xleftarrow{\div 2} 2 \xleftarrow{+1} 1 \xleftarrow{\frac{1}{8}} 1 \xleftarrow{-7} 8$

$0 \leftarrow 0 \leftarrow -1 \checkmark$

26b)  $(2x-1)^8 = 1 \Rightarrow 2x-1 = 1 \vee 2x-1 = -1 \Rightarrow 2x = 2 \vee 2x = 0 \Rightarrow x = 1 \vee x = 0$

27a)  $(3x-1)^3 = 125 \Rightarrow (3x-1) = \sqrt[3]{125} \rightarrow 3x-1 = 5 \Rightarrow 3x = 6 \Rightarrow x = 2$

27b)  $\frac{1}{4x+1} = 0,02 \Rightarrow \frac{1}{4x+1} = \frac{2}{100} \Rightarrow \frac{1}{4x+1} = \frac{1}{50} \Rightarrow 4x+1 = 50 \Rightarrow 4x = 49 \Rightarrow x = 12\frac{1}{4}$

27c)  $7^{(2x+3)} = 2401 \Rightarrow 7^{(2x+3)} = 7^4 \Rightarrow 2x+3 = 4 \Rightarrow x = \frac{1}{2}$

27d)

$\left. \begin{array}{l} {}^2\log\left(\frac{1}{2}x-1\right) = 5 \\ 5 = {}^n\log n^5 \Rightarrow 5 = {}^2\log 2^5 \end{array} \right\} \Rightarrow \frac{1}{2}x-1 = 2^5 \Rightarrow \frac{1}{2}x-1 = 32 \Rightarrow \frac{1}{2}x = 33 \Rightarrow x = 66$

27e)

$\left. \begin{array}{l} \frac{1}{\sqrt{(7x-1)}} = \frac{1}{5} \\ \frac{1}{5} = \frac{1}{\sqrt{5^2}} = \frac{1}{\sqrt{25}} \end{array} \right\} \Rightarrow 7x-1 = 25 \Rightarrow 7x = 26 \Rightarrow x = \frac{26}{7} \Rightarrow x = 3\frac{5}{7} \simeq 3,71$

27f)

$\left. \begin{array}{l} \sqrt{(x^2+6x+20)} = 6 \\ 6 = \sqrt{6^2} = \sqrt{36} \end{array} \right\} \Rightarrow x^2+6x+20 = 36 \Rightarrow x^2+4x-16 = 0 \Rightarrow (x+8)(x-2) = 0 \Rightarrow$   
 $\Rightarrow x = -8 \vee x = 2$

28a)  $t = 0 \Rightarrow h = -0,01 \cdot (0+10)^2 + 18 \Rightarrow h = -0,01 \cdot 10^2 + 18 \Rightarrow h = -0,01 \cdot 100 + 18 = 17 \text{ meter}$

28b)  $2 = -0,01 \cdot (t+10)^2 + 18 \Rightarrow 0,01 \cdot (t+10)^2 = 16 \Rightarrow (t+10)^2 = 1600 \Rightarrow t+10 = \sqrt{1600} \Rightarrow$

$\Rightarrow t+10 = +40 \vee t+10 = -40 \Rightarrow t = 30 \vee t = -50 \leftarrow \text{Vervalt} \rightarrow \text{je gaat niet terug in de tijd}$

Dus  $v = 0,02 \cdot 30 = 0,6 \text{ m/sec}$

29)  $f(x) = \log x \quad g(x) = (0,1)^x \quad x \in [0;5]$

29a)



$x$	$\frac{1}{10}$	0	1	2	3	4
$f(x) = \log x$	-1	-	0	0,3	0,48	0,6
$g(x) = (0,1)^x$	0,79	1	0,1	0,01	0,001	0,0001

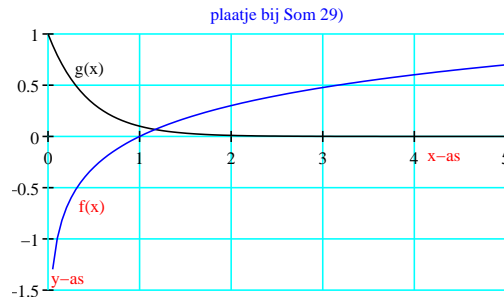
29b)  $f(x) = 0,1 \Rightarrow \log x = 0,1 \Rightarrow$

$^{10}\log 10^{0,1} = 0,1 \Rightarrow x = 10^{0,1} \simeq 1,3$

29c)

$x$	1	1,5	1,25	1,2	1,1
$\log x$	0	0,18	0,097	0,079	0,041
$(0,1)^x$	0,1	0,03	0,056	0,063	0,079
$\Delta$	-0,1	0,15	0,041	0,016	-0,038

$x \simeq 1,2$



30a)  $^3\log x = 0,5 \Rightarrow x = 3^{0,5} \simeq 1,7$

30b)  $4 \cdot 2^x = \left(\frac{1}{2}\right)^x \Rightarrow 4 \cdot 2^x = (2^{-1})^x \Rightarrow 4 \cdot 2^x = 2^{-x} \xrightarrow{\times 2^x} 4 \cdot 2^x \cdot 2^x = 2^{-x} \cdot 2^x \Rightarrow 4 \cdot 2^{2x} = 2^0 = 1 \Rightarrow$   
 $\Rightarrow 2^{2x} = \frac{1}{4} \Rightarrow 2^{2x} = 2^{-2} \Rightarrow 2x = -2 \Rightarrow x = -1$

30c)  $\sqrt{x} = (3-x) \xrightarrow{\text{kwadrateren}} (\sqrt{x})^2 = (3-x)^2 \Rightarrow$

Let Op: Achteraf Kontrolleren op ingebrachte wortels want  $(-\sqrt{x})^2$  is ook  $x$

$\Rightarrow x = (3-x)(3-x) \Rightarrow x = 9 - 3x - 3x + x^2 \Rightarrow x = 9 - 6x + x^2 \Rightarrow x^2 - 7x + 9 = 0 \rightarrow$

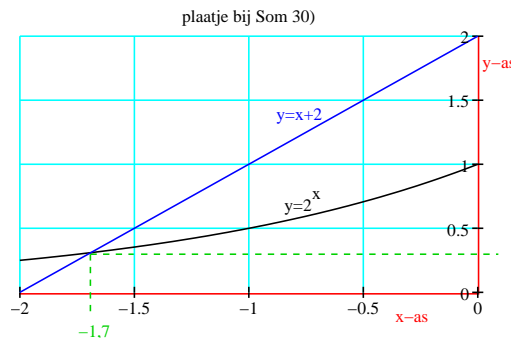
$\left. \begin{matrix} a = 1 \\ b = -7 \\ c = 9 \end{matrix} \right\} \Rightarrow D = (-7)^2 - 4 \cdot 1 \cdot 9 = 49 - 36 \Rightarrow D = 13$

$\left\{ \begin{matrix} -\frac{b}{2a} = -\frac{-7}{2} = 3\frac{1}{2} \\ \frac{\sqrt{D}}{2a} = \frac{\sqrt{13}}{2} \end{matrix} \right. \Rightarrow \left\{ \begin{matrix} x_1 = 3\frac{1}{2} - \frac{1}{2}\sqrt{13} \simeq 1,7 \\ x_2 = 3\frac{1}{2} + \frac{1}{2}\sqrt{13} \simeq 5,3 \end{matrix} \right.$

Kontrolle:  $\left\{ \begin{matrix} \sqrt{5,3} = 2,3 \rightarrow 3 - 5,3 = -2,3 \xrightarrow{\text{Voldoet...Dus}} x = 5,3 \\ \sqrt{1,7} = 1,3 \rightarrow 3 - 1,7 = 1,3 \xrightarrow{\text{Voldoet Niet}} \end{matrix} \right.$

30d)  $2^x = x + 2$

$x$	2	1	0	-1	-2	-1,5	-1,6	-1,65	-1,7
$2^x$	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$	0,35	0,33	0,33	0,31
$x + 2$	4	3	2	1	0	0,5	0,4	0,35	0,3
$\Delta$	0	-1	-1	$-\frac{1}{2}$	$\frac{1}{4}$	-0,15	-0,07	-0,03	+0,01



30e)  $\sin(x) = 0,6 \quad 0 < x < \pi$

$\sin x \simeq \sin(0,64 + 2k\pi) \vee \sin x \simeq \sin(\pi - 0,64 + 2k\pi) \Rightarrow$

$x \simeq 0,64 + 2k\pi \vee x \simeq \pi - 0,64 + 2k\pi \xrightarrow{x \in (0; \pi)} x \simeq 0,64 \vee x \simeq 2,50$

ofwel  $x \simeq 0,6 \vee x \simeq 2,5$

**30f)**  $\cos(x) = 0,6 \quad 0 < x < \pi$

$\cos(x) \simeq \cos(0,93 + 2k\pi) \vee \cos(-0,93 + 2k\pi) \Rightarrow$

$x \simeq 0,93 + 2k\pi \vee x \simeq -0,93 + 2k\pi \xrightarrow{x \in (0;\pi)} x \simeq 0,93 \vee x \simeq 1$

**31a)**

$f(x) = \frac{x-3}{x+2} \leftarrow \text{Verticale Asymptoot: } x=-2$  Dus  $f(x)$  hoort bij de rode grafiek

$g(x) = \frac{x+1}{x-4} \leftarrow \text{Verticale Asymptoot: } x=4$  Dus  $g(x)$  hoort bij de groene grafiek

**31b)** Zie 21a) voor de verticale asymptoot

Horizontale Asymptoot:  $\frac{x-3}{x+2} = \frac{x-3}{x+2} \cdot \frac{1}{x} = \frac{x-3}{x+\frac{2}{x}} = \frac{1-\frac{3}{x}}{1+\frac{2}{x}}$

$$x \rightarrow \infty \Rightarrow \begin{cases} f(x) = \frac{1-\frac{3}{x}}{1+\frac{2}{x}} = \frac{1-0}{1+0} \rightarrow 1 \\ g(x) = \frac{1-\frac{3}{x}}{1+\frac{2}{x}} = \frac{1+0}{1+0} \rightarrow 1 \end{cases} \rightarrow y = 1 \leftarrow \text{Voor beide Functies } y=1 \text{ Horizontale Asymptoot}$$

En er is dus maar 1 snijpunt

**31c)**  $\frac{x-3}{x+2} = \frac{x+1}{x-4}$

**32)**  $3^x < x^3$

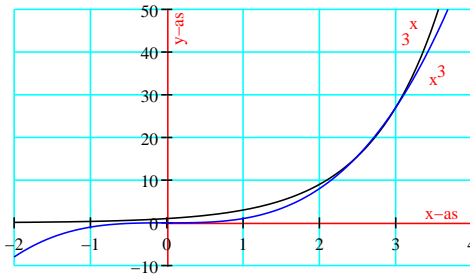
$x$	-2	-1	0	1	2	2,7	3	4
$3^x$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	19,4	27	81
$x^3$	-8	-1	0	1	8	19,7	27	64

$x$	2	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8	2,9	3,0	3,1
$3^x$	9	10,05	11,21	12,51	13,97	15,59	17,40	19,42	21,67	24,19	27	30,14
$x^3$	8	9,26	10,65	12,17	13,82	15,63	17,58	19,68	21,95	24,39	27	29,70

$2,5 \leq x < 3$

plaatje bij Som 32



**33)** Coördinaten  $P(p; \sqrt{4-2p})$  betekent  $P(\text{breedte}; \text{hoogte})$

Stel  $x = p \xrightarrow{\text{Vierkant}} p = \sqrt{4-2p} \Rightarrow p^2 = 4-2p \Rightarrow p^2 + 2p - 4 \Rightarrow \left. \begin{matrix} a = 1 \\ b = 2 \\ c = -4 \end{matrix} \right\} \Rightarrow D = \frac{b^2 - 4ac}{4} = 20$

$\begin{cases} p_1 = -1 + \frac{\sqrt{20}}{2} \simeq 1,24 \xrightarrow{\text{Pheeft de coördinaten:}} P(1,24; 1,24) \\ p_2 = -1 - \frac{\sqrt{20}}{2} \simeq -3,24 \xleftarrow{\text{Vervalt}} \end{cases}$

## KERN 4

### VORMEN HERKENNEN

**34a)**

$p$  met  $x - as : y = 0 \Rightarrow 0 = x^2 \Rightarrow x = 0 \Rightarrow (0; 0)$

$l$  met  $x - as : 0 = x + 4 \Rightarrow x = -4 \Rightarrow (-4; 0)$

**34b)** Snijpunt van produktgrafiek met x-as:  $0 = x^2(x + 4) \Rightarrow x^2 = 0 \vee x + 4 = 0$

Voor vervolg zie a)

**34c)**  $(0; 0)$  en  $(-4; 0)$

**35a)**  $(2x + 6)(3 - 5x) = 0 \Rightarrow 2x + 6 = 0 \vee 3 - 5x = 0 \Rightarrow 2x = -6 \vee 3 = 5x \Rightarrow x = -3 \vee x = \frac{3}{5} = 0, 6$

**35b)**  $x \cdot 2^x = 0 \Rightarrow x = 0 \vee 2^x = 0 \xleftarrow{\text{Geen Oplossing}}$

**35c)**  $x^3(x - 2) = 0 \Rightarrow x^3 = 0 \vee x - 2 = 0 \Rightarrow x = 0 \vee x = 2$

**35d)**  $(2x - 1) \cdot \log x = 0 \Rightarrow 2x - 1 = 0 \vee \log x = 0 \Rightarrow 2x = 1 \vee 10^0 = x \Rightarrow x = \frac{1}{2} \vee x = 1$

**35e)**  $x \cdot \sqrt{3x + 1} = 0 \Rightarrow x = 0 \vee \sqrt{3x + 1} = 0 \Rightarrow x = 0 \vee 3x + 1 = 0 \Rightarrow x = 0 \vee 3x = -1 \Rightarrow x = 0 \vee x = -\frac{1}{3}$

**35f)**  $(x - 1)(x - 2)(x - 3)(x - 4) = 0 \Rightarrow x - 1 = 0 \vee x - 2 = 0 \vee x - 3 = 0 \vee x - 4 = 0 \Rightarrow x = 1 \vee x = 2 \vee x = 3 \vee x = 4$

**36)**  $x^4 - 5x^3 = 0 \quad x^4 = x \cdot x \cdot x \cdot x = x \cdot x^3$

**36a)**  $x^3(x - 5) = 0 \quad x^3 = x \cdot x \cdot x$

**36b)**  $x^3 = 0 \vee x - 5 = 0 \Rightarrow x = 0 \vee x = 5$

**36c)**  $x^8 + 10x^7 - 24x^6 = 0 \Rightarrow x^6(x^2 + 10x - 24) = 0 \Rightarrow x^6 = 0 \vee x^2 + 10x - 24 = 0 \Rightarrow x = 0 \vee (x + 12)(x - 2) = 0 \Rightarrow x = 0 \vee x = -12 \vee x = 2$

**37)**  $f(x) = -x(4 + x)(6 - x)^2$

**37a)**  $-x(4 + x)(6 - x)^2 = 0 \Rightarrow -x = 0 \vee 4 + x = 0 \vee (6 - x)^2 = 0 \Rightarrow x = 0 \vee x = -4 \vee x = 6$   
 $(0; 0)(-4; 0)(6; 0)$

$f(x) < 0 \Rightarrow x < -4$  en  $0 < x < 6 \xrightarrow{\text{Anders Opgeschreven:}} f(x) < 0 \Rightarrow x \in \langle \leftarrow; -4 \rangle \langle 0; 6 \rangle$

**38a)**  $4x^5 \cdot 2 = 4x^5 \cdot x$

**38b&c)**  $8x^5 = 4x^6 \Rightarrow 8x^5 - 4x^6 = 0 \Rightarrow 4x^5(2 - x) = 0 \Rightarrow 4x^5 = 0 \vee 2 - x = 0 \Rightarrow x = 0 \vee x = 2$

**39a)**  $x(x + 3) = x(2x - 5) \Rightarrow x = 0 \vee x + 3 = 2x - 5 \Rightarrow x = 0 \vee 3 = x - 5 \Rightarrow x = 0 \vee x = 8$

**39b)**  $(5 - 2x)(3 + x) = (5 - 2x)(6 + 2x) \Rightarrow 5 - 2x = 0 \vee 3 + x = 6 + 2x \Rightarrow 2x = 5 \vee 3 = 6 + x \Rightarrow x = 2\frac{1}{2} \vee x = -3$

**39c)**  $x\sqrt{x} = 5\sqrt{x} \Rightarrow \sqrt{x} = 0 \vee x = 5 \Rightarrow x = 0 \vee x = 5$

**39d)**  $5x \cdot 6x^3 = (x + 8) \cdot 6x^3 \Rightarrow 6x^3 = 0 \vee 5x = x + 8 \Rightarrow x = 0 \vee 4x = 8 \Rightarrow x = 0 \vee x = 2$

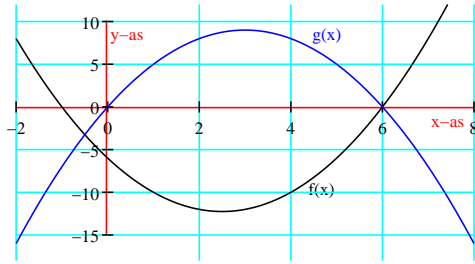
**39e)**  $x \cdot 2^x = 6 \cdot 2^x \Rightarrow x = 6 \vee 2^x = 0 \xleftarrow{\text{Geen oplossing}}$

**39f)**  $\log x \cdot (x - 5) = \log x \Rightarrow \log x = 0 \vee x - 5 = 1 \Rightarrow 10^0 = x \vee x = 6 \Rightarrow x = 1 \vee x = 6$

**40a)**  $f(x) = (x + 1) \cdot (x - 6) \quad g(x) = -x(x - 6)$

$x$		-1		0		$2\frac{1}{2}$		3		4		5		6		7
$f(x)$		0		-6		$-12\frac{1}{4}$		-12		-10		-6		0		$8 \xrightarrow{\text{Sym.as bij } x=2\frac{1}{2}}$
$g(x)$		-7		0				9		8		5		0		$-7 \xrightarrow{\text{Sym.as bij } x=3}$

plaatje bij Som 40)



40b)  $(x+1)(x-6) = -x(x-6) \Rightarrow x-6=0 \vee x+1=-x \Rightarrow x=6 \vee 2x+1=0 \Rightarrow x=6 \vee 2x=-1 \Rightarrow x=6 \vee x=-\frac{1}{2}$

40c)  $g(x) \geq f(x) \Rightarrow -\frac{1}{2} \leq x \leq 6$

41a)  $K = 65 \cdot 10x^2 = 650x^2$

Oppervlak Grondvlak	$x \cdot x$	$x^2$
Oppervlak Bovenvlak	$x \cdot x$	$x^2$
Oppervlak Zijvlak	$2x \cdot x$	$2x^2$
Oppervlak Zijvlak	$2x \cdot x$	$2x^2$
Oppervlak Zijvlak	$2x \cdot x$	$2x^2$
Oppervlak Zijvlak	$2x \cdot x$	$2x^2$
Oppervlakte Totaal		$10x^2$

41b) Inhoud:  $2x \cdot x \cdot x = 2x^3 \Rightarrow P = 39 \cdot 2x^3 = 78x^3$

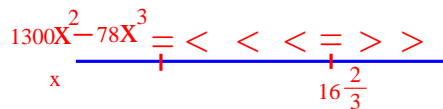
$O = P - K \Rightarrow O = 78x^3 - 650x^2$

41c)  $K \leq O \Rightarrow K \leq P - K \Rightarrow 2K \leq P \Rightarrow 2K - P \leq 0 \Rightarrow$

$\Rightarrow 2 \cdot 650x^2 - 78x^3 = 0 \Rightarrow 1300x^2 - 78x^3 = 0 \Rightarrow x^2(1300 - 78x) = 0 \Rightarrow x = 0 \vee 1300 - 78x = 0 \Rightarrow$

$\Rightarrow x = 0 \vee x = \frac{1300}{78} \Rightarrow x = 0 \vee x = 16\frac{2}{3}$

Dus  $x = 0 \vee x \geq 16\frac{2}{3}$



42a)  $4x - 8 = 0 \Rightarrow 4x = 8 \Rightarrow x = 2$

42b)  $2x - 4 = x^3 \Rightarrow x^3 - 2x + 4 = 0$

Nummeriek:  $x = -2$

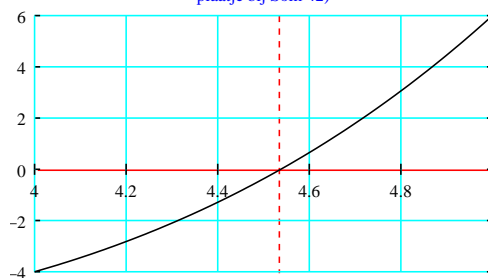
$x$	-5	-4	-3	-2	-1	0	1	2	3
$x^3 + 2x - 4$	-111	-52	-17	0	5	4	3	8	25

42c)  $6x - 4 = 2^x \Rightarrow 2^x - 6x + 4 = 0$

Nummeriek:  $x = 1 \vee x \approx 4,5$

$x$	-2	-1	0	1	2	3	4	4,5	4,55	4,6	5
$2^x - 6x + 4$	$16\frac{1}{4}$	$10\frac{1}{2}$	5	0	-4	-6	-4	-0,37	0,125	0,65	6

plaatje bij Som 42)



42d)

$$x-6=x^2 \Rightarrow x^2-x+6=0 \quad \left. \begin{array}{l} a=1 \\ b=-1 \\ c=1 \end{array} \right\} \Rightarrow D=(-1)^2-4 \cdot 1 \cdot 1 \Rightarrow D=-3 \Rightarrow D < 0 \leftarrow \text{Geen Oplossingen}$$

42e)  $3(x-1) = x(x-1) \Rightarrow x-1=0 \vee 3=x \Rightarrow x=1 \vee x=3$

42f)  $x(x-1) - x(x+1) \Rightarrow x=0 \vee x-1=x+1 \Rightarrow \cdot=0 \vee -1=1 \leftarrow \text{Kan Niet: Geen Oplossing}$

42g)  $3x(x-1) = 3(3x+1) \Rightarrow 3x^2-3x=9x+3 \Rightarrow 3x^2-12x-3=0$

$$\Rightarrow x^2-4-1=0 \Rightarrow \left. \begin{array}{l} a=1 \\ b=-4 \\ c=-1 \end{array} \right\} \Rightarrow D=(-4)^2-4 \cdot 1 \cdot -1 \Rightarrow D=20$$

$$\left\{ \begin{array}{l} -\frac{b}{2a} = -\frac{-4}{2} = 2 \\ \frac{\sqrt{D}}{2a} = \frac{\sqrt{20}}{2} = \frac{\sqrt{4 \cdot 5}}{2} = \frac{\sqrt{4} \cdot \sqrt{5}}{2} = \sqrt{5} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} x_1 = 2 + \sqrt{5} \simeq 4,2 \\ x_2 = 2 - \sqrt{5} \simeq -0,2 \end{array} \right.$$

42h)  $x^3 = 3x \Rightarrow x^3 - 3x = 0 \Rightarrow x(x^2 - 3) = 0 \Rightarrow x=0 \vee x^2 - 3 = 0 \Rightarrow x=0 \vee x^2 = 3 \Rightarrow x=0 \vee x = \sqrt{3} \vee x = -\sqrt{3}$

43a)  $\sqrt{x} + 4 = 20 \Rightarrow \sqrt{x} = 16 \Rightarrow x = 16^2 \Rightarrow x = 256$

43b)  $4 \cdot \sqrt{x+3} - 8 = 1 \Rightarrow 4\sqrt{x+3} = 9 \Rightarrow \sqrt{x+3} = \frac{9}{4} \Rightarrow x+3 = \left(\frac{9}{4}\right)^2 = \frac{81}{16} = 5\frac{1}{16} \Rightarrow x = 2\frac{1}{16} = 2,0625$

43c)  $x^3 - 4 = 61 \Rightarrow x^3 = 65 \Rightarrow x = 65^{\frac{1}{3}} \simeq 4,0$

43d)  $\log(x-7) = 8 \Rightarrow 10^3 = x-7 \Rightarrow 1000 = x-7 \Rightarrow x = 1007$

43e)  $3x+2 = 5 - (x+8) \Rightarrow 3x+2 = 5-x-8 \Rightarrow 3x+2 = -x-3 \Rightarrow 4x+5 = 0 \Rightarrow 4x = -5 \Rightarrow x = -\frac{5}{4} = -1,25$

44)  $Inhoud = \pi r^2 \cdot h \leftarrow \frac{\pi r^2 \equiv \text{oppervlakte grondvlak}}$

$3186 = \pi r^2 \cdot 6 \Rightarrow r^2 = \frac{3186}{6\pi} \Rightarrow r = \sqrt{\frac{3186}{6\pi}} \Rightarrow r \simeq \sqrt{169} \simeq 13 \text{ centimeter} \xrightarrow{\text{ofwel}} d_{\text{diameter}} \simeq 26 \text{ cm}$

45a)  $5^{(3x-1)} = 125 \Rightarrow 5^{(3x-1)} = 5^3 \Rightarrow 3x-1 = 3 \Rightarrow 3x = 4 \Rightarrow x = \frac{4}{3} = 1\frac{1}{3}$

45b)  $x^3 - 2x^2 + 7x = 1 + x^3 \Rightarrow -2x^2 + 7x = 1 \Rightarrow 2x^2 - 7x + 1 = 0 \Rightarrow$

$$\rightarrow \left\{ \begin{array}{l} a=2 \\ b=-7 \\ c=1 \end{array} \right\} \Rightarrow D=(-7)^2-4 \cdot 2 \cdot 1 \Rightarrow D=49-8=41 \rightarrow \left\{ \begin{array}{l} x_1 = \frac{7}{4} - \frac{1}{4}\sqrt{41} \simeq 0,1 \\ x_2 = \frac{7}{4} + \frac{1}{4}\sqrt{41} \simeq 3,4 \end{array} \right.$$

45c)  $x^2 \cdot \sqrt{x+1} = 3 \cdot \sqrt{x+1} \Rightarrow \sqrt{x+1} = 0 \vee x^2 = 3 \Rightarrow x+1 = 0 \vee x = \sqrt{3} \vee x = -\sqrt{3}$

45d)  $\frac{1}{x^2-2x+1} = \frac{1}{16} \Rightarrow x^2-2x+1 = 16 \Rightarrow x^2-2x-15 = 0 \xrightarrow{\text{Zie Tabel!}} (x-5)(x+3) = 0 \Rightarrow x = 5 \vee x = -3$

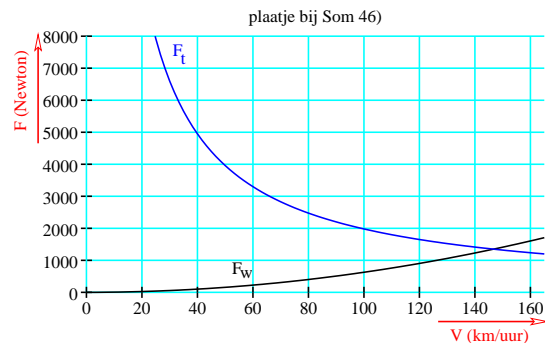
Produkt	Som	$x^2 - 2 \cdot x - 15 = 0$
$1 \cdot (-15) = -15$	$1 + (-15) = -14$	fout
$3 \cdot (-5) = -15$	$3 + (-5) = -2$	Goed

46)  $F_W = 0,0627 \cdot V^2$  waarin  $F_W$  in Newton,  $V$  is snelheid in km/uur

$F_T = \frac{198000}{V}$  waarin  $F_T$  in Newton,  $V$  is snelheid in km/uur

46a)

V	0	10	20	30	40	60	100	160
$F_W$	0	6,27	25,08	56,43	100,32	225,7	627	1605,1
$F_T$	?	19800	9900	6600	4950	3300	1980	1237,5



**46b)**  $F_w = F_T \Rightarrow 0,0627 \cdot V^2 = \frac{19800}{V} \Rightarrow 0,0627V^2 = 198000 \Rightarrow 0,0627V^3 = 19800 \Rightarrow$   
 $\Rightarrow V^3 = \frac{198000}{0,0627} \Rightarrow V = \sqrt[3]{\frac{198000}{0,0627}} \Rightarrow V \simeq 146,7$

Trekkraft groter dan de luchtweerstand als geldt;  $0 < V < 146,7$

**46c)** De auto staat stil en is niet meer in staat de luchtweerstand op te heffen.

## DOORWERKING

**D1)**

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

**D1a)**  $m = 2m_0 \Rightarrow 2m_0 = \frac{m_0}{\sqrt{1 - \frac{v^2}{(300.000)^2}}} \Rightarrow m_0 = 2 \cdot m_0 \cdot \sqrt{1 - \frac{v^2}{9 \cdot 10^{10}}} \Rightarrow 1 = 2 \cdot \sqrt{1 - \frac{v^2}{9 \cdot 10^{10}}} \Rightarrow$

$$\Rightarrow \frac{1}{2} = \sqrt{1 - \frac{v^2}{9 \cdot 10^{10}}} \Rightarrow \frac{1}{4} = 1 - \frac{v^2}{9 \cdot 10^{10}} \Rightarrow \frac{3}{4} = \frac{v^2}{9 \cdot 10^{10}} \Rightarrow v^2 = \frac{3}{4} \cdot 9 \cdot 10^{10} \Rightarrow$$

$$\Rightarrow v = \sqrt{\frac{3}{4} \cdot 9 \cdot 10^{10}} \Rightarrow v \simeq 2,6 \cdot 10^5 \text{ km/sec}$$

**D1b)** 99,99% van 300.000 is 299970

$$\frac{v^2}{c^2} = \frac{299970^2}{300000^2} \simeq 0,9998 \Rightarrow m = \frac{1}{\sqrt{1-0,9998}} \simeq 70,71 \text{ kg}$$

**D1c)**  $m_0(A) = 1 \text{ kg}$

$$10^6 = \frac{1}{\sqrt{1 - \frac{v^2}{9 \cdot 10^{10}}}} \Rightarrow 1 = 10^6 \cdot \sqrt{1 - \frac{v^2}{9 \cdot 10^{10}}} \Rightarrow \sqrt{1 - \frac{v^2}{9 \cdot 10^{10}}} = \frac{1}{10^6} \Rightarrow 1 - \frac{v^2}{9 \cdot 10^{10}} = \frac{1}{10^{12}} \Rightarrow$$

$$\Rightarrow \frac{v^2}{9 \cdot 10^{10}} = 1 - \frac{1}{10^{12}} \Rightarrow v^2 = \left(1 - \frac{1}{10^{12}}\right) \cdot 9 \cdot 10^{10} \Rightarrow v \simeq 300000 \leftarrow \text{Dus bijna de Lichtsnelheid}$$

$$\leftarrow \text{een mil jard kilogram} \Rightarrow v^2 = \left(1 - \frac{1}{10^{18}}\right) \cdot 9 \cdot 10^{10} \Rightarrow v \simeq 300000 \leftarrow \text{Ook bijna Lichtsnelheid}$$

**D1d)**  $1 - \frac{v^2}{c^2} \geq 0 \Rightarrow \frac{v^2}{c^2} \leq 1 \xrightarrow{\text{Dus}} v^2 \leq c^2$

**D2)**  $A = \frac{200}{p} + 40$

**D2a)**  $200 = \frac{200}{p} + 40 \Rightarrow 160 = \frac{200}{p} \Rightarrow 160 \cdot p = 200 \Rightarrow p = \frac{200}{160} = 1,25$

**D2b)**  $\text{Opbrengst} = A \cdot p = \left(\frac{200}{p} + 40\right) \cdot p = \frac{200}{p} \cdot p + 40p \Rightarrow \text{Opbrengst} = 200 + 40p$

**D2c)**  $\text{Winst} = \text{Opbrengst} - \text{Kosten} \Rightarrow \text{Winst} = 40p + 200 - 0,50 \cdot A = 40p + 200 - 0,5 \left(\frac{200}{p} + 40\right) \Rightarrow$

$$\text{Winst} = 40p + 200 - \frac{100}{p} + 20 = 40p + 180 - \frac{100}{p}$$

**D2d)**  $360 = 40p + 180 - \frac{100}{p} \Rightarrow 180 = 40p - \frac{100}{p} \Rightarrow 180p = p \cdot \left(40p - \frac{100}{p}\right) \Rightarrow$

$$180p = 40p^2 - 100 \Rightarrow 4p^2 - 18p - 10 = 0 \Rightarrow 2p^2 - 9p - 5 = 0 \rightarrow \begin{cases} a = 2 \\ b = -9 \\ c = -5 \end{cases} \Rightarrow$$

$$\Rightarrow D = 81 + 40 = 121 \rightarrow \begin{cases} x_1 = \frac{9}{4} + \frac{11}{4} = \frac{20}{4} = 5 \\ x_2 = \frac{9}{4} - \frac{11}{4} < 0 \leftarrow \text{Vervalt} \end{cases} \rightarrow \text{Dus } p = 5$$

**D3)**  $K = -0,1q^2 + 1,2q$  waarbij  $K = \text{kosten in Hfl en } q \cdot 1000$

$$K = 0,1q^3 - 1,1q^2 + 3,7q$$

**D3a)**  $-0,1q^2 + 1,2q = 0,1q^3 - 1,1q^2 + 3,7q \Rightarrow 0,1q^3 - q^2 + 2,5q = 0 \Rightarrow q(0,1q^2 - q + 2,5) = 0 \Rightarrow$

$$q = 0 \vee 0,1q^2 - q + 2,5 = 0 \Rightarrow q = 0 \vee q^2 - 10q + 25 = 0 \Rightarrow q = 0 \vee (q-5)(q-5) = 0 \Rightarrow$$

$$\Rightarrow q = 0 \vee q = 5 \xrightarrow{\text{De Grenswaarde is}} 5$$

**D3b)**  $K^{-0,1 < 0} \Rightarrow \text{Bergparabool } -0,1q^2 + 1,2q \text{ voor } 0 \leq q < 5$

**D3c)**  $4000 | \text{Zakmessen} \Rightarrow q = 4 \Rightarrow$

$$\Rightarrow K = -0,1 \cdot 4^2 + 1,2 \cdot 4 = -1,6 + 4,8 = 3,2 \xrightarrow{\text{Dus maal duizend}} \text{Hfl } 3200, -$$

$$\xrightarrow{\text{Gemiddelde Kosten}} \frac{3200}{4000} = \frac{4}{5} = \text{Hfl } 0,80 \text{ per Zakmes}$$

**D3d)** Gemiddeld kost een produk  $a$  gulden, als er  $q$  worden gemaakt zijn de totale kosten dus  $a \cdot q$  (in duizenden gulden)

**D3e)**  $K = 0,8 \cdot q \Rightarrow 0,8q = 0,1q^3 - 1,1q^2 + 3,79 \Rightarrow 0,1q^3 - 1,1q^2 + 2,9q = 0 \Rightarrow$

$$q(0,1q^2 - 1,1q + 2,9) = 0 \Rightarrow$$

$$q = 0 \vee 0,1q^2 - 1,1q + 2,9 = 0 \Rightarrow q = 0 \vee q^2 - 11q + 29 = 0 \xrightarrow{\text{ABC-Formule}} q = 0 \vee q = 6,6$$

**D4)**  $H(t) = \frac{190}{1+30 \cdot 0,5^t}$  waarin  $H$  de hoogte in cm, en  $t$  de tijd in weken.

**D4a)**  $100 = \frac{190}{1+30 \cdot 0,5^t} \Rightarrow 1 + 30 \cdot 0,5^t = 1,9 \Rightarrow 30 \cdot 0,5^t = 0,9 \Rightarrow 0,5^t = \frac{0,9}{30} \Rightarrow 0,5^t = 0,03 \Rightarrow$   
 $\Rightarrow t = {}^{0,5}\log 0,03 \Rightarrow t = \frac{\log 0,03}{\log 0,5} \simeq 5,1$  weken

**D4b)**  $H(t) = 160 \cdot \sin 0,05\pi t \rightarrow$  maximaal als  $\sin 0,05\pi t$  maximaal is  $\Rightarrow$   
 $\Rightarrow \sin 0,05\pi t = 1 \Rightarrow \sin \frac{1}{2}\pi \Rightarrow 0,05\pi t = \frac{1}{2}\pi \Rightarrow t = 10$

**D4c)**  $\frac{190}{1+30 \cdot 0,5^t} = 160 \cdot \sin 0,05\pi t$

Numeriek:  $t \simeq 6$

$t$	0	2	4	5	6
$160 \cdot \sin 0,05\pi t$	0	49,4	94,0	113,1	129,4
$\frac{190}{1+30 \cdot 0,5^t}$	6,1	22,3	66,1	98,1	129,4
$\Delta$		27,1	27,9	15	0