

Wiskunde voor vrijescholen

Antwoorden Klas 9

B.Geels

14 juli 2021

1 Ongelijkheden

1-1 a. $[-3, -1)$ b. $\langle 0, 1)$ c. $\langle 2, 4)$ d. $[5, 7]$

1-2 ~~5 4 3 2 1 0 1 2 3 4 5 6 7~~

1-3 ~~5 4 3 2 1 0 1 2 3 4 5 6 7~~

1-4 c. $\{-2, -1, 0, 1, 2, 3\}$ d. $\{-1, 0, 1, 2, 3\}$

1-5 b. $\{0, 1, 2, 3, 4\}$; c. $\{-1, 0, 1, 2, 3, 4\}$ d. $\{-1\frac{1}{2}, \frac{2}{3}, 3\frac{1}{3}\}$

1-6	a. $\{-1, 0, 1\}$	c. geen	e. $\{-5, -4, -3, -2\}$
	b. $\{7\}$	d. $\{-1, 0\}$	f. $\{6, 7, 8, 9, 10\}$

1-7 $[70, 120]$

1-8 $[90, 110]$

1-9 a. $\{0, 1, 2, 3\}$ b. $\{-2, -1, 0, 1, 2, 3\}$ c. $\{1\frac{1}{2}, -\frac{1}{3}, 2\frac{3}{4}\}$

1-10 ~~5 4 3 2 1 0 1 2 3 4 5 6 7~~

1-11 ~~8 7 6 5 4 3 2 1 0 1 2 3 4~~

1-12	a. $[1, 4)$	c. $\langle 0, 4)$	e. $[-\frac{1}{3}, 1\frac{1}{2}]$
	b. $[-1, 2]$	d. $\langle 0, 3)$	f. $[1, 2]$
1-13	a. $[2, 3\frac{1}{3}]$	c. $\langle 3, 5)$	e. \emptyset
	b. $[-\frac{1}{2}, \frac{1}{2}]$	d. \emptyset	f. $\langle 1, \rightarrow)$

1-14 a. ja, A c. tussen 11 en 13 zijn A en B beide open.

d. $[12, 13]$ e. $[9, 11)$ en $\langle 15, 17]$

1-15 a. $[3, 8)$ b. $[10, 13)$ c. na dag 21, $[21, \rightarrow)$

1-16 a. 48 km/uur b. $\langle 48, 97]$ c. $\langle 72, 112]$

1-17	a. $\langle -2, 4)$	c. $\langle \leftarrow, 3)$
	b. \mathbb{R}	d. $[-1, \rightarrow)$

1-18	a. $[1, 2)$	c. $\langle 0, 1)$	e. \emptyset
	b. kan niet korter	d. $\{1\}$	f. $\langle \leftarrow, 3)$

1-19	a. $[3\frac{1}{7}, 3\frac{1}{6}]$	c. \emptyset
	b. \emptyset	d. $\langle -1\frac{6}{7}, -1\frac{5}{6})$

1-20	a. $\{3\}$	c. $[1, 5]$	e. \emptyset
	b. k.n.k of: $[1, 5] \setminus \{3\}$	d. $[4, 5)$	f. $[-1, \rightarrow)$

1-21

- | | | | |
|--|--|---|--|
| a $x \leq 2; x \in \langle \leftarrow, 2 \rangle$ | c $x \leq 4; x \in \langle \leftarrow, 4 \rangle$ | e $x > 4; x \in \langle 4 \rightarrow \rangle$ | g $x \leq 0; x \in \langle \leftarrow, 0 \rangle$ |
| b $x > 0; x \in \langle 0 \rightarrow \rangle$ | d $x > 6; x \in \langle 6 \rightarrow \rangle$ | f $x < 4; x \in \langle \leftarrow, 4 \rangle$ | h $x \leq 5; x \in \langle \leftarrow, 5 \rangle$ |

1-22

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|---|--|--|
| a. $x < 1; x \in \langle \leftarrow, 1 \rangle$ | c. $x < -2; x \in \langle \leftarrow, -2 \rangle$ | e. $x \geq 4; [4, \rightarrow)$ |
| b. $x \leq 6; x \in \langle \leftarrow, 6 \rangle$ | d. $x < 16; x \in \langle \leftarrow, 16 \rangle$ | f. $x > 7; x \in \langle 7 \rightarrow \rangle$ |

1-23

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|--|--|--|
| a. $x < 8; x \in \langle \leftarrow, 8 \rangle$ | c. $x < 0; x \in \langle \leftarrow, 0 \rangle$ | e. $x > -5; x \in \langle -5 \rightarrow \rangle$ |
| b. $x > 3; x \in \langle 3 \rightarrow \rangle$ | d. $x > -6; x \in \langle -6 \rightarrow \rangle$ | f. $x > -9; x \in \langle -9 \rightarrow \rangle$ |

1-24

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|--|---|--|
| a. $x \geq 2; [2, \rightarrow)$ | c. $x \leq -2; x \in \langle \leftarrow, -2 \rangle$ | e. $x > 3; x \in \langle 3 \rightarrow \rangle$ |
| b. $x \geq 3; [3, \rightarrow)$ | d. $x < -4\frac{1}{2}$ | f. $x < 4\frac{1}{2}$ |

1-25

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|--|---|---|
| a. $x \geq 2; [2, \rightarrow)$ | c. $x \leq 2; x \in \langle \leftarrow, 2 \rangle$ | e. $x \leq 0; x \in \langle \leftarrow, 0 \rangle$ |
| b. $x \geq 0; [0, \rightarrow)$ | d. $x \leq 3; x \in \langle \leftarrow, 3 \rangle$ | f. $x \leq 3\frac{1}{4}; x \in \langle \leftarrow, 3\frac{1}{4} \rangle$ |

1-26

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|--|--|--|
| a. $x > 2; x \in \langle 2 \rightarrow \rangle$ | c. $x > 5; x \in \langle 5 \rightarrow \rangle$ | e. $x < -4; x \in \langle \leftarrow, -4 \rangle$ |
| b. $x < 7; x \in \langle \leftarrow, 7 \rangle$ | d. $x > -3; x \in \langle -3 \rightarrow \rangle$ | f. $x > -3; x \in \langle -3 \rightarrow \rangle$ |

1-27

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|--|---|------------------------------|
| a. $x > -\frac{5}{2}; x \in \langle -\frac{5}{2} \rightarrow \rangle$ | c. $x > 0; x \in \langle 0 \rightarrow \rangle$ | e. $x \in \mathbb{R}$ |
| b. $x < \frac{25}{2}; x \in \langle \leftarrow, \frac{25}{2} \rangle$ | d. $x \leq 4; x \in \langle \leftarrow, 4 \rangle$ | f. $x \in \mathbb{R}$ |

1-28

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|-----------------------------|---|---|
| a. $x \in \emptyset$ | c. $x \geq -\frac{3}{2}$ | e. $x \leq -\frac{5}{3}$ |
| b. $x < -2$ | d. $x \leq \frac{4}{3}; x \in \langle \leftarrow, \frac{4}{3} \rangle$ | f. voor elke $x; x \in \mathbb{R}$ |

1-29

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|--|--|--|
| a. $x < -6; x \in \langle \leftarrow, -6 \rangle$ | c. $x \geq -\frac{8}{3}; [-\frac{8}{3}, \rightarrow)$ | e. $x \leq 0; x \in \langle \leftarrow, 0 \rangle$ |
| b. $x > 9; x \in \langle 9 \rightarrow \rangle$ | d. $x > \frac{11}{2}; x \in \langle \frac{11}{2} \rightarrow \rangle$ | f. $x < -\frac{11}{2}; x \in \langle \leftarrow, -\frac{11}{2} \rangle$ |

1-30

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| a. $x > 12; x \in \langle 12 \rightarrow \rangle$ | c. $x < -\frac{69}{2}; x \in \langle \leftarrow, -\frac{69}{2} \rangle$ |
| b. $x < \frac{3}{2}; x \in \langle \leftarrow, \frac{3}{2} \rangle$ | d. $x < 0; x \in \langle \leftarrow, 0 \rangle$ |

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|-------------|--|---|
| 1-31 | a. $x < 7$; $x \in \langle \leftarrow, 7 \rangle$
b. $x < \frac{5}{2}$; $x \in \langle \leftarrow, \frac{5}{2} \rangle$ | c. $x < 2$; $x \in \langle \leftarrow, 2 \rangle$
d. $x > 1$; $x \in \langle 1 \rightarrow$ |
| 1-32 | a. $x > 6$; $x \in \langle 6 \rightarrow$
b. $x < -\frac{5}{2}$; $x \in \langle \leftarrow, -\frac{5}{2} \rangle$ | c. $x > \frac{3}{2}$; $x \in \langle \frac{3}{2} \rightarrow$
d. $x > -\frac{1}{2}$; $x \in \langle -\frac{1}{2} \rightarrow$ |
| 1-33 | a. $x \leq 5$
b. $x \leq 5$ | e. $x > -5$; $x \in \langle -5 \rightarrow$
f. $x < -\frac{3}{2}$; $x \in \langle \leftarrow, -\frac{3}{2} \rangle$
c. $x \geq 4$
d. $x < \frac{5}{2}$; $x \in \langle \leftarrow, \frac{5}{2} \rangle$
e. $x \geq -3$
f. $x > -4$; $x \in \langle -4 \rightarrow$ |
| 1-34 | a. $x < 3$; $x \in \langle \leftarrow, 3 \rangle$
b. $x \leq -\frac{11}{2}$; $x \in \langle \leftarrow, -\frac{11}{2}]$ | c. $x \leq 3$; $x \in \langle \leftarrow, 3]$
d. $x \leq -6$; $x \in \langle \leftarrow, -6]$
e. $x \geq 2$; $[2, \rightarrow)$
f. $x \geq \frac{2}{3}$; $[\frac{2}{3}, \rightarrow)$ |
| 1-35 | a. $x \geq 0$ | b. $x \leq 5$ |
| 1-36 | a. $x \geq -2$
b. $x \in \mathbb{R}$ | c. $a \leq 4$
d. $p \leq 4$
e. $z \leq \frac{5}{3}$
f. $k \geq -\frac{10}{3}$ |
| 1-37 | a. $x < -2\frac{1}{2}$; $x \in \langle \leftarrow, -2\frac{1}{2} \rangle$
b. $x > 9$; $x \in \langle 9, \rightarrow$
c. $x \leq -2\frac{2}{5}$; $x \in \langle \leftarrow, -2\frac{2}{5}]$ | d. $x \geq -6\frac{1}{4}$; $x \in [-6\frac{1}{4}, \rightarrow)$
e. $x \leq -6$; $x \in \langle \leftarrow, -6]$
f. alle x |
| 1-38 | a. $4 < x < 6$
b. k.n. | c. k.n.
d. $-2 < x < 3$ |
| 1-39 | a. $x \in \langle 3, 7 \rangle$
b. $x \in [4, \rightarrow)$ | c. $x \in \mathbb{R}$
d. $x \in \langle 3, \rightarrow)$ |
| 1-40 | a. $x \in \langle \leftarrow, -1 \rangle$
b. $x \in \emptyset$ | c. $x \in \mathbb{R}$
d. $x \in \langle \leftarrow, -1 \rangle \cup \langle 2, \rightarrow)$ |
| 1-41 | a. $x \in \langle 0, 3 \rangle$ b. $x \in \langle \leftarrow, 7 \rangle$ c. $x \in \langle -3, \rightarrow)$ d. $x \in \langle -1, 0 \rangle$ | |
| 1-42 | a. $x \in \langle 3, 5 \rangle$
b. $x \in [-5, -1)$ | c. $x \in [0, 1)$
d. $x \in [-1\frac{1}{2}, -\frac{1}{2}]$ |
| 1-43 | a. $x \in \langle \leftarrow, 1 \rangle$ b. $x \in \emptyset$ c. $x \in \langle 1\frac{1}{2}, 3\frac{1}{2} \rangle$ | |
| 1-44 | a. $x \in \langle 3, \rightarrow)$ b. $x \in \langle 3, \rightarrow)$ c. $x \in \langle -4, -\frac{3}{2} \rangle$ | |
| 1-45 | a. $x \in \emptyset$
b. $x \in \mathbb{R}$ | c. $x \in \mathbb{R}$
d. $x \in \emptyset$ |

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|-------------|--|--|---|
| 1-46 | a. $x < -4 \vee x > 4$
b. $x \leq -3 \vee x \geq 3$ | c. $-6 < x < 6$
d. \emptyset | e. $-2 \leq x \leq 2$
f. \mathbb{R} |
| 1-47 | a. $-10 < x < 10$
b. $x \leq -3 \vee x \geq 3$ | c. $x \leq -\frac{1}{2} \vee x \geq \frac{1}{2}$
d. $x < -30 \vee x > 30$ | e. \emptyset
f. \emptyset |
| 1-48 | a. \emptyset
b. $x \neq 0$ | c. $x = 0$
d. $x \in \langle \leftarrow, -1\frac{2}{5} \rangle \cup \langle 4\frac{1}{5}, \rightarrow \rangle$ | e. \mathbb{R}
f. $x \in \langle -5, 1 \rangle$ |
| 1-49 | a. $x \in \langle \leftarrow, -\frac{5}{12} \rangle \cup \langle -1\frac{1}{4}, \rightarrow \rangle$
b. $x \in \langle -1\frac{1}{2}, 4\frac{1}{2} \rangle$ | c. $x \in [-12, 20]$
d. $x \in \langle \leftarrow, -3 \rangle \cup [-\frac{1}{3}, \rightarrow)$ | e. $x \in \langle \leftarrow, 2\frac{1}{2} \rangle \cup \langle 4\frac{1}{2}, \rightarrow \rangle$
f. $x \in \langle -\frac{12}{13}, \frac{2}{13} \rangle$ |
| 1-50 | a. $x \in [-6, 10]$
b. $x \in \mathbb{R}$ | c. $x \in \langle \leftarrow, -7 \rangle \cup [11, \rightarrow)$
d. $x \in \langle 1\frac{1}{2}, 6\frac{1}{2} \rangle$ | |
| 1-51 | a. $\langle -3, 3 \rangle$
b. $[-10, 10]$ | c. $\langle \leftarrow, -5 \rangle \cup [5, \rightarrow)$
d. $\langle \leftarrow, -4 \rangle \cup \langle 4, \rightarrow \rangle$ | e. $\langle -1, 1 \rangle$
f. $[-3, 3]$ |
| 1-52 | a. \mathbb{R}
b. \emptyset | c. \emptyset
d. \mathbb{R} | e. \mathbb{R}
f. $[-2, 2]$ |
| 1-53 | a. \emptyset
b. $x = 0$ | c. \mathbb{R}
d. $x < 0 \vee x > 6, x \in \langle \leftarrow, 0 \rangle \cup \langle 6, \rightarrow \rangle$ | e. $x \neq 0$
f. $1 \leq x \leq 5, x \in [1, 5]$ |
| 1-54 | a. $-\frac{9}{2} < x < \frac{1}{2}, x \in \langle -\frac{9}{2}, \frac{1}{2} \rangle$
b. $x \in \emptyset$ | c. $x \leq \frac{2}{3} \vee x \geq 3\frac{1}{3}; x \in \langle \leftarrow, \frac{2}{3} \rangle \cup [3\frac{1}{3}, \rightarrow)$
d. $1\frac{1}{4} \leq x \leq 2\frac{3}{4}; x \in [1\frac{1}{4}, 2\frac{3}{4}]$ | e. $x \in \mathbb{R}$
f. $x < 4 \vee x > 8, x \in \langle \leftarrow, 4 \rangle \cup \langle 8, \rightarrow \rangle$ |
| 1-55 | a. $x \in \emptyset$
b. $x \neq 6, x \in \langle \leftarrow, 6 \rangle \cup \langle 6, \rightarrow \rangle, x \in \mathbb{R} \setminus \{6\}$ | c. $-1 < x < 7, x \in \langle -1, 7 \rangle$
d. $x \in \emptyset$ | |

2 Irrationale getallen

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|------------|----------------|-----------------|---------------------------|---------------------------|
| 2-1 | a. 4
b. 0,7 | c. 10
d. 0,8 | e. 12
f. $\frac{1}{2}$ | g. 13
h. $\frac{2}{3}$ |
|------------|----------------|-----------------|---------------------------|---------------------------|

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|-------------|--------------------------------------|--|---------------------------------------|--|--|--|--|--------------------------------------|---------------------------------------|
| 2-2 | a. $4 + 3 = 7$
b. $13 - 12 = 1$ | | | | | | | | |
| 2-3 | a. -2
b. 10 | | c. -9
d. 1 | | | | | e. 10
f. 4 | |
| 2-4 | a. 6
b. 4 | | | | | | | c. -2
d. 0 | |
| 2-5 | a. 5
b. 5 | | c. 7
d. 20 | | | | | e. 6
f. 10 | |
| 2-6 | a. 2
b. 6 | | c. k.n.
d. -6 | | | | | e. 0
f. 1 | g. k.n.
h. -1 |
| 2-7 | a. -3
b. -2 | | c. k.n.
d. 10 | | | | | e. 2
f. -10 | |
| 2-8 | a. $\frac{2}{3}$
b. $\frac{9}{2}$ | | c. $\frac{1}{6}$
d. $\frac{5}{4}$ | | | | | e. k.n.
f. $\frac{8}{9}$ | g. $-\frac{1}{2}$
h. $\frac{7}{5}$ |
| 2-9 | a. $\frac{3}{2}$
b. $\frac{6}{5}$ | | c. $\frac{5}{2}$
d. $\frac{10}{3}$ | | | | | e. $\frac{4}{3}$
f. $\frac{2}{9}$ | g. $\frac{7}{3}$
h. $\frac{7}{4}$ |
| 2-10 | a. $\frac{2}{5}$
b. $\frac{1}{4}$ | | | | | | | c. $\frac{3}{2}$
d. $\frac{1}{2}$ | |
| 2-11 | a. 144
b. $0,01$ | | c. $1,44$
d. $0,49$ | | | | | e. 441
f. $0,04$ | g. $4,41$
h. $6,25$ |
| 2-12 | a. 11
b. $0,9$ | | c. $1,1$
d. $0,7$ | | | | | e. $1,3$
f. $0,3$ | g. $0,6$
h. $0,1$ |
| 2-13 | a. $0,1$
b. $0,2$ | | | | | | | c. $0,2$
d. $-0,3$ | |
| 2-14 | a. 21
b. 0 | | c. -20
d. -1 | | | | | e. 3
f. 8 | g. 5
h. -5 |
| 2-15 | a. 23
b. $19\frac{1}{3}$ | | | | | | | c. 6
d. -69 | |

2-16	a. 17		c. -6
	b. 22		d. 0
2-17	a. $9\sqrt{3}$	c. $5\sqrt{5}$	e. $-6\sqrt{13}$
	b. $-\sqrt{11}$	d. $\sqrt{2}$	f. $-16\sqrt{6}$
2-18	a. $8\sqrt{3}$	c. $7\sqrt{3}$	e. $2\sqrt{7}$
	b. 0	d. 12	f. k.n.
2-19	a. $-4\sqrt{2}$		d. -40
	b. 0		e. k.n.
	c. $\frac{1}{2}\sqrt{5}$		f. $1\frac{1}{6}\sqrt{5}$
2-20	a. $5\sqrt{2} + 11\sqrt{3}$		d. $3\sqrt{6} + 7\sqrt{10}$
	b. $-5\sqrt{2} - 3\sqrt{5}$		e. $2\sqrt{2} + \sqrt{3}$
	c. $-\sqrt{2} - \sqrt{5}$		f. $2\sqrt{5} + 2\sqrt{3}$
2-21	a. 5		c. 4
	b. 14		d. $3 + 3\sqrt{3}$
2-22	a. $5 + 6\sqrt{2}$		d. $\sqrt{7} + \frac{2}{3}\sqrt{5}$
	b. $\frac{3}{4}\sqrt{2} - \frac{4}{5}\sqrt{6}$		e. $-\frac{1}{4}\sqrt{2}$
	c. $2\sqrt{5} - 2\sqrt{3} + \sqrt[3]{5}$		f. $3\sqrt{7} + \sqrt[3]{10} + 2\sqrt{2}$
2-23	a. $14\sqrt{3}$		c. $31\sqrt{7}$
	b. $10\sqrt{3} + 15\sqrt{7}$		d. $6\sqrt{3} - 3\sqrt{2}$
2-24	a. $6\sqrt{5} + 9\sqrt{2}$		c. $4\sqrt{5} - 7\sqrt{2}$
	b. $9\sqrt{3} - 3\sqrt{7}$		d. $-22\sqrt{6} + 24\sqrt{3}$
2-25	a. $\sqrt{6}$	c. $\sqrt{10}$	e. $6\sqrt{12}$ (of: $12\sqrt{3}$)
	b. $15\sqrt{56}$ (of: $30\sqrt{14}$)	d. 6	f. $10\sqrt{80}$ (of: $40\sqrt{5}$)
2-26	a. 90	c. $2\sqrt{14}$	e. $6\sqrt{ab}$
	b. $15\sqrt{abc}$	d. $8\sqrt{a^2b}$ (of: $8a\sqrt{b}$)	f. $6\sqrt{\frac{ac}{b}}$
2-27	a. 11	c. 4	e. 4
	b. 10	d. k.n.	f. $3\sqrt{5}$
2-28	a. $\sqrt{6}$	c. k.n.	e. $3\sqrt{42}$
	b. $\sqrt{6}$	d. 1	f. 12

2-29	a. $2\sqrt{6} + 2\sqrt{3}$	c. $2 - \sqrt{5}$	e. 16
	b. \sqrt{ab}	d. $\sqrt{a^2b}$ (of: $a\sqrt{b}$)	f. $7\sqrt{a}$
2-30	a. 80	c. -32	e. 18
	b. $\sqrt{18}$ (of: $3\sqrt{2}$)	d. 20	f. 10
2-31	a. $\sqrt{2}$	c. $\sqrt{3}$	e. 4
	b. 1	d. $28\sqrt{15}$	f. $40\sqrt{55}$
2-32	a. $2\sqrt{5}$	c. $\frac{1}{2}\sqrt{3}$	e. $\sqrt{7}$
	b. 3	d. 2	f. 10
2-33	a. $4\sqrt{3}$	c. $1\frac{1}{2}\sqrt{10}$	e. $\frac{1}{2}\sqrt{2}$
	b. $\frac{1}{8}\sqrt{15}$	d. $2\sqrt{7}$	f. $\frac{16}{5}$
2-34	a. $12 + 6\sqrt{3} + 2\sqrt{5} + \sqrt{15}$	c. $7\sqrt{2} - 2 - 7\sqrt{5} + \sqrt{10}$	
	b. $-3 - \sqrt{5}$	d. $2\sqrt{6} + 3\sqrt{3}$	
2-35	a. -1	c. 1	
	b. $38 - 12\sqrt{10}$	d. $21 + 8\sqrt{5}$	
2-36	a. $18 + 6\sqrt{5} + 3\sqrt{2} + \sqrt{10}$	d. $15 - 5\sqrt{2} + 6\sqrt{3} - 2\sqrt{6}$	
	b. $\sqrt{30} - 6\sqrt{10} - 2\sqrt{3} + 12$	e. $2\sqrt{10} + 2\sqrt{2} + 30 + 6\sqrt{5}$	
	c. $57 - 12\sqrt{15}$	f. $18 + 4\sqrt{18}$ (of: $18 + 12\sqrt{2}$)	
2-37	a. 6	c. $9\sqrt[3]{3}$	
	b. a^2	d. $4x^4\sqrt{x}$	
2-38	a. 6	c. $3\sqrt{3} + 2\sqrt{2}$	
	b. $-3\sqrt{2}$	d. $-\sqrt{6} + 3$	
2-39	a. 7	c. $-3\sqrt{10}$	
	b. $-\sqrt{10} - \frac{1}{9}$	d. $\frac{2}{3}\sqrt{5}$	
2-40	a. $2\sqrt{2}$	c. $-5\frac{7}{8}$	
	b. $-2\sqrt{6}$	d. $-12\sqrt{2}$	
2-41	a. 6	c. 6	
	b. 6	d. 6	
2-42	a. $2\sqrt{5}$	c. $2\sqrt{6}$	e. $4\sqrt{2}$
	b. $2\sqrt{7}$	d. $3\sqrt{3}$	f. $3\sqrt{2}$

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|---|--|--|--|
| <p>2-43 a. $2\sqrt{3}$
b. $5\sqrt{6}$</p> <p>2-44 a. $6\sqrt{2}$
b. $3\sqrt{2}$</p> <p>2-45 a. -11
b. $13\frac{1}{2}\sqrt{7}$
c. 0</p> <p>2-46 a. -4
b. $18\sqrt{11}$
c. 30</p> <p>2-47 a. $2\sqrt{10}$
b. $3\sqrt{5}$
c. $\sqrt{3}$
d. $6\sqrt{6}$</p> <p>2-48 a. $10\sqrt{6}$
b. $12\sqrt{15}$</p> <p>2-49 a. $6\sqrt[3]{7}$
b. $10\sqrt{1814}$</p> <p>2-50 a. $6\sqrt[3]{30}$
b. $10\sqrt[4]{54}$</p> <p>2-51 a. $a\sqrt[3]{a^2}$
b. $a\sqrt[3]{a^2b}$</p> <p>2-52 a. $ab\sqrt[3]{a^2b^2}$
b. $a^2\sqrt{b}$</p> <p>2-53 a. \sqrt{a}
b. $\frac{b^3}{a}\sqrt{a}$</p> <p>2-54 a. $\frac{2}{3}$
b. $\frac{3}{4}\sqrt{3}$</p> | <p>c. $10\sqrt{2}$
d. $4\sqrt{3}$
c. $22\frac{3}{4}$
d. $\frac{5}{12}$</p> <p>c. $6\sqrt{70}$
d. $30\sqrt{14}$
c. $6\sqrt[4]{24}$
d. $35\sqrt{2}$
c. 6
d. $4\sqrt{95}$
c. $a\sqrt[4]{ab}$
d. $a^2\sqrt[3]{b}$
c. $ab\sqrt{a}$
d. $a^2b\sqrt[4]{b}$
c. $ab^2\sqrt{b}$
d. $\frac{b}{a}$
c. $\frac{1}{3}\sqrt{5}$
d. $\frac{1}{5}\sqrt{10}$</p> | <p>e. $2\sqrt{15}$
f. $2\sqrt{110}$
e. $-2\sqrt{3}$
f. 0
d. $-12\sqrt{2}$
e. $-25\sqrt{10}$
f. $\frac{1}{3}\sqrt{5}$
d. $-23\sqrt{6}$
e. $2\sqrt{6}$
f. $-3\sqrt{10}$
e. $12\sqrt{2}$
f. $3\sqrt{6}$
g. 6
h. $6\sqrt{3}$
e. $2\sqrt{155}$
f. $36\sqrt{14}$
e. $3\sqrt[3]{210}$
f. $30\sqrt{5}$
e. $6\sqrt[3]{21}$
f. $6\sqrt{141}$
e. $a\sqrt[3]{a^2b^2}$
f. $a^2\sqrt{ab}$
e. $ab\sqrt[3]{a^2}$
f. $ab\sqrt[3]{a^2}$
e. $a\sqrt[3]{b^2}$
f. $\frac{a}{b}\sqrt{a}$
e. $\frac{1}{4}\sqrt{7}$
f. $\frac{1}{7}\sqrt{7}$</p> | <p>g. $b\sqrt[4]{a^3}$
h. $\frac{1}{ab}\sqrt{a}$</p> |
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|--|---|---|
| <p>2-55 a. $\frac{2}{3}\sqrt{6}$
b. $\frac{1}{6}\sqrt{30}$</p> | <p>c. $\frac{1}{10}\sqrt{410}$
d. $\frac{3}{5}\sqrt{5}$</p> | <p>e. $\frac{1}{4}\sqrt{5}$
f. $\frac{7}{3}\sqrt{3}$</p> |
| <p>2-56 a. $2\frac{1}{2}\sqrt{2}$
b. $\frac{8}{3}\sqrt{3}$</p> | <p>c. $\frac{5}{7}\sqrt{7}$
d. $\frac{1}{2}$</p> | <p>e. $\sqrt{2}$
f. $\frac{3}{4}$</p> |
| <p>2-57 a. $\frac{1}{3}\sqrt{3}$
b. $\frac{5}{6}$</p> | <p>c. $\frac{1}{7}\sqrt{7}$
d. $\sqrt{3}$</p> | <p>e. $\frac{4}{5}$
f. $2\sqrt{10}$</p> |
| <p>2-58 a. $\frac{2}{10}\sqrt{10} = \frac{1}{5}\sqrt{10}$
b. $\frac{1}{6}\sqrt{3}$</p> | <p>c. $\sqrt{5}$
d. $\frac{1}{2}\sqrt{6}$</p> | <p>e. $\frac{1}{5}\sqrt{5}$
f. $\frac{1}{2}\sqrt{7}$</p> |
| <p>2-59 a. $\frac{1}{2}\sqrt{14}$
b. $\frac{1}{4}\sqrt{14}$</p> | <p>c. $\frac{1}{4}\sqrt{10}$
d. $\frac{1}{10}\sqrt{30}$</p> | <p>e. $\frac{1}{6}\sqrt{6}$
f. $\frac{2}{15}\sqrt{15}$</p> |
| <p>2-60 a. $\frac{1}{8}\sqrt{2}$
b. $-1\frac{1}{2}\sqrt{2}$</p> | <p>c. $-6\sqrt{7}$
d. $4\frac{1}{3}\sqrt{6}$</p> | <p>e. $-3\sqrt{13}$
f. $1\frac{1}{2}\sqrt{2}$</p> |
| <p>2-61 a. $-\frac{2}{9}$
b. 1,7
c. $110\frac{1}{4}$</p> | <p>d. $1\frac{1}{4}$
e. 1,1
f. $\frac{1}{6}$</p> | |
| <p>2-62 a. $\frac{5}{3}(2\sqrt{2} + \sqrt{5})$
b. $\frac{5\sqrt{a} + 5\sqrt{b}}{a - b}$</p> | <p>c. $\frac{2\sqrt{10} - \sqrt{15}}{5}$
d. $-6(\sqrt{2} + \sqrt{3})$</p> | <p>e. $\frac{9 + 2\sqrt{14}}{5}$
f. $\frac{50 + 5\sqrt{3}}{97}$</p> |
| <p>2-63 a. $2 + 6\sqrt{2} + 6\sqrt{3} + \sqrt{6}$
b. $7 - 3\sqrt{5}$</p> | <p>c. $21\frac{1}{2} - 4\frac{1}{2}\sqrt{15}$
d. $2 + \sqrt{3}$</p> | <p>e. $\frac{3}{7}\sqrt{6} + \frac{12}{7}\sqrt{3}$
f. $3\sqrt{2} - 2\sqrt{3}$</p> |
| <p>2-64 a. $3\sqrt{3}$
b. $2\sqrt[4]{4}$</p> | <p>c. $7\sqrt[3]{7}$
d. 17</p> | <p>e. $\sqrt[3]{25}$
f. 125</p> |
| <p>2-65 a. a^2b
b. $a^2b^2\sqrt[3]{a^2}$</p> | <p>c. 81
d. $a^3b\sqrt{b}$</p> | <p>e. $10\sqrt[5]{100}$
f. 50</p> |
| <p>2-66 a. $\sqrt[20]{a}$
b. $\frac{2}{5}\sqrt[4]{6}\sqrt{5}$</p> | <p>c. $\sqrt{2}\sqrt[4]{5}$
d. $3\sqrt[6]{10}\sqrt[3]{a^2}$</p> | |
| <p>2-67 $\sqrt{45} = 3\sqrt{5}$, $\sqrt{90} = 3\sqrt{10}$, $\sqrt{180} = 6\sqrt{5}$ en $\sqrt{60} = 2\sqrt{15}$</p> | | |

- 2-68** 3, $20 - \sqrt{105}$
- 2-69** a. $\sqrt{51}$ b. $\sqrt{21}$
- 2-70** a. $\sqrt{113}$ b. 6
- 2-71** a. $3\sqrt{13}$ b. $\sqrt{139}$
- 2-72** a. $2\sqrt{5}$ b. $\sqrt{3}$
- 2-73** a. $\frac{8}{13}\sqrt{13}$ b. $\frac{4}{3}\sqrt{3}$
- 2-74** a. $\frac{5}{6}\sqrt{6}$ c. $19 + 12\sqrt{2} + 6\sqrt{3} + 5\sqrt{6}$
 b. $2\sqrt{3} - 1$ d. $10 + 2\sqrt{6} + 2\sqrt{10} + 2\sqrt{15}$
- 2-75** a. $a^2 + 2a\sqrt{b} + b$ c. $b^2 + 2ab\sqrt{b} + a^2b$
 b. $x^2 - 2x\sqrt{y} + y$ d. $b^2 - bc$
- 2-76** a. $2\sqrt{6}$ c. $1 + 3\sqrt{3}$
 b. $x - 2x\sqrt{2}$ d. $11\sqrt{2} + 9\sqrt{3}$
- 2-77** a. $a\sqrt{a} + 6a\sqrt{b} + 12b\sqrt{a} + 8b\sqrt{b}$
 b. $24 + 7\sqrt{6}$
 c. $2y$
- 2-78** a. $3\sqrt{7} + 5$ c. $3\sqrt{2} + 4\sqrt{3} - \sqrt{5}$
 b. 25 d. $\sqrt{3} - 16$
- 2-79** a. $1 + \sqrt{2}$ c. $\frac{1}{2} + \frac{1}{2}\sqrt{5}$ e. $6\sqrt{5} - 12$
 b. $\frac{1}{3}(\sqrt{5} - \sqrt{2})$ d. $\frac{7+\sqrt{5}}{11}$ f. $\frac{1}{5}(9 + 2\sqrt{14})$
- 2-80** a. $\frac{21}{2}\sqrt{3} - 2\frac{1}{2}$ c. $\frac{2}{5}\sqrt{2} + \frac{1}{5}\sqrt{3}$ e. $\frac{1}{97}(-56 + 15\sqrt{10} - 6\sqrt{14} + 20\sqrt{35})$
 b. $\frac{103}{71} + \frac{80}{71}\sqrt{3}$ d. $3\sqrt{2} - 2\sqrt{3}$ f. $\frac{17}{2}\sqrt{10} + 27$
- 2-81** a. $\frac{1}{17}(9 + 5\sqrt{3} + 10\sqrt{5} + 6\sqrt{15})$ c. $4 - 3\frac{1}{2}\sqrt{2}$
 b. $2 + \frac{3}{13}\sqrt{10} - \frac{15}{13}\sqrt{3}$ d. $\sqrt{3}$
- 2-82** a. $\frac{1}{12}(3\sqrt{2} + 2\sqrt{3} - \sqrt{30})$ c. $\sqrt{2} + \sqrt{5} + \sqrt{6}$
 b. $\frac{1}{12}(\sqrt{2} + \sqrt{3} - \sqrt{5})$ d. $1 + \sqrt{3} + \sqrt{5}$
- 2-83** a. $-1 + \frac{1}{4}\sqrt{2} + \frac{1}{2}\sqrt{3} + \frac{3}{4}\sqrt{6}$ c. $2 + \sqrt{2} + \sqrt{3} + \sqrt{6}$
 b. 14 d. $\frac{5}{24}$

2-84 a. 98; b. $\frac{177}{161} + \frac{52}{161}\sqrt{2}$; c. $\frac{1}{30}$; d. 0; e. $2\frac{1}{2}$; f. $\frac{1}{3}$

3 Tweedegraads vergelijkingen

3-1	a. $2 \vee 3$ b. -2	c. $0 \vee 2$ d. $2 \vee 4$	e. $-7 \vee 7$ f. $0 \vee 4$
3-2	a. $-2 \vee -4$ b. $3 \vee 40$	c. $-9 \vee 10$ d. $3 \vee 4$	e. $1 \vee 5$ f. -3
3-3	a. $2 \vee -5$ b. $3 \vee 7$	c. $-2 \vee 4$ d. $-1 \vee 3$	e. $5 \vee 7$ f. $1 \vee 5$
3-4	a. $0 \vee 3$ b. $-3 \vee 9$	c. $0 \vee 12$ d. $0 \vee 13$	e. $-1 \vee 0 \vee 1$ f. $-4 \vee 0$
3-5	a. $-6 \vee -4$ b. $-3 \vee -1$	c. $-12 \vee 2$ d. -2	e. $-2 \vee 12$ f. $-2 \vee 5$
3-6	a. $\pm 2\sqrt{3}$ b. $\pm 0,4$	c. ± 4 d. $\pm \frac{1}{2}$	e. $\pm 0,9$ f. $\pm \frac{3}{2}$
3-7	a. ± 2 b. geen opl. c. geen opl.	d. geen opl. e. ± 8 f. geen opl.	g. 0 h. ± 3 i. $\pm \frac{1}{2}$
3-8	a. $\pm\sqrt{7}$ b. $\pm\sqrt{7}$	c. $\pm\frac{3}{4}$ d. $\pm\frac{1}{3}$	e. $\pm\sqrt{10}$ f. geen opl.
3-9	a. -6 b. $-5, 13$	c. $-9, -3$ d. geen opl.	e. $-8, 2$ f. $5\frac{4}{5} \vee 6\frac{1}{5}$
3-10	a. ± 12 b. $\pm \frac{1}{3}$	c. ± 3 d. ± 10	e. geen opl. f. ± 2
3-11	a. -2 b. $\frac{3}{2}$	c. -3 d. $-\frac{23}{2}$	e. 5 f. $\frac{2}{5}$
3-12	a. $-5 \pm \sqrt{7}$ b. $-6 \pm \sqrt{6}$	c. $-4 \pm \sqrt{3}$ d. $-2 \pm \sqrt{7}$	e. $-3 \pm \sqrt{5}$ f. $3 \pm 2\sqrt{6}$
3-13	a. $-2 \pm \sqrt{19}$ b. $5 \pm \sqrt{17}$	c. $1 \pm \sqrt{14}$ d. $4 \pm \sqrt{15}$	e. $-4 \pm \sqrt{14}$ f. $-3 \pm 2\sqrt{3}$

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|-------------|--|--|---|
| 3-14 | a. $10 \vee -10$ | c. $9 \vee -9$ | e. $13 \vee -13$ |
| | b. $1 \vee -1$ | d. $4 \vee -4$ | f. $0,9 \vee -0,9$ |
| 3-15 | a. $0 \vee 1$ | c. $0 \vee -1\frac{1}{2}$ | e. $0 \vee 3$ |
| | b. $0 \vee \frac{11}{6}$ | d. $0 \vee 14$ | f. $0 \vee \frac{1}{7}$ |
| 3-16 | a. $-6 \vee -4$ | c. $-12 \vee 2$ | e. $-2 \vee 12$ |
| | b. $-3 \vee -1$ | d. -2 | f. $-2 \vee 5$ |
| 3-17 | a. $-12 \vee 12$ | c. $-2\frac{1}{2} \vee 2\frac{1}{2}$ | e. $-0,8 \vee 0,8$ |
| | b. $-\frac{8}{3} \vee \frac{8}{3}$ | d. $-\frac{2}{3} \vee \frac{2}{3}$ | f. $-3\frac{1}{2} \vee 3\frac{1}{2}$ |
| 3-18 | a. $-1 \vee 12$ | c. $-12 \vee 1$ | e. $-2 \vee 6$ |
| | b. $-6 \vee 2$ | d. $-3 \vee 4$ | f. $-4 \vee 3$ |
| 3-19 | a. -5 | c. $-1; 7$ | e. $-7 \pm \sqrt{3}$ |
| | b. $-7; -3$ | d. -9 | f. $-7; -5$ |
| 3-20 | $x_{1,2} = \frac{a \pm \sqrt{b^2 - 4ac}}{2} = \frac{-2 \pm \sqrt{2^2 - 4 \cdot 1 \cdot -1}}{2 \cdot 1} = \frac{-2 \pm \sqrt{4+4}}{2} = \frac{-2 \pm 2\sqrt{2}}{2} = -1 \pm \sqrt{2}$ | | |
| 3-21 | a. $-2 \pm \sqrt{3}$ | c. $3 \pm \sqrt{7}$ | e. $-4 \pm \sqrt{7}$ |
| | b. $4 \pm \sqrt{10}$ | d. $-3 \pm 2\sqrt{2}$ | f. $1; 13$ |
| 3-22 | a. $-5 \pm \sqrt{2}$ | c. $3 \pm \sqrt{11}$ | e. $-7; -3$ |
| | b. $6 \pm \sqrt{6}$ | d. $-12; -4$ | f. $2; 6$ |
| 3-23 | a. $-1 \pm \sqrt{5}$ | c. $-1 \vee \frac{1}{2}$ | e. $-2\frac{1}{2} \vee 1$ |
| | b. $\frac{5}{2} \pm \frac{1}{2}\sqrt{13}$ | d. $-3 \pm \sqrt{5}$ | f. $2 \pm \sqrt{5}$ |
| 3-24 | a. $-1, \frac{1}{2}$ | c. $-1 \pm \sqrt{5}$ | e. $-2\frac{1}{2}, 1$ |
| | b. $2\frac{1}{2} \pm \frac{1}{2}\sqrt{13}$ | d. $-5 \pm \sqrt{5}$ | f. $5 \pm \sqrt{3}$ |
| 3-25 | a. $2 \pm \sqrt{6}$ | c. $-3 \pm 2\sqrt{2}$ | e. geen oplossing |
| | b. $-\frac{1}{3} \vee 2$ | d. $-1\frac{1}{2} \vee 2$ | f. $-\frac{6}{5} \vee 2$ |
| 3-26 | a. $2 \pm \sqrt{6}$ | c. $-3 \pm 2\sqrt{2}$ | e. geen oplossing |
| | b. $-\frac{1}{3} \vee 2$ | d. $-1\frac{1}{2} \vee 2$ | f. $-\frac{6}{5} \vee 2$ |
| 3-27 | a. $\frac{1}{3} \vee 3$ | c. $\frac{5}{4} \pm \frac{1}{4}\sqrt{33}$ | e. $3 \pm \sqrt{3}$ |
| | b. $1 \vee 2\frac{1}{2}$ | d. $1 \pm \sqrt{2}$ | f. $\frac{2}{3} \pm \frac{1}{3}\sqrt{19}$ |
| 3-28 | a. $5 \pm 5\sqrt{3}$ | c. $\frac{13}{6} \pm \frac{1}{6}\sqrt{97}$ | |
| | b. geen opl. | d. $\frac{1}{2} \vee 6$ | |

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| <p>3-29 a. $\frac{-7}{2} \pm \frac{1}{2}\sqrt{5}$
b. $\frac{1}{10} \pm \frac{1}{10}\sqrt{21}$</p> | <p>c. $\frac{-3}{2} \pm \frac{1}{2}\sqrt{33}$
d. 5</p> |
| <p>3-30 a. $-1 \pm \sqrt{2}$
b. $-5 \vee 1$</p> | <p>c. $\frac{5 \pm 2\sqrt{15}}{5}$
d. -1</p> |
| <p>3-31 a. 2
b. 0</p> | <p>c. 1
d. 2</p> |
| <p>3-32 a. 2
b. 0</p> | <p>c. 0
d. 2</p> |
| <p>3-33 a. 0
b. 2</p> | <p>c. 1
d. 2</p> |
| <p>3-34 a. geen opl.
b. $\frac{2}{5}$</p> | <p>c. 6
d. geen opl.</p> |
| <p>3-35 a. $-6 \vee 0$
b. $-3 \pm \sqrt{2}$</p> | <p>c. $-7 \vee 1$
d. $1\frac{1}{2} \pm \frac{1}{2}\sqrt{29}$</p> |
| <p>3-36 a. $-3 \vee 7$
b. $\frac{1}{2} \vee 1$</p> | <p>c. $-3 \vee 9$
d. $-2\sqrt{2} \vee 0$</p> |
| <p>3-37 a. $\frac{-3}{2} \pm \frac{1}{2}\sqrt{29}$
b. geen opl.</p> | <p>c. $3 \vee -9$
d. $\pm \frac{5}{7}$</p> |
| <p>3-38 a. $0 \vee 6$
b. $\frac{3}{2} \pm \frac{1}{2}\sqrt{29}$</p> | <p>c. $\frac{3}{2} \pm \frac{1}{2}\sqrt{5}$
d. geen opl.</p> |
| <p>3-39 a. $0 \vee \frac{5}{2}$
b. $\frac{1}{4} \pm \frac{1}{4}\sqrt{5}$</p> | <p>c. $5 \pm 2\sqrt{3}$
d. $-2 \vee 8$</p> |
| <p>3-40 a. $-\frac{1}{4} \vee \frac{5}{8}$
b. $2 \vee 30$</p> | <p>c. $-5 \pm 5\sqrt{2}$
d. $\frac{5}{6} \pm \frac{1}{6}\sqrt{19}$</p> |
| <p>3-41 a. $-\frac{1}{3} \vee 15$
b. $9 \pm \sqrt{7}$</p> | <p>d. $4\frac{9}{10} \pm \frac{7}{10}\sqrt{69}$
e. $2\frac{2}{3} \vee 4$</p> |
| <p>3-42 a. $3 \pm \sqrt{11}$
b. $1 \pm \sqrt{2}$</p> | <p>c. $6 \pm \sqrt{6}$
d. $4 \vee 6$</p> |
| | <p>e. 0
f. 2
e. 2
f. 0</p> |
| | <p>e. geen opl.
f. -1,0
e. 1
f. $0 \vee \frac{7}{3}$
e. $-\frac{7}{3} \vee \frac{1}{2}$
f. geen opl.</p> |
| | <p>f. $-1\frac{1}{7} \pm 1\frac{5}{7}\sqrt{2}$
e. $-1 \pm \sqrt{5}$
f. $\frac{2}{3} \vee \frac{3}{2}$</p> |

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|------|--|-------------------------------------|-------------------------------------|
| 3-43 | a. geen oplossing | c. $0 \vee 2$ | e. $0 \vee 9$ |
| | b. $-3\frac{1}{2} \pm \frac{1}{2}\sqrt{5}$ | d. $-2\sqrt{7} \vee 2\sqrt{7}$ | f. $1 \vee 9$ |
| 3-44 | a. $-3 \pm \sqrt{2}$ | c. $-5 \vee 6$ | e. $-4 \vee 5$ |
| | b. $-7 \vee 2$ | d. $-6 \vee 6$ | f. $1 \vee 3$ |
| 3-45 | a. $-\frac{1}{5} \vee -1$ | c. $-\frac{1}{4} \vee -\frac{1}{2}$ | e. $-\frac{1}{8} \vee -\frac{1}{6}$ |
| | b. $-\frac{1}{3} \vee \frac{1}{2}$ | d. geen opl. | f. $\frac{1}{5} \vee -\frac{1}{4}$ |
| 3-46 | a. $-\frac{1}{3} \vee 5$ | c. $\frac{1}{5} \vee 7$ | e. $-\frac{1}{2} \vee -\frac{2}{3}$ |
| | b. $\frac{1}{4} \vee -\frac{2}{3}$ | d. $\frac{1}{3} \vee 3$ | f. $\frac{2}{3} \vee \frac{3}{2}$ |
| 3-47 | a. $\frac{1}{4} \vee 5$ | c. $\frac{1}{3} \vee -\frac{5}{6}$ | e. $-\frac{1}{6} \vee \frac{1}{3}$ |
| | b. $-\frac{5}{8} \vee 6$ | d. $\frac{1}{5} \vee \frac{1}{4}$ | f. $\frac{4}{5} \vee \frac{5}{4}$ |
| 3-48 | a. $p < 12\frac{1}{4}$ | c. $p < 1\frac{1}{3}$ | |
| | b. $p > -3\frac{1}{8}$ | d. $p < 9$ | |
| 3-49 | a. $p < -10 \vee p > 10$; b. $-4 < p < 4$; c. $p^2 + 24 > 0$ is waar voor alle waarden van p | | |
| 3-50 | a. $p = -3$ met $x = -3$; b. $p = 3$ met $x = 2$ | | |
| 3-51 | a. $3x + 1 = 0$ heeft één oplossing; b. $D = 9 - 4p$ geeft $p < 2\frac{1}{4}$ verder moet gelden: $p \neq 0$ dus antwoord: $p < 0 \vee 0 < p < 2\frac{1}{4}$ | | |
| 3-52 | a. $p < 0 \vee 0 < p < 3\frac{1}{8}$; b. $-\frac{9}{16} < p < 0 \vee p > 0$ | | |
| 3-53 | a. $p > \frac{1}{8}$; b. $-\frac{1}{2} < p < 0 \vee 0 < p < \frac{1}{2}$; c. $p < -2\sqrt{2} \vee p > 2\sqrt{2}$ | | |
| 3-54 | a. $p = 1$ met $x = -3$; b. $p = -2$ met $x = 1$ of $p = 2$ met $x = -1$ | | |

4 Wortel vergelijkingen & gebroken vergelijkingen

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|-----|----------------------|---------------------|-------------------|
| 4-1 | a. 4 | c. 17 | e. 75 |
| | b. 8 | d. $\frac{17}{2}$ | f. $\frac{15}{2}$ |
| 4-2 | a. 0; 3 | c. $0; \frac{5}{4}$ | e. 0; 8 |
| | b. 45 | d. 30 | f. ± 9 |
| 4-3 | a. $0; \frac{1}{16}$ | c. $0; \frac{3}{2}$ | e. 0 |
| | b. $0; \frac{3}{16}$ | d. 0 | f. 0 |
| 4-4 | a. -2; 2 | c. -2; 6 | e. -3; 3 |
| | b. -5; 1 | d. 5 | f. 1; 5 |

4-5	a. 0;2 b. geen opl.	c. -3;2 d. geen opl.	e. $-\frac{1}{4}; \frac{13}{4}$ f. 5;9
4-6	a. 1;2 b. 2;3	c. $\frac{13 + \sqrt{217}}{2}$ d. 4	e. 1;4 f. 3
4-7	a. 8 b. 1	c. 1;7 d. 9	e. 3;4 f. 1
4-8	a. 8 b. 4	c. 1;4 d. 4	e. 10 f. 5
4-9	a. 3 b. 5		c. $\frac{1}{2}$ d. 3
4-10	a. $-\frac{1}{2}, 2$ b. 9		c. geen opl. d. $-1, -\frac{3}{4}$
4-11	a. 1 b. -1, -4		c. geen opl. d. -7
4-12	a. -4 b. 4 c. -1		
4-13	a. $\frac{1}{3}$ b. 2	c. $-\frac{1}{6}$ d. 6	e. $-\frac{1}{2}$ f. $\frac{8}{3}$
4-14	a. $-\frac{1}{6}$ b. 17	c. $-\frac{1}{6}$ d. $\frac{13}{4}$	e. $-\frac{1}{10}$ f. 3
4-15	a. $\frac{1}{4}$ b. $-\frac{13}{4}$	c. -10 d. 5	e. $-\frac{3}{2}$ f. $-\frac{7}{2}$
4-16	a. -1 b. $\frac{3}{5}$	c. -7 d. $\frac{7}{6}$	e. $\frac{10}{3}$ f. $\frac{7}{5}$
4-17	a. -17 b. $\frac{121}{25}$	c. $-\frac{1}{9}$ d. $\frac{5}{4}$	e. 1 f. 2

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|---|---|--|
| <p>4-18 a. $-\frac{1}{3}$
b. k.n.</p> <p>4-19 a. $-\frac{3}{4}$
b. k.n.</p> <p>4-20 a. k.n.
b. -9</p> <p>4-21 a. 2
b. geen opl.</p> <p>4-22 a. $-\sqrt{5}, \sqrt{5}, 2, -2$
b. $3, -3$</p> <p>4-23 a. k.n.
b. -4</p> <p>4-24 a. $0; -\frac{7}{4}$
b. $\frac{15 \pm \sqrt{193}}{4}$</p> <p>4-25 a. $-1; \frac{7}{10}$
b. 0</p> <p>4-26 a. 1
b. $3; \frac{5}{3}$</p> <p>4-27 a. -4
b. geen opl.</p> <p>4-28 a. geen opl.
b. -5</p> <p>4-29 a. $x = 2 \vee x = -1$
b. $x = \pm 2 \vee x = 3$
c. $x = 0$</p> | <p>c. $-\frac{2}{21}$
d. 2</p> <p>c. $-\frac{5}{4}$
d. 0</p> <p>c. 0
d. $2, \frac{9}{2}$</p> | <p>e. $\frac{2}{5}$
f. $-\frac{6}{13}$</p> <p>e. 5
f. $x \neq -7$</p> <p>e. $-\frac{8}{5}$
f. $-1, 2, -2$</p> |
|---|---|--|
- | |
|---|
| <p>c. $-1, 2$
d. $2, -2, 3$
c. 1
d. -3
c. 2
d. k.n.
c. k.n.
d. 1
c. $0; 1$
d. k.n.
c. k.n.
d. $-\frac{2}{21}$
c. $\frac{24}{5}$
d. $-\sqrt{6}, 0, \sqrt{6}$
c. geen opl.
d. $\frac{26}{19}$
d. $x = \pm 2\sqrt{3}$
e. $x = \pm 2 \vee x = \pm \frac{3}{2}\sqrt{14}$
f. $x = 4$</p> |
|---|

4-30	a. $x = \pm 3 \vee x = 1$	d. $x = 0 \vee x = 2 \vee x = \pm\sqrt{3}$
	b. $x = \pm 2 \vee x = \pm\frac{1}{2}\sqrt{2}$	e. $x = 4$
	c. $x = 0 \vee x = 3$	f. $x = 4 \vee x = 16$

5 Cirkelmeetkunde

5-35	61°
5-36	$45^\circ, 45^\circ$ en 90°
5-37	6
5-39	5
5-42	
5-43	$80^\circ, 150^\circ$
5-44	$70^\circ, 35^\circ, 35^\circ$
5-45	$10^\circ, 10^\circ, 15^\circ, 15^\circ, 25^\circ$ en 155°
5-46	$55^\circ, 90^\circ, 35^\circ, 15^\circ, 20^\circ, 30^\circ, 150^\circ, 15^\circ, 55^\circ$ en 105°
5-47	30°
5-48	$30^\circ, 30^\circ, 60^\circ$ en 60°
5-49	$70^\circ, 110^\circ, 20^\circ, 50^\circ$
5-50	$27,5^\circ, 152,5^\circ, 12,5^\circ, 15^\circ$
5-51	44 cm
5-52	440 m
5-53	223,5 cm
5-54	12739 km
5-55	b. 9π
5-56	$2\pi \approx 6,28$ m
5-57	$R = 100$ m, $O = 30.000$ m ²
5-58	$8\pi \approx 25,1$ m
5-59	$36 - 4\frac{1}{2}\pi$
5-60	308 en 88
5-61	8π en 12π
5-62	80 cm; $1600\pi \approx 5027$ cm ² ; $6400 - 1600\pi \approx 1373$ cm ²
5-63	28; 22
5-64	$38\frac{98}{113}$; $28\frac{64}{113}$
5-65	$64 - 16\pi \approx 13,73$; $8 + 8\pi \approx 33,13$
5-66	$45 - 7\frac{13}{16}\pi$
5-67	$15 + 4\pi$

- 5-68 72π
- 5-69 $42 - 6\frac{3}{4}\pi$
- 5-70 $48 - 4\pi$
- 5-71 8
- 5-72 32

6 Combinatoriek

- 6-4 $\frac{4!}{2!2!} = 6$
- 6-5 $\frac{7!}{4!} = 210$
- 6-6 $\frac{9!}{2!2!2!} = 45360$
- 6-7 $2! = 2, \quad \frac{4!}{2!} = 12, \quad \frac{7!}{3!2!} = 420$
- 6-8

a. 12	d. $\frac{1}{12}$
b. 1320	e. $\frac{1}{210}$
c. 120	f. 11
- 6-9 **a.** $(n-1)n$ **b.** $\frac{1}{n+1}$ **c.** $n(n+1)$
- 6-10 **a.** $\frac{9}{8!}$ **b.** $\frac{5}{4!}$ **c.** $\frac{6}{7!}$
- 6-11

a. $\frac{11}{10!}$	c. $\frac{14}{5!}$
b. 4!	d. $\frac{1}{8!}$
- 6-12

a. 11!	c. $\frac{1}{11!}$
b. $\frac{1}{4}$	d. $\frac{9!}{10!}$
- 6-13 **a.** Als A drie sets gewonnen heeft, dan is A 'best of five' en komt er geen nieuwe set. **b.** 20
- 6-14 **a.** Dat de teams slechts éénmaal tegen elkaar uitkomen. **b.** 10
- 6-15 **a.** 66, **b.** 17
- 6-16 **a.** 21; **b.** 6
- 6-17 **a.** 24; **b.** 4; **c.** 6
- 6-18 $3 \cdot 5 \cdot 2 = 30$
- 6-19 $10^3 = 1000$
- 6-20 $6^4 = 1296$
- 6-21 $21^3 \cdot 9^3 = 6.751.269$
- 6-22 $26^2 \cdot 10^2 = 67.600$
- 6-23 **a.** $5 + 5 \times 4 = 25$; **b.** $5 + 5 \times 5 = 30$
- 6-24 **a.** 9; **b.** 19; **c.** 22

6-25 a.24; b.576; c.360

6-26 $\binom{10}{2} = 45$

6-27 a.5040; b.604800

6-28 a.32768; b.6720; c.20

6-29 a.1680; b.4096; c.30

6-30 a.5; b.210; c.5313; d.1890

6-31 a.56; b.256; c.24

6-32 $P_3^6 = 120$ en dat is meer dan 100, zes kleuren is dus voldoende.

6-33 $C_1^6 + C_2^6 + C_3^6 + C_4^6 + C_5^6 + C_6^6 = 6 + 15 + 20 + 15 + 6 + 1 = 63$

6-35 $10^9 = 1.000.000.000$, want de nummers moeten met een nul beginnen.

6-36 Het gaat om combinaties:

$\binom{10}{6} = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5}{6 \times 5 \times 4 \times 3 \times 2 \times 1} = 210$, Sneller is:

$\binom{10}{4} = \frac{10 \times 9 \times 8 \times 7}{4 \times 3 \times 2 \times 1} = 210$

6-37 Aantal kortste wegen van:

a. $A \rightarrow B$ is $\binom{8}{3} = \frac{8 \times 7 \times 6}{3 \times 2 \times 1} = 56$

b. $B \rightarrow C$ is $\binom{6}{3} = \frac{6 \times 5 \times 4}{3 \times 2 \times 1} = 20$

c. $A \rightarrow C$, dan moet je over B dus:

$\binom{8}{3} \times \binom{6}{3} = 56 \times 20 = 1120$

d. $A \rightarrow D$ dan ga je van $A \rightarrow B$ en dan op één manier naar D.

Dus $\binom{8}{3} \times 1 = 56 \times 1 = 56$

6-38 a. $A \rightarrow B$: $\binom{11}{4} = \frac{11 \times 10 \times 9 \times 8}{4 \times 3 \times 2 \times 1} = 330$

b. $A \rightarrow C$ dan: $A \rightarrow E \rightarrow C$: $1 \times \binom{6}{3} = 1 \times \frac{6 \times 5 \times 4}{3 \times 2 \times 1} = 20$

6-39 $56 \times 210 = 11760$

6-40 a. 45 | c. 1 | e. 66

b. 3 | d. 105 | f. 1

6-41 a. 4950 | c. 236 | e. 19900

b. 1 | d. 35 | f. 495

6-42 a. 56 | c. 126 | e. 220

b. 56 | d. 1330 | f. 210

6-43 $\binom{3}{0} = 3$, $\binom{6}{4} 15$, $\binom{10}{5} = 252$, $\binom{100}{3} = 161700$, $\binom{48}{4} = 194580$

6-44 a. 48 | c. 720 | e. 455

b. 3628800 | d. 3003 | f. 3160

- | | | |
|------|--|------------------------------------|
| 6-45 | a. 45 | c. 90 |
| | b. 40320 | d. 360 |
| 6-46 | a. 10 | c. 42 |
| | b. 24 | d. 120 |
| 6-47 | $C_3^{40} = 9880$ | |
| 6-48 | $C_4^{50} = 230300$ | |
| 6-49 | $P_3^{12} = 1320$ | |
| 6-50 | $3^6 = 729$ | |
| 6-51 | $7 \cdot 5 \cdot 7 = 245$ | |
| 6-52 | $P_8 = 8! = 40320, 403200 \text{ sec} = 112 \text{ uur}$ | |
| 6-53 | $P_3^8 = 336$ | |
| 6-54 | $C_4^{25} = 12650$ | |
| 6-55 | $C_6^{13} = 1716$ | |
| 6-56 | $2 \cdot \frac{15!}{6!} = 3.632.428.800$ | |
| 6-57 | $C_3^{12} = 220, P_3^{12} = 1320$ | |
| 6-58 | $a^7 + 7a^6b + 21a^5b^2 + 35a^4b^3 + 35a^3b^4 + 21a^2b^5 + 7ab^6 + b^7$ | |
| 6-59 | a. $1 + 9x + 27x^2 + 27x^3$ | c. $16 - 32y + 24y^2 - 8y^3 + y^4$ |
| | b. $10^5 + 10^5 + 4 \cdot 10^4 + 8 \cdot 10^3 + 80 \cdot 10 + 32 = 248832$ | d. $4x^2 + 12xy + 9y^2$ |
| 6-60 | a. 1111 | c. 10110 |
| | b. 11101010 | d. 1000100 |
| 6-61 | a. 5 | c. 28 |
| | b. 54 | d. 27 |
| 6-62 | a. 1110 | c. 1100 |
| | b. 10001 | d. 11110101 |
| 6-63 | a. 101101 | c. 100011 |
| | b. 111100 | d. 11110111100 |

7 Meetkunde

- 7-1
- $60 \text{ cm}^3; 30 \text{ cm}^3; 6 \text{ cm}^2; \text{ja}$
-
- 7-2
- 32; 40; 36
-
- 7-3
- $36 \text{ cm}^3; 54 \text{ cm}^3$
-
- 7-4
- $2,2 \text{ m}^3$

- 7-5 1,6 m; 4,4 m; 97,4 m³
- 7-6 42 liter; 35 dm³; 1,1 m²
- 7-7 1.000.000 liter; €1666
- 7-8 4,6 liter
- 7-9 809 ml; 8 ml
- 7-10 282,7 liter; 188,5 cm
- 7-11 1325 cm³; 79%
- 7-12 45
- 7-13 **a.** 4,48 dm³; **b.** 50,6 kg
- 7-14 2035 liter per minuut
- 7-15 6; ja; $\frac{1}{6}$; $\frac{1}{3}$
- 7-16 20; $6\frac{2}{3}$; 14
- 7-17 $21\frac{1}{3}$; $10\frac{2}{3}$; $10\frac{2}{3}$
- 7-18 **a.** 42 cm³; $42\frac{2}{3}$; $41\frac{2}{3}$ **b.** 22:43
- 7-19 28; 10950; 11200
- 7-20 balk(toren): 4176; balk(schip): 4320; piramide(toren): 288; prisma(schip)540;
bij elkaar: 9324 m³
- 7-21 740
- 7-22 **a.** 216; **b.** $\sqrt{4,5^2 + 8^2} \approx 9,1788$ **c.** 166
- 7-23 94,2 cm³
- 7-24 0,177 km³
- 7-25 **a.** 18,84 cm³; **b.** 17,6 g
- 7-26 3976 l
- 7-27 196 g
- 7-28 0,75 m; 156 m; 1:24
- 7-30 2; 2,7
- 7-31 2,3; 10,9 cm
- 7-32 1,7; 12,6 cm
- 7-33 1,5; 2,1 cm; 0,77; 19 mm
- 7-34 8,8; 132 cm
- 7-35 0,49; 45 mm
- 7-36 **a.** 42 m; **b.** 12 m
- 7-37 25 stuks; 25 ×
- 7-38 3,25 cm²
- 7-39 26 cm²
- 7-40 8 l
- 7-41 175

- 7-42 225 g
- 7-43 4492 m²
- 7-44 9; k=3
- 7-45 **a.** $k = \sqrt{8}$ dus $28,3 \times 42,4$ cm; **b.** $k = \sqrt{12}$ dus $52,0 \times 34,6$ cm; **c.** $k = \frac{25}{15} = \frac{5}{3}$,
417 cm²
- 7-46 5,4
- 7-47 45×30; 15×10
- 7-48 **a.** 4,8 m²; **b.** 1,31; **c.** 3,67 m bij 1,53 m
- 7-49 9; 3; 27
- 7-50 262 l; 32 dm²; 8,1 dm
- 7-51 29 ml
- 7-52 9375 ml, minder; 100
- 7-53 1,7; 4,0 l; 510 cm²
- 7-54 $\frac{3}{4}$; 19 ml; 88 ml; 94 cm²
- 7-55 37,5 m, 12,8 m; 1181,3 m³; 405 m²; 4,5 m, 55 treden; 75%; 87°
- 7-56 2
- 7-57 2; 3; 1; 10; 2,57; 4,38; 9,56; 0,95
- 7-58 0,87; 107,8 cm²
- 7-59 1,19; 17,3 cm
- 7-60 1,19; 2,15 m²; 101,2 cm
- 7-61 96 cm³; 40 cm³; 16 cm³
- 7-62 25π cm³
- 7-63 91.000 cm³=91 l; 1838 cm²
- 7-64 948 cm³=0,948 dm³; 0,65 kg; 81 g
- 7-65 1,4; 17,6 cm²; 192 ml; 2; 560 ml
- 7-66 98; 6,4 en 4
- 7-67 37%
- 7-68 **a.** $A'C' = 6\frac{2}{3}$; $B'C' = 5$; $k = \pm\frac{5}{6}$
b. $A'C' = 22\frac{1}{2}$; $B'C' = 35$; $k = \pm 2\frac{1}{2}$
c. $A'C' = 9$; $B'C' = 6$; $k = \pm\frac{3}{5}$
- 7-69 $PQ = 4\frac{1}{5}$, $PR = 4\frac{4}{5}$
- 7-70 $PQ = 4\frac{1}{2}$, $QR = 5\frac{1}{4}$
- 7-71 $RQ = 5$
- 7-72 $PQ = 72$ en $QR = 63$
- 7-76 12 en 18
- 7-77 $22\frac{1}{2}$ en 15
- 7-80 $BE = 4$
- 7-81 **a.** 36, **b.** 28, 21 en 14

- 7-82 $4, 5\frac{1}{3}$ en 1
- 7-83 $12, 3\frac{1}{3}$ en $8\frac{2}{3}$
- 7-84 $11\frac{1}{4}$ en $1\frac{3}{4}$
- 7-85 $1\frac{5}{7}$
- 7-86 $1\frac{2}{3}$ en $4\frac{1}{3}$.
- 7-88 $AB = 8\frac{1}{3}, AC = 5, BC = 6\frac{2}{3}$ en $BD = 5\frac{1}{3}$
- 7-89 $h_C = 12, h_A = h_B = 9\frac{3}{13}$
- 7-90 $AQ \parallel DC$, dus: $\triangle APQ \sim \triangle DPC$, $AQ = 4$.
- 7-91 $CQ \parallel DA$, dus: $\triangle CPQ \sim \triangle DPA$, $CQ = \frac{8}{3}$.
- 7-92 $2\frac{2}{3}, 3\frac{3}{4}$
- 7-93 $4, 5$ en $3\frac{3}{4}$.
- 7-94 $5\frac{1}{2}$
- 7-95 4
- 7-96 20
- 7-97 $15 = 6\frac{1}{4} + 8\frac{3}{4}$ en $18 = 7\frac{1}{2} + 11\frac{1}{2}$
- 7-98 $4\frac{1}{2}$
- 7-99 18 en 27 .
- 7-102 $AP = \frac{b^2}{a}$
- 7-103 $PQ = \sqrt{ab}$
- 7-104 $AP = 3$ en $CL = 1\frac{1}{2}$.
- 7-105 $2, 1, 2$ en 3 .
- 7-106 $BK = 3\frac{3}{5}$
- 7-107 $EQ = 3\frac{3}{7}$
- 7-108 10 en 16
- 7-110 **a.** middenparallel; **b.** $-\frac{1}{2}$; **c.** $EZ = \frac{1}{2}BZ, DZ = \frac{1}{3}CD$; **d.** $2 : 1$
- 7-111 18 en 10
- 7-112 **a.** $\sqrt{41}$ en $\frac{2}{3}\sqrt{41}$ **b.** 2
- 7-113 **a.** 36 **b.** $7\frac{1}{2}$
- 7-114 28
- 7-115 $3\frac{9}{17}$
- 7-116 $\frac{4}{5}\sqrt{5}$
- 7-117 $CD = 12; AE = 9\frac{3}{13}$
- 7-118 $CF = 1\frac{3}{5}\sqrt{5}$
- 7-119 $\frac{32}{\sqrt{137}}$
- 7-121 6
- 7-122 10

- 7-123 10
- 7-125 a. 24, 192 b. 8
- 7-126 $O' = k^2 O \Rightarrow 100 = k^2 \cdot 4 \times 16 \rightarrow k^2 = \frac{100}{64} \rightarrow k = \frac{5}{4}$
- 7-127 ja; 125; 343
- 7-129 a. 80 b. 10.000 c. 30
- 7-130 a. 62, 30 b. 558, 810 c. 15360 d. 992
- 7-132 a. 108 b. $\frac{4}{3}$ c. 10
- 7-133 €40,50
- 7-134 deze is 8× zo groot
- 7-135 $\frac{1}{4} \text{ m}^2$
- 7-136 a. 27×
- 7-137 5 $5^2 \cdot 4 = 100$
- 7-138 a. 40 b. 160 c. $17\frac{7}{9}$
- 7-139 $k^2 = \frac{2}{8} = \frac{1}{4}$ dus $k = \frac{1}{2}$
- 7-140 $r_B = 10\frac{2}{3}$
- 7-141 170 m
- 7-142 180 m; 45 m
- 7-143 60 m
- 7-1 108
- 7-2 283,52
- 7-3 64; BT = $\sqrt{8^2 + 6^2}$; DT = $\sqrt{6^2 + 4^2}$; $88 + 8\sqrt{13}$
- 7-4 2,3; 18 cm²
- 7-5 1,26; 4,4 cm; 4,29; 0,65 cm²
- 7-6 874,32 m³
- 7-1 6
- 7-2 81°
- 7-3 6; 20; 14
- 7-4 60°; 75°; 82,5°
- 7-5 12 cm
- 7-6 66°
- 7-7 25
- 7-8 11,5°
- 7-9 3:8
- 7-10 13,5°
- 7-11 18
- 7-12 71,25
- 7-13 20

7-14	42°
7-15	45
7-16	115,5°
7-17	28
7-18	51°
7-19	28
7-20	51°
7-21	9
7-22	61,5°
7-23	15
7-24	130°
7-25	8
7-26	75°
7-27	4
7-28	60°
7-29	240
7-30	45°; 67,5°; 78,75°
7-31	6

8 Goniometrie

- 8-2 a. 14° b. 22° c. 45°
- 8-3 a. 200 m b. 800 m c. 150 m
- 8-4 b. 1,8 c. 0,36
- 8-5 a. $\angle CAB = \angle C'AB'$ en $\angle B = \angle B'$
 b. $\frac{AC}{BC} = \frac{BC}{AB}$
 $\frac{AC'}{BC} = \frac{B'C'}{AB}$
 c. $\frac{BC}{B'C'} = \frac{AB}{AB'} \Leftrightarrow BC \cdot AB' = AB \cdot B'C' \Leftrightarrow \frac{BC}{AB} = \frac{B'C'}{AB'}$
- 8-6 $\frac{3}{4}$
- 8-7 $\frac{2}{3}$
- 8-8 $\frac{4}{2\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$
- 8-10 $\frac{4}{3}$ $\frac{1}{5}$
- 8-11 $BC \approx 1,6$ $\tan 18^\circ \approx 0,3$

- | | | | |
|------|-----------|----------|----------|
| 8-12 | a. 0,781 | d. 0,424 | g. 0,070 |
| | b. 0,839 | e. 1,235 | h. 2,747 |
| | c. 57,290 | f. 0,017 | i. 0,466 |
| 8-13 | a. 0,208 | c. 0,500 | e. 0,743 |
| | b. 0,999 | d. 0,017 | f. 1,000 |
| 8-14 | a. 39° | c. 61° | e. 84° |
| | b. 79° | d. 27° | f. 3° |
| 8-15 | a. 18° | c. 35° | e. 49° |
| | b. 71° | d. 30° | f. 19° |
| 8-16 | a. 37° | c. 19° | e. 60° |
| | b. 89° | d. 35° | f. 30° |

8-17 $\tan \beta = \frac{AC}{AB}$ en $\tan \gamma = \frac{AB}{AC}$

8-18 a. $\sin \alpha = \frac{BC}{AC}$, $\cos \alpha = \frac{AB}{AC}$, $\tan \alpha = \frac{BC}{AB}$

b. $\sin \gamma = \frac{AB}{AC}$, $\cos \gamma = \frac{BC}{AC}$, $\tan \gamma = \frac{AB}{BC}$

- | | | | |
|------|-----------|----------|-----------|
| 8-19 | a. 6,846 | c. 6,761 | e. 3,111 |
| | b. 38,332 | d. 7,247 | f. 30,794 |

8-20 b. $\tan \angle D = \frac{EF}{DE}$, $\tan \angle F = \frac{DE}{EF}$

8-21 a. AC b. $\frac{AD}{AC}$, $\frac{CD}{AC}$, $\frac{AD}{CD}$

- | | | | |
|------|--------------------|--------------------|--------------------|
| 8-22 | a. $\frac{CD}{AC}$ | d. $\frac{CD}{BC}$ | g. $\frac{BD}{BC}$ |
| | b. $\frac{AD}{AC}$ | e. $\frac{BC}{BD}$ | h. $\frac{CD}{BC}$ |
| | c. $\frac{AC}{CD}$ | f. $\frac{BC}{CD}$ | i. $\frac{BD}{CD}$ |
| | | f. $\frac{AD}{BD}$ | |

8-23 a. $\triangle ADC$, CD , AD

b. $\tan \angle A = \frac{CD}{AD}$

c. $\tan \angle B = \frac{CD}{BD}$, $\tan \angle C_1 = \frac{AD}{CD}$, $\tan \angle C_2 = \frac{BD}{CD}$.

d. Er wordt vanuit gegaan dat $\angle C = 90^\circ$

8-24 28° , 62°

8-25 67°

8-26 $\tan \alpha = \frac{BC}{AC}$; 2,66

8-27 $\tan \beta = \frac{AC}{AB}; 2,91$

8-28 4,44

8-29 39,25

8-30 a. $AC = 12$

b. $\frac{12}{13}, \frac{5}{13}, \frac{12}{5}$

c. $\frac{12}{13}, \frac{5}{13}, \frac{12}{5}$

8-31 a. $\sin \alpha = \frac{BC}{AC}, \sin 20^\circ = \frac{BC}{12,6}$ b. 4,309

c. 1. 11,840

2. $\cos \alpha = \frac{AB}{AC}, \cos 20^\circ = \frac{AB}{12,6}$

$AB = 12,6 \cos 20^\circ \approx 11,840$

8-32 37°

8-33 13°

8-34 63°

8-35 a. $\sin \beta$ b. 4,915

8-36 $AC \approx 1,798$ en $BC \approx 0,877$

8-37 $AB \approx 4,448$ en $BC \approx 5,365$

8-38 $\alpha = 32^\circ$ en $\beta = 58^\circ$

8-39 b. $CD = \sqrt{21}$

c. $\angle ACD \approx 23,578^\circ \approx 24^\circ$

d. $\angle A \approx 66^\circ, \angle B \approx 66^\circ$ en $\angle C \approx 47^\circ$.

8-40 $CD \approx 5,638$ en $AB \approx 4,104$

8-41 39°

8-42 104 m

8-43 22°

8-44 27,6 m

8-45 11,9

8-46 13,05

8-47 b. 68° c. 51° d. 1,028

8-48 3,73

8-49 $\beta = 63^\circ$ en $\gamma = 117^\circ$

8-50 b. 44° c. 5,6

8-51 a. $\triangle APM \cong \triangle ARM$ b. 4,289 c. 21,22 d. 21,2

8-52 c. 283 m

8-53 a. $\angle C_1 = 14^\circ$ en $\angle C_2 = 5^\circ$ b. $x = 0,249 \cdot d$ c. $y = 0,087 \cdot d$

d. $x + y = 0,337 \cdot d$ e. $d = 89$ m

8-54 $4\sqrt{2}, 4\sqrt{2}$

8-55 $21\sqrt{3}, 42$

8-56 $88, 44\sqrt{3}$

8-57 $5, 10$

8-58 $2\sqrt{3}, 4\sqrt{3}, 6, 6\sqrt{2}$

8-59 $3\sqrt{2}, 3\sqrt{2}, 6\sqrt{2}, 3\sqrt{6}$

8-60 $6\sqrt{3}, 6$

8-61 a. 0

b. 1

c. 0

8-62 a. 0,940

b. -0,643

c. -0,781

8-63 a. $\frac{1}{2}\sqrt{2}$

b. $-\frac{1}{2}\sqrt{2}$

8-64 a. $\alpha \approx 17^\circ \vee \alpha \approx 163^\circ$

b. $\alpha \approx 96^\circ$

8-65 a. $\alpha = 0^\circ \vee \alpha = 180^\circ$

b. $\alpha = 90^\circ$

d. 0

e. -1

f. 0

d. 0,438

e. -0,988

f. 0,017

c. $\frac{1}{2}$

d. $-\frac{1}{2}\sqrt{3}$

c. $\alpha \approx 64^\circ \vee \alpha \approx 116^\circ$

d. $\alpha \approx 85^\circ$

c. $\alpha = 60^\circ \vee \alpha = 120^\circ$

d. $\alpha = 135^\circ$

g. -1

h. 0

i. b.n.

g. -0,087

h. -0,921

i. -0,649

e. $-\frac{1}{2}\sqrt{3}$

f. $\frac{1}{2}$

e. $\alpha \approx 14^\circ \vee \alpha \approx 166^\circ$

f. $\alpha \approx 117^\circ$

e. $\alpha = 90^\circ$

f. $\alpha = 120^\circ$

8-66

a. tussen 0° en 180° is $\sin \alpha$ positief

b. omdat $-1 \leq \sin \alpha \leq 1$

8-67 a. $\alpha \approx 19^\circ \vee \alpha \approx 161^\circ$

b. $\alpha \approx 48^\circ$

c. geen enkele α

d. $\alpha \approx 110^\circ$

e. $\alpha \approx 48^\circ \vee \alpha \approx 132^\circ$

f. geen enkele α

8-68 a. $\frac{16}{25}$

b. $\frac{9}{25}$

c. $\cos \alpha = -\frac{3}{5}$ of $\cos \alpha = \frac{3}{5}$

d. $\tan \alpha = -\frac{4}{3}$ of $\tan \alpha = \frac{4}{3}$

8-69 $\sin \alpha = -\frac{3}{5}$ of $\sin \alpha = \frac{3}{5}$

$\tan \alpha = \frac{3}{4}$ of $\tan \alpha = -\frac{3}{4}$.

8-70 $\cos \alpha = -\frac{5}{13}$

$\tan \alpha = -\frac{12}{5}$.

8-71 $\sin \alpha = \frac{1}{3}$.

8-72 $\cos \alpha = -\frac{1}{4}\sqrt{15}$ of $\cos \alpha = \frac{1}{4}\sqrt{15}$.

8-73 $\text{Opp}(\triangle ABC) = \frac{1}{2} \cdot AB \cdot BC \sin \angle B$
 $\text{Opp}(\triangle ABC) = \frac{1}{2} \cdot BC \cdot AC \sin \angle C$

8-74 12,045

8-75 12,632

8-76 41,366

8-77 $\frac{27}{4}\sqrt{3}$, 32, $54\sqrt{3}$

8-78 **a.** 104,1; 40,4; 35,2; 77,6; 74,9; 11,0 m

b. 7233,4 m²

8-79 **a.** 72°; **b.** 7,053; **c.** 85,595; **d.** 27,502

8-80 **a.** 3,139; **b.** 99,93%; **c.** $\pi \approx 3,139$; **d.** 0,07%; **e.** nee, nee

8-81 **a.** 36°, 72° en 108°; **b.** 9,511

8-82 $b \approx 4,9$ en $c \approx 6,6$.

8-83 $b \approx 5,6$ en $c \approx 4,6$.

8-84 $DF = 6\sqrt{2}$

8-85 $AB = 1112$ meter.

8-86 $b = 3$

8-88 **b.** $\sin \gamma \approx 0,511$ **c.** $\gamma \approx 31^\circ$

8-89 **b.** $\sin \beta \approx 0,704$ **c.** 135° en 45°

8-90 **a.** $\odot(C, 2)$ snijdt het andere been van hoek A niet.

b. $\sin \beta \approx 1,299$. Dit is niet mogelijk.

8-91 76° of 104°.

8-93 27°, 78°

8-94 **a.** $\beta = 45^\circ$; $\gamma = 103^\circ$ of $\beta = 135^\circ$; $\gamma = 13^\circ$

b. $\beta = 25^\circ$; $\gamma = 123^\circ$

c. 2,120

8-95 86°

8-96 108°

8-97 $\cos \angle K = \frac{1}{2}$, $\angle K = 60^\circ$

8-98 45°

8-100 12,5

- 8-101 $\sqrt{61}$
- 8-102 1,313; 129°
- 8-103 61°
- 8-104 6,890 km
- 8-105 55,1; 91°
- 8-107 2691 m
- 8-108 11,696 m

9 Analytische meetkunde

9-1 A(-5, 3), B(6, 1), C(3, 5); (-3, 5), D(0, -4), E(-3, 0), F(6, 0)

9-4 a. afst= $2\sqrt{5}$; midden: (-1, 3) b. afst=3; midden: $(1, 3\frac{1}{2})$

9-5 a. afst= $\sqrt{41}$; midden: $(-1\frac{1}{2}, 4)$ b. afst= $\sqrt{17}$; midden: $(-1, 4\frac{1}{2})$

9-6 a. afst= $\sqrt{5}$; midden: $(-3\frac{1}{2}, 5)$ b. afst= $\sqrt{26}$; midden: $(-1\frac{1}{2}, 5\frac{1}{2})$

9-7 P : l; Q: l; R: k, l en m

9-8 P: b; Q: c; R: a en b

9-9

x	-3	-2	-1	0	1	2	3	4	5
y	-9	-7	-5	-3	-1	1	3	5	7

x	-2	-1	0	1	2	3	4
$y_1 = \frac{1}{2}x + 1$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
9-10 $y_2 = -2x + 5$	9	7	5	3	1	-1	-3
$y_3 = 1\frac{1}{2}x$	-3	$-1\frac{1}{2}$	0	$1\frac{1}{2}$	3	$4\frac{1}{2}$	6
$y_4 = 3x - 4$	-10	-7	-4	-1	2	5	8

9-11 ja, ja

9-12 nee, ja

A(2, 4) en B(0, 0)

9-13 C(1, -3) en D(5, 5)

E(0, 8) en F(-2, 0)

G(0, -4) en H(-2, 0)

9-14 (4, 0) en (0, -6)

9-15 a. (0, -4) en (3, 0)

b. Alleen B

c. $p = 4\frac{1}{2}$

9-16 a: rico=3 b: rico=2 c: rico=3/2 d: rico=-1

e: rico=-1/3 f: rico=5/2 g: rico=-3/2

9-18 $y = \frac{1}{2}x$

9-23 a. $(0, 5)$ en $(2, 0)$; b. B en C; c. $p = 1\frac{1}{5}$

9-24 a. $(0, -5)$ en $(2, 0)$; b. A en C; c. $p = 2\frac{4}{5}$

9-25 lijn r.c. doorsnijpunt y-as

l	3	-4
m	-2	5
n	$\frac{1}{3}$	5
o	$\frac{5}{3}$	10

9-26 lijn r.c. doorsnijpunt y-as

l	$-1\frac{1}{2}$	3
m	2	-2
n	$\frac{1}{2}$	$-\frac{3}{4}$
o	$\frac{1}{2}$	2

9-31 $y = 3$ $y = -2$ $x = 1$ $x = -2$

9-32 $\text{rico}_a = -1$; $\text{rico}_b = \text{b.n.}$; $\text{rico}_c = -\frac{1}{3}$; $\text{rico}_d = -\frac{1}{3}$

$c \parallel d$

9-34 $\text{rico}_a = -2$ $\text{rico}_e = 2$ i heeft geen rico
 $\text{rico}_b = -3$ $\text{rico}_f = -\frac{1}{3}$ $\text{rico}_j = -3$
 $\text{rico}_c = -1$ $\text{rico}_g = \frac{1}{2}$ $\text{rico}_k = 1$
 $\text{rico}_d = -2$ $\text{rico}_h = \frac{1}{2}$ $\text{rico}_l = -3$

evenwijdig: a en d, g en h

en: b, j en l

loodrecht: $a \perp g$ $d \perp g$ $a \perp h$ $c \perp k$

9-35 $y = 2x - 1$

9-36 l: $y = -2x + 1$

9-37 $y = -2x - 1$

9-38 $\text{rico}_l = -2$; $\text{rico}_{AB} = -2$; $\text{rico}_m = \frac{1}{2}$;

9-39 p: $4x - 2y = 20$

9-40 l $y = 3x$
 m $2x - 4y = -8$
 n $y = 3x + 1$
 o $x + 3y = 14$
 p $y = 2x$

9-41 a. $\text{rico}_l = -\frac{1}{2}$; b. AB: $y = -x + 3$; c. $y = \frac{1}{2}x + 5\frac{1}{2}$

9-42 l: $y = x + 1$
 m: $y = 3x + 3$
 n: $y = 3$

9-43 $y = 4x - 23$

9-44 $y = 3x - 3$

9-45 $y = 3x - 3$

P	l	$m \parallel l$	$n \perp l$
(3,2)	$y = 3x - 1$	$y = 3x - 7$	$y = -\frac{1}{3}x + 3$
(6,1)	$y = \frac{1}{2}x$	$y = \frac{1}{2}x - 2$	$y = -2x + 13$
(8,0)	$y = -x + 3$	$y = -x + 8$	$y = x - 8$
9-46 (0,0)	$y = 2x + 6$	$y = 2x$	$y = -\frac{1}{2}x$
(7,1)	$y = -5x - 3$	$y = -5x + 36$	$y = \frac{1}{5}x - \frac{2}{5}$
(3,0)	$y = 1$	$y = 0$	$x = 3$
(5,8)	$y = x$	$y = x + 3$	$y = -x + 13$
(2,2)	$x = 3$	$x = 2$	$y = 2$

P	l	$m \parallel l$	$n \perp l$
(5,6)	$y = -3x - 1$	$y = -3x + 21$	$y = \frac{1}{3}x + 4\frac{1}{3}$
(3,2)	$y = \frac{1}{2}x$	$y = \frac{1}{2}x + \frac{1}{2}$	$y = -2x + 8$
(3,4)	$y = 4x + 3$	$y = 4x - 8$	$y = -\frac{1}{4}x + 4\frac{3}{4}$
9-47 (0,4)	$y = -3x + 6$	$y = -3x + 4$	$y = \frac{1}{3}x + 4$
(4,0)	$y = \frac{1}{3}x - 3$	$y = \frac{1}{3}x - 1\frac{1}{3}$	$y = -3x + 12$
(3,2)	$y = -5$	$y = 2$	$x = 3$
(5,2)	$y = -\frac{2}{3}x$	$y = -\frac{2}{3}x + 5\frac{1}{3}$	$y = \frac{3}{2}x - 5\frac{1}{2}$
(-2,2)	$x = -3$	$x = -2$	$y = 2$

9-48 (1,4)

9-49 $l: y = 3x + 3; m: y = -x - 1; (-1, 1)$

9-50 $l \cap m = (-5\frac{1}{3}, -8\frac{1}{3})$

$l \cap n = (0, -3)$

$m \cap n = (-1\frac{1}{15}, \frac{1}{5})$

9-51 $S(3, 1)$

9-52 a. (1, -1)	c. (14 $\frac{1}{2}$, 3)	e. (-6, 9)
b. (4, 2 $\frac{1}{4}$)	d. (3, -2)	f. (2, -1)
9-53 a. (1, -2)	c. (2, -1)	e. (1, -3)
b. (1, 1)	d. (2, 4)	f. (0, -4)

9-54 $l \cap m = (2, 2); l \cap n = (0, -2); m \cap n = (-3, 1)$

9-57 AB: $y = x + 8$, C ligt op AB

9-58 AB: $y = -2 \rightarrow h_C: x = 2$

AC: $y = x + 2 \rightarrow h_B: y = -x + 1$

$H = h_C \cap h_B = (2, -1)$

9-59 $\left. \begin{aligned} \text{AB: } y = \frac{1}{2}x + 1\frac{1}{2} &\rightarrow \text{DE: } y = \frac{1}{2}x + 3 \\ \text{AD: } y = 2x &\rightarrow \text{BE: } y = 2x - 3 \end{aligned} \right\} \Rightarrow E(4, 5)$
 $\left. \begin{aligned} \text{BD: } y = -x + 6 \\ \text{AE: } y = x + 1 \end{aligned} \right\} \Rightarrow \text{AE} \perp \text{BD}$

- 9-63 a. $y = 2x + \dots$ b. $y = -\frac{1}{2}x + \dots$
- 9-64 ja, nee
- 9-65 (2, 3)
- 9-66 (3, 5)
- 9-67 a. (2, -1)
- 9-68 l: $y = -x + 5$; m: $y = \frac{1}{2}x + 3\frac{1}{2}$; n: $y = -2x - 4$
- 9-69 l: $y = 0, 3x + 7$; m: $y = -\frac{1}{10}x$; n: $y = \frac{1}{5}x + 2$
- 9-70 m: $y = 3x + 3$; n: $y = -x + 4$
- 9-71 $\text{rico}_k = 2$; $\text{rico}_l = -1$; $\text{rico}_m = 3$;
- 9-75 A: nee; B: ja
- 9-76 P: nee; B: ja
- 9-77 a. k: $y = 6x + 19$; b. $(-3\frac{1}{6}, 0)$; c. (0, 19)
- 9-78 a. m: $y = -3x + 2$; b. $(\frac{2}{3}, 0)$; c. (0, 2)
- 9-79 $k \cap m = (-2, 2)$ ligt niet op l
- 9-80 $k \cap l = (2, 3)$ ligt op m
- 9-81 a. $y = -1\frac{1}{3}x + 5\frac{1}{3}$; b. $y = -1\frac{1}{3}x - 4$
- 9-82 AB: $y = x$; BC: $y = 20$; AC: $y = -\frac{1}{3}x + 20$; h_B : $y = \frac{1}{3}x + 12\frac{1}{3}$;
 h_A : $x = 5$; h_C : $y = -x + 20$; D(5, 20); E(2, 14); F(10, 10); H(5, 15); AH = 10;
 BH = $5\sqrt{10}$; CH = $5\sqrt{2}$; AE = $3\sqrt{10}$; AF = $5\sqrt{2}$; BF = $10\sqrt{2}$; BD = 15; CD = 5;
 CE = $2\sqrt{10}$; DH = 5; EH = $\sqrt{10}$; FH = $5\sqrt{2}$; EB = $6\sqrt{10}$; CF = $10\sqrt{2}$; 150
- 9-83 AB: $y = -\frac{1}{4}x + 12\frac{1}{2}$; BC: $y = 8x - 4$; AC: $y = \frac{7}{5}x - 4$; D(6, 11);
 E(1, 4); F(5, 3); z_A : $y = \frac{2}{3}x + 3\frac{1}{3}$; z_B : $y = -3x + 18$; z_C : $y = 2\frac{1}{2}x - 4$; Z(4, 6);
 ED: $y = \frac{7}{5}x + 2\frac{3}{5}$; DF: $y = 8x - 37$; EF: $y = -\frac{1}{4}x + 4\frac{1}{4}$; AB = $2\sqrt{17}$; AC = $2\sqrt{74}$;
 BC = $2\sqrt{65}$; DE = $\sqrt{74}$; EF = $\sqrt{17}$; DF = $\sqrt{65}$; 2 : 1; ZA = $2\sqrt{13}$; ZB = $2\sqrt{10}$;
 ZC = $2\sqrt{29}$; ZD = $\sqrt{29}$; ZE = $\sqrt{13}$; ZF = $\sqrt{10}$; 2 : 1
- 9-84 AB: $x = 10$; BC = $\frac{1}{7}x + 10\frac{4}{7}$; AC: $y = -x + 6$; D(10, 4); E(3, 11); F(3, 3);
 m_a : $y = -7x + 32$; m_b : $y = x$; m_c : $y = 4$; M(4, 4); AM = BM = CM = 10

10 Kangoeroe opgaven

- | | | | | | |
|------|---|-------|---|-------|---|
| 10-1 | E | 10-8 | B | 10-15 | E |
| 10-2 | C | 10-9 | B | 10-16 | A |
| 10-3 | C | 10-10 | E | 10-17 | C |
| 10-4 | E | 10-11 | B | 10-18 | C |
| 10-5 | C | 10-12 | E | 10-19 | B |
| 10-6 | A | 10-13 | B | 10-20 | B |
| 10-7 | E | 10-14 | D | 10-21 | C |

10-22	A	10-48	E	10-75	D
10-23	E	10-49	D	10-76	D
10-24	B	10-50	D	10-77	E
10-25	C	10-51	B	10-78	A
10-26	C	10-52	C	10-79	C
10-27	D	10-53	C	10-80	B
10-28	D	10-54	D	10-81	E
10-29	E	10-55	D	10-82	B
10-30	C	10-56	D	10-83	E
10-31	D	10-57	D	10-84	D
10-32	B	10-58	A	10-85	D
10-33	C	10-60	E	10-86	A
10-34	B	10-61	A	10-87	D
10-35	C	10-62	D	10-88	E
10-36	E	10-63	C	10-89	B
10-37	A	10-64	C	10-90	A
10-38	C	10-65	E	10-91	A
10-39	B	10-66	E	10-92	A
10-40	C	10-67	C	10-93	E
10-41	C	10-68	E	10-94	D
10-42	C	10-69	B	10-95	D
10-43	B	10-70	C	10-96	E
10-44	A	10-71	D	10-98	E
10-45	C	10-72	E	10-99	C
10-46	B	10-73	D	10-100	C
10-47	D	10-74	B		