

1 I, II, IV en V zijn tweedegraadsvergelijkingen. (de hoogste macht van  $x$  is steeds  $x^2$ ; te zien na wegwerken haakjes?)  
(III is een eerstegraadsvergelijking en VI is een derdegraadsvergelijking)

\*\*\* **Neem GR - practicum 1 door.** (uitwerkingen aan het eind)

**Voorkennis: Ontbinden in factoren blz. 164** (op bladzijde 9 in het boek wordt hiernaar verwezen)

V1a  $x^2 + 5x = x \cdot (x + 5)$ .

V1d  $5x^2 + 20x = 5x \cdot (x + 4)$ .

V1b  $x^2 + x = x \cdot (x + 1)$ .

V1e  $x^3 - 5x^2 = x^2 \cdot (x - 5)$ .

V1c  $3x^2 - 7x = x \cdot (3x - 7)$ .

V1f  $-3x^2 - 8x = -x \cdot (3x + 8)$ .

V2a  $(x+3) \cdot (x+5) = x^2 + 5x + 3x + 15 = x^2 + 8x + 15$ .

V2b  $15 = 3 \times 5$  en  $8 = 3 + 5$ .

V3a  $x^2 + 5x + 4 = (x + 1) \cdot (x + 4)$ .

V3g  $x^2 - 24x - 52 = (x - 26) \cdot (x + 2)$ .

V3b  $x^2 + 4x - 5 = (x + 5) \cdot (x - 1)$ .

V3h  $x^2 + 1x - 56 = (x + 8) \cdot (x - 7)$ .

V3c  $x^2 - 1x - 30 = (x - 6) \cdot (x + 5)$ .

V3i  $x^2 - 1x - 2 = (x - 2) \cdot (x + 1)$ .

V3d  $x^2 + 7x + 10 = (x + 5) \cdot (x + 2)$ .

V3j  $x^2 - 4x + 3 = (x - 3) \cdot (x - 1)$ .

V3e  $x^2 + 10x + 9 = (x + 9) \cdot (x + 1)$ .

V3k  $x^2 - 4x - 12 = (x - 6) \cdot (x + 2)$ .

V3f  $x^2 + 18x - 19 = (x + 19) \cdot (x - 1)$ .

V3l  $x^2 + 5x - 50 = (x + 10) \cdot (x - 5)$ .

V4a  $6x^2 - 6x = 6x \cdot (x - 1)$ .

V4d  $x^2 + 1x - 56 = (x + 8) \cdot (x - 7)$ .

V4b  $x^2 + 10 - 7x = x^2 - 7x + 10 = (x - 5) \cdot (x - 2)$ .

V4e  $12x^2 + 6x = 6x \cdot (2x + 1)$ .

V4c  $x^2 + x = x \cdot (x + 1)$ . (zie V1b)

V4f  $-3x^2 + x = x \cdot (-3x + 1)$ .

V5a  $x^2 - 12x = x \cdot (x - 12)$ .

V5d  $4x^2 + 8x = 4x \cdot (x + 2)$ .

V5b  $x^2 - 12x + 36 = (x - 6) \cdot (x - 6) = (x - 6)^2$ .

V5e  $x^2 + 8x = x \cdot (x + 8)$ .

V5c  $x^2 - 12x - 28 = (x - 14) \cdot (x + 2)$ .

V5f  $x^2 + 8x - 20 = (x + 10) \cdot (x - 2)$ .

2a  $x^2 + 6 = 5x$   
 $x^2 - 5x + 6 = 0$   
 $(x - 3) \cdot (x - 2) = 0$   
 $x - 3 = 0 \vee x - 2 = 0$   
 $x = 3 \vee x = 2$ .

2b  $x \cdot (x - 1) = 12$   
 $x^2 - x = 12$   
 $x^2 - x - 12 = 0$   
 $(x - 4) \cdot (x + 3) = 0$   
 $x - 4 = 0 \vee x + 3 = 0$   
 $x = 4 \vee x = -3$ .

2c  $2x^2 = 5x$   
 $2x^2 - 5x = 0$   
 $x \cdot (2x - 5) = 0$   
 $x = 0 \vee 2x - 5 = 0$   
 $x = 0 \vee 2x = 5$   
 $x = 0 \vee x = \frac{5}{2} = 2\frac{1}{2}$ .

2d  $x = x^2$   
 $x - x^2 = 0$   
 $x \cdot (1 - x) = 0$   
 $x = 0 \vee 1 - x = 0$   
 $x = 0 \vee x = 1$ .

2e  $x^2 = 11$   
 $x = \pm\sqrt{11}$   
 $x = \sqrt{11} \vee x = -\sqrt{11}$ .

2f  $x^2 + 4 = 1$   
 $x^2 = -3$  (kan niet)  
(een kwadraat kan nooit negatief zijn)  
geen oplossingen.

3a  $3x^2 - 6x = 24$   
 $3x^2 - 6x - 24 = 0$   
 $x^2 - 2x - 8 = 0$   
 $(x - 4) \cdot (x + 2) = 0$   
 $x - 4 = 0 \vee x + 2 = 0$   
 $x = 4 \vee x = -2$ .

3b  $3x^2 - 6x = -3 \cdot (x - 6)$   
 $3x^2 - 6x = -3x + 18$   
 $3x^2 - 3x - 18 = 0$   
 $x^2 - 1x - 6 = 0$   
 $(x - 3) \cdot (x + 2) = 0$   
 $x - 3 = 0 \vee x + 2 = 0$   
 $x = 3 \vee x = -2$ .

3c  $2x^2 - 3x = 2$   
 $2x^2 - 3x - 2 = 0$   
 $a = 2, b = -3$  en  $c = -2$   
 $D = b^2 - 4ac = (-3)^2 - 4 \cdot 2 \cdot -2 = 9 + 16 = 25$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-3) \pm \sqrt{25}}{2 \cdot 2} = \frac{3 \pm 5}{4}$   
 $x = \frac{3+5}{4} = \frac{8}{4} = 2 \vee x = \frac{3-5}{4} = \frac{-2}{4} = -\frac{1}{2}$ .

3d  $0,5x^2 - 2x - 6 = 0$   
 $x^2 - 4x - 12 = 0$   
 $(x - 6) \cdot (x + 2) = 0$   
 $x - 6 = 0 \vee x + 2 = 0$   
 $x = 6 \vee x = -2$ .

3e  $x^2 - 3x = 5 \cdot (x - 3)$   
 $x^2 - 3x = 5x - 15$   
 $x^2 - 8x + 15 = 0$   
 $(x - 5) \cdot (x - 3) = 0$   
 $x - 5 = 0 \vee x - 3 = 0$   
 $x = 5 \vee x = 3$ .

3f  $2x^2 - 5x = 3x$   
 $2x^2 - 8x = 0$   
 $2x \cdot (x - 4) = 0$   
 $2x = 0 \vee x - 4 = 0$   
 $x = 0 \vee x = 4$ .

4a  $\square$   $6 - x^2 = -2$   
 $-x^2 = -8$   
 $x^2 = 8$   
 $x = \pm\sqrt{8}$   
 $x = \sqrt{8} \vee x = -\sqrt{8}$ .

4b  $\square$   $2x^2 = 9x + 5$   
 $2x^2 - 9x - 5 = 0$   
 $a = 2, b = -9$  en  $c = -5$   
 $D = b^2 - 4ac = (-9)^2 - 4 \cdot 2 \cdot -5 = 81 + 40 = 121$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-9) \pm \sqrt{121}}{2 \cdot 2} = \frac{9 \pm 11}{4}$   $\sqrt{(121)} = 11$   
 $x = \frac{9+11}{4} = \frac{20}{4} = 5 \vee x = \frac{9-11}{4} = \frac{-2}{4} = -\frac{1}{2}$ .

4c  $\square$   $3 \cdot (x+2)^2 + 5 = 80$   
 $3 \cdot (x+2)^2 = 75$   
 $(x+2)^2 = 25$   
 $(x+2) = \pm\sqrt{25} = \pm 5$   
 $x+2 = 5 \vee x+2 = -5$   
 $x = 3 \vee x = -7$ .

4d  $\square$   $\frac{1}{2} \cdot (x-3)^2 - 3 = 5$   
 $\frac{1}{2} \cdot (x-3)^2 = 8$   
 $(x-3)^2 = 16$   
 $(x-3) = \pm\sqrt{16} = \pm 4$   
 $x-3 = 4 \vee x-3 = -4$   
 $x = 7 \vee x = -1$ .

4e  $\square$   $-(2x-1)^2 + 5 = 1$   
 $-(2x-1)^2 = -4$   
 $(2x-1)^2 = 4$   
 $(2x-1) = \pm\sqrt{4} = \pm 2$   
 $2x-1 = 2 \vee 2x-1 = -2$   
 $2x = 3 \vee 2x = -1$   
 $x = 1\frac{1}{2} \vee x = -\frac{1}{2}$ .

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

5a  $\square$   $x^2 - 5x = 0$   
 $x \cdot (x-5) = 0$   
 $x = 0 \vee x - 5 = 0$   
 $x = 0 \vee x = 5$ .

5b  $\square$   $x^2 - 5x = 14$   
 $x^2 - 5x - 14 = 0$   
 $(x-7) \cdot (x+2) = 0$   
 $x-7 = 0 \vee x+2 = 0$   
 $x = 7 \vee x = -2$ .

5c  $\square$   $x^2 - 5 = 14$   
 $x^2 = 19$   
 $x = \pm\sqrt{19}$   
 $x = \sqrt{19} \vee x = -\sqrt{19}$ .

5d  $\square$   $x^2 - 5 = 14x$   
 $x^2 - 14x - 5 = 0$   
 $a = 1, b = -14$  en  $c = -5$   
 $D = b^2 - 4ac = (-14)^2 - 4 \cdot 1 \cdot -5 = 196 + 20 = 216$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-14) \pm \sqrt{216}}{2 \cdot 1} = \frac{14 \pm \sqrt{216}}{2}$   $\sqrt{(216)} = 14.69693846$   
 $x = \frac{14 + \sqrt{216}}{2} \vee x = \frac{14 - \sqrt{216}}{2}$ .

5e  $\square$   $(2x-1) \cdot (3x+6) = 0$   
 $2x-1 = 0 \vee 3x+6 = 0$   
 $2x = 1 \vee 3x = -6$   
 $x = \frac{1}{2} \vee x = -2$ .

5f  $\square$   $(2x-1) \cdot (3x+6) = 9x$   
 $6x^2 + 12x - 3x - 6 = 9x$   
 $6x^2 + 9x - 6 = 9x$   
 $6x^2 - 6 = 0$   
 $6x^2 = 6$   
 $x^2 = 1$   
 $x = \pm\sqrt{1} = \pm 1$   
 $x = 1 \vee x = -1$ .

5g  $\square$   $(2x-1) \cdot 3x = 6$   
 $6x^2 - 3x - 6 = 0$   
 $2x^2 - 1x - 2 = 0$   
 $a = 2, b = -1$  en  $c = -2$   
 $D = (-1)^2 - 4 \cdot 2 \cdot -2 = 1 + 16 = 17$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-1) \pm \sqrt{17}}{2 \cdot 2} = \frac{1 \pm \sqrt{17}}{4}$   
 $x = \frac{1 + \sqrt{17}}{4} \vee x = \frac{1 - \sqrt{17}}{4}$ .

5h  $\square$   $(2x-1) \cdot 3x = 6 - 9x$   
 $6x^2 - 3x - 6 + 9x = 0$   
 $6x^2 + 6x - 6 = 0$   
 $x^2 + 1x - 1 = 0$   
 $a = 1, b = 1$  en  $c = -1$   
 $D = 1^2 - 4 \cdot 1 \cdot -1 = 1 + 4 = 5$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{5}}{2 \cdot 1} = \frac{-1 \pm \sqrt{5}}{2}$   
 $x = \frac{-1 + \sqrt{5}}{2} \vee x = \frac{-1 - \sqrt{5}}{2}$ .

6a  $\square$   $(x+3)^2 = 16x$   
 $(x+3) \cdot (x+3) = 16x$   
 $x^2 + 3x + 3x + 9 = 16x$   
 $x^2 - 10x + 9 = 0$   
 $(x-9) \cdot (x-1) = 0$   
 $x = 9 \vee x = 1$ .

6b  $\square$   $(2x+3)^2 = -16$  kan niet  
 (een kwadraat kan niet negatief zijn)  
 geen oplossingen.

6c  $\square$   $2(x+3)^2 = -4x$   
 $(x+3) \cdot (x+3) = -2x$   
 $x^2 + 3x + 3x + 9 = -2x$   
 $x^2 + 8x + 9 = 0$   
 $a = 1, b = 8$  en  $c = 9$   
 $D = 8^2 - 4 \cdot 1 \cdot 9 = 64 - 36 = 28$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-8 \pm \sqrt{28}}{2 \cdot 1} = \frac{-8 \pm \sqrt{28}}{2}$   
 $x = \frac{-8 + \sqrt{28}}{2} \vee x = \frac{-8 - \sqrt{28}}{2}$ .

6d  $\square$   $(2x+3) \cdot (4-x) = 9$   
 $8x - 2x^2 + 12 - 3x = 9$   
 $-2x^2 + 5x + 3 = 0$   
 $a = -2, b = 5$  en  $c = 3$   
 $D = 5^2 - 4 \cdot -2 \cdot 3 = 25 + 24 = 49$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-5 \pm \sqrt{49}}{2 \cdot -2} = \frac{-5 \pm 7}{-4} = \frac{5 \mp 7}{4}$   
 $x = \frac{5+7}{4} = \frac{12}{4} = 3 \vee x = \frac{5-7}{4} = \frac{-2}{4} = -\frac{1}{2}$ .

6e  $\square$   $(-4x+3)^2 = 36$   
 $-4x+3 = \pm\sqrt{36} = \pm 6$   
 $-4x+3 = 6 \vee -4x+3 = -6$   
 $-4x = 3 \vee -4x = -9$   
 $x = \frac{3}{-4} = -\frac{3}{4} \vee x = \frac{-9}{-4} = 2\frac{1}{4}$ .

- 6f  $-4(x+3)^2 = 4x$   
 $(x+3)^2 = -x$   
 $x^2 + 6x + 9 = -x$   
 $x^2 + 7x + 9 = 0$   
 $a=1, b=7$  en  $c=9$   
 $D = 7^2 - 4 \cdot 1 \cdot 9 = 49 - 36 = 13$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-7 \pm \sqrt{13}}{2 \cdot 1} = \frac{-7 \pm \sqrt{13}}{2}$   
 $x = \frac{-7 + \sqrt{13}}{2} \vee x = \frac{-7 - \sqrt{13}}{2}$ .
- 6g  $x^2 - (x+1)^2 = (x+3)^2$   
 $x^2 - (x^2 + 2x + 1) = x^2 + 6x + 9$   
 $-2x - 1 = x^2 + 6x + 9$   
 $-x^2 - 8x - 10 = 0$   
 $x^2 + 8x + 10 = 0$   
 $a=1, b=8$  en  $c=10$   
 $D = 8^2 - 4 \cdot 1 \cdot 10 = 64 - 40 = 24$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-8 \pm \sqrt{24}}{2 \cdot 1} = \frac{-8 \pm \sqrt{24}}{2}$   
 $x = \frac{-8 + \sqrt{24}}{2} \vee x = \frac{-8 - \sqrt{24}}{2}$ .
- 6h  $(x+3)^2 + (x+2)^2 = 25$   
 $x^2 + 6x + 9 + x^2 + 4x + 4 = 25$   
 $2x^2 + 10x - 12 = 0$   
 $x^2 + 5x - 6 = 0$   
 $(x+6) \cdot (x-1) = 0$   
 $x = -6 \vee x = 1$ .
- 7a  $x^2 - 1x - 6 = 0$   
 $(x-3) \cdot (x+2) = 0$   
 $x = 3 \vee x = -2$ .
- 7b  $x^2 + 2x - 6 = 0$   
 $a=1, b=2$  en  $c=-6$   
 $D = 2^2 - 4 \cdot 1 \cdot -6 = 4 + 24 > 0$   
 dus 2 oplossingen.
- 7c  $x^2 + px - 6 = 0$   
 $a=1, b=p$  en  $c=-6$   
 $D = p^2 - 4 \cdot 1 \cdot -6 = p^2 + 24 \geq 24 > 0$   
 dus 2 oplossingen.
- 8a  $a=1, b=-7$  en  $c=p$   
 $D = (-7)^2 - 4 \cdot 1 \cdot p = 49 - 4p$   
 2 oplossingen  $\Rightarrow D = 49 - 4p > 0$   
 $-4p > -49$   
 $p < \frac{-49}{-4} = 12\frac{1}{4}$ .
- 8b  $a=2, b=-5$  en  $c=-p$   
 $D = (-5)^2 - 4 \cdot 2 \cdot -p = 25 + 8p$   
 2 oplossingen  $\Rightarrow D = 25 + 8p > 0$   
 $8p > -25$   
 $p > \frac{-25}{8} = -3\frac{1}{8}$ .
- 8c  $a=-3, b=4$  en  $c=-p$   
 $D = 4^2 - 4 \cdot -3 \cdot -p = 16 - 12p$   
 twee oplossingen  $\Rightarrow D = 16 - 12p > 0$   
 $-12p > -16$   
 $p < \frac{-16}{-12} = 1\frac{1}{3}$ .
- 8d  $a=\frac{1}{4}, b=-3$  en  $c=p$   
 $D = (-3)^2 - 4 \cdot \frac{1}{4} \cdot p = 9 - p$   
 twee oplossingen  $\Rightarrow D = 9 - p > 0$   
 $-p > -9$   
 $p < \frac{-9}{-1} = 9$ .
- 9a  $a=1, b=p$  en  $c=25$   
 $D = p^2 - 4 \cdot 1 \cdot 25 = p^2 - 100$   
 twee opl.  $\Rightarrow D = p^2 - 100 > 0$  ☺  
 $p^2 > 100$   
 $p < -10 \vee p > 10$ .
- 9b  $a=1, b=p$  en  $c=4$   
 $D = p^2 - 4 \cdot 1 \cdot 4 = p^2 - 16$   
 geen opl.  $\Rightarrow D = p^2 - 16 < 0$  ☹  
 $p^2 < 16$   
 $-4 < p < 4$ .
- 9c  $a=-2, b=p$  en  $c=3$   
 $D = p^2 - 4 \cdot -2 \cdot 3 = p^2 + 24 > 0$   
 (dus voor elke  $p$  twee oplossingen)
- 10a  $1^2 + 2 \cdot 1 + p = 0 \Rightarrow 3 + p = 0 \Rightarrow p = -3$ .  
 De vergelijking is:  $x^2 + 2x - 3 = 0$   
 $(x+3) \cdot (x-1) = 0$   
 $x = -3 \vee x = 1$  (was bekend).
- 10b  $p \cdot 2^2 - 11 \cdot 2 + 10 = 0 \Rightarrow 4p - 12 = 0 \Rightarrow 4p = 12 \Rightarrow p = 3$ .  
 Dus  $3x^2 - 11x + 10 = 0$  ( $a=3, b=-11$  en  $c=10$ )  
 $D = (-11)^2 - 4 \cdot 3 \cdot 10 = 121 - 120 = 1$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{11 \pm \sqrt{1}}{2 \cdot 3} = \frac{11 \pm 1}{6}$   
 $x = \frac{11+1}{6} = \frac{12}{6} = 2$  (bekend)  $\vee x = \frac{11-1}{6} = \frac{10}{6} = \frac{5}{3} = 1\frac{2}{3}$ .
- 11a De vergelijking is:  $0 + 3x + 1 = 0$ ; deze heeft één oplossing (het is een eerstegraadsvergelijking).
- 11b  $px^2 + 3x + 1 = 0$  ( $a=p \neq 0, b=3$  en  $c=1$ )  $\Rightarrow D = 3^2 - 4 \cdot p \cdot 1 = 9 - 4p$ ;  
 twee oplossingen  $\Rightarrow D = 9 - 4p > 0 \Rightarrow -4p > -9 \Rightarrow p < \frac{-9}{-4}$ . Dus  $p < \frac{9}{4}$  én  $p \neq 0 \Rightarrow p < 0 \vee 0 < p < 2\frac{1}{4}$ .
- 12a  $px^2 + 5x + 2 = 0$  ( $a=p \neq 0, b=5$  en  $c=2$ )  $\Rightarrow D = 5^2 - 4 \cdot p \cdot 2 = 25 - 8p$ ;  
 twee oplossingen  $\Rightarrow D = 25 - 8p > 0 \Rightarrow -8p > -25 \Rightarrow p < \frac{-25}{-8}$ . Dus  $p < \frac{25}{8}$  én  $p \neq 0 \Rightarrow p < 0 \vee 0 < p < 3\frac{1}{8}$ .
- 12b  $px^2 - 3x - 4 = 0$  ( $a=p \neq 0, b=-3$  en  $c=-4$ )  $\Rightarrow D = (-3)^2 - 4 \cdot p \cdot -4 = 9 + 16p$ ;  
 twee oplossingen  $\Rightarrow D = 9 + 16p > 0 \Rightarrow 16p > -9 \Rightarrow p > \frac{-9}{16}$ . Dus  $p > -\frac{9}{16}$  én  $p \neq 0 \Rightarrow -\frac{9}{16} < p < 0 \vee p > 0$ .
- 13a  $2x^2 + x + p = 0$  ( $a=2, b=1$  en  $c=p$ ); geen oplossing  $\Rightarrow D = 1^2 - 4 \cdot 2 \cdot p = 1 - 8p < 0 \Rightarrow -8p < -1 \Rightarrow p > \frac{-1}{-8} \Rightarrow p > \frac{1}{8}$ .

13b  $px^2 + x + p = 0$  ( $a = p \neq 0$ ,  $b = 1$  en  $c = p$ ) ( $p = 0$  geeft 1 oplossing, namelijk  $x = 0$ );  
twee oplossingen  $\Rightarrow D = 1^2 - 4 \cdot p \cdot p = 1 - 4p^2 > 0 \Rightarrow -4p^2 > -1 \Rightarrow 4p^2 < 1 \Rightarrow p^2 < \frac{1}{4} \odot \Rightarrow -\frac{1}{2} < p < \frac{1}{2}$  én  $p \neq 0$ .

13c  $2x^2 + px + 1 = 0$  ( $a = 2$ ,  $b = p$  en  $c = 1$ );  
twee oplossingen  $\Rightarrow D = p^2 - 4 \cdot 2 \cdot 1 = p^2 - 8 > 0 \Rightarrow p^2 > 8 \Rightarrow \odot$  (grafiek is dalparabool)  $\Rightarrow p < -\sqrt{8} \vee p > \sqrt{8}$ .

14a  $p = 0 \Rightarrow 6x + 9 = 0 \Rightarrow 6x = -9 \Rightarrow x = -\frac{9}{6} = -\frac{3}{2} = -1\frac{1}{2}$ .  
 $p \neq 0 \Rightarrow px^2 + 6x + 9 = 0$  ( $a = p \neq 0$ ,  $b = 6$  en  $c = 9$ );  
één oplossing  $\Rightarrow D = 6^2 - 4 \cdot p \cdot 9 = 36 - 36p = 0 \Rightarrow -36p = -36 \Rightarrow p = 1 \Rightarrow x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-6 \pm \sqrt{0}}{2 \cdot 1} = \frac{-6}{2} = -3$ .

14b  $x^2 + px + 1 = 0$  ( $a = 1$ ,  $b = p$  en  $c = 1$ );  
één oplossing  $\Rightarrow D = p^2 - 4 \cdot 1 \cdot 1 = p^2 - 4 = 0 \Rightarrow p^2 = 4 \Rightarrow p = \pm 2$ .  
 $p = b = 2 \Rightarrow x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-2 \pm \sqrt{0}}{2 \cdot 1} = \frac{-2}{2} = -1$  en  $p = b = -2 \Rightarrow x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-2) \pm \sqrt{0}}{2 \cdot 1} = \frac{2}{2} = 1$ .

15a  $x^3 = 10$  heeft één oplossing, omdat de grafiek van  $f$  en de horizontale lijn  $y = 10$  één snijpunt hebben. (zie fig. 1.1a)  
 $x^3 = -10$  heeft ook één oplossing, omdat de grafiek van  $f$  en de horizontale lijn  $y = -10$  één snijpunt hebben.

15b  $x^4 = 10$  heeft twee oplossingen, omdat de grafiek van  $f$  en de lijn  $y = 10$  twee snijpunten hebben. (zie figuur 1.1b)  
 $x^4 = -10$  heeft geen oplossingen, omdat de grafiek van  $f$  en de lijn  $y = -10$  geen snijpunten hebben.

16a

16b \*

x	x <sup>2</sup>	x <sup>3</sup>	x <sup>4</sup>	x <sup>5</sup>	x <sup>6</sup>
1	1	1	1	1	1
2	4	8	16	32	64
3	9	27	81	243	729
4	16	64	256	1024	
5	25	125	625		
6	36	216			
7	49	343			
8	64				
9	81				

17a  $x^6 = 20$   
 $x = \pm \sqrt[6]{20}$

17b  $5x^3 = 135$   
 $x^3 = 27$   
 $x = \sqrt[3]{27} = 3$

17c  $0,5x^5 = 20$   
 $x^5 = 40$   
 $x = \sqrt[5]{40}$

17d  $x^4 + 7 = 88$   
 $x^4 = 81$   
 $x = \pm \sqrt[4]{81} = \pm 3$

17e  $1 - 3x^5 = 97$   
 $-3x^5 = 96$   
 $x^5 = -32$   
 $x = \sqrt[5]{-32} = -2$

17f  $\frac{1}{4}x^8 + 3 = 10$   
 $\frac{1}{4}x^8 = 7$   
 $x^8 = 28$   
 $x = \pm \sqrt[8]{28}$

18a  $5x^4 - 1 = 4$   
 $5x^4 = 5$   
 $x^4 = 1$   
 $x = \pm \sqrt[4]{1} = \pm 1$

18b  $5x^4 = -4$   
 $x^4 = -\frac{4}{5} = -0.8$   
geen oplossing.

18c  $5x^3 - 1 = 9$   
 $5x^3 = 10$   
 $x^3 = 2$   
 $x = \sqrt[3]{2}$

18d  $8x^3 + 2 = 1$   
 $8x^3 = -1$   
 $x^3 = -\frac{1}{8} = -0.125$   
 $x = \sqrt[3]{-\frac{1}{8}} = -\frac{1}{2}$

18e  $5x^6 + 7 = 97$   
 $5x^6 = 90$   
 $x^6 = 18$   
 $x = \pm \sqrt[6]{18}$

18f  $0,1x^7 - 1 = 999$   
 $0,1x^7 = 1000$   
 $x^7 = 10000$   
 $x = \sqrt[7]{10000}$

19a  $3(x-2)^4 + 7 = 37$   
 $3(x-2)^4 = 30$   
 $(x-2)^4 = 10$   
 $x-2 = \pm \sqrt[4]{10}$   
 $x = 2 \pm \sqrt[4]{10}$   
 $x = 2 + \sqrt[4]{10} \vee x = 2 - \sqrt[4]{10}$

19b  $6 - (2x-1)^3 = 1$   
 $-(2x-1)^3 = -5$   
 $(2x-1)^3 = 5$   
 $2x-1 = \sqrt[3]{5}$   
 $2x = 1 + \sqrt[3]{5}$   
 $x = \frac{1}{2} + \frac{1}{2} \cdot \sqrt[3]{5}$

19c  $\frac{1}{2}(3x-1)^4 = 8$   
 $(3x-1)^4 = 16$   
 $3x-1 = \pm\sqrt[4]{16} = \pm 2$   
 $3x = 1 \pm 2$   
 $x = \frac{1 \pm 2}{3}$   
 $x = \frac{1+2}{3} = 1 \vee x = \frac{1-2}{3} = -\frac{1}{3}$

$8/(1/2)$	16
$4*\sqrt[4]{16}$	2
$(1-2)/3 \rightarrow \text{Frac}$	$-1/3$

19d  $100 - \frac{1}{3}(4x-3)^5 = 19$   
 $-\frac{1}{3}(4x-3)^5 = -81$   
 $(4x-3)^5 = 243$   
 $4x-3 = \sqrt[5]{243} = 3$   
 $4x = 6$   
 $x = \frac{6}{4} = \frac{3}{2} = 1\frac{1}{2}$

$19-100$	-81
$\text{Ans}/(-1/3)$	243
$5*\sqrt[5]{243}$	3
$3+3$	6
$6/4$	1.5
$\text{Ans} \rightarrow \text{Frac}$	$3/2$

20a  $5x^4 - 3 = 17$   
 $5x^4 = 20$   
 $x^4 = 4$   
 $x = \pm\sqrt[4]{4}$

$17+3$	20
$\text{Ans}/5$	4
$4*\sqrt[4]{4}$	1.414213562

20b  $4x^3 - 5 = 1367$   
 $4x^3 = 1372$   
 $x^3 = 343$   
 $x = \sqrt[3]{343} = 7$

$1367+5$	1372
$1372/4$	343
$3*\sqrt[3]{343}$	7

20c  $3(4x-5)^3 = 15$   
 $(4x-5)^3 = 5$   
 $4x-5 = \sqrt[3]{5}$   
 $4x = 5 + \sqrt[3]{5}$   
 $x = \frac{5}{4} + \frac{1}{4} \cdot \sqrt[3]{5} = 1\frac{1}{4} + \frac{1}{4} \cdot \sqrt[3]{5}$

$15/3$	5
$3*\sqrt[3]{5}$	1.709975947

20d  $17 - 2(1-3x)^4 = 5$   
 $-2(1-3x)^4 = -12$   
 $(1-3x)^4 = 6$   
 $1-3x = \pm\sqrt[4]{6}$   
 $-3x = -1 \pm \sqrt[4]{6}$   
 $x = \frac{1}{3} \mp \frac{1}{3} \cdot \sqrt[4]{6} = \frac{1}{3} \pm \frac{1}{3} \cdot \sqrt[4]{6}$

$5-17$	-12
$-12/-2$	6
$4*\sqrt[4]{6}$	1.56508458

21ab  $x^3 - x^2 - 2x = x \cdot (x^2 - x - 2) = x \cdot (x-2) \cdot (x+1) = 0 \Rightarrow x = 0 \vee x = 2 \vee x = -1$

22a  $x^3 - 5x^2 + 6x = 0$   
 $x \cdot (x^2 - 5x + 6) = 0$   
 $x \cdot (x-3) \cdot (x-2) = 0$   
 $x = 0 \vee x = 3 \vee x = 2$

22b  $x^3 - 5x^2 = 6x$   
 $x^3 - 5x^2 - 6x = 0$   
 $x \cdot (x^2 - 5x - 6) = 0$   
 $x \cdot (x-6) \cdot (x+1) = 0$   
 $x = 0 \vee x = 6 \vee x = -1$

22c  $x^3 = 4x^2 + 12x$   
 $x^3 - 4x^2 - 12x = 0$   
 $x \cdot (x^2 - 4x - 12) = 0$   
 $x \cdot (x-6) \cdot (x+2) = 0$   
 $x = 0 \vee x = 6 \vee x = -2$

22d  $x^4 - 13x^2 + 36 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $t^2 - 13t + 36 = 0$   
 $(t-4) \cdot (t-9) = 0$   
 $t = x^2 = 4 \vee t = x^2 = 9$   
 $x = \pm 2 \vee x = \pm 3$

23a  $x^4 - 10x^2 + 9 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $t^2 - 10t + 9 = 0$   
 $(t-9) \cdot (t-1) = 0$   
 $t = x^2 = 9 \vee t = x^2 = 1$   
 $x = \pm 3 \vee x = \pm 1$

23b  $x^4 - 8x^2 - 9 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $t^2 - 8t - 9 = 0$   
 $(t-9) \cdot (t+1) = 0$   
 $t = x^2 = 9 \vee t = x^2 = -1$  (kan niet)  
 $x = \pm 3$

23c  $x^4 + 16 = 10x^2$   
 $x^4 - 10x^2 + 16 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $t^2 - 10t + 16 = 0$   
 $(t-8) \cdot (t-2) = 0$   
 $t = x^2 = 8 \vee t = x^2 = 2$   
 $x = \pm\sqrt{8} \vee x = \pm\sqrt{2}$

23d  $x^3 + 25x = 10x^2$   
 $x^3 - 10x^2 + 25x = 0$   
 $x \cdot (x^2 - 10x + 25) = 0$   
 $x \cdot (x-5) \cdot (x-5) = 0$   
 $x = 0 \vee x = 5$  (dubbel).

24ab  $2x^4 - 11x^2 + 12 = 0$  (noem  $x^2$  tijdelijk  $p$ )  
 $2p^2 - 11p + 12 = 0$  ( $a = 2$ ,  $b = -11$  en  $c = 12$ )  
 $D = (-11)^2 - 4 \cdot 2 \cdot 12 = 121 - 96 = 25$   
 $p = \frac{-b \pm \sqrt{D}}{2a} = \frac{11 \pm \sqrt{25}}{2 \cdot 2} = \frac{11 \pm 5}{4}$   
 $p = x^2 = \frac{11+5}{4} = \frac{16}{4} = 4 \vee p = x^2 = \frac{11-5}{4} = \frac{6}{4} = \frac{3}{2} = 1\frac{1}{2}$   
 $x = \pm 2 \vee x = \pm\sqrt{1\frac{1}{2}}$

$(-11)^2 - 4*2*12$	25
$\sqrt{(11 \pm 5)/4}$	1.224744871



25a  $6x^4 + 2 = 7x^2$   
 $6x^4 - 7x^2 + 2 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $6t^2 - 7t + 2 = 0$  ( $a = 6$ ,  $b = -7$  en  $c = 2$ )  
 $D = (-7)^2 - 4 \cdot 6 \cdot 2 = 49 - 48 = 1$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{7 \pm \sqrt{1}}{2 \cdot 6} = \frac{7 \pm 1}{12}$   
 $t = x^2 = \frac{7+1}{12} = \frac{8}{12} = \frac{2}{3}$   $\vee$   $t = x^2 = \frac{7-1}{12} = \frac{6}{12} = \frac{1}{2}$   
 $x = \pm \sqrt{\frac{2}{3}}$   $\vee$   $x = \pm \sqrt{\frac{1}{2}}$ .

25b  $2x^4 = x^2 + 3$   
 $2x^4 - x^2 - 3 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $2t^2 - t - 3 = 0$  ( $a = 2$ ,  $b = -1$  en  $c = -3$ )  
 $D = (-1)^2 - 4 \cdot 2 \cdot (-3) = 1 + 24 = 25$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{1 \pm \sqrt{25}}{2 \cdot 2} = \frac{1 \pm 5}{4}$   
 $t = x^2 = \frac{1+5}{4} = \frac{6}{4} = 1\frac{1}{2}$   $\vee$   $t = x^2 = \frac{1-5}{4} = -1$  (k.n.)  
 $x = \pm \sqrt{1\frac{1}{2}}$ .

25c  $4x^4 + 7x^2 = 2$   
 $4x^4 + 7x^2 - 2 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $4t^2 + 7t - 2 = 0$  ( $a = 4$ ,  $b = 7$  en  $c = -2$ )  
 $D = 7^2 - 4 \cdot 4 \cdot (-2) = 49 + 32 = 81$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{-7 \pm \sqrt{81}}{2 \cdot 4} = \frac{-7 \pm 9}{8}$   
 $t = x^2 = \frac{-7+9}{8} = \frac{2}{8} = \frac{1}{4}$   $\vee$   $t = x^2 = \frac{-7-9}{8} = \frac{-16}{8} = -2$  (k.n.)  
 $x = \pm \sqrt{\frac{1}{4}} = \pm \frac{1}{2}$ .

25d  $16x^4 + 225 = 136x^2$   
 $16x^4 - 136x^2 + 225 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $16t^2 - 136t + 225 = 0$  ( $a = 16$ ,  $b = -136$  en  $c = 225$ )  
 $D = (-136)^2 - 4 \cdot 16 \cdot 225 = 4096$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{136 \pm \sqrt{4096}}{2 \cdot 16} = \frac{136 \pm 64}{32}$   
 $t = x^2 = \frac{136+64}{32} = \frac{200}{32} = \frac{25}{4}$   $\vee$   $t = x^2 = \frac{136-64}{32} = \frac{72}{32} = \frac{9}{4}$   
 $x = \pm \sqrt{\frac{25}{4}} = \pm \frac{5}{2}$   $\vee$   $x = \pm \sqrt{\frac{9}{4}} = \pm \frac{3}{2}$ .

26a  $4x^4 + 153 = 53x^2$   
 $4x^4 - 53x^2 + 153 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $4t^2 - 53t + 153 = 0$  ( $a = 4$ ,  $b = -53$  en  $c = 153$ )  
 $D = (-53)^2 - 4 \cdot 4 \cdot 153 = 361$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{53 \pm \sqrt{361}}{2 \cdot 4} = \frac{53 \pm 19}{8}$   
 $x^2 = \frac{53+19}{8} = \frac{72}{8} = 9$   $\vee$   $x^2 = \frac{53-19}{8} = \frac{34}{8} = \frac{17}{4} = 4\frac{1}{4}$   
 $x = \pm 3$   $\vee$   $x = \pm \sqrt{4\frac{1}{4}}$ .

26b  $4x^4 + 21x^2 = 148$   
 $4x^4 + 21x^2 - 148 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $4t^2 + 21t - 148 = 0$  ( $a = 4$ ,  $b = 21$  en  $c = -148$ )  
 $D = 21^2 - 4 \cdot 4 \cdot (-148) = 2809$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{-21 \pm \sqrt{2809}}{2 \cdot 4} = \frac{-21 \pm 53}{8}$   
 $x^2 = \frac{-21+53}{8} = \frac{32}{8} = 4$   $\vee$   $x^2 = \frac{-21-53}{8} = -\dots$  (k.n.)  
 $x = \pm 2$ .

26c  $4x^6 + 35 = 24x^3$   
 $4x^6 - 24x^3 + 35 = 0$  (noem  $x^3$  tijdelijk  $t$ )  
 $4t^2 - 24t + 35 = 0$  ( $a = 4$ ,  $b = -24$  en  $c = 35$ )  
 $D = (-24)^2 - 4 \cdot 4 \cdot 35 = 16$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{24 \pm \sqrt{16}}{2 \cdot 4} = \frac{24 \pm 4}{8}$   
 $x^3 = \frac{24+4}{8} = \frac{28}{8} = \frac{7}{2}$   $\vee$   $x^3 = \frac{24-4}{8} = \frac{20}{8} = \frac{5}{2}$   
 $x = \sqrt[3]{3\frac{1}{2}}$   $\vee$   $x = \sqrt[3]{2\frac{1}{2}}$ .

26d  $64x^6 + 27 = 224x^3$   
 $64x^6 - 224x^3 + 27 = 0$  (noem  $x^3$  tijdelijk  $t$ )  
 $64t^2 - 224t + 27 = 0$  ( $a = 64$ ,  $b = -224$  en  $c = 27$ )  
 $D = (-224)^2 - 4 \cdot 64 \cdot 27 = 43264$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{224 \pm \sqrt{43264}}{2 \cdot 64} = \frac{224 \pm 208}{128}$   
 $x^3 = \frac{224+208}{128} = \frac{432}{128} = \frac{27}{8}$   $\vee$   $x^3 = \frac{224-208}{128} = \frac{16}{128} = \frac{1}{8}$   
 $x = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}$   $\vee$   $x = \sqrt[3]{\frac{1}{8}} = \frac{1}{2}$ .

27a De getallen 7 en  $-7$ .

27b  $2x - 1 = 7$   $\vee$   $2x - 1 = -7$   
 $2x = 8$   $\vee$   $2x = -6$   
 $x = 4$   $\vee$   $x = -3$ .



28a  $|2x - 1| = 8$   
 $2x - 1 = 8$   $\vee$   $2x - 1 = -8$   
 $2x = 9$   $\vee$   $2x = -7$   
 $x = \frac{9}{2} = 4\frac{1}{2}$   $\vee$   $x = \frac{-7}{2} = -3\frac{1}{2}$ .

28b  $|x^2 - 3| = 1$   
 $x^2 - 3 = 1$   $\vee$   $x^2 - 3 = -1$   
 $x^2 = 4$   $\vee$   $x^2 = 2$   
 $x = \pm 2$   $\vee$   $x = \pm \sqrt{2}$ .

28c  $|2x^2 - 5| = 11$   
 $2x^2 - 5 = 11$   $\vee$   $2x^2 - 5 = -11$   
 $2x^2 = 16$   $\vee$   $2x^2 = -6$   
 $x^2 = 8$   $\vee$   $x^2 = -3$  (k.n.)  
 $x = \pm \sqrt{8}$ .

28d  $|5 - x^2| = 11$   
 $5 - x^2 = 11$   $\vee$   $5 - x^2 = -11$   
 $-x^2 = 6$   $\vee$   $-x^2 = -16$   
 $x^2 = -6$  (k.n.)  $\vee$   $x^2 = 16$   
 $x = \pm 4$ .

29a  $|2x^4 - 5| = 15$   
 $2x^4 - 5 = 15 \vee 2x^4 - 5 = -15$   
 $2x^4 = 20 \vee 2x^4 = -10$   
 $x^4 = 10 \vee x^4 = -5$  (k.n.)  
 $x = \pm\sqrt[4]{10}$ .

29b  $|2x^3 - 5| = 15$   
 $2x^3 - 5 = 15 \vee 2x^3 - 5 = -15$   
 $2x^3 = 20 \vee 2x^3 = -10$   
 $x^3 = 10 \vee x^3 = -5$   
 $x = \sqrt[3]{10} \vee x = \sqrt[3]{-5}$ .

29c  $|x^4 - 5x^2| = 6$   
 $x^4 - 5x^2 = 6 \vee x^4 - 5x^2 = -6$   
 $x^4 - 5x^2 - 6 = 0 \vee x^4 - 5x^2 + 6 = 0$  (noem  $x^2$  tijdelijk  $t$ )  
 $t^2 - 5t - 6 = 0 \vee t^2 - 5t + 6 = 0$   
 $(t-6) \cdot (t+1) = 0 \vee (t-3) \cdot (t-2) = 0$   
 $t = x^2 = 6 \vee x^2 = -1$  (k.n.)  $\vee x^2 = 3 \vee x^2 = 2$   
 $x = \pm\sqrt{6} \vee x = \pm\sqrt{3} \vee x = \pm\sqrt{2}$ .

29d  $|x^6 - 10x^3| = 24$   
 $x^6 - 10x^3 = 24 \vee x^6 - 10x^3 = -24$   
 $x^6 - 10x^3 - 24 = 0 \vee x^6 - 10x^3 + 24 = 0$  (stel  $x^3 = t$ )  
 $t^2 - 10t - 24 = 0 \vee t^2 - 10t + 24 = 0$   
 $(t-12) \cdot (t+2) = 0 \vee (t-6) \cdot (t-4) = 0$   
 $t = x^3 = 12 \vee x^3 = -2 \vee x^3 = 6 \vee x^3 = 4$   
 $x = \sqrt[3]{12} \vee x = \sqrt[3]{-2} \vee x = \sqrt[3]{6} \vee x = \sqrt[3]{4}$ .

30a  $\sqrt{2x-5} = 3$  (kwadrateren)  $\Rightarrow 2x - 5 = 9 \Rightarrow 2x = 14 \Rightarrow x = 7$ .

30b  $\sqrt{2x-5} = -3$  heeft geen oplossing, omdat een wortel niet negatief kan zijn.

3 <sup>2</sup>	9
Ans=+5	14
Ans=2	7

31a  $x = \sqrt{5x+14}$  (kwadrateren)  
 $x^2 = 5x + 14$   
 $x^2 - 5x - 14 = 0$   
 $(x-7) \cdot (x+2) = 0$   
 $x = 7$  (voldoet)  $\vee x = -2$  (voldoet niet).

$\sqrt{(5*7+14)}$	7
$\sqrt{(5*-2+14)}$	2

31b  $3x = \sqrt{8x+20}$  (kwadrateren)  
 $(3x)^2 = 8x + 20$   
 $9x^2 - 8x - 20 = 0$  ( $a = 9, b = -8$  en  $c = -20$ )  
 $D = (-8)^2 - 4 \cdot 9 \cdot -20 = 64 + 720 = 784$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{8 \pm \sqrt{784}}{2 \cdot 9} = \frac{8 \pm 28}{18}$   
 $x = \frac{8+28}{18} = \frac{36}{18} = 2$  (voldoet)  $\vee x = \frac{8-28}{18} = \frac{-20}{18} = -\dots$  (voldoet niet).

$(-8)^2 - 4*9*-20$	784
$\sqrt{784}$	28
$3*2$	6
$\sqrt{(8*2+20)}$	6
$3*-20/18$	-3.333333333

31c  $5\sqrt{x} = x$  (kwadrateren)  
 $25x = x^2$   
 $0 = x^2 - 25x$   
 $0 = x \cdot (x - 25)$   
 $x = 0$  (voldoet)  $\vee x = 25$  (voldoet).

$5*\sqrt{0}$	0
$5*\sqrt{25}$	25

31d  $3x = \sqrt{18x+72}$  (kwadrateren)  
 $(3x)^2 = 18x + 72$   
 $9x^2 - 18x - 72 = 0$   
 $x^2 - 2x - 8 = 0$   
 $(x-4) \cdot (x+2) = 0$   
 $x = 4$  (voldoet)  $\vee x = -2$  (voldoet niet).

$3*4$	12
$\sqrt{(18*4+72)}$	12
$3*-2$	-6
$\sqrt{(18*-2+72)}$	6

32a  $4 - 3\sqrt{x} = 2$   
 $-3\sqrt{x} = -2$   
 $\sqrt{x} = \frac{2}{3}$  (kwadrateren)  
 $x = \frac{4}{9}$  (voldoet).

$4-3*\sqrt{(4/9)}$	2
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32b  $5\sqrt{x} - 2x = 0$   
 $5\sqrt{x} = 2x$  (kwadrateren)  
 $25x = 4x^2$   
 $0 = 4x^2 - 25x = 4x \cdot (x - \frac{25}{4})$   
 $x = 0$  (voldoet)  $x = 6\frac{1}{4}$  (voldoet).

$5*\sqrt{0}-2*0$	0
$6+1/4*x$	6.25
$5\sqrt{x}-2x$	0

32c  $2x - 5\sqrt{x} = 3$   
 $2x - 3 = 5\sqrt{x}$  (kwadrateren)  
 $4x^2 - 6x - 6x + 9 = 25x$   
 $4x^2 - 37x + 9 = 0$  ( $a = 4, b = -37$  en  $c = 9$ )  
 $D = (-37)^2 - 4 \cdot 4 \cdot 9 = 1225$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{37 \pm \sqrt{1225}}{2 \cdot 4} = \frac{37 \pm 35}{8}$   
 $x = \frac{37+35}{8} = \frac{72}{8} = 9$  (voldoet)  $\vee x = \frac{37-35}{8} = \frac{2}{8} = \frac{1}{4}$  (voldoet niet).

$(-37)^2 - 4*4*9$	1225
$\sqrt{1225}$	35
$(37+35)/8*x$	9
$2x-5\sqrt{x}$	3
$(37-35)/8*x$	.25
$2x-5\sqrt{x}$	-2

32d  $5 - 2\sqrt{x} = 3$   
 $2 = 2\sqrt{x}$   
 $1 = \sqrt{x}$  (kwadrateren)  
 $1 = x$  (voldoet).

$5-3$	2
$1*\sqrt{x}$	1
$5-2\sqrt{x}$	3

33a  $2x + \sqrt{x} = 10$   
 $\sqrt{x} = 10 - 2x$  (kwadrateren)  
 $x = 100 - 20x - 20x + 4x^2$   
 $0 = 4x^2 - 41x + 100$  ( $a = 4, b = -41$  en  $c = 100$ )  
 $D = (-41)^2 - 4 \cdot 4 \cdot 100 = 81$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{41 \pm \sqrt{81}}{2 \cdot 4} = \frac{41 \pm 9}{8}$   
 $x = \frac{41+9}{8} = \frac{50}{8} = 6\frac{1}{4}$  (voldoet niet)  $\vee x = \frac{41-9}{8} = \frac{32}{8} = 4$  (voldoet).

$(-41)^2 - 4*4*100$	81
$(41+9)/8*x$	6.25
$2x+\sqrt{x}$	15
$(41-9)/8*x$	4
$2x+\sqrt{x}$	10

33b  $\sqrt{x+12} = x$  (kwadrateren)  
 $x + 12 = x^2$   
 $0 = x^2 - x - 12$   
 $0 = (x-4) \cdot (x+3)$   
 $x = 4$  (voldoet)  $\vee x = -3$  (voldoet niet).

$4*x$	4
$\sqrt{x+12}$	4
$-3*x$	-3
$\sqrt{x+12}$	3

33c  $2x + \sqrt{x} = 6$   
 $\sqrt{x} = 6 - 2x$  (kwadrateren)  
 $x = 36 - 12x - 12x + 4x^2$   
 $0 = 4x^2 - 25x + 36$  ( $a = 4$ ,  $b = -25$  en  $c = 36$ )  
 $D = (-25)^2 - 4 \cdot 4 \cdot 36 = 49$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{25 \pm \sqrt{49}}{2 \cdot 4} = \frac{25 \pm 7}{8}$   
 $x = \frac{25+7}{8} = \frac{32}{8} = 4$  (voldoet niet)  $\vee$   $x = \frac{25-7}{8} = \frac{18}{8} = 2\frac{1}{4}$  (voldoet).

33d  $10 - x\sqrt{x} = 2$   
 $8 = x\sqrt{x}$  (kwadrateren)  
 $64 = x^2 \cdot x = x^3$   
 $x = \sqrt[3]{64} = 4$  (voldoet).

34a  $(x\sqrt{x})^2 + x\sqrt{x} - 6 = 0$  (stel  $x\sqrt{x} = p$ )  
 $p^2 + p - 6 = 0$   
 $(p+3) \cdot (p-2) = 0$   
 $p = x\sqrt{x} = -3 \vee p = x\sqrt{x} = 2$

34b  $x\sqrt{x} = -3$  ( $x = 0$  voldoet niet,  $x > 0$  of  $x < 0$  kan ook niet)  
 $x\sqrt{x} = 2$  (kwadrateren)  $\Rightarrow x^2 \cdot x = 4 \Rightarrow x^3 = 4 \Rightarrow x = \sqrt[3]{4}$ .

35a  $x^3 - 9x\sqrt{x} + 8 = 0$  (stel  $x\sqrt{x} = t$ )  
 $t^2 - 9t + 8 = 0$   
 $(t-8) \cdot (t-1) = 0$   
 $t = x\sqrt{x} = 8 \vee t = x\sqrt{x} = 1$  (kwadrateren)  
 $x^2 \cdot x = x^3 = 8^2 = 64 \vee x^3 = 1^2 = 1$   
 $x = \sqrt[3]{64} = 4 \vee x = \sqrt[3]{1} = 1$ .

35b  $x^3 + 27 = 28x\sqrt{x}$   
 $x^3 - 28x\sqrt{x} + 27 = 0$  (stel  $x\sqrt{x} = t$ )  
 $t^2 - 28t + 27 = 0$   
 $(t-27) \cdot (t-1) = 0$   
 $t = x\sqrt{x} = 27 \vee x\sqrt{x} = 1$  (kwadrateren)  
 $x^3 = 27^2 = 729 \vee x^3 = 1^2 = 1$   
 $x = \sqrt[3]{729} = 9 \vee x = \sqrt[3]{1} = 1$ .

35c  $8x^3 + 8 = 65x\sqrt{x}$   
 $8x^3 - 65x\sqrt{x} + 8 = 0$  (stel  $x\sqrt{x} = t$ )  
 $8t^2 - 65t + 8 = 0$  ( $a = 8$ ,  $b = -65$  en  $c = 8$ )  
 $D = (-65)^2 - 4 \cdot 8 \cdot 8 = 3969$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{65 \pm \sqrt{3969}}{2 \cdot 8} = \frac{65 \pm 63}{16}$   
 $x\sqrt{x} = \frac{65+63}{16} = \frac{128}{16} = 8 \vee x\sqrt{x} = \frac{65-63}{16} = \frac{2}{16} = \frac{1}{8}$  (kwadr.)  
 $x^3 = 8^2 = 64 \vee x^3 = \left(\frac{1}{8}\right)^2 = \frac{1}{64}$   
 $x = \sqrt[3]{64} = 4 \vee x = \sqrt[3]{\frac{1}{64}} = \frac{1}{4}$ .

35d  $x^5 - 33x^2\sqrt{x} + 32 = 0$  (stel  $x^2\sqrt{x} = t$ )  
 $t^2 - 33t + 32 = 0$   
 $(t-32) \cdot (t-1) = 0$   
 $t = x^2\sqrt{x} = 32 \vee x^2\sqrt{x} = 1$  (kwadrateren)  
 $x^5 = 32^2 = 1024 \vee x^5 = 1^2 = 1$   
 $x = \sqrt[5]{1024} = 4 \vee x = \sqrt[5]{1} = 1$ .

36a  $x^3 + 30 = 11x\sqrt{x}$   
 $x^3 - 11x\sqrt{x} + 30 = 0$  ( $x\sqrt{x} = t$ )  
 $t^2 - 11t + 30 = 0$   
 $(t-6) \cdot (t-5) = 0$   
 $t = x\sqrt{x} = 6 \vee x\sqrt{x} = 5$  (kwadrateren)  
 $x^3 = 6^2 = 36 \vee x^3 = 5^2 = 25$   
 $x = \sqrt[3]{36} \vee x = \sqrt[3]{25}$ .

36b  $x^3 + 125 = 126x\sqrt{x}$   
 $x^3 - 126x\sqrt{x} + 125 = 0$  ( $x\sqrt{x} = t$ )  
 $t^2 - 126t + 125 = 0$   
 $(t-125) \cdot (t-1) = 0$   
 $t = x\sqrt{x} = 125 \vee x\sqrt{x} = 1$  (kwadrateren)  
 $x^3 = 125^2 = 15625 \vee x^3 = 1^2 = 1$   
 $x = \sqrt[3]{15625} = 25 \vee x = \sqrt[3]{1} = 1$ .

36c  $x^5 + 10 = 7x^2\sqrt{x}$   
 $x^5 - 7x^2\sqrt{x} + 10 = 0$  (stel  $x^2\sqrt{x} = t$ )  
 $t^2 - 7t + 10 = 0$   
 $(t-2) \cdot (t-5) = 0$   
 $t = x^2\sqrt{x} = 2 \vee x^2\sqrt{x} = 5$  (kwadr.)  
 $x^5 = 2^2 = 4 \vee x^5 = 5^2 = 25$   
 $x = \sqrt[5]{4} \vee x = \sqrt[5]{25}$ .

36d  $32x^5 + 32 = 1025x^2\sqrt{x}$   
 $32x^5 - 1025x^2\sqrt{x} + 32 = 0$  (stel  $x^2\sqrt{x} = t$ )  
 $32t^2 - 1025t + 32 = 0$  ( $a = 32$ ,  $b = -1025$  en  $c = 32$ )  
 $D = (-1025)^2 - 4 \cdot 32 \cdot 32 = 1046529$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{1025 \pm \sqrt{1046529}}{2 \cdot 32} = \frac{1025 \pm 1023}{64}$   
 $x^2\sqrt{x} = \frac{1025+1023}{64} = 32 \vee x^2\sqrt{x} = \frac{1025-1023}{64} = \frac{2}{64} = \frac{1}{32}$  (kwadr.)  
 $x^5 = 32^2 = 1024 \vee x^5 = \left(\frac{1}{32}\right)^2 = \frac{1}{1024}$   
 $x = \sqrt[5]{1024} = 4 \vee x = \sqrt[5]{\frac{1}{1024}} = \frac{1}{4}$ .

37 •  $x - \sqrt{x} = 12 \Rightarrow x - 12 = \sqrt{x}$  (kwadrateren)  
 $x^2 - 12x - 12x + 144 = x \Rightarrow x^2 - 25x + 144 = 0$   
 $(x-9) \cdot (x-16) = 0 \Rightarrow x = 9$  (voldoet niet)  $\vee x = 16$  (voldoet).

•  $x - \sqrt{x} = 12 \Rightarrow x - \sqrt{x} - 12 = 0$  (stel  $\sqrt{x} = t$ )  
 $t^2 - t - 12 = 0 \Rightarrow (t-4) \cdot (t+3) = 0$   
 $t = \sqrt{x} = 4 \vee t = \sqrt{x} = -3$  (k.n.)  $\Rightarrow x = 4^2 = 16$ .



38a De kruisproducten bij de tabel geeft  $x \cdot x = 2 \cdot (x + 4) \Rightarrow x^2 = 2x + 8 \Rightarrow x^2 - 2x - 8 = 0$ .

38b  $x^2 - 2x - 8 = 0 \Rightarrow (x - 4) \cdot (x + 2) = 0 \Rightarrow x = 4 \vee x = -2$ .

39a  $\frac{x+3}{x-1} = \frac{10}{x}$   
 $x \cdot (x+3) = 10 \cdot (x-1)$   
 $x^2 + 3x = 10x - 10$   
 $x^2 - 7x + 10 = 0$   
 $(x-5) \cdot (x-2) = 0$   
 $x = 5$  (vold.)  $\vee$   $x = 2$  (vold.).

39b  $\frac{2x+3}{x+1} = \frac{2x+2}{x-1}$   
 $(2x+3) \cdot (x-1) = (2x+2) \cdot (x+1)$   
 $2x^2 - 2x + 3x - 3 = 2x^2 + 2x + 2x + 2$   
 $-3x = 5$   
 $x = \frac{5}{-3} = -1\frac{2}{3}$  (vold.).

39c  $\frac{x-3}{x+1} = 1\frac{1}{2} = \frac{3}{2}$   
 $2 \cdot (x-3) = 3 \cdot (x+1)$   
 $2x - 6 = 3x + 3$   
 $-x = 9$   
 $x = -9$  (vold.).

39d  $\frac{x-1}{x} + 1 = 3$   
 $\frac{x-1}{x} = 2 = \frac{2}{1}$   
 $2 \cdot x = 1 \cdot (x-1)$   
 $2x = x - 1$   
 $x = -1$  (vold.).

**VOLDOET NIET ALS EEN NOEMER NUL WORDT !!!**

39e  $\frac{3x+4}{x-1} = \frac{x+18}{x}$   
 $x \cdot (3x+4) = (x+18) \cdot (x-1)$   
 $3x^2 + 4x = x^2 - x + 18x - 18$   
 $2x^2 - 13x + 18 = 0$  ( $a=2, b=-13$  en  $c=18$ )  
 $D = (-13)^2 - 4 \cdot 2 \cdot 18 = 25$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{13 \pm \sqrt{25}}{2 \cdot 2} = \frac{13 \pm 5}{4}$   
 $x = \frac{13+5}{4} = \frac{18}{4} = 4,5$  (vold.)  $\vee$   $x = \frac{13-5}{4} = \frac{8}{4} = 2$  (vold.).

39f  $\frac{2x-5}{4-x} = \frac{x+2}{3x-4}$   
 $(2x-5) \cdot (3x-4) = (x+2) \cdot (4-x)$   
 $6x^2 - 8x - 15x + 20 = 4x - x^2 + 8 - 2x$   
 $7x^2 - 25x + 12 = 0$  ( $a=7, b=-25$  en  $c=12$ )  
 $D = (-25)^2 - 4 \cdot 7 \cdot 12 = 289$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{25 \pm \sqrt{289}}{2 \cdot 7} = \frac{25 \pm 17}{14}$   
 $x = \frac{25+17}{14} = \frac{42}{14} = 3$  (vold.)  $\vee$   $x = \frac{25-17}{14} = \frac{8}{14} = \frac{4}{7}$  (vold.).

40a  $\frac{5x^2-15}{x^2+5} = 0$   
 $5x^2 - 15 = 0$   
 $5x^2 = 15$   
 $x^2 = 3$   
 $x = \sqrt{3} \vee x = -\sqrt{3}$ .  
 (vold.) (vold.)

40b  $\frac{x^2-3}{x^2+1} = \frac{x-1}{x^2+1}$   
 $x^2 - 3 = x - 1$   
 $x^2 - x - 2 = 0$   
 $(x-2) \cdot (x+1) = 0$   
 $x = 2 \vee x = -1$ .  
 (vold.) (vold.)

40c  $\frac{x^2-4}{2x+5} = \frac{x^2-4}{x+4}$   
 $x^2 - 4 = 0 \vee 2x + 5 = x + 4$   
 $x^2 = 4 \vee x = -1$   
 $x = 2 \vee x = -2 \vee x = -1$ .  
 (vold.) (vold.) (vold.)

40d  $\frac{x^2+1}{x+1} = \frac{x+3}{x+1}$   
 $x^2 + 1 = x + 3$   
 $x^2 - x - 2 = 0$   
 $(x-2) \cdot (x+1) = 0$   
 $x = 2 \vee x = -1$ .  
 (vold.) (vold. niet)

41a  $\frac{3x^2-10}{x^2+1} = 2 = \frac{2}{1}$   
 $1 \cdot (3x^2 - 10) = 2 \cdot (x^2 + 1)$   
 $3x^2 - 10 = 2x^2 + 2$   
 $x^2 = 12$   
 $x = \sqrt{12} \vee x = -\sqrt{12}$ .  
 (vold.) (vold.)

41b  $\frac{x^3-8}{x^2+2} = \frac{x^3-8}{x+8}$   
 $x^3 - 8 = 0 \vee x^2 + 2 = x + 8$   
 $x^3 = 8 \vee x^2 - x - 6 = 0$   
 $x = \sqrt[3]{8} = 2 \vee (x-3) \cdot (x+2) = 0$   
 $x = 2 \vee x = 3 \vee x = -2$ .  
 (vold.) (vold.) (vold.)

41c  $\frac{3x^2-10}{(x^2+1)^2} = \frac{2}{25}$   
 $25 \cdot (3x^2 - 10) = 2 \cdot (x^2 + 1)^2$   
 $75x^2 - 250 = 2 \cdot (x^4 + x^2 + x^2 + 1)$   
 $75x^2 - 250 = 2x^4 + 4x^2 + 2$   
 $0 = 2x^4 - 71x^2 + 252$  (stel  $x^2 = t$ )  
 $2t^2 - 71t + 252 = 0$  ( $a=2, b=-71$  en  $c=252$ )  
 $D = (-71)^2 - 4 \cdot 2 \cdot 252 = 3025$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{71 \pm \sqrt{3025}}{2 \cdot 2} = \frac{71 \pm 55}{4}$   
 $t = x^2 = \frac{71+55}{4} = 31,5 \vee x^2 = \frac{71-55}{4} = 4$   
 $x = \sqrt{31,5} \vee x = -\sqrt{31,5} \vee x = 2 \vee x = -2$ .  
 (vold.) (vold.) (vold.) (vold.)

41d  $\frac{6x^2-12}{(x^2-1)^2} = 1\frac{1}{3} = \frac{4}{3}$   
 $3 \cdot (6x^2 - 12) = 4 \cdot (x^2 - 1)^2$   
 $18x^2 - 36 = 4 \cdot (x^4 - x^2 - x^2 + 1)$   
 $18x^2 - 36 = 4x^4 - 8x^2 + 4$   
 $0 = 4x^4 - 26x^2 + 40$   
 $0 = 2x^4 - 13x^2 + 20$  (stel  $x^2 = t$ )  
 $2t^2 - 13t + 20 = 0$  ( $a=2, b=-13$  en  $c=20$ )  
 $D = (-13)^2 - 4 \cdot 2 \cdot 20 = 169 - 160 = 9$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{13 \pm \sqrt{9}}{2 \cdot 2} = \frac{13 \pm 3}{4}$   
 $t = x^2 = \frac{13+3}{4} = 4 \vee x^2 = \frac{13-3}{4} = 2,5$   
 $x = 2 \vee x = -2 \vee x = \sqrt{2,5} \vee x = -\sqrt{2,5}$ .  
 (vold.) (vold.) (vold.) (vold.)

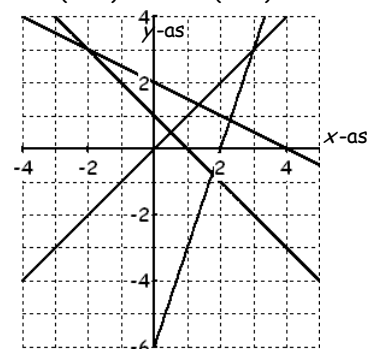
42a  $x = 0$  en  $y = 3$  invullen in  $x + 4y = 12$  geeft  $0 + 4 \cdot 3 = 12$  (klopt).

42b  $x = 4$  invullen in / geeft  $y = -\frac{1}{4} \cdot 4 + 3 = -1 + 3 = 2 \Rightarrow (4, 2)$  ligt op /.

42c  $y = -\frac{1}{4}x + 3 \Rightarrow 4y = -x + 12 \Rightarrow x + 4y = 12$ .

43

$3x - y = 6$	$x + y = 1$	$x - y = 0$	$x + 2y = 4$
$\begin{array}{l l} x & 0 & 2 \\ y & -6 & 0 \end{array}$	$\begin{array}{l l} x & 0 & 1 \\ y & 1 & 0 \end{array}$	$\begin{array}{l l} x & 0 & 1 \\ y & 0 & 1 \end{array}$	$\begin{array}{l l} x & 4 & 0 \\ y & 0 & 2 \end{array}$



44a  $y = 0 \Rightarrow 4x = 24 \Rightarrow x = 6$ ; dus snijpunt met de  $x$ -as:  $(6, 0)$ .  
 $x = 0 \Rightarrow -3y = 24 \Rightarrow y = -8$ ; dus snijpunt met de  $y$ -as:  $(0, -8)$ .

44b  $4 \cdot 8 - 3 \cdot 3 \neq 24 \Rightarrow (8, 3)$  ligt niet op  $l$ .  
 $4 \cdot 18 - 3 \cdot 16 = 24 \Rightarrow (18, 16)$  ligt op  $l$ .  
 $4 \cdot -30 - 3 \cdot -48 = 24 \Rightarrow (-30, -48)$  ligt op  $l$ .

$$\begin{array}{r} 4 \cdot 8 - 3 \cdot 3 \\ 4 \cdot 18 - 3 \cdot 16 \\ 4 \cdot -30 - 3 \cdot -48 \end{array} \begin{array}{l} 23 \\ 24 \\ 24 \end{array}$$

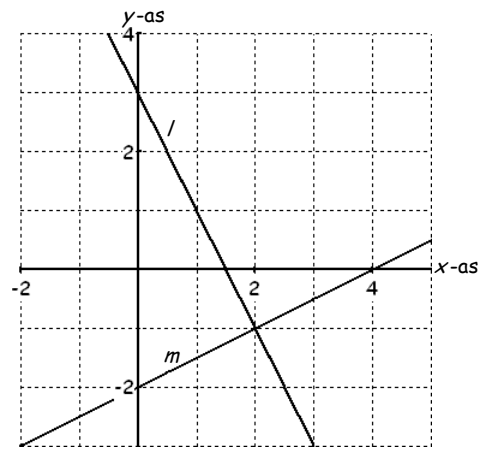
44c  $4 \cdot 16 - 3 \cdot p = 24 \Rightarrow -3p = -40 \Rightarrow p = \frac{40}{3} = 13\frac{1}{3}$ .

$$\begin{array}{r} 24 - 4 \cdot 16 \\ \text{Ans} \div -3 \end{array} \begin{array}{l} -40 \\ 13.33333333 \end{array}$$

44d  $4 \cdot q - 3 \cdot 48 = 24 \Rightarrow 4q = 168 \Rightarrow q = 42$ .

$$\begin{array}{r} 24 + 3 \cdot 48 \\ \text{Ans} \div 4 \end{array} \begin{array}{l} 168 \\ 42 \end{array}$$

45a  $l: 2x + y = 3$  gaat door  $(0, 3)$  en  $(1, 1)$ ;  
 $m: x - 2y = 4$  gaat door  $(0, -2)$  en  $(4, 0)$ .  
 (de grafieken van de lijnen in de figuur hiernaast)



45b Het snijpunt is  $(2, -1)$ .

45c  $x = 2 \wedge y = -1$  is zowel oplossing van  $2x + y = 3$  als van  $x - 2y = 4$ .

46a 
$$\begin{cases} 5x - 4y = -8 \\ -x + 4y = -12 \end{cases} +$$
  

$$\begin{array}{r} 4x \\ \hline 4x = -20 \\ x = -5 \end{array}$$
  

$$\begin{cases} x = -5 \\ -x + 4y = -12 \end{cases} \Rightarrow \begin{cases} 5 + 4y = -12 \\ 4y = -17 \\ y = -\frac{17}{4} = -4\frac{1}{4} \end{cases}$$

46b 
$$\begin{cases} -2x + y = 7 \\ -2x + 3y = -1 \end{cases} -$$
  

$$\begin{array}{r} -2y = 8 \\ y = -4 \end{array}$$
  

$$\begin{cases} y = -4 \\ -2x + y = 7 \end{cases} \Rightarrow \begin{cases} -2x - 4 = 7 \\ -2x = 11 \\ x = -5\frac{1}{2} \end{cases}$$

46c 
$$\begin{cases} -x - 3y = -8 \\ -2x + 3y = -1 \end{cases} +$$
  

$$\begin{array}{r} -3x \\ \hline -3x = -9 \\ x = 3 \end{array}$$
  

$$\begin{cases} x = 3 \\ -2x + 3y = -1 \end{cases} \Rightarrow \begin{cases} -6 + 3y = -1 \\ 3y = 5 \\ y = \frac{5}{3} = 1\frac{2}{3} \end{cases}$$

47a 
$$\begin{cases} 3x - 4y = 7 \\ 2x + 3y = 16 \end{cases} +$$
  

$$\begin{array}{r} 5x - y = 23 \end{array}$$
  
 Nee, er is geen variabele geëlimineerd.

47b 
$$\begin{cases} 3x - 4y = 7 \\ 2x + 3y = 16 \end{cases} -$$
  

$$\begin{array}{r} x - 7y = -9 \end{array}$$
  
 Nee, er is geen variabele geëlimineerd.

48a 
$$\begin{cases} 3x + 5y = -7 \\ 2x + y = 0 \end{cases} \begin{array}{l} | \\ 5 \end{array}$$
  

$$\begin{array}{r} 3x + 5y = -7 \\ 10x + 5y = 0 \\ \hline -7x = -7 \\ x = 1 \end{array}$$
  

$$\begin{cases} x = 1 \\ 2x + y = 0 \end{cases} \Rightarrow \begin{cases} 2 + y = 0 \\ y = -2 \end{cases}$$

48b 
$$\begin{cases} 2x - 4y = 6 \\ 3x - y = 19 \end{cases} \begin{array}{l} | \\ 4 \end{array}$$
  

$$\begin{array}{r} 2x - 4y = 6 \\ 12x - 4y = 76 \\ \hline -10x = -70 \\ x = 7 \end{array}$$
  

$$\begin{cases} x = 7 \\ 3x - y = 19 \end{cases} \Rightarrow \begin{cases} 21 - y = 19 \\ 2 = y \end{cases}$$

48c 
$$\begin{cases} 4x + y = 13 \\ x - 2y = 1 \end{cases} \begin{array}{l} | \\ 2 \end{array}$$
  

$$\begin{array}{r} 8x + 2y = 26 \\ x - 2y = 1 \\ \hline 9x = 27 \\ x = 3 \end{array}$$
  

$$\begin{cases} x = 3 \\ 4x + y = 13 \end{cases} \Rightarrow \begin{cases} 12 + y = 13 \\ y = 1 \end{cases}$$

49a 
$$\begin{cases} 5x + 2y = 69 \\ x + 3y = -7 \end{cases} \begin{array}{l} | \\ 5 \end{array}$$
  

$$\begin{array}{r} 5x + 2y = 69 \\ 5x + 15y = -35 \\ \hline -13y = 104 \\ y = -8 \end{array}$$
  

$$\begin{cases} y = -8 \\ x + 3y = -7 \end{cases} \Rightarrow \begin{cases} x - 24 = -7 \\ x = 17 \end{cases}$$

49b 
$$\begin{cases} 2x - 5y = -19 \\ 5x + 4y = 35 \end{cases} \begin{array}{l} | \\ 4 \end{array}$$
  

$$\begin{array}{r} 2x - 5y = -19 \\ 8x - 20y = -76 \\ 25x + 20y = 175 \\ \hline 33x = 99 \\ x = 3 \end{array}$$
  

$$\begin{cases} x = 3 \\ 5x + 4y = 35 \end{cases} \Rightarrow \begin{cases} 15 + 4y = 35 \\ 4y = 20 \\ y = 5 \end{cases}$$

49c 
$$\begin{cases} 0,8x + 0,2y = 1 \\ 0,3x - 0,3y = 1,5 \end{cases} \begin{array}{l} | \\ 30 \\ 20 \end{array}$$
  

$$\begin{array}{r} 24x + 6y = 30 \\ 6x - 6y = 30 \\ \hline 30x = 60 \\ x = 2 \end{array}$$
  

$$\begin{cases} x = 2 \\ 6x - 6y = 30 \end{cases} \Rightarrow \begin{cases} 12 - 6y = 30 \\ -6y = 18 \\ y = -3 \end{cases}$$

50 
$$\begin{cases} 3x - 2y = -12 \\ x + 4y = 38 \end{cases} \begin{array}{l} | \\ 2 \\ 1 \end{array}$$
  

$$\begin{array}{r} 6x - 4y = -24 \\ x + 4y = 38 \\ \hline 7x = 14 \\ x = 2 \end{array}$$
  

$$\begin{cases} x = 2 \\ x + 4y = 38 \end{cases} \Rightarrow \begin{cases} 2 + 4y = 38 \\ 4y = 36 \\ y = 9 \end{cases}$$

51ab  $x = 1 \wedge y = -2$  invullen:  
 $-2 = 1^2 + b \cdot 1 + c$   
 $-2 = 1 + b + c$   
 $-3 = b + c$   
 $x = 2 \wedge y = 3$  invullen:  
 $3 = 2^2 + b \cdot 2 + c$   
 $3 = 4 + 2b + c$   
 $-1 = 2b + c$

51c 
$$\begin{cases} b + c = -3 \\ 2b + c = -1 \end{cases} -$$
  

$$\begin{array}{r} -b \\ \hline -b = -2 \\ b = 2 \end{array}$$
  

$$\begin{cases} b = 2 \\ b + c = -3 \end{cases} \Rightarrow \begin{cases} 2 + c = -3 \\ c = -5 \end{cases}$$

52 (1, 8) op parabool  $\Rightarrow 8 = a \cdot 1 + c$ ;  
(2, 17) op parabool  $\Rightarrow 17 = a \cdot 4 + c$ .

$$\begin{aligned} &\begin{cases} a+c=8 \\ 4a+c=17 \end{cases} \\ &\quad \underline{-3a = -9} \\ &\quad a=3 \\ &\begin{cases} a+c=8 \\ a=3 \end{cases} \Rightarrow 3+c=8 \\ &\quad c=5. \end{aligned}$$

53 (2, 8) op  $k \Rightarrow 2a + b = 8$ ;  
(2, 8) op  $l \Rightarrow 2b + a = 8$ .

$$\begin{aligned} &\begin{cases} 2a+b=8 & | -2 \\ a+2b=8 & | 1 \end{cases} \\ &\quad \underline{-4a-2b=-16} \\ &\quad a+2b=8 \\ &\quad \underline{-3a = -8} \\ &\quad a = \frac{8}{3} \\ &\begin{cases} a = \frac{8}{3} \\ 2a+b=8 \end{cases} \Rightarrow \frac{16}{3} + b = 8 \Rightarrow b = \frac{24}{3} - \frac{16}{3} = \frac{8}{3} = 2\frac{2}{3}. \end{aligned}$$

54a (2, -1) op parabool  $\Rightarrow -1 = 4 + 2p + q$ ;  
(2, -1) op lijn  $\Rightarrow -1 = 4p - q$ .

$$\begin{aligned} &\begin{cases} 2p+q=-5 \\ 4p-q=-1 \end{cases} \\ &\quad \underline{6p = -6} \\ &\quad p = -1 \\ &\begin{cases} 2p+q=-5 \\ p=-1 \end{cases} \Rightarrow -2+q=-5 \\ &\quad q = -3. \end{aligned}$$

54b De parabool  $y = x^2 - x - 3$  snijden met de lijn  $y = -2x + 3$ .

$$\begin{aligned} &x^2 - x - 3 = -2x + 3 \\ &x^2 + x - 6 = 0 \\ &(x+3) \cdot (x-2) = 0 \\ &\begin{cases} x = -3 \\ y = -2 \cdot (-3) + 3 = 9 \end{cases} \vee \begin{cases} x = 2 \text{ (was gegeven)} \\ y = -2 \cdot 2 + 3 = -1. \end{cases} \end{aligned}$$

55 (-2, -10) op parabool  $\Rightarrow -10 = a \cdot 4 + b \cdot (-2) + c$  ❶;  
(0, 4) op parabool  $\Rightarrow 4 = c$  ❷;  
(3, 5) op parabool  $\Rightarrow 5 = a \cdot 9 + b \cdot 3 + c$  ❸.  
❷ invullen in ❶ en ❸ geeft:  
 $-10 = 4a - 2b + 4 \Rightarrow 4a - 2b = -14 \Rightarrow 2a - b = -7$  en  
 $5 = 9a + 3b + 4 \Rightarrow 9a + 3b = 1$ .

$$\begin{aligned} &\begin{cases} 2a-b=-7 & | 3 \\ 9a+3b=1 & | 1 \end{cases} \\ &\quad \underline{6a-3b=-21} \\ &\quad 9a+3b=1 \\ &\quad \underline{15a = -20} \\ &\quad a = -\frac{4}{3} \\ &\begin{cases} 2a-b=-7 \\ a = -\frac{4}{3} \end{cases} \Rightarrow -\frac{8}{3} - b = -7 \\ &\quad -b = -\frac{21}{3} + \frac{8}{3} = -\frac{13}{3} \Rightarrow b = 4\frac{1}{3}. \end{aligned}$$

56  $\begin{cases} 2x+3y=12 \\ y=4x-10 \end{cases}$

$$\begin{aligned} &\begin{cases} 2x+3y=12 & | 1 \\ -4x+y=-10 & | -3 \end{cases} \\ &\quad \underline{12x-3y=30} \\ &\quad 14x = 42 \\ &\quad x = 3 \\ &\begin{cases} x = 3 \\ y = 4x - 10 \end{cases} \Rightarrow y = 4 \cdot 3 - 10 = 2. \end{aligned}$$

57a  $\begin{cases} 2x+2y=9 & \text{❶} \\ y=4x-3 & \text{❷} \end{cases}$   
❷ in ❶ geeft:  $2x + 2 \cdot (4x - 3) = 9$   
 $2x + 8x - 6 = 9$   
 $10x = 15$   
 $x = 1,5$  in ❷  
 $y = 4 \cdot 1,5 - 3 = 3$ .

57b  $\begin{cases} y = \frac{1}{2}x + 1 & \text{❶} \\ 3x + 6y = 8 & \text{❷} \end{cases}$   
❶ in ❷ geeft:  $3x + 6 \cdot (\frac{1}{2}x + 1) = 8$   
 $3x + 3x + 6 = 8$   
 $6x = 2$   
 $x = \frac{1}{3}$  in ❶  
 $y = \frac{1}{2} \cdot \frac{1}{3} + 1 = 1\frac{1}{6}$ .

57c  $\begin{cases} x = 5y - 3 & \text{❶} \\ 3x + 4y = 29 & \text{❷} \end{cases}$   
❶ in ❷ geeft:  $3 \cdot (5y - 3) + 4y = 29$   
 $15y - 9 + 4y = 29$   
 $19y = 38$   
 $y = 2$  in ❶  
 $x = 5 \cdot 2 - 3 = 7$ .

58a  $\begin{cases} y = x^2 - 3 & \text{❶} \\ x - y = -3 & \text{❷} \end{cases}$   
❶ in ❷ geeft:  $x - (x^2 - 3) = -3$   
 $x - x^2 + 3 = -3$   
 $0 = x^2 - x - 6$   
 $0 = (x-3) \cdot (x+2)$   
 $\begin{cases} x = 3 \text{ in ❶} \\ y = 9 - 3 = 6 \end{cases} \vee \begin{cases} x = -2 \text{ in ❶} \\ y = 4 - 3 = 1. \end{cases}$

58b  $\begin{cases} x^2 + y^2 = 25 \\ 3x + y = 5 \end{cases} \Rightarrow \begin{cases} x^2 + y^2 = 25 & \text{❶} \\ y = -3x + 5 & \text{❷} \end{cases}$   
❷ in ❶ geeft:  $x^2 + (-3x + 5)^2 = 25$   
 $x^2 + 9x^2 - 15x - 15x + 25 = 25$   
 $10x^2 - 30x = 0$   
 $10x \cdot (x - 3) = 0$   
 $\begin{cases} x = 0 \text{ in ❷} \\ y = 0 + 5 = 5 \end{cases} \vee \begin{cases} x = 3 \text{ in ❷} \\ y = -9 + 5 = -4. \end{cases}$

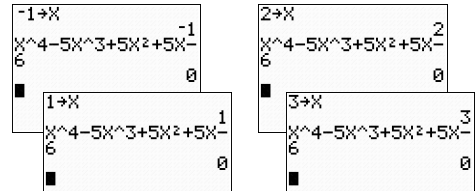
58c  $\begin{cases} x^2 + y^2 = 20 \\ xy = 8 \end{cases} \Rightarrow \begin{cases} x^2 + y^2 = 20 & \textcircled{1} \\ y = \frac{8}{x} & \textcircled{2} \end{cases}$        $\textcircled{2}$  in  $\textcircled{1}$  geeft:  $x^2 + \left(\frac{8}{x}\right)^2 = 20$   
 $x^2 + \frac{64}{x^2} - 20 = 0$  (vermenigvuldigen met  $x^2$ )  
 $x^4 - 20x^2 + 64 = 0$  (stel  $x^2 = t$ )  
 $t^2 - 20t + 64 = 0$   
 $(t-16) \cdot (t-4) = 0$   
 $t = x^2 = 16 \vee t = x^2 = 4$

$\begin{cases} x = 4 \text{ in } \textcircled{2} \\ y = \frac{8}{4} = 2 \end{cases} \vee \begin{cases} x = -4 \text{ in } \textcircled{2} \\ y = \frac{8}{-4} = -2 \end{cases} \vee \begin{cases} x = 2 \text{ in } \textcircled{2} \\ y = \frac{8}{2} = 4 \end{cases} \vee \begin{cases} x = -2 \text{ in } \textcircled{2} \\ y = \frac{8}{-2} = -4 \end{cases}$

59  $x^4 - x^2 - 2 = 0$  kun je algebraïsch oplossen door  $x^2 = t$  te stellen. Je krijgt  $(t-2) \cdot (t+1) = 0$   
 $x^4 - x^3 - 2 = 0$  kun je niet algebraïsch oplossen.  
 $x^4 - x^3 - 2x = 0 \Rightarrow x \cdot (x^3 - x^2 - 2) = 0$  kun je niet algebraïsch oplossen.  
 $x^4 - x^3 - 2x^2 = 0 \Rightarrow x^2 \cdot (x^2 - x - 2) = 0 \Rightarrow x^2 \cdot (x-2) \cdot (x+1) = 0$  kun je algebraïsch oplossen.

60a  $x = -1, x = 1, x = 2$  en  $x = 3$ .

60b  $x = -1$  geeft  $y = (-1)^4 - 5 \cdot (-1)^3 + 5 \cdot (-1)^2 + 5 \cdot -1 - 6 = 0$  (klopt),  
 $x = 1$  geeft  $y = 1^4 - 5 \cdot 1^3 + 5 \cdot 1^2 + 5 \cdot 1 - 6 = 0$  (klopt),  
 $x = 2$  geeft  $y = 2^4 - 5 \cdot 2^3 + 5 \cdot 2^2 + 5 \cdot 2 - 6 = 0$  (klopt) en  
 $x = 3$  geeft  $y = 3^4 - 5 \cdot 3^3 + 5 \cdot 3^2 + 5 \cdot 3 - 6 = 0$  (klopt).

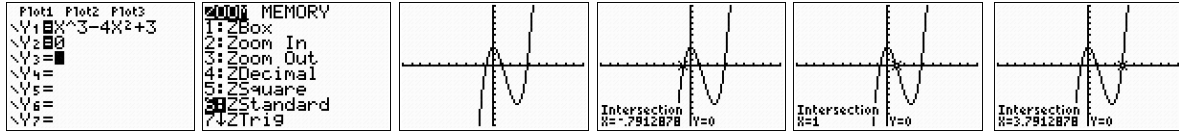


61a  $x = -2, x = 2$  en  $x = 4$ .

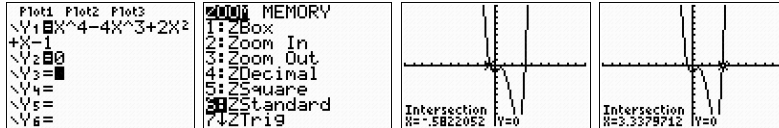
61b  $x = -2 \vee x = 2 \vee x = 4$ .

\*\*\* **Neem GR - practicum 2 door.** (uitwerkingen aan het eind)

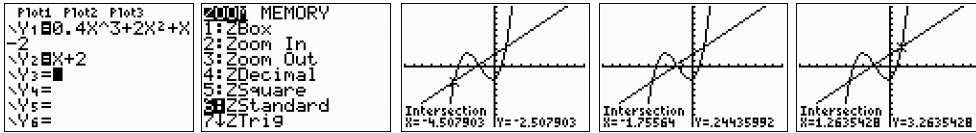
62a  $x^3 - 4x^2 + 3 = 0$  (intersect met ZStandard)  $\Rightarrow x \approx -0,79 \vee x = 1 \vee x \approx 3,79$ .



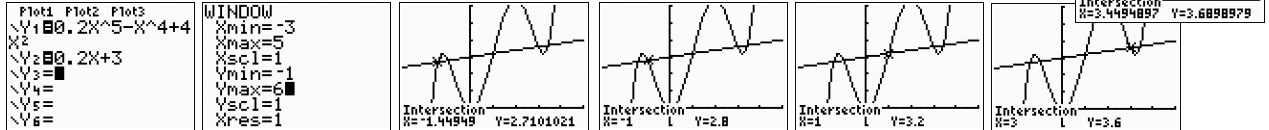
62b  $x^4 - 4x^3 + 2x^2 + x - 1 = 0$  (intersect met ZStandard)  $\Rightarrow x \approx -0,58 \vee x \approx 3,34$ .



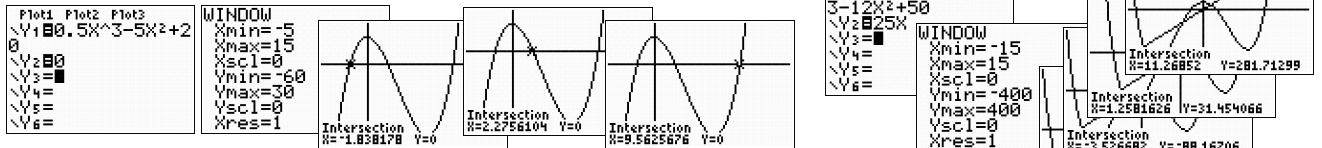
62c  $0,4x^3 + 2x^2 + x - 2 = x + 2$  (intersect)  $\Rightarrow x \approx -4,51 \vee x \approx -1,76 \vee x \approx 1,26$ .



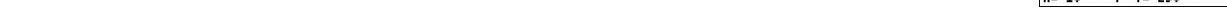
62d  $0,2x^5 - x^4 + 4x^2 = 0,2x + 3$  (intersect)  $\Rightarrow x \approx -1,45 \vee x = -1 \vee x = 1 \vee x = 3 \vee x \approx 3,45$ .



63a  $0,5x^3 - 5x^2 + 20 = 0$  (intersect)  $\Rightarrow x \approx -1,84 \vee x \approx 2,28 \vee x \approx 9,56$ .

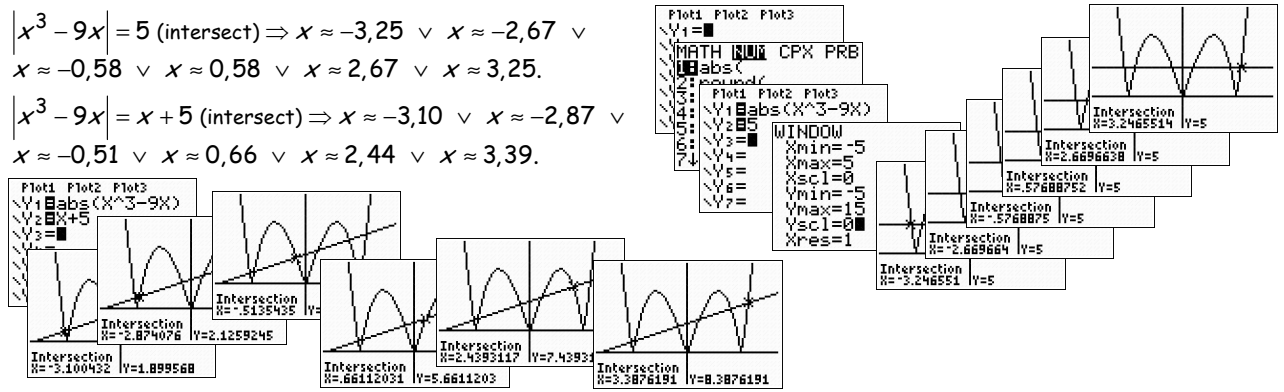


63b  $0,1x^4 + 0,1x^3 - 12x^2 + 50 = 25x$  (intersect)  $\Rightarrow x = -10 \vee x \approx -3,53 \vee x \approx 1,26 \vee x \approx 11,27$ .

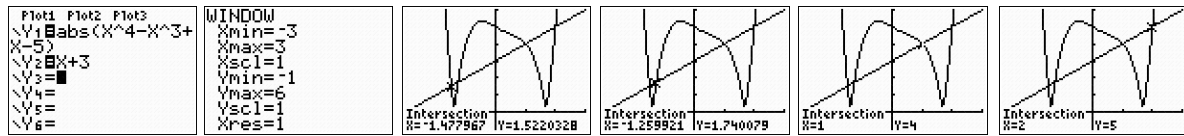


64a  $|x^3 - 9x| = 5$  (intersect)  $\Rightarrow x \approx -3,25 \vee x \approx -2,67 \vee$   
 $x \approx -0,58 \vee x \approx 0,58 \vee x \approx 2,67 \vee x \approx 3,25.$

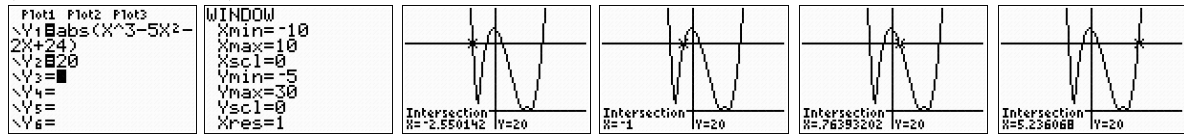
64b  $|x^3 - 9x| = x + 5$  (intersect)  $\Rightarrow x \approx -3,10 \vee x \approx -2,87 \vee$   
 $x \approx -0,51 \vee x \approx 0,66 \vee x \approx 2,44 \vee x \approx 3,39.$



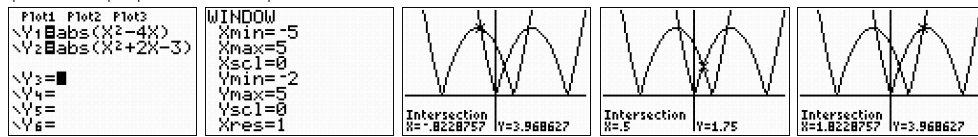
65a  $|x^4 - x^3 + x - 5| = x + 3$  (intersect)  $\Rightarrow x \approx -1,48 \vee x \approx -1,26 \vee x = 1 \vee x = 2.$



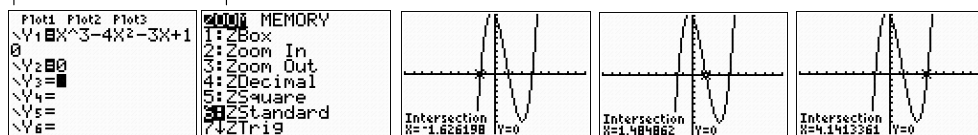
65b  $|x^3 - 5x^2 - 2x + 24| = 20$  (intersect)  $\Rightarrow x \approx -2,55 \vee x = -1 \vee x \approx 0,76 \vee x \approx 5,24.$



65c  $|x^2 - 4x| = |x^2 + 2x - 3|$  (intersect)  $\Rightarrow x \approx -0,82 \vee x = 0,5 \vee x \approx 1,82.$

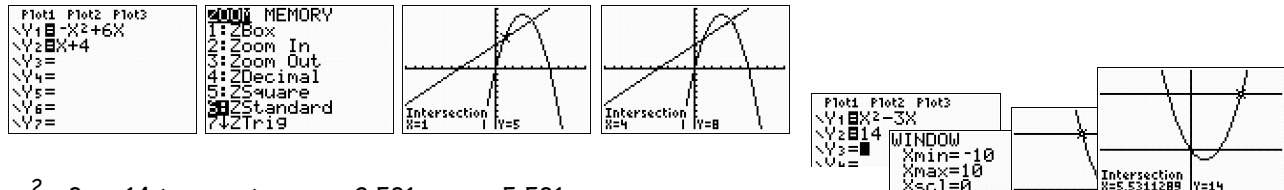


65d  $|x^3 - 4x^2 - 3x + 10| = 0$  (intersect lukt niet)  $\Rightarrow x^3 - 4x^2 - 3x + 10 = 0$  (intersect)  $\Rightarrow x \approx -1,63 \vee x \approx 1,48 \vee x \approx 4,14.$



66a  $-x^2 + 6x = x + 4$  (intersect)  $\Rightarrow x = 1 \vee x = 4.$

66b Uit de plot volgt nu:  $1 < x < 4.$  (voor  $x$  tussen 1 en 4)



67a  $x^2 - 3x = 14$  (intersect)  $\Rightarrow x \approx -2,531 \vee x \approx 5,531.$

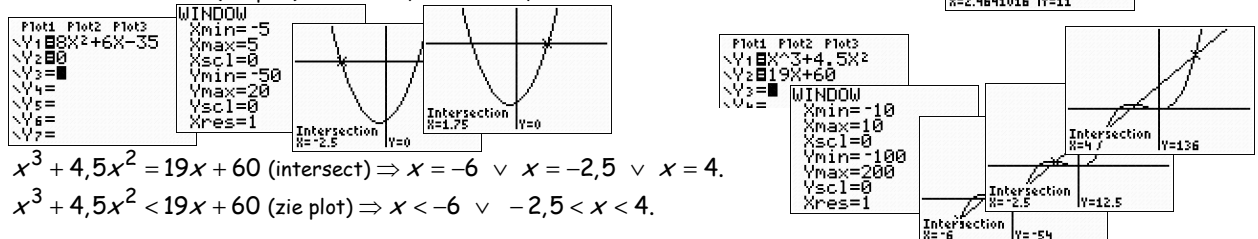
$x^2 - 3x \leq 14$  (zie plot)  $\Rightarrow -2,531 \leq x \leq 5,531.$

67b  $x^2 + 2x = 11$  (intersect)  $\Rightarrow x \approx -4,464 \vee x \approx 2,464.$

$x^2 + 2x > 11$  (zie plot)  $\Rightarrow x < -4,464 \vee x > 2,464.$

67c  $8x^2 + 6x - 35 = 0$  (intersect)  $\Rightarrow x = -2,5 \vee x = 1,75.$

$8x^2 + 6x - 35 \geq 0$  (zie plot)  $\Rightarrow x \leq -2,5 \vee x \geq 1,75.$



67d  $x^3 + 4,5x^2 = 19x + 60$  (intersect)  $\Rightarrow x = -6 \vee x = -2,5 \vee x = 4.$

$x^3 + 4,5x^2 < 19x + 60$  (zie plot)  $\Rightarrow x < -6 \vee -2,5 < x < 4.$

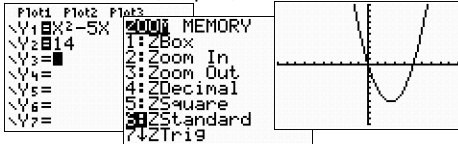
68a  $x^2 - 5x = 14$  (niet met intersect !!!)

$x^2 - 5x - 14 = 0$

$(x-7) \cdot (x+2) = 0$

$x = 7 \vee x = -2$

$x^2 - 5x < 14$  (zie plot)  $\Rightarrow -2 < x < 7$ .



68b  $2x^2 - 3x = 2$  (niet intersect !!!)

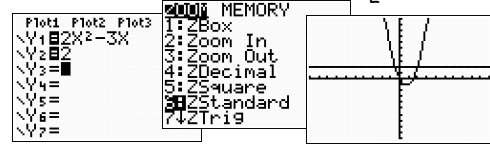
$2x^2 - 3x - 2 = 0$  ( $a = 2, b = -3$  en  $c = -2$ )

$D = (-3)^2 - 4 \cdot 2 \cdot (-2) = 9 + 16 = 25$

$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{3 \pm \sqrt{25}}{2 \cdot 2} = \frac{3 \pm 5}{4}$

$x = \frac{3+5}{4} = \frac{8}{4} = 2 \vee x = \frac{3-5}{4} = \frac{-2}{4} = -\frac{1}{2}$ .

$2x^2 - 3x \geq 2$  (zie plot)  $\Rightarrow x \leq -\frac{1}{2} \vee x \geq 2$ .



68c  $x^2 - 4x = -x^2 - 5x + 6$  (niet intersect)

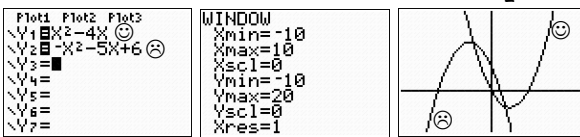
$2x^2 + x - 6 = 0$  ( $a = 2, b = 1$  en  $c = -6$ )

$D = 1^2 - 4 \cdot 2 \cdot (-6) = 1 + 48 = 49$

$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{49}}{2 \cdot 2} = \frac{-1 \pm 7}{4}$

$x = \frac{-1+7}{4} = \frac{6}{4} = 1\frac{1}{2} \vee x = \frac{-1-7}{4} = \frac{-8}{4} = -2$ .

$x^2 - 4x \leq -x^2 - 5x + 6$  (zie plot)  $\Rightarrow -2 \leq x \leq 1\frac{1}{2}$ .



68d  $x^3 + 2x^2 = 3x$  (niet intersect)

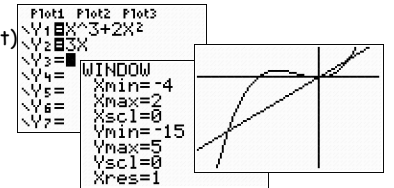
$x^3 + 2x^2 - 3x = 0$

$x \cdot (x^2 + 2x - 3) = 0$

$x \cdot (x+3) \cdot (x-1) = 0$

$x = 0 \vee x = -3 \vee x = 1$ .

$x^3 + 2x^2 > 3x$  (zie plot)  $\Rightarrow -3 < x < 0 \vee x > 1$ .



69a  $0,1x^3 - 2x^2 + 8x + 10 = -x + 15$  (intersect)  $\Rightarrow x \approx 0,65 \vee x \approx 5,66 \vee x \approx 13,69$ .

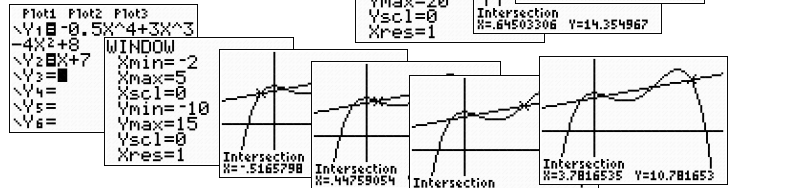
$0,1x^3 - 2x^2 + 8x + 10 \geq -x + 15$  (zie plot)  $\Rightarrow 0,65 \leq x \leq 5,66 \vee x \geq 13,69$ .

69b  $-0,5x^4 + 3x^3 - 4x^2 + 8 = x + 7$  (intersect)

$x \approx -0,52 \vee x \approx 0,45 \vee x \approx 2,29 \vee x \approx 3,78$ .

$-0,5x^4 + 3x^3 - 4x^2 + 8 \geq x + 7$  (zie plot)

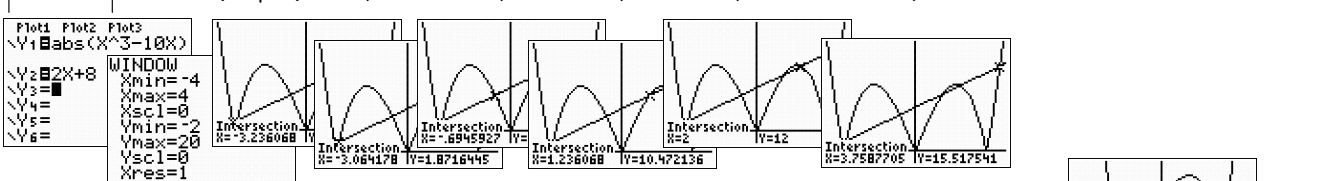
$-0,52 \leq x \leq 0,45 \vee 2,29 \leq x \leq 3,78$ .



69c  $|x^3 - 10x| = 2x + 8$  (intersect)

$x \approx -3,24 \vee x \approx -3,06 \vee x \approx -0,69 \vee x \approx 1,24 \vee x = 2 \vee x \approx 3,76$ .

$|x^3 - 10x| \leq 2x + 8$  (zie plot)  $\Rightarrow -3,24 \leq x \leq -3,06 \vee -0,69 \leq x \leq 1,24 \vee 2 \leq x \leq 3,76$ .

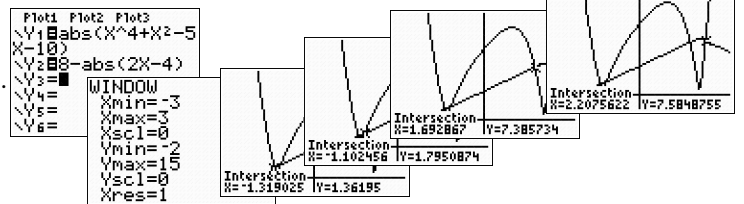


69d  $|x^4 + x^2 - 5x - 10| = 8 - |2x - 4|$  (intersect)

$x \approx -1,32 \vee x \approx -1,10 \vee x \approx 1,69 \vee x \approx 2,21$ .

$|x^4 + x^2 - 5x - 10| \leq 8 - |2x - 4|$  (zie plot)

$-1,32 \leq x \leq -1,10 \vee 1,69 \leq x \leq 2,21$ .



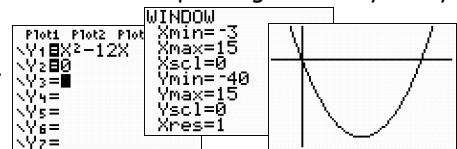
70a  $x^2 + px + p = 0$  ( $a = 1, b = p$  en  $c = p$ )  $\Rightarrow D = p^2 - 4 \cdot 1 \cdot p = p^2 - 4p$ .

70b Twee oplossingen  $\Rightarrow D = p^2 - 4p > 0$ .

71a  $x^2 + px + 3p = 0$  ( $a = 1, b = p$  en  $c = 3p$ )  $\Rightarrow D = p^2 - 4 \cdot 1 \cdot 3p = p^2 - 12p$ .

$D = 0 \Rightarrow p^2 - 12p = p \cdot (p - 12) = 0$  (of intersect)  $\Rightarrow p = 0 \vee p = 12$ .

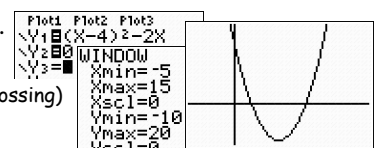
Twee oplossingen  $\Rightarrow D > 0$  (zie plot)  $\Rightarrow p < 0 \vee p > 12$ .



71b  $px^2 + (p-4) \cdot x + 0,5 = 0$  ( $a = p \neq 0, b = p-4$  en  $c = 0,5$ )  $\Rightarrow D = (p-4)^2 - 4 \cdot p \cdot 0,5$ .

$D = 0 \Rightarrow p^2 - 10p + 16 = (p-8) \cdot (p-2) = 0$  (of intersect)  $\Rightarrow p = 8 \vee p = 2$ .

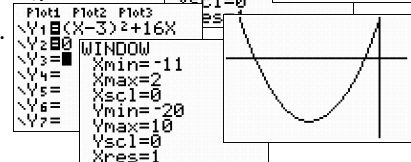
Twee oplossingen  $\Rightarrow D > 0$  (zie plot)  $\Rightarrow p < 0 \vee 0 < p < 2 \vee p > 8$ . ( $p = 0$  geeft 1 oplossing)



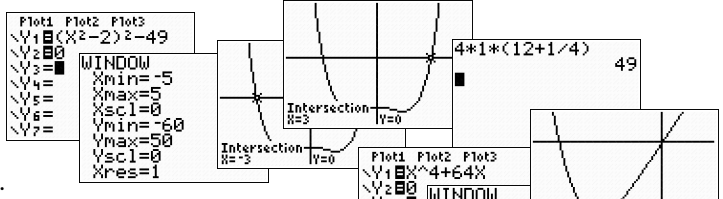
71c  $px^2 + (p-3) \cdot x - 4 = 0$  ( $a = p \neq 0, b = p-3$  en  $c = -4$ )  $\Rightarrow D = (p-3)^2 - 4 \cdot p \cdot (-4)$ .

$D = 0 \Rightarrow p^2 + 10p + 9 = (p+9) \cdot (p+1) = 0$  (of intersect)  $\Rightarrow p = -9 \vee p = -1$ .

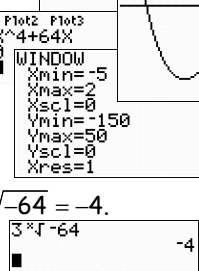
Geen oplossingen  $\Rightarrow D < 0$  (zie plot)  $\Rightarrow -9 < p < -1$ . ( $p = 0$  geeft 1 oplossing)



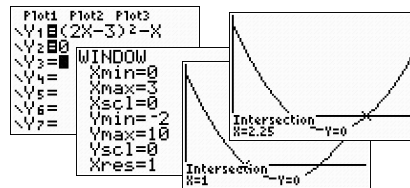
72a  $x^2 + (p^2 - 2) \cdot x + 12\frac{1}{4} = 0$  ( $a = 1$ ,  $b = p^2 - 2$  en  $c = 12\frac{1}{4}$ ).  
 $D = (p^2 - 2)^2 - 4 \cdot 1 \cdot 12\frac{1}{4} = (p^2 - 2)^2 - 49$ .  
 $D = 0 \Rightarrow (p^2 - 2)^2 = 49 \Rightarrow p^2 - 2 = \pm 7 \Rightarrow p^2 = 2 \pm 7 \Rightarrow$   
 $p^2 = 9 \vee p^2 = -5$  (kan niet)  $\Rightarrow$  (of met intersect)  $p = \pm 3$ .  
 Twee oplossingen  $\Rightarrow D > 0$  (zie plot)  $\Rightarrow p < -3 \vee p > 3$ .



72b  $px^3 + p^2x^2 - 16x = x \cdot (px^2 + p^2x - 16) = 0 \Rightarrow x = 0 \vee px^2 + p^2x - 16 = 0$ .  
 Drie oplossingen als  $px^2 + p^2x - 16 = 0$  ( $a = p \neq 0$ ,  $b = p^2$  en  $c = -16$ ) twee oplossingen heeft.  
 $D = (p^2)^2 - 4 \cdot p \cdot -16 = p^4 + 64p$ .  
 $D = 0 \Rightarrow p^4 + 64p = p \cdot (p^3 + 64) = 0 \Rightarrow p = 0 \vee p^3 = -64 \Rightarrow$  (of met intersect)  $p = 0 \vee p = \sqrt[3]{-64} = -4$ .  
 Drie oplossingen  $\Rightarrow D > 0$  (zie plot)  $\Rightarrow p < -4 \vee p > 0$ .  
 ( $p = 0$  geeft  $-16x = 0 \Rightarrow x = 0 \Rightarrow 1$  oplossing)



72c  $px^3 + 2px^2 - 3x^2 + \frac{1}{4}x = px^3 + (2p - 3) \cdot x^2 + \frac{1}{4}x = x \cdot (px^2 + (2p - 3)x + \frac{1}{4}) = 0 \Rightarrow$   
 $x = 0 \vee px^2 + (2p - 3)x + \frac{1}{4} = 0$ .  
 Eén oplossing als  $px^2 + (2p - 3)x + \frac{1}{4} = 0$  ( $a = p \neq 0$ ,  $b = 2p - 3$  en  $c = \frac{1}{4}$ ) geen oplossing heeft.  
 $D = (2p - 3)^2 - 4 \cdot p \cdot \frac{1}{4} = (2p - 3)^2 - p$ .  
 $D = 0 \Rightarrow (2p - 3)^2 - p = 0$  (exact of intersect)  $\Rightarrow p = 1 \vee p = 2\frac{1}{4}$ .  
 Eén oplossing  $\Rightarrow D < 0$  (zie plot)  $\Rightarrow 1 < p < 2\frac{1}{4}$ .  
 ( $p = 0$  geeft  $-3x^2 + \frac{1}{4}x = x \cdot (-3x + \frac{1}{4}) = 0 \Rightarrow 2$  oplossingen)



Diagnostische toets

D1a  $\square$   $3x^2 - x = 0$   
 $x \cdot (3x - 1) = 0$   
 $x = 0 \vee 3x - 1 = 0$   
 $x = 0 \vee 3 = 1$   
 $x = 0 \vee x = \frac{1}{3}$ .

D1b  $\square$   $3x^2 - 9x = 12$   
 $3x^2 - 9x - 12 = 0$   
 $x^2 - 3x - 4 = 0$   
 $(x - 4) \cdot (x + 1) = 0$   
 $x = 4 \vee x = -1$ .

D1c  $\square$   $3x^2 - x = 2$   
 $3x^2 - x - 2 = 0$  ( $a = 3, b = -1$  en  $c = -2$ )  
 $D = (-1)^2 - 4 \cdot 3 \cdot -2 = 1 + 24 = 25$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{1 \pm \sqrt{25}}{2 \cdot 3} = \frac{1 \pm 5}{6}$   
 $x = \frac{1+5}{6} = \frac{6}{6} = 1 \vee x = \frac{1-5}{6} = \frac{-4}{6} = -\frac{2}{3}$ .

D1d  $\square$   $x^2 + 14 = 16$   
 $x^2 = 2$   
 $x = \pm\sqrt{2}$ .  
 $(x = \sqrt{2} \vee x = -\sqrt{2})$

D1e  $\square$   $(2x - 3)^2 = 81$   
 $2x - 3 = \pm\sqrt{81} = \pm 9$   
 $2x = 3 \pm 9$   
 $x = 1,5 \pm 4,5$   
 $x = 6 \vee x = -3$ .

D1f  $\square$   $(3x + 2) \cdot (x - 1) = 0$   
 $3x + 2 = 0 \vee x - 1 = 0$   
 $3x = -2 \vee x = 1$   
 $x = -\frac{2}{3} \vee x = 1$ .

D1g  $\square$   $x^2 = 7x + 13$   
 $x^2 - 7x - 13 = 0$  ( $a = 1, b = -7$  en  $c = -13$ )  
 $D = (-7)^2 - 4 \cdot 1 \cdot -13 = 49 + 52 = 101$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{7 \pm \sqrt{101}}{2 \cdot 1} = \frac{7 \pm \sqrt{101}}{2}$   
 $x = \frac{7 + \sqrt{101}}{2} \vee x = \frac{7 - \sqrt{101}}{2}$ .

D1h  $\square$   $(3x + 2) \cdot (x - 1) = (x + 5) \cdot x$   
 $3x^2 - 3x + 2x - 2 = x^2 + 5x$   
 $2x^2 - 6x - 2 = 0$   
 $x^2 - 3x - 1 = 0$  ( $a = 1, b = -3$  en  $c = -1$ )  
 $D = (-3)^2 - 4 \cdot 1 \cdot -1 = 9 + 4 = 13$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{3 \pm \sqrt{13}}{2 \cdot 1} = \frac{3 \pm \sqrt{13}}{2}$   
 $x = \frac{3 + \sqrt{13}}{2} \vee x = \frac{3 - \sqrt{13}}{2}$ .

D1i  $\square$   $(x + 2) \cdot (x + 2) = 3x + 7$   
 $x^2 + 2x + 2x + 4 = 3x + 7$   
 $x^2 + x - 3 = 0$  ( $a = 1, b = 1$  en  $c = -3$ )  
 $D = 1^2 - 4 \cdot 1 \cdot -3 = 1 + 12 = 13$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{13}}{2 \cdot 1} = \frac{-1 \pm \sqrt{13}}{2}$   
 $x = \frac{-1 + \sqrt{13}}{2} \vee x = \frac{-1 - \sqrt{13}}{2}$ .

D1j  $\square$   $(x - 3) \cdot (x - 3) - (x + 1) \cdot (x + 1) = (x - 4) \cdot (x - 4)$   
 $x^2 - 3x - 3x + 9 - (x^2 + x + x + 1) = x^2 - 4x - 4x + 16$   
 ~~$x^2 - 6x + 9 - 2x - 1 = x^2 - 8x + 16$~~   
 $0 = x^2 + 8$   
 $-8 = x^2$  (kan niet)  
 geen oplossingen.

D2a  $\square$   $2x^2 + 4x + p = 0$   
 ( $a = 2, b = 4$  en  $c = p$ )  
 $D = 4^2 - 4 \cdot 2 \cdot p = 16 - 8p < 0$   
 $-8p < -16$   
 $p > \frac{-16}{-8} = 2$ .

D2b  $\square$   $3x^2 + px + 27 = 0$   
 ( $a = 3, b = p$  en  $c = 27$ )  
 $D = p^2 - 4 \cdot 3 \cdot 27 = p^2 - 324 > 0$   
 $p^2 > 324 \odot$   
 $p < -18 \vee p > 18$ .

D2c  $\square$   $px^2 - 6x + 12 = 0$   
 ( $a = p \neq 0, b = -6$  en  $c = 12$ )  
 $D = (-6)^2 - 4 \cdot p \cdot 12 = 36 - 48p = 0$   
 $36 = 48p$   
 $\frac{36}{48} = \frac{3}{4} = p$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{6 \pm \sqrt{0}}{2 \cdot \frac{3}{4}} = \frac{6}{1,5} = \frac{12}{3} = 4$ ;  
 voor  $p = 0 \Rightarrow -6x + 12 = 0 \Rightarrow x = 2$ .

D3a  $\square$   $x = 2 \Rightarrow 2^2 + 4 \cdot 2 + p = 0 \Rightarrow 4 + 8 + p = 0 \Rightarrow p = -12$ ;  
 $x^2 + 4x - 12 = 0 \Rightarrow (x + 6) \cdot (x - 2) = 0 \Rightarrow x = -6 \vee x = 2$  (was bekend).

D3b  $\square$   $px^2 + 2x + 5 = 0$  ( $a = p \neq 0, b = 2$  en  $c = 5$ );  
 twee oplossingen  $\Rightarrow D = 2^2 - 4 \cdot p \cdot 5 = 4 - 20p > 0 \Rightarrow -20p > -4 \Rightarrow p < \frac{-4}{-20} = \frac{1}{5}$ .  
 ( $p = 0$  geeft een eerstegraadsvergelijking met één oplossing)

D4a  $\square$   $3x^3 + 5 = 86$   
 $3x^3 = 81$   
 $x^3 = 27$   
 $x = \sqrt[3]{27} = 3$ .

D4b  $\square$   $5x^4 - 6 = 9$   
 $5x^4 = 15$   
 $x^4 = 3$   
 $x = \pm\sqrt[4]{3}$ .

D4c  $\square$   $2x^3 + 19 = 5$   
 $2x^3 = -14$   
 $x^3 = -7$   
 $x = \sqrt[3]{-7}$ .

D4d  $\square$   $\frac{1}{2}(x + 2)^4 = \frac{1}{32}$   
 $(x + 2)^4 = \frac{1}{16}$   
 $x + 2 = \pm\sqrt[4]{\frac{1}{16}} = \pm\frac{1}{2}$   
 $x = -2 \pm \frac{1}{2}$   
 $x = -1\frac{1}{2} \vee x = -2\frac{1}{2}$ .

D4e  $\square$   $100 - (2x + 1)^5 = 68$   
 $32 = (2x + 1)^5$   
 $2x + 1 = \sqrt[5]{32} = 2$   
 $2x = 1$   
 $x = \frac{1}{2}$ .

D4f  $\square$   $(2x + 4)^3 = 10$   
 $2x + 4 = \sqrt[3]{10}$   
 $2x = -4 + \sqrt[3]{10}$   
 $x = -2 + \frac{1}{2} \cdot \sqrt[3]{10}$ .



D5a  $x^4 - 6x^2 + 5 = 0$  (stel  $x^2 = t$ )  
 $t^2 - 6t + 5 = 0$   
 $(t-5) \cdot (t-1) = 0$   
 $t = x^2 = 5 \vee t = x^2 = 1$   
 $x = \pm\sqrt{5} \vee x = \pm\sqrt{1} = \pm 1$ .

D5b  $5x^4 - 6x^2 + 1 = 0$  (stel  $x^2 = t$ )  
 $5t^2 - 6t + 1 = 0$  ( $a=5, b=-6$  en  $c=1$ )  
 $D = (-6)^2 - 4 \cdot 5 \cdot 1 = 36 - 20 = 16$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{6 \pm \sqrt{16}}{2 \cdot 5} = \frac{6 \pm 4}{10} \Rightarrow x^2 = \frac{6+4}{10} = 1 \vee x^2 = \frac{6-4}{10} = \frac{2}{10} = \frac{1}{5}$   
 $x = \pm\sqrt{1} = \pm 1 \vee x = \pm\sqrt{\frac{1}{5}}$ .

D5c  $x^4 - 6x^3 + 5x^2 = 0$   
 $x^2 \cdot (x^2 - 6x + 5) = 0$   
 $x^2 \cdot (x-5) \cdot (x-1) = 0$   
 $x = 0$  (dubbel)  $\vee x = 5 \vee x = 1$ .

D5d  $x^3 + 6x^2 + 2x = 0$   
 $x \cdot (x^2 + 6x + 2) = 0$   
 $x = 0 \vee x^2 + 6x + 2 = 0$  ( $a=1, b=6$  en  $c=2$ )  
 $D = 6^2 - 4 \cdot 1 \cdot 2 = 36 - 8 = 28 \Rightarrow x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-6 \pm \sqrt{28}}{2 \cdot 1} = \frac{-6 \pm \sqrt{28}}{2}$   
 $x = 0 \vee x = \frac{-6 + \sqrt{28}}{2} \vee x = \frac{-6 - \sqrt{28}}{2}$ .

D5e  $3x^6 + 3 = 10x^3$   
 $3x^6 - 10x^3 + 3 = 0$  (stel  $x^3 = t$ )  
 $3t^2 - 10t + 3 = 0$  ( $a=3, b=-10$  en  $c=3$ )  
 $D = (-10)^2 - 4 \cdot 3 \cdot 3 = 100 - 36 = 64$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{10 \pm \sqrt{64}}{2 \cdot 3} = \frac{10 \pm 8}{6} \Rightarrow x^3 = \frac{10+8}{6} = 3 \vee x^3 = \frac{10-8}{6} = \frac{2}{6} = \frac{1}{3}$   
 $x = \sqrt[3]{3} \vee x = \sqrt[3]{\frac{1}{3}}$ .

D5f  $x^8 + x^4 = 42$   
 $x^8 + x^4 - 42 = 0$  (stel  $x^4 = t$ )  
 $t^2 + t - 42 = 0$   
 $(t+7) \cdot (t-6) = 0$   
 $x^4 = -7$  (k.n.)  $\vee x^4 = 6$   
 $x = \pm\sqrt[4]{6}$ .

D6a  $|x^2 - 4| = 21$   
 $x^2 - 4 = 21 \vee x^2 - 4 = -21$   
 $x^2 = 25 \vee x^2 = -17$  (kan niet)  
 $x = \pm\sqrt{25} = \pm 5$ .

D6b  $|4x^3 - 5| = 17$   
 $4x^3 - 5 = 17 \vee 4x^3 - 5 = -17$   
 $4x^3 = 22 \vee 4x^3 = -12$   
 $x^3 = 5,5 \vee x^3 = -3$   
 $x = \sqrt[3]{5,5} \vee x = \sqrt[3]{-3}$ .

D7a  $\sqrt{3x+5} + 1 = 5$   
 $\sqrt{3x+5} = 4$  (kwadrateren)  
 $3x + 5 = 16$   
 $3x = 11$   
 $x = \frac{11}{3} = 3\frac{2}{3}$  (voldoet).

5-1  
Ans=2 4  
Ans=5 16  
11/3+X 11  
3,666666667  
sqrt(3X+5)+1 5

D7b  $3x = 5\sqrt{x+4}$  (kwadrateren)  
 $9x^2 = 25(x+4)$   
 $9x^2 - 25x - 100 = 0$  ( $a=9, b=-25$  en  $c=-100$ )  
 $D = (-25)^2 - 4 \cdot 9 \cdot -100 = 4225$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{25 \pm \sqrt{4225}}{2 \cdot 9} = \frac{25 \pm 65}{18}$   
 $x = \frac{25+65}{18} = 5$  (voldoet)  $\vee x = \frac{25-65}{18} = \frac{-40}{18} = -2\frac{2}{9}$  (voldoet niet).

(-25)^2-4\*9\*-100 4225  
sqrt(4225) 65  
(25+65)/18 5  
5+X 5  
3X-5sqrt(X+4) 0  
-40/18+X 2,222222222  
3X-5sqrt(X+4) -13,33333333

D7c  $x = \sqrt{x} + 6$   
 $x - 6 = \sqrt{x}$  (kwadrateren)  
 $x^2 - 6x - 6x + 36 = x$   
 $x^2 - 13x + 36 = 0$   
 $(x-9) \cdot (x-4) = 0$   
 $x = 9$  (voldoet)  $\vee x = 4$  (voldoet niet).

9+X 9  
sqrt(X)+6 9  
4+X 4  
sqrt(X)+6 8

D7d  $2x + 3\sqrt{x} = 2$   
 $3\sqrt{x} = 2 - 2x$  (kwadrateren)  
 $9x = 4 - 4x - 4x + 4x^2$   
 $0 = 4x^2 - 17x + 4$  ( $a=4, b=-17$  en  $c=4$ )  
 $D = (-17)^2 - 4 \cdot 4 \cdot 4 = 225$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{17 \pm \sqrt{225}}{2 \cdot 4} = \frac{17 \pm 15}{8}$   
 $x = \frac{17+15}{8} = \frac{32}{8} = 4$  (voldoet niet)  $\vee x = \frac{17-15}{8} = \frac{2}{8} = \frac{1}{4}$  (voldoet).

(-17)^2-4\*4\*4 225  
sqrt(225) 15  
(17+15)/8+X 4  
2X+3sqrt(X) 14  
(17-15)/8+X 2  
2X+3sqrt(X) 2

D8a  $x^3 - 189 = 20x\sqrt{x}$   
 $x^3 - 20x\sqrt{x} - 189 = 0$  (stel  $x\sqrt{x} = t$ )  
 $t^2 - 20t - 189 = 0$   
 $(t-27) \cdot (t+7) = 0$   
 $t = x\sqrt{x} = 27 \vee t = x\sqrt{x} = -7$  (k.n.) (kwadrateren)  
 $x^3 = 27^2 = 729$   
 $x = \sqrt[3]{729} = 9$  (voldoet).

-27\*7 -189  
27^2 729  
3\*sqrt(729)+X 9  
X\*sqrt(X) 27

D8b  $x^5 + 12 = 8x^2\sqrt{x}$   
 $x^5 - 8x^2\sqrt{x} + 12 = 0$  (stel  $x^2\sqrt{x} = t$ )  
 $t^2 - 8t + 12 = 0$   
 $(t-6) \cdot (t-2) = 0$   
 $t = x^2\sqrt{x} = 6 \vee t = x^2\sqrt{x} = 2$  (kwadrateren)  
 $x^5 = 6^2 = 36 \vee x^5 = 2^2 = 4$   
 $x = \sqrt[5]{36}$  (voldoet)  $\vee x = \sqrt[5]{4}$  (voldoet).

5\*sqrt(36)+X 6  
X^2\*sqrt(X) 2,047672511  
5\*sqrt(4)+X 1,319507911  
X^2\*sqrt(X) 2

D9a  $\frac{6x-18}{x+1} = 0$  (teller = 0 en noemer  $\neq 0$ )  $\Rightarrow 6x - 18 = 0 \Rightarrow 6x = 18 \Rightarrow x = 3$  (voldoet, want de noemer  $\neq 0$ ).

D9b  $\frac{x^2-5x+6}{2x+4} = 0$   
 $x^2-5x+6=0$   
 $(x-3) \cdot (x-2)=0$   
 $x=3$  (vold.)  $\vee x=2$  (vold.)

D9c  $\frac{3x-5}{x+1} = \frac{x+2}{x+1}$   
 $3x-5=x+2$   
 $2x=7$   
 $x=3,5$  (vold.)

D9d  $\frac{x^2-4}{2x+1} = \frac{x^2-4}{x-4}$   
 $x^2-4=0 \vee 2x+1=x-4$   
 $x^2=4 \vee x-5$   
 $x=2$  (vold.)  $\vee x=-2$  (vold.)  $\vee x=-5$  (vold.)

D9e  $\frac{2x-1}{x+1} = \frac{x+3}{x-4}$   
 $(2x-1) \cdot (x-4) = (x+3) \cdot (x+1)$   
 $2x^2-8x-x+4 = x^2+x+3x+3$   
 $x^2-13x+1=0$  ( $a=1, b=-13$  en  $c=1$ )

$D = (-13)^2 - 4 \cdot 1 \cdot 1 = 169 - 4 = 165$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{13 \pm \sqrt{165}}{2 \cdot 1} = \frac{13 \pm \sqrt{165}}{2}$   
 $x = \frac{13 + \sqrt{165}}{2}$  (vold.)  $\vee x = \frac{13 - \sqrt{165}}{2}$  (vold.)

D9f  $\frac{2x^2-4}{x+5} = 1\frac{3}{4} = \frac{7}{4}$   
 $4 \cdot (2x^2-4) = 7 \cdot (x+5)$   
 $8x^2-16 = 7x+35$

$8x^2-7x-51=0$  ( $a=8, b=-7$  en  $c=-51$ )  
 $D = (-7)^2 - 4 \cdot 8 \cdot -51 = 1681$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{7 \pm \sqrt{1681}}{2 \cdot 8} = \frac{7 \pm 41}{16}$   
 $x = \frac{7+41}{16} = \frac{48}{16} = 3$  (vold.)  $\vee x = \frac{7-41}{16} = \frac{-34}{16} = -2\frac{1}{8}$  (vold.)

D10a  $\begin{cases} 4x+5y=27 & |1 \\ -2x+3y=25 & |2 \end{cases}$   
 $\begin{cases} 4x+5y=27 \\ -4x+6y=50 \end{cases} +$   
 $11y=77$   
 $y=7$   
 $\begin{cases} 4x+5y=27 \\ 4x+35=27 \end{cases} \Rightarrow 4x-8=27$   
 $4x=-8$   
 $x=-2$

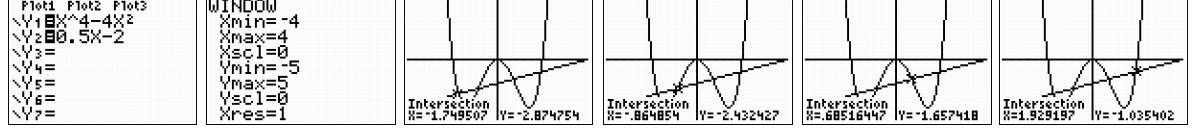
D10b  $\begin{cases} 2x+3y=7 & |2 \\ 5x-2y=8 & |3 \end{cases}$   
 $\begin{cases} 4x+6y=14 \\ 15x-6y=24 \end{cases} +$   
 $19x=38$   
 $x=2$   
 $\begin{cases} 2x+3y=7 \\ 2x+3y=7 \end{cases} \Rightarrow 4+3y=7$   
 $3y=3$   
 $y=1$

D11  $(2, 18)$  op parabool  $\Rightarrow 18 = a \cdot 4 + b \cdot 2$ ;  
 $(-4, 0)$  op parabool  $\Rightarrow 0 = a \cdot 16 + b \cdot -4$ .  
 $\begin{cases} 4a+2b=18 \\ 8a-2b=0 \end{cases} +$   
 $12a=18$   
 $a=1\frac{1}{2}$   
 $\begin{cases} 4a+2b=18 \\ 6+2b=18 \end{cases} \Rightarrow 2b=12$   
 $b=6$

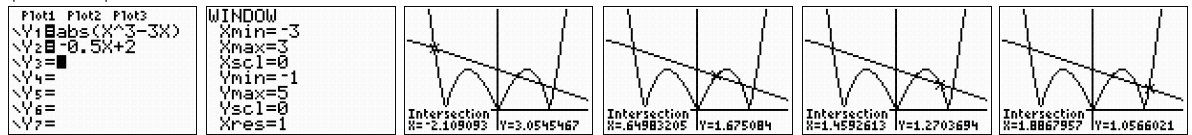
D12a  $\begin{cases} 5x-3y=3 & \textcircled{1} \\ y=\frac{2}{3}x-4 & \textcircled{2} \end{cases}$   
 $\textcircled{2}$  in  $\textcircled{1}$  geeft:  $5x-3 \cdot (\frac{2}{3}x-4) = 3$   
 $5x-2x+12=3$   
 $3x=-9$   
 $x=-3$  in  $\textcircled{2}$   
 $y=\frac{2}{3} \cdot -3-4 = -6$

D12b  $\begin{cases} 2x+3y=10 & \textcircled{1} \\ y=x^2-4x+6 & \textcircled{2} \end{cases}$   
 $\textcircled{2}$  in  $\textcircled{1}$  geeft:  $2x+3 \cdot (x^2-4x+6) = 10$   
 $2x+3x^2-12x+18=10$   
 $3x^2-10x+8=0$  ( $a=3, b=-10$  en  $c=8$ )  
 $D = (-10)^2 - 4 \cdot 3 \cdot 8 = 4$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{10 \pm \sqrt{4}}{2 \cdot 3} = \frac{10 \pm 2}{6}$   
 $x = \frac{10+2}{6} = \frac{12}{6} = 2 \vee x = \frac{10-2}{6} = \frac{8}{6} = \frac{4}{3}$   
 $\begin{cases} x=2 \text{ in } \textcircled{2} \\ y=4-8+6=2 \end{cases} \vee \begin{cases} x=1\frac{1}{3} \text{ in } \textcircled{2} \\ y=\frac{22}{9}=2\frac{4}{9} \end{cases}$

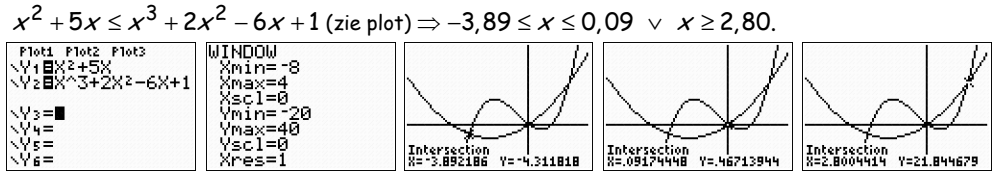
D13a  $x^4-4x^2=0,5x-2$  (intersect)  $\Rightarrow x \approx -1,75 \vee x \approx -0,86 \vee x \approx 0,69 \vee x \approx 1,93$ .



D13b  $|x^3-3x| = -\frac{1}{2}x+2$  (intersect)  $\Rightarrow x \approx -2,11 \vee x \approx 0,65 \vee x \approx 1,46 \vee x \approx 1,89$ .

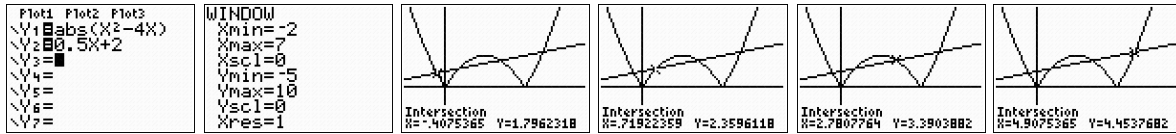


D14a  $x^2+5x = x^3+2x^2-6x+1$  (intersect)  $\Rightarrow x \approx -3,89 \vee x \approx 0,09 \vee x \approx 2,80$ .



D14b  $|x^2 - 4x| = \frac{1}{2}x + 2$  (intersect)  $\Rightarrow x \approx -0,41 \vee x \approx 0,72 \vee x \approx 2,78 \vee x \approx 4,91$ .

$|x^2 - 4x| > \frac{1}{2}x + 2$  (zie plot)  $\Rightarrow x < -0,41 \vee 0,72 < x < 2,78 \vee x > 4,91$ .



D15a  $3x^2 + 2x = 33$  (niet met intersect !!!)

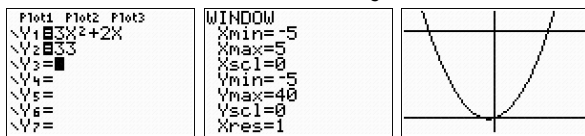
$3x^2 + 2x - 33 = 0$  ( $a = 3$ ,  $b = 2$  en  $c = -33$ )

$D = 2^2 - 4 \cdot 3 \cdot -33 = 400$

$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-2 \pm \sqrt{400}}{2 \cdot 3} = \frac{-2 \pm 20}{6}$

$x = \frac{-2+20}{6} = \frac{18}{6} = 3 \vee x = \frac{-2-20}{6} = \frac{-22}{6} = -\frac{11}{3} = -3\frac{2}{3}$ .

$3x^2 + 2x \geq 33$  (zie plot)  $\Rightarrow x \leq -3\frac{2}{3} \vee x \geq 3$ .



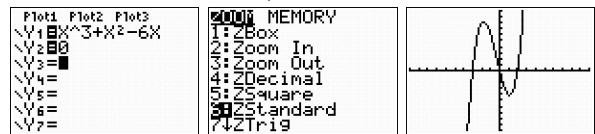
D15b  $x^3 + x^2 - 6x = 0$  (niet met intersect !!!)

$x \cdot (x^2 + x - 6) = 0$

$x \cdot (x+3) \cdot (x-2) = 0$

$x = 0 \vee x = -3 \vee x = 2$ .

$x^3 + x^2 - 6x < 0$  (zie plot)  $\Rightarrow x < -3 \vee 0 < x < 2$ .



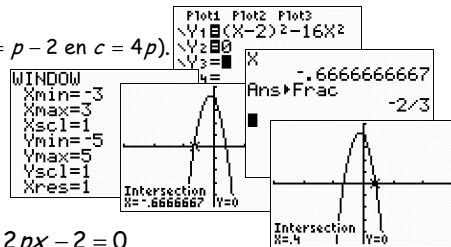
D16a  $px^2 + px - 2x + 4p = px^2 + (p-2) \cdot x + 4p = 0$  ( $a = p \neq 0$ ,  $b = p-2$  en  $c = 4p$ ).

$D = (p-2)^2 - 4 \cdot p \cdot 4p = (p-2)^2 - 16p^2$ .

$D = 0 \Rightarrow (p-2)^2 - 16p^2 = 0$  (intersect)  $\Rightarrow p = -\frac{2}{3} \vee p = 0,4$ .

Geen oplossing  $\Rightarrow D < 0$  (zie plot)  $\Rightarrow p < -\frac{2}{3} \vee p > 0,4$ .

( $p = 0$  geeft  $-2x = 0 \Rightarrow x = 0 \Rightarrow 1$  oplossing)



D16b  $px^3 + 2px^2 - 2x = x \cdot (px^2 + 2px - 2) = 0 \Rightarrow x = 0 \vee px^2 + 2px - 2 = 0$ .

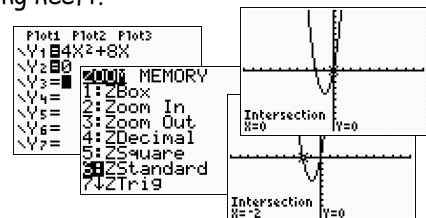
Eén oplossing als  $px^2 + 2px - 2 = 0$  ( $a = p \neq 0$ ,  $b = 2p$  en  $c = -2$ ) geen oplossing heeft.

$D = (2p)^2 - 4 \cdot p \cdot -2 = 4p^2 + 8p$ .

$D = 0 \Rightarrow 4p^2 + 8p = 0 \Rightarrow 4p \cdot (p+2) = 0$  (of intersect)  $\Rightarrow p = 0 \vee p = -2$ .

$D < 0$  (zie plot)  $\Rightarrow -2 < p < 0$ . ( $p = 0$  geeft  $-2x = 0 \Rightarrow x = 0 \Rightarrow$  ook 1 oplossing)

Dus één oplossing als  $-2 < p \leq 0$ .



**Gemengde opgaven 1. Vergelijkingen en ongelijkheden**

G1a  $7x^2 = 5x$   
 $7x^2 - 5x = 0$   
 $x \cdot (7x - 5) = 0$   
 $x = 0 \vee 7x = 5$   
 $x = 0 \vee x = \frac{5}{7}$

G1b  $2x^2 + x = 3$   
 $2x^2 + x - 3 = 0$  ( $a=2, b=1$  en  $c=-3$ )  
 $D = 1^2 - 4 \cdot 2 \cdot -3 = 1 + 24 = 25$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{25}}{2 \cdot 2} = \frac{-1 \pm 5}{4}$   
 $x = \frac{-1+5}{4} = \frac{4}{4} = 1 \vee x = \frac{-1-5}{4} = \frac{-6}{4} = -1\frac{1}{2}$

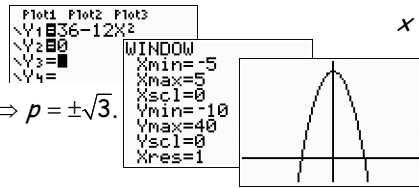
G1c  $(x+2) \cdot (x-6) = 9$   
 $x^2 - 6x + 2x - 12 = 9$   
 $x^2 - 4x - 21 = 0$   
 $(x-7) \cdot (x+3) = 0$   
 $x = 7 \vee x = -3$

G1d  $(x-3)^2 - (x+1)^2 = x^2 - 1$   
 $x^2 - 3x - 3x + 9 - (x^2 + x + x + 1) = x^2 - 1$   
 $x^2 - 6x + 9 - x^2 - 2x - 1 = x^2 - 1$   
 $0 = x^2 + 8x - 9$   
 $(x+9) \cdot (x-1) = 0$   
 $x = -9 \vee x = 1$

G1e  $(2x-3)^2 = 36$   
 $2x-3 = \pm 6$   
 $2x = 3 \pm 6$   
 $x = \frac{3+6}{2} \vee x = \frac{3-6}{2}$   
 $x = 4\frac{1}{2} \vee x = -1\frac{1}{2}$

G1f  $4 - (x-2)^2 = 7x - 3$   
 $4 - (x^2 - 2x - 2x + 4) = 7x - 3$   
 $4 - x^2 + 4x - 4 = 7x - 3$   
 $0 = x^2 + 3x - 3$  ( $a=1, b=3$  en  $c=-3$ )  
 $D = 3^2 - 4 \cdot 1 \cdot -3 = 9 + 12 = 21$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-3 \pm \sqrt{21}}{2 \cdot 1} = \frac{-3 \pm \sqrt{21}}{2}$   
 $x = \frac{-3+\sqrt{21}}{2} \vee x = \frac{-3-\sqrt{21}}{2}$

G2a  $px^2 + 6x + 3p = 0$  ( $a=p \neq 0, b=6$  en  $c=3p$ )  
 $D = 6^2 - 4 \cdot p \cdot 3p = 36 - 12p^2$   
 $D = 0 \Rightarrow 36 - 12p^2 = 0 \Rightarrow 36 = 12p^2 \Rightarrow p^2 = 3 \Rightarrow p = \pm\sqrt{3}$   
 $D > 0$  (zie plot)  $\Rightarrow -\sqrt{3} < p < \sqrt{3}$   
 ( $p=0 \Rightarrow 6x=0 \Rightarrow x=0 \Rightarrow 1$  oplossing)



G2b  $6^2 + p \cdot 6 - 6p^2 = 0$   
 $-6p^2 + 6p + 36 = 0$   
 $p^2 - p - 6 = 0$   
 $(p-3) \cdot (p+2) = 0$   
 $p = 3 \vee p = -2$

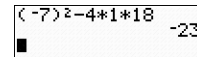
$p = 3$  geeft:  
 $x^2 + 3x - 54 = 0$   
 $(x-6) \cdot (x+9) = 0$   
 $x = 6$  (bekend)  $\vee x = -9$

$p = -2$  geeft:  
 $x^2 - 2x - 24 = 0$   
 $(x-6) \cdot (x+4) = 0$   
 $x = 6$  (bekend)  $\vee x = -4$

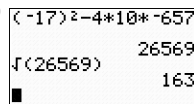
G2c  $px^2 - 2px + 4 = 0$  ( $a=p \neq 0, b=-2p$  en  $c=4$ )  
 $D = (-2p)^2 - 4 \cdot p \cdot 4 = 4p^2 - 16p$   
 $D = 0 \Rightarrow 4p^2 - 16p = 0 \Rightarrow 4p \cdot (p-4) = 0 \Rightarrow p = 0 \vee p = 4$   
 ( $p=0 \Rightarrow 4=0$  (kan niet)  $\Rightarrow$  geen oplossing)  
 $p = 4 \Rightarrow 4x^2 - 8x + 4 = 0$   
 $x^2 - 2x + 1 = 0$   
 $(x-1) \cdot (x-1) = 0 \Rightarrow x = 1$  (dubbel)

G3a  $x^6 - 6x^3 + 5 = 0$  (stel  $x^3 = t$ )  
 $t^2 - 6t + 5 = 0$   
 $(t-5) \cdot (t-1) = 0$   
 $t = x^3 = 5 \vee x^3 = 1$   
 $x = \sqrt[3]{5} \vee x = \sqrt[3]{1} = 1$

G3b  $|x^4 - 7x^2| = 18$   
 $x^4 - 7x^2 = 18 \vee x^4 - 7x^2 = -18$  (stel  $x^2 = t$ )  
 $t^2 - 7t - 18 = 0 \vee t^2 - 7t + 18 = 0$  ( $a=1, b=-7$  en  $c=18$ )  
 $(t-9) \cdot (t+2) = 0 \vee D = (-7)^2 - 4 \cdot 1 \cdot 18 < 0$  (geen oplossingen)  
 $x^2 = 9 \vee x^2 = -2$  (k.n.)  
 $x = 3 \vee x = -3$



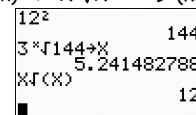
G3c  $10x^4 = 17x^2 + 657$   
 $10x^4 - 17x^2 - 657 = 0$  (stel  $x^2 = t$ )  
 $10t^2 - 17t - 657 = 0$  ( $a=10, b=-17$  en  $c=-657$ )  
 $D = (-17)^2 - 4 \cdot 10 \cdot -657 = 26569$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{17 \pm \sqrt{26569}}{2 \cdot 10} = \frac{17 \pm 163}{20}$   
 $x^2 = \frac{17+163}{20} = \frac{180}{20} = 9 \vee x^2 = \frac{17-163}{20} = \frac{-147}{20} = \dots$  (k.n.)  $\Rightarrow x = 3 \vee x = -3$



G3d  $10 - (2x-1)^4 = 8$   
 $2 = (2x-1)^4$   
 $2x-1 = \pm \sqrt[4]{2}$   
 $2x = 1 \pm \sqrt[4]{2}$   
 $x = \frac{1}{2} + \frac{1}{2} \sqrt[4]{2} \vee x = \frac{1}{2} - \frac{1}{2} \sqrt[4]{2}$

G3e  $x^5 - 16x^3 + 28x = 0$   
 $x \cdot (x^4 - 16x^2 + 28) = 0$  (stel  $x^2 = t$ )  
 $x = 0 \vee t^2 - 16t + 28 = 0$   
 $x = 0 \vee (t-14) \cdot (t-2) = 0$   
 $x = 0 \vee x^2 = 14 \vee x^2 = 2$   
 $x = 0 \vee x = \pm\sqrt{14} \vee x = \pm\sqrt{2}$

G3f  $x^3 - 3x\sqrt{x} - 108 = 0$  (stel  $x\sqrt{x} = t$ )  
 $t^2 - 3t - 108 = 0$   
 $(t-12) \cdot (t+9) = 0$   
 $x\sqrt{x} = 12$  (kwadrateren)  $\vee x\sqrt{x} = -9$  (k.n.)  
 $x^2 \cdot \sqrt{x} = x^3 = 144$   
 $x = \sqrt[3]{144}$  (voldoet)



G3g  $\square$   $6x^5 + 10x^2 \cdot \sqrt{x} - 464 = 0$  (stel  $x^2 \cdot \sqrt{x} = t$ )  
 $6t^2 + 10t - 464 = 0$   
 $3t^2 + 5t - 232 = 0$  ( $a = 3, b = 5$  en  $c = -232$ )  
 $D = 5^2 - 4 \cdot 3 \cdot -232 = 2809$   
 $t = \frac{-b \pm \sqrt{D}}{2a} = \frac{-5 \pm \sqrt{2809}}{2 \cdot 3} = \frac{-5 \pm 53}{6}$   
 $x^2 \cdot \sqrt{x} = \frac{-5 + 53}{6} = 8$  (kwadr.)  $\vee$   $x^2 \cdot \sqrt{x} = \frac{-5 - 53}{6} = \dots$  (k.n.)  
 $x^4 \cdot x = x^5 = 64$   
 $x = \sqrt[5]{64}$  (voldoet).

G3h  $\square$   $(2x-1)^4 - 5(2x-1)^2 + 4 = 0$  (stel  $(2x-1)^2 = t$ )  
 $t^2 - 5t + 4 = 0$   
 $(t-4) \cdot (t-1) = 0$   
 $(2x-1)^2 = 4 \vee (2x-1)^2 = 1$   
 $2x-1 = \pm 2 \vee 2x-1 = \pm 1$   
 $2x = 1 \pm 2 \vee 2x = 1 \pm 1$   
 $x = 1\frac{1}{2} \vee x = -\frac{1}{2} \vee x = 1 \vee x = 0.$

G4a  $\square$   $\frac{2x}{x-1} - 2 = 4$   
 $\frac{2x}{x-1} = 6 = \frac{6}{1}$   
 $2x \cdot 1 = 6 \cdot (x-1)$   
 $2x = 6x - 6$   
 $-4x = -6$   
 $x = \frac{-6}{-4} = 1\frac{1}{2}$  (voldoet).

G4b  $\square$   $3\sqrt{2-3x} = 21$   
 $\sqrt{2-3x} = 7$  (kwadrateren)  
 $2-3x = 49$   
 $-3x = 47$   
 $x = \frac{47}{-3} = -15\frac{2}{3}$  (voldoet).

G4c  $\square$   $\frac{x+2}{x-1} = \frac{x}{x+5}$   
 $(x+2) \cdot (x+5) = x \cdot (x-1)$   
 $x^2 + 5x + 2x + 10 = x^2 - x$   
 $8x = -10$   
 $x = \frac{-10}{8} = -1\frac{1}{4}$  (voldoet).

G4d  $\square$   $\frac{2x-1}{x+2} = \frac{x+4}{x-2}$   
 $(2x-1) \cdot (x-2) = (x+2) \cdot (x+4)$   
 $2x^2 - 4x - x + 2 = x^2 + 4x + 2x + 8$   
 $x^2 - 11x - 6 = 0$  ( $a = 1, b = -11$  en  $c = -6$ )  
 $D = (-11)^2 - 4 \cdot 1 \cdot -6 = 145$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{11 \pm \sqrt{145}}{2 \cdot 1} = \frac{11 \pm \sqrt{145}}{2}$   
 $x = \frac{11 + \sqrt{145}}{2}$  (voldoet)  $\vee$   $x = \frac{11 - \sqrt{145}}{2}$  (voldoet).

G4e  $\square$   $2\sqrt{x-1} + 8 = 15$   
 $2\sqrt{x-1} = 7$   
 $\sqrt{x-1} = \frac{7}{2}$  (kwadrateren)  
 $x-1 = \frac{49}{4} = 12\frac{1}{4}$   
 $x = 13\frac{1}{4}$  (voldoet).

G4f  $\square$   $\frac{4+2x}{x} = \frac{12}{x+1}$   
 $(4+2x) \cdot (x+1) = 12 \cdot x$   
 $4x + 4 + 2x^2 + 2x = 12x$   
 $2x^2 - 6x + 4 = 0$   
 $x^2 - 3x + 2 = 0$   
 $(x-2) \cdot (x-1) = 0$   
 $x = 2$  (vold.)  $\vee$   $x = 1$  (vold.).

G4g  $\square$   $\sqrt{2-2x} = -2x$  (kwadrateren)  
 $2-2x = (-2x)^2$   
 $0 = 4x^2 + 2x - 2$   
 $2x^2 + 1x - 1 = 0$  ( $a = 2, b = 1$  en  $c = -1$ )  
 $D = 1^2 - 4 \cdot 2 \cdot -1 = 1 + 8 = 9$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{9}}{2 \cdot 2} = \frac{-1 \pm 3}{4}$   
 $x = \frac{-1+3}{4} = \frac{2}{4} = \frac{1}{2}$  (vold. niet)  $\vee$   $x = \frac{-1-3}{4} = \frac{-4}{4} = -1$  (vold.).

G4h  $\square$   $3x = \sqrt{8x+1}$  (kwadrateren)  
 $(3x)^2 = 8x+1$   
 $9x^2 - 8x - 1 = 0$  ( $a = 9, b = -8$  en  $c = -1$ )  
 $D = (-8)^2 - 4 \cdot 9 \cdot -1 = 64 + 36 = 100$   
 $x = \frac{-b \pm \sqrt{D}}{2a} = \frac{8 \pm \sqrt{100}}{2 \cdot 9} = \frac{8 \pm 10}{18}$   
 $x = \frac{8+10}{18} = 1$  (vold.)  $\vee$   $x = \frac{8-10}{18} = \frac{-2}{18} = -\frac{1}{9}$  (vold. niet).

G5a  $\square$   $\begin{cases} 3x - 2y = -5 & |1| \\ -x + 5y = 32 & |3| \end{cases}$   
 $\begin{cases} 3x - 2y = -5 \\ -3x + 15y = 96 \end{cases} +$   
 $13y = 91$   
 $y = 7$   
 $\begin{cases} -x + 5y = 32 \\ -x + 35 = 32 \end{cases} \Rightarrow -x + 35 = 32$   
 $-x = -3$   
 $x = 3.$

G5b  $\square$   $\begin{cases} 4x + 2y = 14 & |3| \\ 5x - 3y = 45 & |2| \end{cases}$   
 $\begin{cases} 12x + 6y = 42 \\ 10x - 6y = 90 \end{cases} +$   
 $22x = 132$   
 $x = 6$   
 $\begin{cases} 4x + 2y = 14 \\ 24 + 2y = 14 \end{cases} \Rightarrow 24 + 2y = 14$   
 $2y = -10$   
 $y = -5.$

G6  $\square$   $(-4, 42)$  op grafiek  $\Rightarrow 42 = -32 + a \cdot 16 + b \cdot -4 + 6$ ;  
 $(2, 12)$  op parabool  $\Rightarrow 12 = 4 + a \cdot 4 + b \cdot 2 + 6$ .  
 $\begin{cases} 16a - 4b = 68 & |1| \\ 4a + 2b = 2 & |2| \end{cases}$   
 $\begin{cases} 16a - 4b = 68 \\ 8a + 4b = 4 \end{cases} +$   
 $24a = 72$   
 $a = 3$   
 $\begin{cases} 4a + 2b = 2 \\ 12 + 2b = 2 \end{cases} \Rightarrow 12 + 2b = 2$   
 $2b = -10$   
 $b = -5.$

67a  $\begin{cases} a + b = 150 \\ 8,6a + 7,0b = 1185 \end{cases} \begin{matrix} 7 \cdot 9 \cdot 150 & 1185 \\ 7 \cdot 150 & 1050 \\ -135 \cdot -1,6 & 84,375 \\ 150 - \text{Ans} & \end{matrix}$

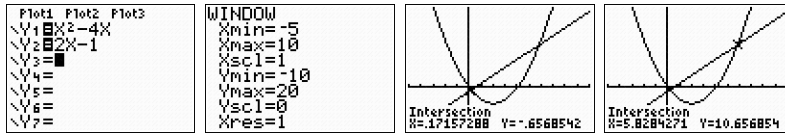
$a = 84,375$   
 $\Rightarrow 84,375 + b = 150$   
 $\Rightarrow a + b = 150$   
 $b = 65,625$

67b Stel hij neemt  $x$  ml van 15% en  $y$  ml van 30%.

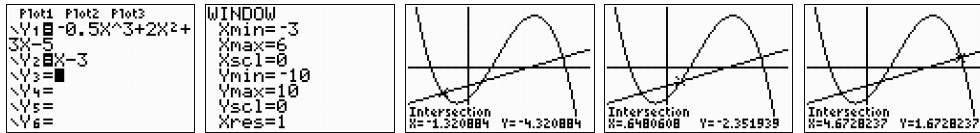
$\begin{cases} x + y = 600 \\ 15x + 30y = 13200 \end{cases} \begin{matrix} 22 \cdot 600 & 13200 \\ 4200 \cdot 15 & 280 \\ 600 - 280 & 320 \end{matrix}$

$-15y = -4200$   
 $y = 280$   
 $\Rightarrow x + 280 = 600$   
 $x = 320$

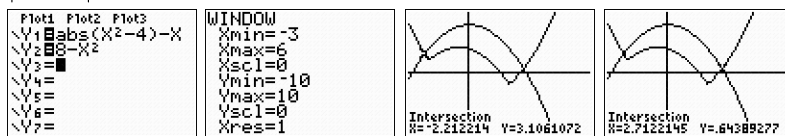
68a  $x^2 - 4x = 2x - 1$  (intersect)  $\Rightarrow x \approx 0,17 \vee x \approx 5,83$ .  
 $x^2 - 4x > 2x - 1$  (zie plot)  $\Rightarrow x < 0,17 \vee x > 5,83$ .



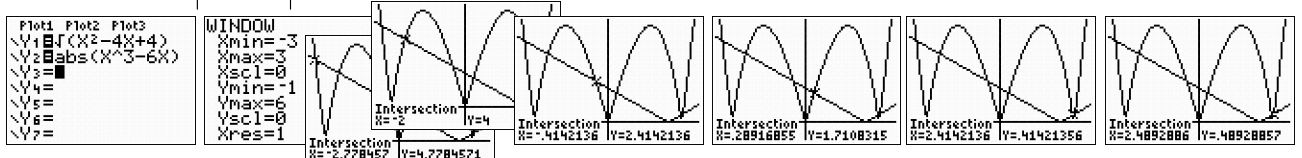
68b  $-0,5x^3 + 2x^2 + 3x - 5 = x - 3$  (intersect)  $\Rightarrow x \approx -1,32 \vee x \approx 0,65 \vee x \approx 4,67$ .  
 $-0,5x^3 + 2x^2 + 3x - 5 \leq x - 3$  (zie plot)  $\Rightarrow -1,32 \leq x \leq 0,65 \vee x \geq 4,67$ .



68c  $x^2 - 4 - x = 8 - x^2$  (intersect)  $\Rightarrow x \approx -2,21 \vee x \approx 2,71$ .  
 $x^2 - 4 - x < 8 - x^2$  (zie plot)  $\Rightarrow -2,21 < x < 2,71$ .



68d  $\sqrt{x^2 - 4x + 4} = x^3 - 6x$  (intersect)  $\Rightarrow x \approx -2,78 \vee x = -2 \vee x \approx -0,41 \vee x \approx 0,29 \vee x \approx 2,41 \vee x \approx 2,49$ .  
 $\sqrt{x^2 - 4x + 4} > x^3 - 6x$  (zie plot)  $\Rightarrow -2,78 < x < -2 \vee -0,41 < x < 0,29 \vee 2,41 < x < 2,49$ .



69a  $px^3 + 2px^2 + x^2 + 2\frac{1}{4}x = px^3 + (2p+1) \cdot x^2 + 2\frac{1}{4}x = x \cdot (px^2 + (2p+1)x + 2\frac{1}{4}) = 0$   
 $x = 0 \vee px^2 + (2p+1)x + 2\frac{1}{4} = 0$

Drie oplossingen als  $px^2 + (2p+1)x + 2\frac{1}{4} = 0$  ( $a = p \neq 0$ ,  $b = 2p+1$  en  $c = 2\frac{1}{4}$ ) twee oplossingen heeft.

$D = (2p+1)^2 - 4 \cdot p \cdot 2\frac{1}{4} = (2p+1)^2 - 9p$ .

$D = 0 \Rightarrow (2p+1)^2 - 9p = 0$  (exact of intersect)  $\Rightarrow p = \frac{1}{4} \vee p = 1$ .

Drie oplossingen  $\Rightarrow D > 0$  (zie plot)  $\Rightarrow p < 0 \vee 0 < p < \frac{1}{4} \vee p > 1$ .

( $p = 0$  geeft  $x^2 - 2\frac{1}{4}x = 0 \Rightarrow x \cdot (x - 2\frac{1}{4}) = 0 \Rightarrow x = 0 \vee x = 2\frac{1}{4} \Rightarrow 2$  oplossingen)

69b  $2px^4 - px^3 + 5x^3 + 2x^2 = 2px^4 + (5-p) \cdot x^3 + 2x^2 = x^2 \cdot (2px^2 + (5-p)x + 2) = 0$   
 $x = 0 \vee 2px^2 + (5-p)x + 2 = 0$

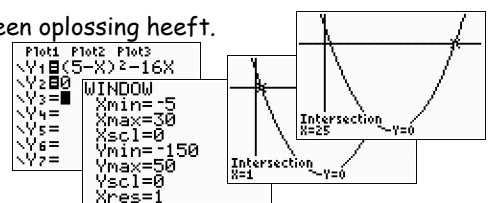
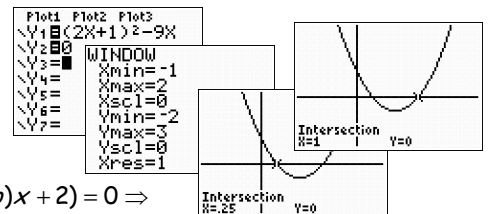
Eén oplossing als  $2px^2 + (5-p)x + 2 = 0$  ( $a = 2p \neq 0$ ,  $b = 5-p$  en  $c = 2$ ) geen oplossing heeft.

$D = (5-p)^2 - 4 \cdot 2p \cdot 2 = (5-p)^2 - 16p$ .

$D = 0 \Rightarrow (5-p)^2 - 16p = 0$  (exact of intersect)  $\Rightarrow p = 1 \vee p = 25$ .

Eén oplossing  $\Rightarrow D < 0$  (zie plot)  $\Rightarrow 1 < p < 25$ .

( $p = 0$  geeft  $5x^3 - x^2 = x^2 \cdot (5-x) = 0 \Rightarrow x = 0 \vee x = 5 \Rightarrow 2$  oplossingen)



TI-84 1. Berekeningen op het basisscherm

- |    |   |  |    |  |  |
|----|---|--|----|--|--|
| 1a | $5,36^4 + 5 \times 1,47^2 \approx 836,19.$                      |  | 1c | $1,8^2 : 3^5 \approx 0,01.$  |  |
| 1b | $\sqrt{34} + 6,5^3 \approx 280,46.$                             |  | 1d | $11,5^2 + \sqrt{8,7} \approx 135,20.$                                    |  |
| 2a | $\sqrt{12} + 3,51 \approx 6,97.$                                |  | 2c | $\sqrt{21,8} : 3,51 \approx 1,33.$                                       |  |
| 2b | $\sqrt{12 + 3,51} \approx 3,94.$                                |  | 2d | $\sqrt{21,8 : 3,51} \approx 2,49.$                                       |  |
| 3a | $-3,5^2 - 8 \times -3 = 11,75.$                                 |  | 3c | $-8,13^4 - \sqrt{5} : 1,6^3 \approx -4\,368,25.$                         |  |
| 3b | $\sqrt{8,91} - 3,1 \times 1,3^3 \approx -3,83.$                 |  | 3d | $-8,1 \times 1,3^4 - 5,7^2 : -8 \approx -19,07.$                         |  |
| 4a | $(-5,7)^2 = 32,49.$   |  | 4c | $-5,7^2 = -32,49.$   |  |
| 4b | $(-1,8)^4 = 10,4976.$   |  | 4d | $-1,8^4 = -10,4976.$   |  |
| 5a | $\frac{118-53}{53} \times 100 \approx 122,6.$                   |  | 5c | $\frac{1371-862}{128} \approx 4,0.$                                      |  |
| 5b | $\frac{100}{352 \times 1,23} \approx 0,2.$                      |  | 5d | $\frac{1283-1827}{1827} \times 100 \approx -29,8.$                       |  |
| 6a | $\frac{118,6}{8,3^2 - 5,6} \approx 1,87.$                       |  | 6c | $\frac{-1,31 + 8,3 \times 7,05}{21,3^2 - 7,5^3} \approx 1,80.$           |  |
| 6b | $\frac{5,93 + \sqrt{23}}{8,41 - 3\sqrt{15}} \approx -3,34.$     |  | 6d | $\frac{3,88^2 + 4,26^3}{1 + \sqrt{5,6} - 2,9^2} + 7,4^3 \approx 386,91.$ |  |
| 7a | $\frac{2}{3} + \frac{1}{4} = \frac{11}{12}.$                    |  | 7c | $20 \times \frac{1}{3} = \frac{200}{3}.$                                 |  |
| 7b | $(\frac{2}{9})^2 = \frac{121}{81}.$                             |  | 7d | $19 \times 2\frac{1}{3} - 8 \times 2\frac{4}{7} = \frac{499}{21}.$       |  |
| 8a | $8\frac{3}{5} : 2\frac{1}{4} = \frac{172}{45}.$                 |  | 8c | $(3\frac{1}{6} - 2\frac{1}{7})^2 = \frac{1849}{1764}.$                   |  |
| 8b | $(3\frac{1}{6} - 2\frac{1}{5}) : 2\frac{1}{5} = \frac{29}{66}.$ |  | 8d | $21 : 2\frac{3}{7} = \frac{147}{17}.$                                    |  |
| 9a | $(\frac{2}{3})^2 = \frac{25}{9}.$                               |  | 9b | $(-2\frac{3}{7})^4 = \frac{83521}{2401}.$                                |  |
|    |   |  | 9c | $5 : 1\frac{1}{3} = \frac{15}{4}.$                                       |  |

TI-84 2. Formules, grafieken en tabellen

- 1a Zie de eerste drie schermen hiernaast.
- 1c Kies WINDOW:  $[-5, 15] \times [-10, 15]$ . (gebruik deze notatie) (schaalstreepjes uit met Xscl = 0 en Yscl = 0)
- 1d Zie de schermen hieronder. Neem (bijvoorbeeld) WINDOW:  $[-15, 15] \times [-10, 15]$ .
- Plot1 Plot2 Plot3

V1=0,9X^2-3X-4

V2=0,4X^2+5X-2

V3=0,3X^2+2X-6

V4=

V5=

V6=

V7=

WINDOW

Xmin=-15

Xmax=15

Xscl=0

Vmin=-10

Vmax=15

Yscl=0

Xres=1
- 2a Zie de schermen hiernaast (neem Zoom 6 = ZStandard).
- 2c Met ZStandard is er één snijpunt te zien.
- Plot1 Plot2 Plot3

V1=0,5X^3-3X^2+2X+5

V2=0,5X^4-2,7X^3+8X^2-3

V3=

MEMORY

1:ZBox

2:Zoom In

3:Zoom Out

4:ZDecimal

5:ZSquare

6:ZStandard

7:ZTrig
- 3abcd Zie de schermen hieronder; het linker snijpunt:  $(-1,702; -0,726)$  en de top van  $y_2$ :  $(2,553; 6,499)$ .
- Plot1 Plot2 Plot3

V1=0,3X^2-2X-5

V2=

V3=

WINDOW

Xmin=-1,702128

Ymin=-0,7265731

Plot1 Plot2 Plot3

V1=0,3X^2-2X-5

V2=

V3=

WINDOW

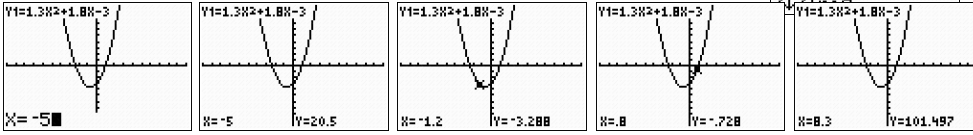
Xmin=2,5531915

Ymax=6,4988683

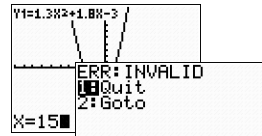
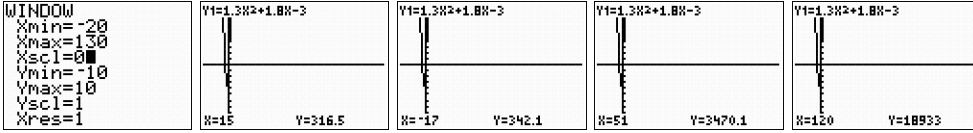
4a Zie de schermen hiernaast.

4b  $f(-5) = 20,5$ ;  $f(-1,2) = -3,288$ ;  $f(0,8) = -0,728$ ;  $f(8,3) = 101,497$ .

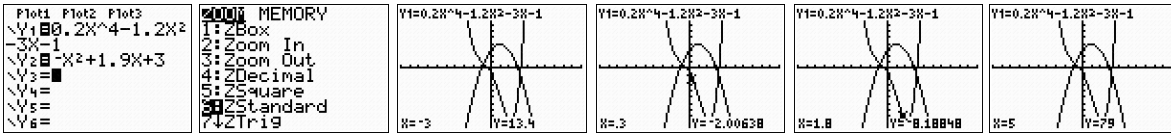
(de optie value in [CALC] [2nd][TRACE] werkt als [TRACE]). (zie de schermen hieronder)



4cde  $f(15) = 316,5$ ;  $f(-17) = 342,1$ ;  $f(51) = 3470,1$ ;  $f(120) = 18933$ .



5a  $y_1(-3) = 13,4$ ;  $y_1(0,3) = -2,00638$ ;  $y_1(1,8) = -8,18848$ ;  $y_1(5) = 79$ .



5b  $y_2(-3) = -11,7$ ;  $y_2(0,3) = 3,48$ ;  $y_2(1,8) = 3,18$ ;  $y_2(5) = -12,5$ .

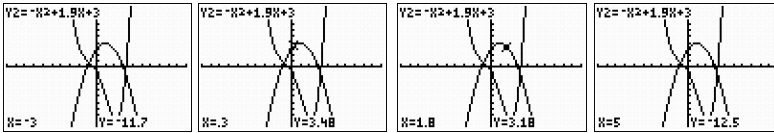
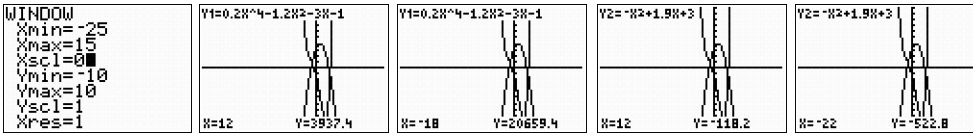


TABLE SETUP  
TblStart=1  
ΔTbl=1  
Indent: Auto  
Depend: Auto Ask

X	V1	V2
-3	13.4	-11.7
0.3	-2.00638	3.48
1.8	-8.18848	3.18
5	79	-12.5
12	3937.4	-522.8
-18	20659.4	-522.8
-22	46335	-522.8

V1 = -2.00638

5cd  $y_1(12) = 3937,4$ ;  $y_1(-18) = 20659,4$ ;  $y_2(12) = -118,2$ ;  $y_2(-22) = -522,8$ .



6ab Zie hieronder:  $y_1(4,15) = -1,83875$ .

6c  $y_1(12,74) = 44,9338$  en  $y_2(12,68) = -296,5448$ . (zie hieronder)

TABLE SETUP  
TblStart=4  
ΔTbl=0.03  
Indent: Auto Ask  
Depend: Auto Ask

X	V1	V2
4	-2	-20
4.03	-1.87	-20.44
4.06	-1.838	-20.88
4.09	-1.806	-21.32
4.12	-1.777	-21.77
4.15	-1.75	-22.22
4.18	-1.804	-22.67

V1 = -1.83875

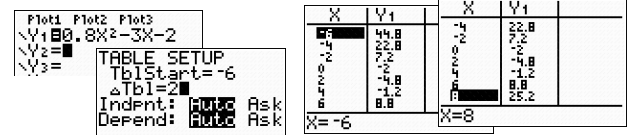
TABLE SETUP  
TblStart=12.68  
ΔTbl=0.06  
Indent: Auto Ask  
Depend: Auto Ask

X	V1	V2
12.68	44.9338	-296.5448
12.74	44.9338	-299.5
12.8	45.52	-302.5
12.86	46.11	-305.5
12.92	46.703	-308.5
12.98	47.3	-311.5
13.04	47.901	-314.5

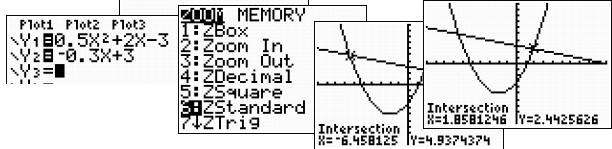
V1 = 44.9338  
V2 = -296.5448

7 Haal de antwoorden uit de tabel hiernaast.

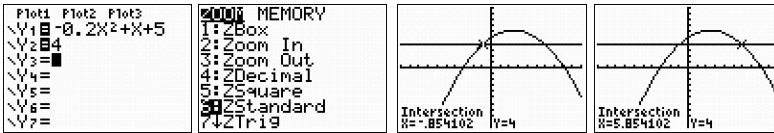
x	-6	-4	-2	0	2	4	6	8
f(x)	44,8	22,8	7,2	-2	-4,8	-1,2	8,8	25,2



8  $y_1 = 0,5x^2 + 2x - 3$  en  $y_2 = -0,3x^2 + 3$ . (zie hiernaast)  
optie intersect  $\Rightarrow S_1(-6,46; 4,94)$  en  $S_2(1,86; 2,44)$ .

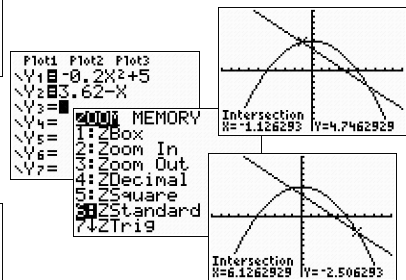
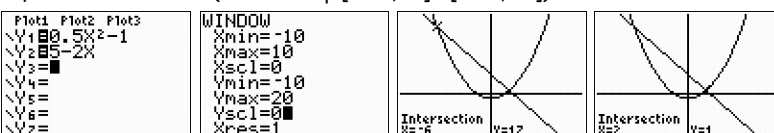


9  $-0,2x^2 + x + 5 = 4$  (intersect in ZStandard)  $\Rightarrow x \approx -0,85 \vee x \approx 5,85$ . (zie de schermen hieronder)



10a  $-0,2x^2 + 5 = 3,62 - x$  (intersect in ZStandard)  $\Rightarrow x \approx -1,13 \vee x \approx 6,13$ .

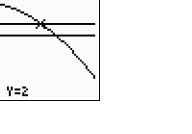
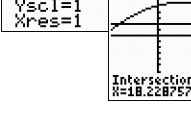
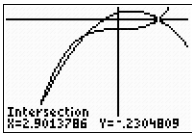
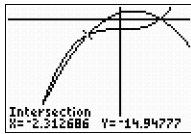
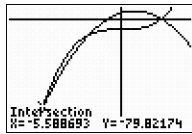
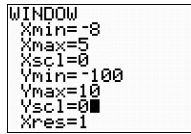
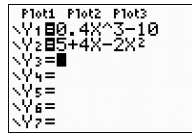
10b  $0,5x^2 - 1 = 5 - 2x$  (intersect op  $[-10, 10] \times [-10, 20]$ )  $\Rightarrow x = -6 \vee x = 2$ .



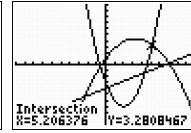
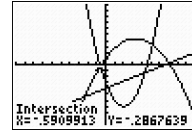
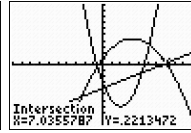
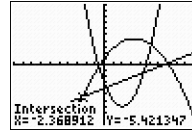
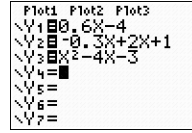


10c  $-0,02x^2 + 0,2x + 5 = 2$  (intersect op  $[-10, 30] \times [-10, 10]$ )  $\Rightarrow x \approx -8,23 \vee x \approx 18,23$ .

10d  $-0,4x^3 - 10 = 5 + 4x - 2x^2$  (intersect op  $[-8, 5] \times [-100, 10]$ )  
 $x \approx -5,59 \vee x \approx -2,31 \vee x \approx 2,90$ . (zie de schermen hieronder)



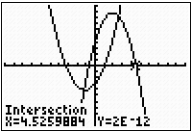
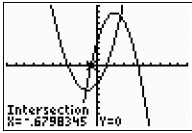
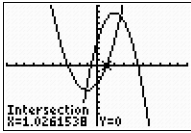
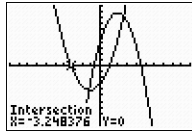
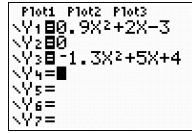
11ab  $0,6x - 4 = -0,3x^2 + 2x + 1$  (intersect in ZStandard)  $\Rightarrow x \approx -2,37 \vee x \approx 7,04$ . (zie de schermen hieronder)



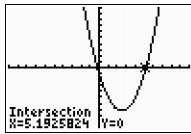
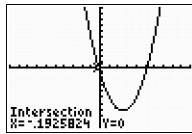
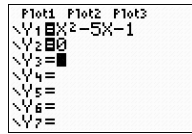
11c  $0,6x - 4 = -0,3x^2 + 2x + 1$  (intersect in ZStandard)  $\Rightarrow x \approx -0,59 \vee x \approx 5,21$ . (zie de schermen hierboven)  
(het is niet nodig om grafieken uit te zetten; kies met  $\square$  of  $\square$  bij First curve? en/of Second curve? de juiste formules)

12abc  $0,9x^2 + 2x - 3 = 0$  (intersect in ZStandard)  $\Rightarrow x \approx -3,25 \vee x \approx 1,03$ . (zie de schermen hieronder)

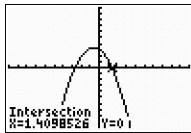
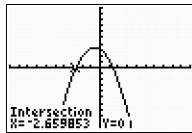
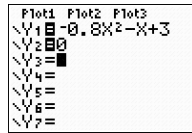
12d  $-1,3x^2 + 5x + 4 = 0$  (intersect in ZStandard)  $\Rightarrow x \approx -0,68 \vee x \approx 4,53$ . (zie de schermen hieronder)



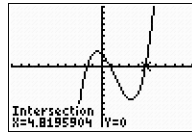
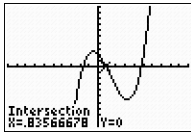
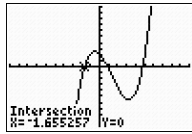
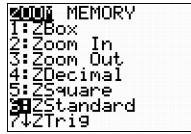
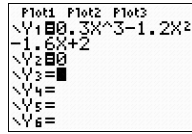
13a  $x^2 - 5x - 1 = 0$  (intersect in ZStandard)  $\Rightarrow x \approx -0,19 \vee x \approx 5,19$ . (zie de schermen hieronder)



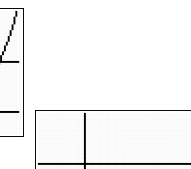
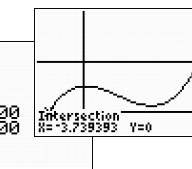
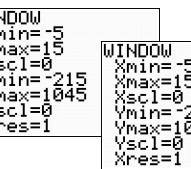
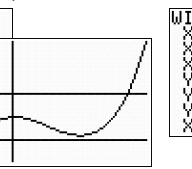
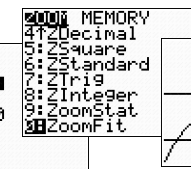
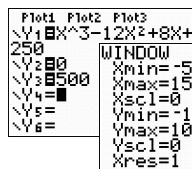
13b  $-0,8x^2 - x + 3 = 0$  (intersect in ZStandard)  $\Rightarrow x \approx -2,66 \vee x \approx 1,41$ . (zie de schermen hieronder)



13c  $0,3x^3 - 1,2x^2 - 1,6x + 2 = 0$  (intersect in ZStandard)  $\Rightarrow x \approx -1,66 \vee x \approx 0,84 \vee x \approx 4,82$ . (zie de schermen hieronder)



14ab  $x^3 - 12x^2 + 8x + 250 = 0$  (intersect op  $[-5, 15] \times [-200, 1000]$ )  $\Rightarrow x \approx -3,74$ . (zie de schermen hieronder)



14c  $x^3 - 12x^2 + 8x + 250 = 500$  (intersect)  $\Rightarrow x \approx 12,88$ . (zie het scherm hiernaast)



15a WINDOW:  $[-1, 2] \times [0, 50]$ ; vanaf  $x \approx 1,49$  (intersect en plot).

15b  $x \approx -0,78 \vee x \approx 1,11$  (intersect).

