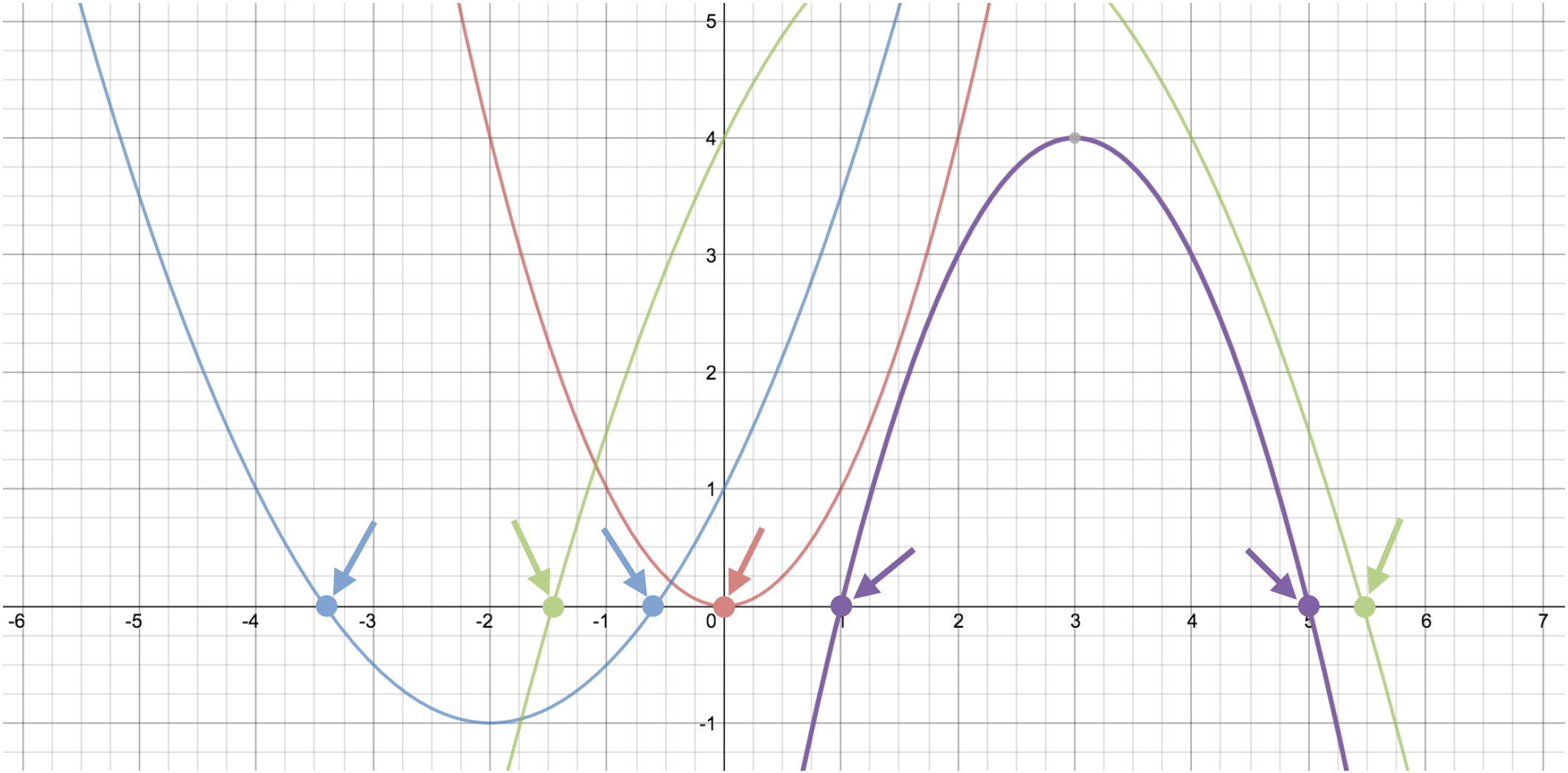
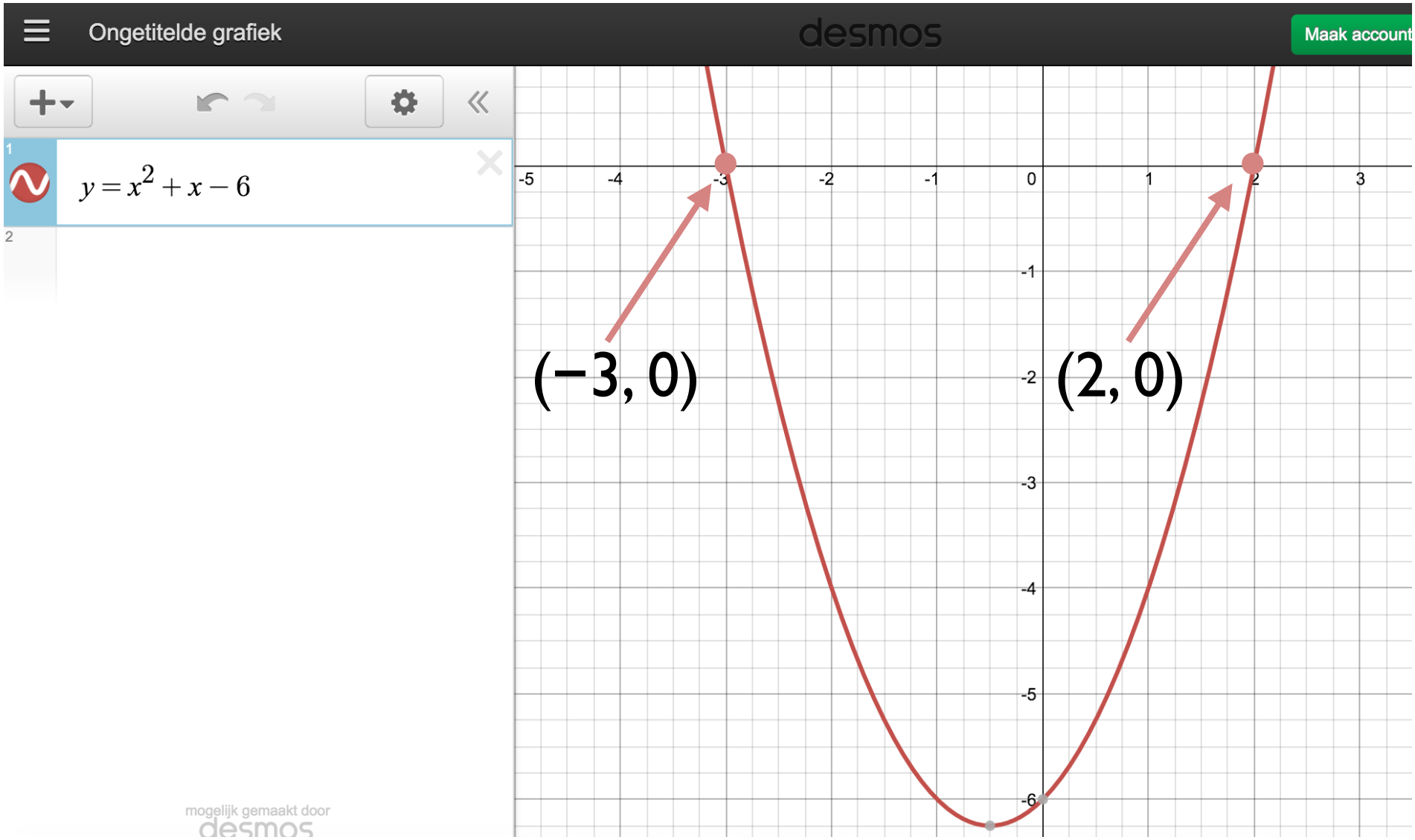

Tweedegraads verbanden (Parabolen)
mbo 2 - periode 5

parabolen en nulpunten



Noorderpoort

parabolen en nulpunten



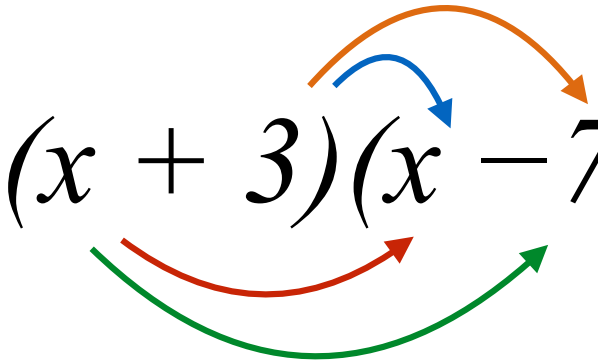
Noorderpoort

parabolen en nulpunten

Je kunt de nulpunten op 3 manieren berekenen:

1. ontbinden in factoren
2. kwadraat afsplitsen
3. abc-formule

Haakjes wegwerken



$$(x+3)(x-7) = x^2-7x+3x-21$$

$$= x^2-4x-21$$

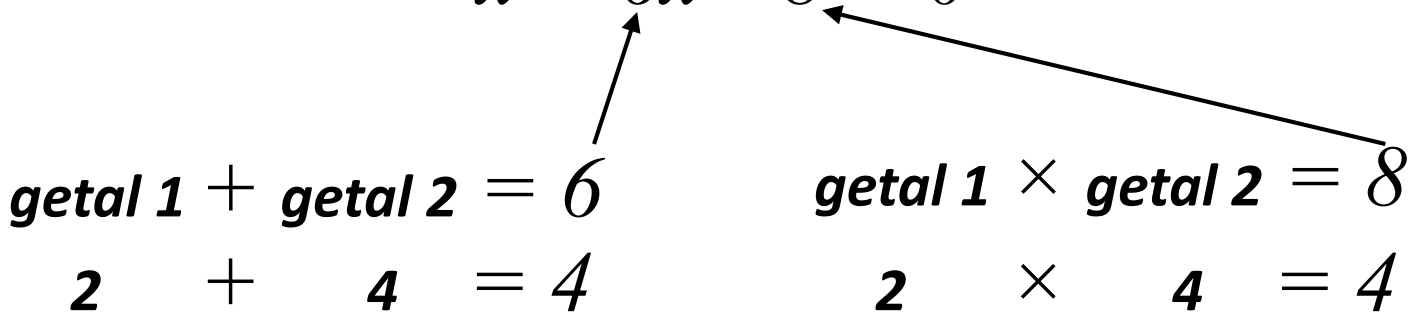
1. ontbinden in factoren

- Zet $= 0$ achter de formule
- Schrijf de formule in deze vorm: $(x \ \ \ldots\ldots)\,(x \ \ \ldots\ldots) = 0$
- Vind twee getallen waarmee het ‘puzzeltje’ klopt.
  $y = ax^2 + bx + c \ \Rightarrow b = g1 + g1 \quad en \quad c = g1 \times g2$
- De x-waarden van de nulpunten zijn die twee getallen, maar dan met een − ervoor.

1. ontbinden in factoren

Voorbeeld 1: $y = x^2 + 6x + 8$

$$x^2 + 6x + 8 = 0$$



$$(x + \textbf{getal 1})(x + \textbf{getal 2}) = 0$$

$$(x + 2)(x + 4) = 0$$

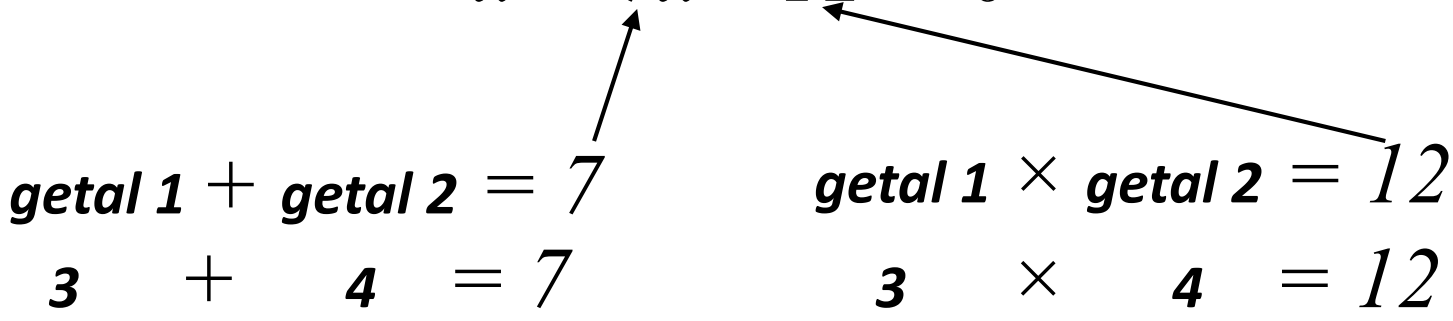
De x-waarden zijn −2 en −4.

De nulpunten zijn $(-2, 0)$ en $(-4, 0)$.

1. ontbinden in factoren

Voorbeeld 2: $y = x^2 + 7x + 12$

$$x^2 + 7x + 12 = 0$$



$$(x + \textbf{getal 1})(x + \textbf{getal 2}) = 0$$

$$(x + 3)(x + 4) = 0$$

De x-waarden zijn −3 en −4

De nulpunten zijn $(-3, 0)$ en $(-4, 0)$.

1. ontbinden in factoren

Voorbeeld 3: $y = x^2 - 5x + 6$

$$x^2 - 5x + 6 = 0$$

getal 1 $+$ ***getal 2*** $= -5$ ***getal 1*** $\times$ ***getal 2*** $= 6$

–2 $+$ ***–3*** $= -5$ ***-2*** $\times$ ***-3*** $= 6$

$$(x + \textbf{\textit{getal 1}})(x + \textbf{\textit{getal 2}}) = 0$$

$$(x - 2)(x - 3) = 0$$

De x-waarden zijn 2 en 3

De nulpunten zijn $(2, 0)$ en $(3, 0)$.

1. ontbinden in factoren

Hoe geef je antwoord op de toets?

$$y = x^2 - 5x + 6$$

$$\Leftrightarrow x^2 - 5x + 6 = 0$$

$$\Leftrightarrow (x-2)(x-3) = 0$$

$$\Leftrightarrow x - 2 = 0 \quad of \quad x - 3 = 0$$

$$\Leftrightarrow x = 2 \quad of \quad x = 3$$

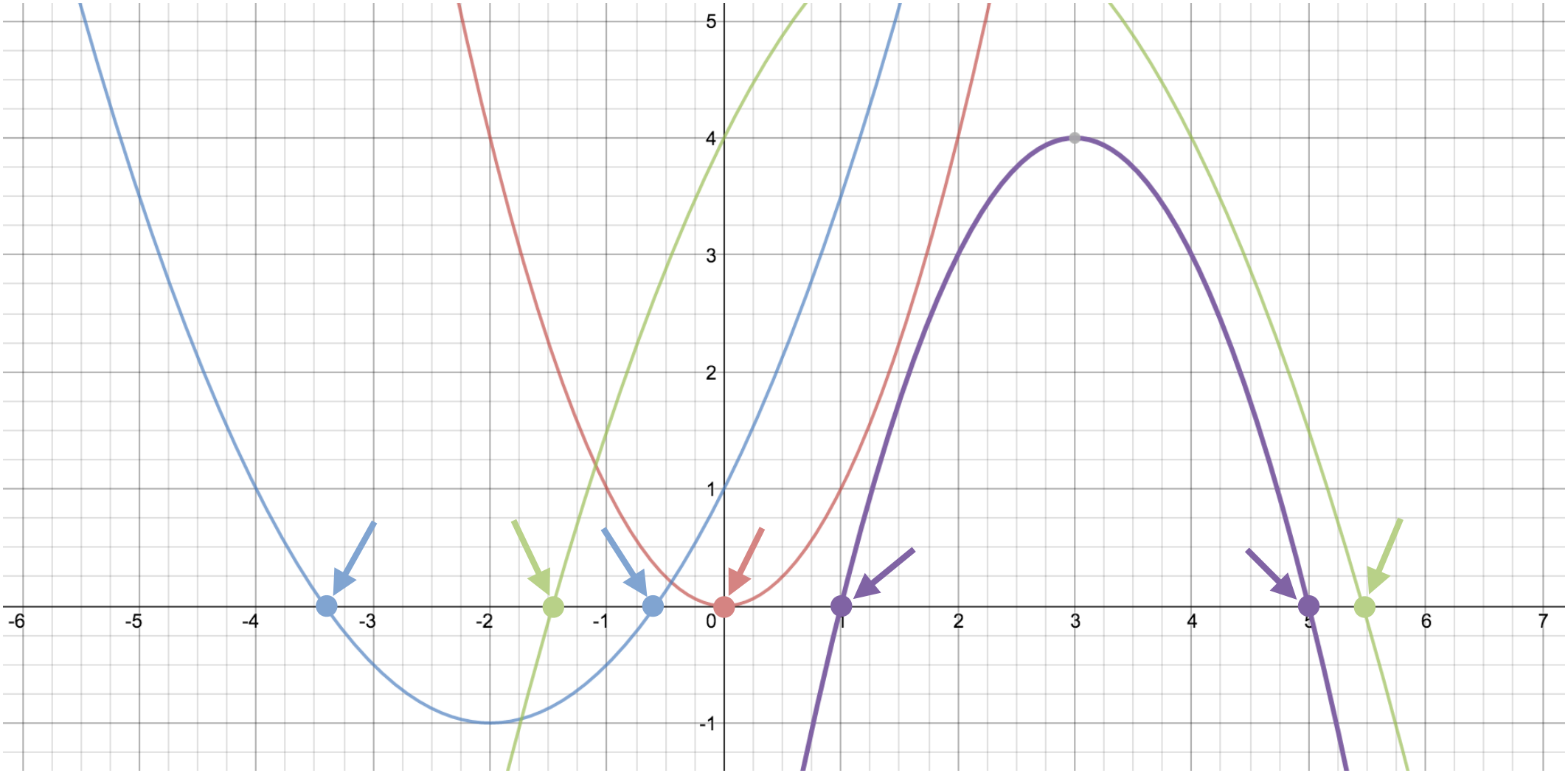
$$\Leftrightarrow nulpunten: (2, 0) \text{ en } (3, 0)$$

1. ontbinden in factoren

Oefeningen Bereken de nulpunten d.m.v. ontbinden in factoren.

1. $y = x^2 + 4x + 4$
2. $y = x^2 + 7x + 12$
3. $y = x^2 + 6x + 9$
4. $y = x^2 + 7x + 10$
5. $y = x^2 + 5x + 6$
6. $y = x^2 + 7x + 6$
7. $y = x^2 + x - 12$
8. $y = x^2 + 3x - 10$
9. $y = x^2 - x - 6$
10. $y = x^2 - 8x + 7$
11. $y = x^2 + 5x + 6$
12. $y = x^2 + 11x + 28$
13. $y = x^2 - 19x + 60$
14. $y = x^2 + 12x + 32$
15. $y = x^2 + 16x + 48$
16. $y = x^2 - 8x + 15$
17. $y = x^2 - x - 56$
18. $y = x^2 + 9x + 20$
19. $y = x^2 + 18x + 32$
20. $y = x^2 - 15x + 54$
21. $y = x^2 + 12x + 35$
22. $y = x^2 + 23x + 60$
23. $y = x^2 + 3x - 70$
24. $y = x^2 - 10x + 21$
25. $y = x^2 - x - 72$

parabolen en nulpunten



Noorderpoort

parabolen en nulpunten

Je kunt de nulpunten op 3 manieren berekenen:

1. ontbinden in factoren
2. kwadraat afsplitsen
3. abc-formule

2. kwadraat afsplitsen

$y=ax^2+bx+c$

- Zet $= 0$ achter de formule $ax^2+bx+c = 0$
- Schrijf de formule in deze vorm: $(x - \ldots)^2 - \ldots + c = 0$
- Neem de helft van b en vul die hier in.
- Neem het kwadraat van deze helft en vul die hier in.
- Werk de formule nu verder uit.

2. kwadraat afsplitsen

Voorbeeld 1: $y = x^2 + 6x + 8$

$x^2 + 6x + 8 = 0$

de helft van 6 is 3 ***+8 laat ik staan***

$(x + 3)^2 \quad -9 \quad +8 = 0$

3^2 er weer afhalen

$(x + 3)^2 - 1 = 0$

$\Rightarrow (x + 3)^2 = 1$

$\Rightarrow (x + 3) = \sqrt{1}$ *of* $(x + 3) = -\sqrt{1}$

$\Rightarrow (x + 3) = 1$ *of* $(x + 3) = -1$

$\Rightarrow x = -2$ *of* $x = -4$

De nulpunten zijn $(-2, 0)$ en $(-4, 0)$.

Noorderpoort

2. kwadraat afsplitsen

Voorbeeld 2: $y = x^2 + 12x + 35$

$$x^2 + 12x + 35 = 0$$

de helft van 12 is 6 ***+35 laat ik staan***

$$(x + 6)^2 \quad -36 \quad +35 = 0$$

6^2 er weer afhalen

$$(x + 6)^2 - 1 = 0$$

$$\Rightarrow (x + 6)^2 = 1$$

$$\Rightarrow (x + 6) = \sqrt{1} \text{ of } (x + 6) = -\sqrt{1}$$

$$\Rightarrow (x + 6) = 1 \text{ of } (x + 6) = -1$$

$$\Rightarrow x = -5 \text{ of } x = -7$$

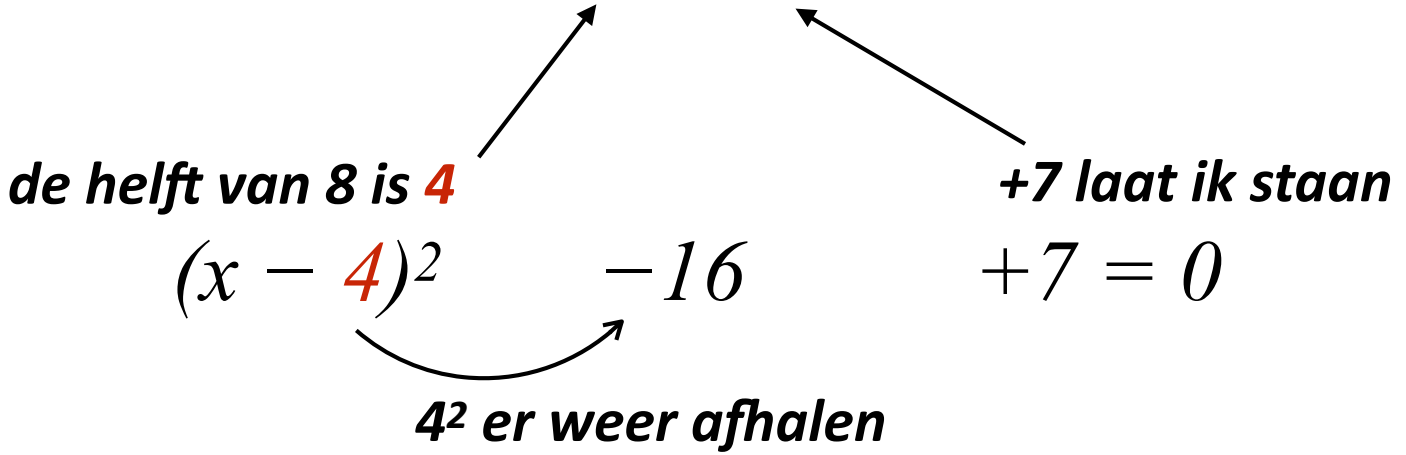
De nulpunten zijn $(-5, 0)$ en $(-7, 0)$.

Noorderpoort

2. kwadraat afsplitsen

Voorbeeld 3: $y = x^2 - 8x + 7$

$$x^2 - 8x + 7 = 0$$



$$(x - 4)^2 - 9 = 0$$
$$\Rightarrow (x - 4)^2 = 9$$
$$\Rightarrow (x - 4) = \sqrt{9} \text{ of } (x - 4) = -\sqrt{9}$$
$$\Rightarrow (x - 4) = 3 \text{ of } (x - 4) = -3$$
$$\Rightarrow x = 7 \text{ of } x = 1$$

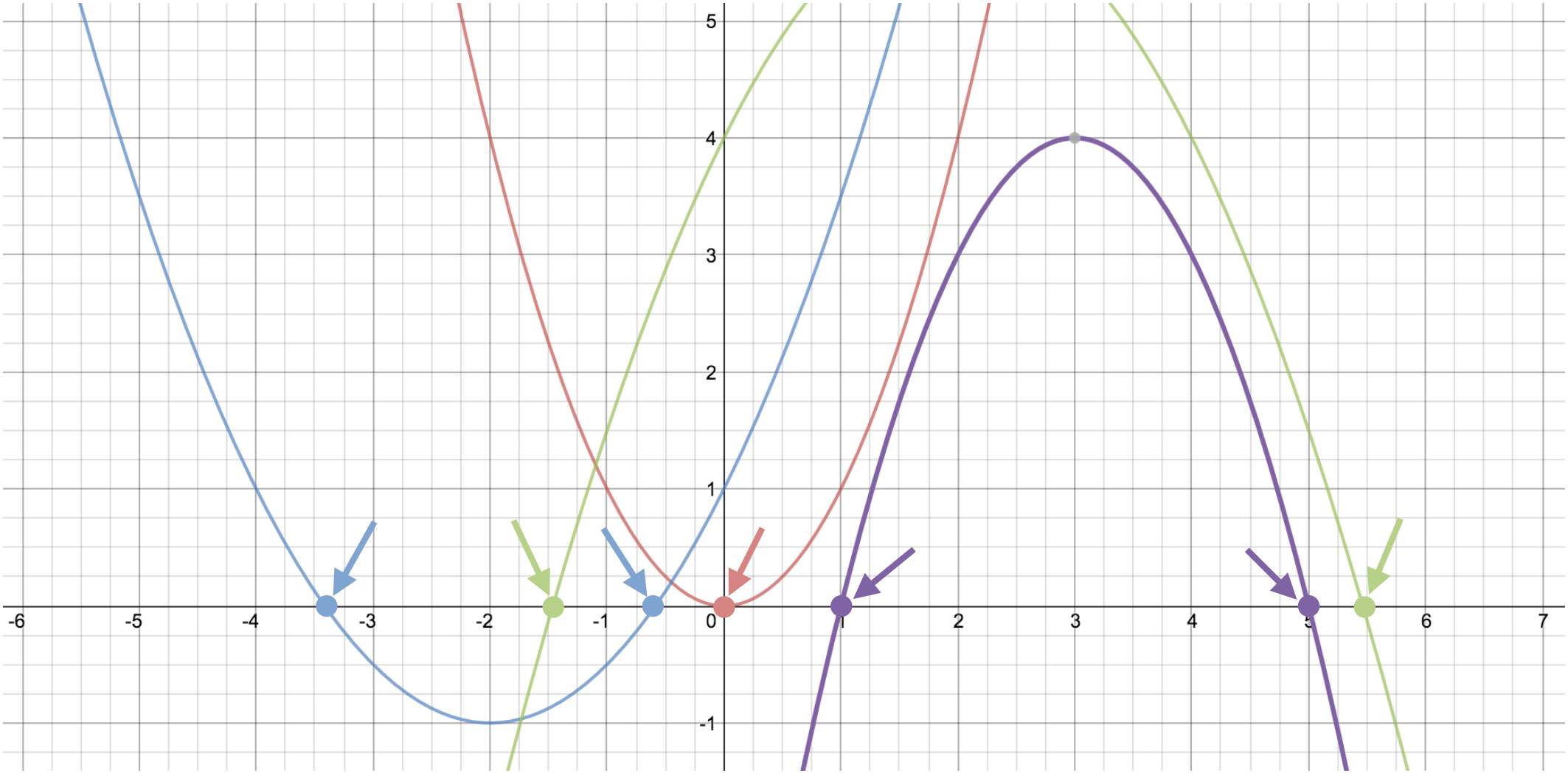
De nulpunten zijn $(7, 0)$ en $(1, 0)$.

2. kwadraat afsplitsen

Oefeningen Bereken de nulpunten d.m.v. kwadraat afsplitsen.

26. $y = x^2 + 4x + 4$
27. $y = x^2 + 6x + 9$
28. $y = x^2 - 8x + 7$
29. $y = x^2 + 12x + 32$
30. $y = x^2 - 8x + 15$
31. $y = x^2 + 18x + 32$
32. $y = x^2 + 12x + 35$
33. $y = x^2 - 10x + 21$
34. $y = x^2 + 16x + 48$
35. $y = x^2 - 8x + 12$
36. $y = x^2 + 4x - 5$
37. $y = x^2 + 4x + 3$
38. $y = x^2 + 6x + 5$
39. $y = x^2 - 6x + 5$
40. $y = x^2 - 2x - 8$

parabolen en nulpunten



Noorderpoort

parabolen en nulpunten

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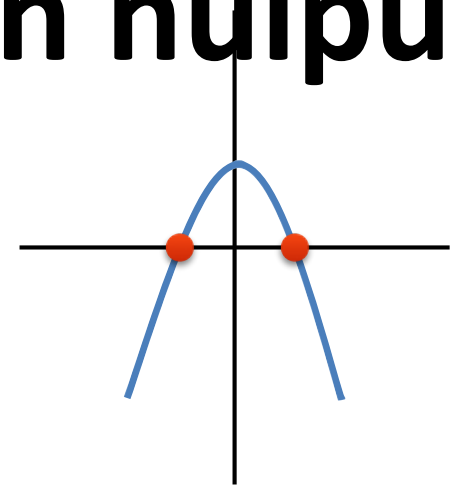
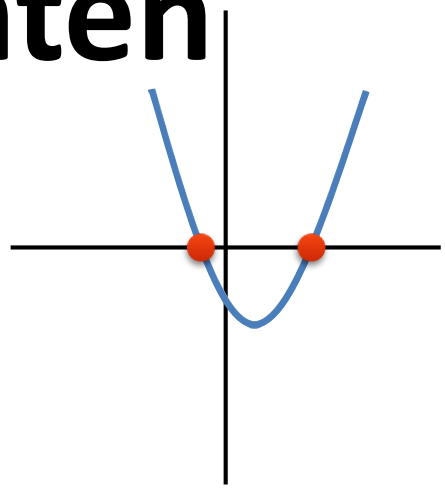
3. abc-formule

parabolen en nulpunten

Twee oplossingen

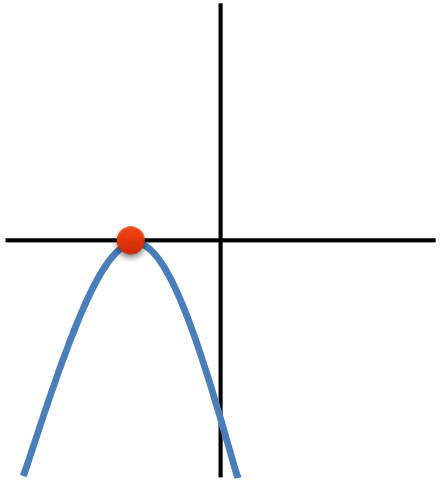
Er zijn **twee** x-waarden waarvoor geldt dat $y = 0$

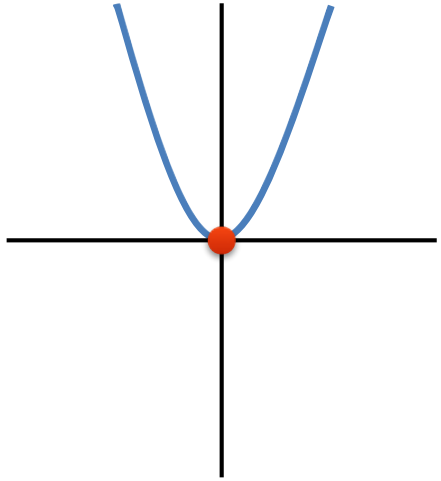




Eén oplossing

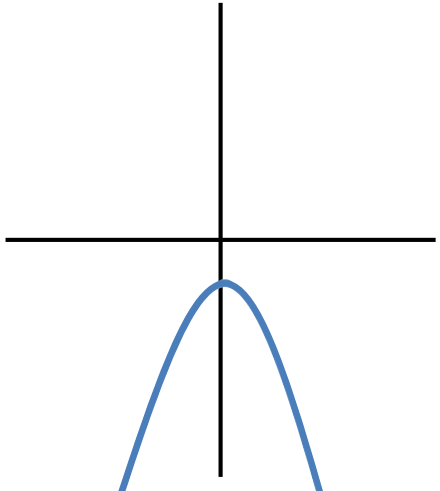
Er is **één** x-waarde waarvoor geldt dat $y = 0$

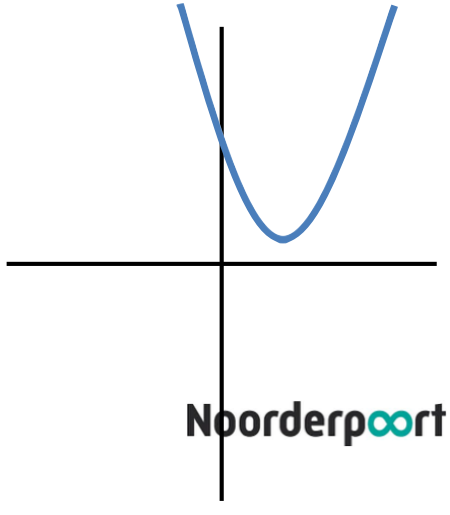




Geen oplossing

Er is **géén** x-waarde waarvoor geldt dat $y = 0$





parabolen en nulpunten

Je kunt de nulpunten op 3 manieren berekenen:

1. ontbinden in factoren
2. kwadraat afsplitsen
3. de abc-formule

3. de abc-formule

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

3. de abc-formule

$$y = 2x^2 + 8x + 6$$

$$a = 2 \qquad b = 8 \qquad c = 6$$

a)	$y = 4x^2 + 18x + 32$	$a=4$	$b=18$	$c=32$
b)	$y = 3x^2 + 12x + 35$	$a=3$	$b=12$	$c=35$
c)	$y = \frac{1}{3}x^2 - 2x + 21$	$a=\frac{1}{3}$	$b=-2$	$c=21$
d)	$y = 2x^2 + 16x - 48$	$a=2$	$b=16$	$c=-48$
e)	$y = x^2 - 8x + 12$	$a=1$	$b=-8$	$c=12$

3. de abc-formule

$$y = 2x^2 + 8x + 6$$

$a = 2$ $\quad$ $b = 8$ $\quad$ $c = 6$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x = \frac{-8 \pm \sqrt{8^2 - 4.2.6}}{2.2}$$

$$x = \frac{-8 \pm \sqrt{16}}{4} \qquad x = \frac{-8 + 4}{4} \quad of \quad x = \frac{-8 - 4}{4}$$

$$x = -1 \quad of \quad x = -3$$

Noorderpoort

3. de abc-formule

Oefeningen Bereken de nulpunten met de abc-formule.

41. $y = x^2 + 5x + 4$
42. $y = x^2 + 6x + 5$
43. $y = 2x^2 + 7x + 3$
44. $y = -x^2 + 7x - 6$
45. $y = 3x^2 + 8x + 4$
46. $y = 2x^2 + 5x + 2$
47. $y = 5x^2 + 6x + 1$
48. $y = -x^2 + 6x - 8$
49. $y = x^2 + 7x + 6$
50. $y = -x^2 + 6x - 5$
51. $y = -2x^2 + 6x - 4$
52. $y = 4x^2 + 9x + 2$
53. $y = 5x^2 + 8x + 3$
54. $y = 2x^2 + 8x + 6$
55. $y = 3x^2 + 8x + 5$
56. $y = 4x^2 - 5x + 1$
57. $y = 2x^2 + 6x + 4$
58. $y = x^2 + 6x + 8$
59. $y = -x^2 + 7x - 10$
60. $y = -x^2 + 8x - 7$
61. $y = x^2 + 7x + 10$
62. $y = -2x^2 + 8x - 6$
63. $y = -4x^2 + 9x - 2$
64. $y = -5x^2 + 7x - 2$
65. $y = 6x^2 + 7x + 1$

Antwoorden en uitwerkingen

1.

$x^2 + 4x + 4 = 0$
$\Leftrightarrow (x + 2)(x + 2) = 0$
$\Leftrightarrow x + 2 = 0$
$\Leftrightarrow x = -2$
nulpunt: $(-2, 0)$

2.

$x^2 + 7x + 12 = 0$
$\Leftrightarrow (x + 3)(x + 4) = 0$
$\Leftrightarrow x + 3 = 0$ of $x + 4 = 0$
$\Leftrightarrow x = -3$ of $x = -4$
nulpunten: $(-3, 0)$ en $(-4, 0)$

3.

$x^2 + 6x + 9 = 0$
$\Leftrightarrow (x + 3)(x + 3) = 0$
$\Leftrightarrow x + 3 = 0$
$\Leftrightarrow x = -3$
nulpunt: $(-3, 0)$

4.

$x^2 + 7x + 10 = 0$
$\Leftrightarrow (x + 5)(x + 2) = 0$
$\Leftrightarrow x + 5 = 0$ of $x + 2 = 0$
$\Leftrightarrow x = -5$ of $x = -2$
nulpunten: $(-5, 0)$ en $(-2, 0)$

5.

$x^2 + 5x + 6 = 0$
$\Leftrightarrow (x + 2)(x + 3) = 0$
$\Leftrightarrow x + 2 = 0$ of $x + 3 = 0$
$\Leftrightarrow x = -2$ of $x = -3$
nulpunten: $(-2, 0)$ en $(-3, 0)$

6.

$x^2 + 7x + 6 = 0$
$\Leftrightarrow (x + 6)(x + 1) = 0$
$\Leftrightarrow x + 6 = 0$ of $x + 1 = 0$
$\Leftrightarrow x = -6$ of $x = -1$
nulpunten: $(-6, 0)$ en $(-1, 0)$

7.

$x^2 + x - 12 = 0$
$\Leftrightarrow (x + 4)(x - 3) = 0$
$\Leftrightarrow x + 4 = 0$ of $x - 3 = 0$
$\Leftrightarrow x = -4$ of $x = 3$
nulpunten: $(-4, 0)$ en $(3, 0)$

8.

$x^2 + 3x - 10 = 0$
$\Leftrightarrow (x - 2)(x + 5) = 0$
$\Leftrightarrow x - 2 = 0$ of $x + 5 = 0$
$\Leftrightarrow x = 2$ of $x = -5$
nulpunten: $(2, 0)$ en $(-5, 0)$

9.

$x^2 - x - 6 = 0$
$\Leftrightarrow (x + 2)(x - 3) = 0$
$\Leftrightarrow x + 2 = 0$ of $x - 3 = 0$
$\Leftrightarrow x = -2$ of $x = 3$
nulpunten: $(-2, 0)$ en $(3, 0)$

10.

$x^2 - 8x + 7 = 0$
$\Leftrightarrow (x - 7)(x - 1) = 0$
$\Leftrightarrow x - 7 = 0$ of $x - 1 = 0$
$\Leftrightarrow x = 7$ of $x = 1$
nulpunten: $(7, 0)$ en $(1, 0)$

11.

$x^2 + 5x + 6 = 0$
$\Leftrightarrow (x + 2)(x + 3) = 0$
$\Leftrightarrow x + 2 = 0$ of $x + 3 = 0$
$\Leftrightarrow x = -2$ of $x = -3$
nulpunten: $(-2, 0)$ en $(-3, 0)$

12.

$x^2 + 11x + 28 = 0$
$\Leftrightarrow (x + 4)(x + 7) = 0$
$\Leftrightarrow x + 4 = 0$ of $x + 7 = 0$
$\Leftrightarrow x = -4$ of $x = -7$
nulpunten: $(-4, 0)$ en $(-7, 0)$

13.

$x^2 - 19x + 60 = 0$
$\Leftrightarrow (x - 4)(x - 15) = 0$
$\Leftrightarrow x - 4 = 0$ of $x - 15 = 0$
$\Leftrightarrow x = 4$ of $x = 15$
nulpunten: $(4, 0)$ en $(15, 0)$

14.

$x^2 + 12x + 32 = 0$
$\Leftrightarrow (x + 4)(x + 8) = 0$
$\Leftrightarrow x + 4 = 0$ of $x + 8 = 0$
$\Leftrightarrow x = -4$ of $x = -8$
nulpunten: $(-4, 0)$ en $(-8, 0)$

15.

$x^2 + 16x + 48 = 0$
$\Leftrightarrow (x + 4)(x + 12) = 0$
$\Leftrightarrow x + 4 = 0$ of $x + 12 = 0$
$\Leftrightarrow x = -4$ of $x = -12$
nulpunten: $(-4, 0)$ en $(-12, 0)$

16.

$x^2 - 8x + 15 = 0$
$\Leftrightarrow (x - 3)(x - 5) = 0$
$\Leftrightarrow x - 3 = 0$ of $x - 5 = 0$
$\Leftrightarrow x = 3$ of $x = 5$
nulpunten: $(3, 0)$ en $(5, 0)$

Antwoorden en uitwerkingen

17.

$x^2 - x - 56 = 0$
$\Leftrightarrow (x + 7)(x - 8) = 0$
$\Leftrightarrow x + 7 = 0$ *of* $x - 8 = 0$
$\Leftrightarrow x = -7$ *of* $x = 8$
nulpunten: $(-7, 0)$ *en* $(8, 0)$

18.

$x^2 + 9x + 20 = 0$
$\Leftrightarrow (x + 5)(x + 4) = 0$
$\Leftrightarrow x + 5 = 0$ *of* $x + 4 = 0$
$\Leftrightarrow x = -5$ *of* $x = -4$
nulpunten: $(-5, 0)$ *en* $(-4, 0)$

19.

$x^2 + 18x + 32 = 0$
$\Leftrightarrow (x + 16)(x + 2) = 0$
$\Leftrightarrow x + 16 = 0$ *of* $x + 2 = 0$
$\Leftrightarrow x = -16$ *of* $x = -2$
nulpunten: $(-16, 0)$ *en* $(-2, 0)$

20.

$x^2 - 15x + 54 = 0$
$\Leftrightarrow (x - 6)(x - 9) = 0$
$\Leftrightarrow x - 6 = 0$ *of* $x - 9 = 0$
$\Leftrightarrow x = 6$ *of* $x = 9$
nulpunten: $(6, 0)$ *en* $(9, 0)$

21.

$x^2 + 12x + 35 = 0$
$\Leftrightarrow (x + 5)(x + 7) = 0$
$\Leftrightarrow x + 5 = 0$ *of* $x + 7 = 0$
$\Leftrightarrow x = -5$ *of* $x = -7$
nulpunten: $(-5, 0)$ *en* $(-7, 0)$

22.

$x^2 + 23x + 60 = 0$
$\Leftrightarrow (x + 3)(x + 20) = 0$
$\Leftrightarrow x + 3 = 0$ *of* $x + 20 = 0$
$\Leftrightarrow x = -3$ *of* $x = -20$
nulpunten: $(-3, 0)$ *en* $(-20, 0)$

23.

$x^2 + 3x - 70 = 0$
$\Leftrightarrow (x - 7)(x + 10) = 0$
$\Leftrightarrow x - 7 = 0$ *of* $x + 10 = 0$
$\Leftrightarrow x = 7$ *of* $x = -10$
nulpunten: $(7, 0)$ *en* $(-10, 0)$

24.

$x^2 - 10x + 21 = 0$
$\Leftrightarrow (x - 3)(x - 7) = 0$
$\Leftrightarrow x - 3 = 0$ *of* $x - 7 = 0$
$\Leftrightarrow x = 3$ *of* $x = 7$
nulpunten: $(3, 0)$ *en* $(7, 0)$

25.

$x^2 - x - 72 = 0$
$\Leftrightarrow (x + 8)(x - 9) = 0$
$\Leftrightarrow x + 8 = 0$ *of* $x - 9 = 0$
$\Leftrightarrow x = -8$ *of* $x = 9$
nulpunten: $(-8, 0)$ *en* $(9, 0)$

26.

$x^2 + 4x + 4 = 0$
$\Leftrightarrow (x + 2)^2 - 4 + 4 = 0$
$\Leftrightarrow (x + 2)^2 = 0$
$\Leftrightarrow x + 2 = \sqrt{0} = 0$
$\Leftrightarrow x = -2$
nulpunt: $(-2, 0)$

27.

$x^2 + 6x + 9 = 0$
$\Leftrightarrow (x + 3)^2 - 9 + 9 = 0$
$\Leftrightarrow (x + 3)^2 = 0$
$\Leftrightarrow x + 3 = \sqrt{0} = 0$
$\Leftrightarrow x = -3$
nulpunt: $(-3, 0)$

28.

$x^2 - 8x + 7 = 0$
$\Leftrightarrow (x - 4)^2 - 16 + 7 = 0$
$\Leftrightarrow (x - 4)^2 - 9 = 0$
$\Leftrightarrow (x - 4)^2 = 9$
$\Leftrightarrow x - 4 = \sqrt{9}$ *of* $x - 4 = -\sqrt{9}$
$\Leftrightarrow x - 4 = 3$ *of* $x - 4 = -3$
$\Leftrightarrow x = 7$ *of* $x = 1$
nulpunten: $(7, 0)$ *en* $(1, 0)$

Antwoorden en uitwerkingen

29.

$x^2 - 12x + 32 = 0$
$\Leftrightarrow (x - 6)^2 - 36 + 32 = 0$
$\Leftrightarrow (x - 6)^2 - 4 = 0$
$\Leftrightarrow (x - 6)^2 = 4$
$\Leftrightarrow x - 6 = \sqrt{4}$ of $x - 6 = -\sqrt{4}$
$\Leftrightarrow x - 4 = 2$ of $x - 4 = -2$
$\Leftrightarrow x = 6$ of $x = 2$
nulpunt: (6, 0) en (2, 0)

30.

$x^2 - 8x + 15 = 0$
$\Leftrightarrow (x - 4)^2 - 16 + 15 = 0$
$\Leftrightarrow (x - 4)^2 - 1 = 0$
$\Leftrightarrow (x - 4)^2 = 1$
$\Leftrightarrow x - 4 = \sqrt{1}$ of $x - 4 = -\sqrt{1}$
$\Leftrightarrow x - 4 = 1$ of $x - 4 = -1$
$\Leftrightarrow x = 5$ of $x = 3$
nulpunt: (5, 0) en (3, 0)

31.

$x^2 + 18x + 32 = 0$
$\Leftrightarrow (x + 9)^2 - 81 + 32 = 0$
$\Leftrightarrow (x + 9)^2 - 49 = 0$
$\Leftrightarrow (x + 9)^2 = 49$
$\Leftrightarrow x + 9 = \sqrt{49}$ of $x + 9 = -\sqrt{49}$
$\Leftrightarrow x + 9 = 7$ of $x + 9 = -7$
$\Leftrightarrow x = -2$ of $x = -16$
nulpunt: (−2, 0) en (−16, 0)

32.

$x^2 + 12 + 32 = 0$
$\Leftrightarrow (x + 6)^2 - 36 + 32 = 0$
$\Leftrightarrow (x + 6)^2 - 4 = 0$
$\Leftrightarrow (x + 6)^2 = 4$
$\Leftrightarrow x + 6 = \sqrt{4}$ of $x + 6 = -\sqrt{4}$
$\Leftrightarrow x + 6 = 2$ of $x + 6 = -2$
$\Leftrightarrow x = -4$ of $x = -8$
nulpunt: (−4, 0) en (−8, 0)

33.

$x^2 - 10x + 21 = 0$
$\Leftrightarrow (x - 5)^2 - 25 + 21 = 0$
$\Leftrightarrow (x - 5)^2 - 4 = 0$
$\Leftrightarrow (x - 5)^2 = 4$
$\Leftrightarrow x - 5 = \sqrt{4}$ of $x - 5 = -\sqrt{4}$
$\Leftrightarrow x - 5 = 2$ of $x - 5 = -2$
$\Leftrightarrow x = 7$ of $x = 3$
nulpunt: (7, 0) en (3, 0)

34.

$x^2 + 16x + 48 = 0$
$\Leftrightarrow (x + 8)^2 - 64 + 48 = 0$
$\Leftrightarrow (x + 8)^2 - 16 = 0$
$\Leftrightarrow (x + 8)^2 = 16$
$\Leftrightarrow x + 8 = \sqrt{16}$ of $x + 8 = -\sqrt{16}$
$\Leftrightarrow x + 8 = 4$ of $x + 8 = -4$
$\Leftrightarrow x = -4$ of $x = -12$
nulpunt: (−4, 0) en (−12, 0)

35.

$x^2 - 8x + 12 = 0$
$\Leftrightarrow (x - 4)^2 - 16 + 12 = 0$
$\Leftrightarrow (x - 4)^2 - 4 = 0$
$\Leftrightarrow (x - 4)^2 = 4$
$\Leftrightarrow x - 4 = \sqrt{4}$ of $x - 4 = -\sqrt{4}$
$\Leftrightarrow x - 4 = 2$ of $x - 4 = -2$
$\Leftrightarrow x = 6$ of $x = 2$
nulpunt: (6, 0) en (2, 0)

36.

$x^2 + 4x - 5 = 0$
$\Leftrightarrow (x + 2)^2 - 4 - 5 = 0$
$\Leftrightarrow (x + 2)^2 - 9 = 0$
$\Leftrightarrow (x + 2)^2 = 9$
$\Leftrightarrow x + 2 = \sqrt{9}$ of $x + 2 = -\sqrt{9}$
$\Leftrightarrow x + 2 = 3$ of $x + 2 = -3$
$\Leftrightarrow x = -1$ of $x = -5$
nulpunt: (−1, 0) en (−5, 0)

37.

$x^2 + 4x + 3 = 0$
$\Leftrightarrow (x + 2)^2 - 4 + 3 = 0$
$\Leftrightarrow (x + 2)^2 - 1 = 0$
$\Leftrightarrow (x + 2)^2 = 1$
$\Leftrightarrow x + 2 = \sqrt{1}$ of $x + 2 = -\sqrt{1}$
$\Leftrightarrow x + 2 = 1$ of $x + 2 = -1$
$\Leftrightarrow x = -1$ of $x = -3$
nulpunt: (−1, 0) en (−3, 0)

38.

$x^2 + 6x + 5 = 0$
$\Leftrightarrow (x + 3)^2 - 9 + 5 = 0$
$\Leftrightarrow (x + 3)^2 - 4 = 0$
$\Leftrightarrow (x + 3)^2 = 4$
$\Leftrightarrow x + 3 = \sqrt{4}$ of $x + 3 = -\sqrt{4}$
$\Leftrightarrow x + 3 = 2$ of $x + 3 = -2$
$\Leftrightarrow x = -1$ of $x = -5$
nulpunt: (−1, 0) en (−5, 0)

39.

$x^2 - 6x + 5 = 0$
$\Leftrightarrow (x - 3)^2 - 9 + 5 = 0$
$\Leftrightarrow (x - 3)^2 - 4 = 0$
$\Leftrightarrow (x - 3)^2 = 4$
$\Leftrightarrow x - 3 = \sqrt{4}$ of $x - 3 = -\sqrt{4}$
$\Leftrightarrow x - 3 = 2$ of $x - 3 = -2$
$\Leftrightarrow x = 5$ of $x = 1$
nulpunt: (5, 0) en (1, 0)

40.

$x^2 - 2x - 15 = 0$
$\Leftrightarrow (x - 1)^2 - 1 - 15 = 0$
$\Leftrightarrow (x - 1)^2 - 16 = 0$
$\Leftrightarrow (x - 1)^2 = 16$
$\Leftrightarrow x - 1 = \sqrt{16}$ of $x - 1 = -\sqrt{16}$
$\Leftrightarrow x - 1 = 4$ of $x - 1 = -4$
$\Leftrightarrow x = 5$ of $x = -3$
nulpunt: (5, 0) en (−3, 0)

Antwoorden en uitwerkingen

41.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

42.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-6 \pm \sqrt{6^2 - 4 \cdot 1 \cdot 5}}{2 \cdot 1}$$
$$= \frac{-6 \pm \sqrt{36 - 20}}{2}$$
$$= \frac{-6 + \sqrt{16}}{2} \text{ of } \frac{-6 - \sqrt{16}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-10}{2}$$
$$= -1 \text{ of } -5$$
$$\text{nulpunten} : (-1,0) \text{ en } (-5,0)$$

43.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

44.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

45.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

46.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

47.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

48.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

49.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$

50.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$$
$$= \frac{-5 \pm \sqrt{25 - 16}}{2}$$
$$= \frac{-5 + \sqrt{9}}{2} \text{ of } \frac{-5 - \sqrt{9}}{2}$$
$$= \frac{-2}{2} \text{ of } \frac{-8}{2}$$
$$= -1 \text{ of } -4$$
$$\text{nulpunten} : (-1,0) \text{ en } (-4,0)$$