

Wiskunde voor vrijescholen

Antwoorden Klas 9

B.Geels

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

1-22

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

1-23

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

1-24

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

1-26

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

1-27

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|--|---|-----------------------|
| a. $x > -\frac{5}{2}; x \in \langle -\frac{5}{2} \rightarrow)$ | c. $x > 0; x \in \langle 0 \rightarrow)$ | e. $x \in \mathbb{R}$ |
| b. $x < \frac{25}{2}; x \in \langle \leftarrow, \frac{25}{2})$ | d. $x \leq 4; x \in \langle \leftarrow, 4]$ | 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. $x > 9; x \in \langle 9, \rightarrow)$ | d. $x > \frac{11}{2}; x \in \langle \frac{11}{2}, \rightarrow)$ | f. $x < -\frac{11}{2}; x \in \langle \leftarrow, -\frac{11}{2} \rangle$ |

1-30

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|---|---|
| a. $x > 12; x \in \langle 12, \rightarrow)$ | 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. $x < 0; x \in \langle \leftarrow, 0 \rangle$ |

1-31

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|---|---|
| a. $x < 7; x \in \langle \leftarrow, 7 \rangle$ | c. $x < 2; x \in \langle \leftarrow, 2 \rangle$ |
| b. $x < \frac{5}{2}; x \in \langle \leftarrow, \frac{5}{2} \rangle$ | d. $x > 1; x \in \langle 1, \rightarrow)$ |

1-32

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|---|---|---|
| a. $x > 6; x \in \langle 6, \rightarrow)$ | c. $x > \frac{3}{2}; x \in \langle \frac{3}{2}, \rightarrow)$ | e. $x > -5; x \in \langle -5, \rightarrow)$ |
| b. $x < -\frac{5}{2}; x \in \langle \leftarrow, -\frac{5}{2} \rangle$ | d. $x > -\frac{1}{2}; x \in \langle -\frac{1}{2}, \rightarrow)$ | f. $x < -\frac{3}{2}; x \in \langle \leftarrow, -\frac{3}{2} \rangle$ |

1-33

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|---------------|---|---|
| a. $x \leq 5$ | c. $x \geq 4$ | e. $x \geq -3$ |
| b. $x \leq 5$ | d. $x < \frac{5}{2}; x \in \langle \leftarrow, \frac{5}{2} \rangle$ | f. $x > -4; x \in \langle -4, \rightarrow)$ |

1-34

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

1-35

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|---------------|---------------|
| a. $x \geq 0$ | b. $x \leq 5$ |
|---------------|---------------|

1-36

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|-----------------------|---------------|---------------------------|
| a. $x \geq -2$ | c. $a \leq 4$ | e. $z \leq \frac{5}{3}$ |
| b. $x \in \mathbb{R}$ | d. $p \leq 4$ | f. $k \geq -\frac{10}{3}$ |

1-37

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|--|---|
| a. $x < -2\frac{1}{2}; x \in \langle \leftarrow, -2\frac{1}{2} \rangle$ | d. $x \geq -6\frac{1}{4}; x \in [-6\frac{1}{4}, \rightarrow)$ |
| b. $x > 9; x \in \langle 9, \rightarrow)$ | e. $x \leq -6; x \in \langle \leftarrow, -6 \rangle$ |
| c. $x \leq -2\frac{2}{5}; x \in \langle \leftarrow, -2\frac{2}{5} \rangle$ | 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. $x \in \langle 3, \rightarrow \rangle$ |
| 1-40 | a. $x \in \langle \leftarrow, -1 \rangle$
b. $x \in \emptyset$ | c. $x \in \mathbb{R}$
d. $x \in \langle \leftarrow, -1 \rangle \cup \langle 2, \rightarrow \rangle$ |
| 1-41 | a. $x \in \langle 0, 3 \rangle$ | b. $x \in \langle \leftarrow, 7 \rangle$ |
| 1-42 | a. $x \in \langle 3, 5 \rangle$
b. $x \in [-5, -1]$ | c. $x \in \langle -3, \rightarrow \rangle$ |
| 1-43 | a. $x \in \langle \leftarrow, 1 \rangle$ | b. $x \in \emptyset$ |
| 1-44 | a. $x \in \langle 3, \rightarrow \rangle$ | b. $x \in \langle 3, \rightarrow \rangle$ |
| 1-45 | a. $x \in \emptyset$
b. $x \in \mathbb{R}$ | c. $x \in \langle -1, 0 \rangle$
d. $x \in [0, 1]$
e. $x \in [-1\frac{1}{2}, -\frac{1}{2}]$
f. $x \in \langle 1\frac{1}{2}, 3\frac{1}{2} \rangle$
g. $x \in \langle -4, -\frac{3}{2} \rangle$
h. $x \in \mathbb{R}$
i. $x \in \emptyset$ |
| 1-46 | a. $x < -4 \vee x > 4$
b. $x \leq -3 \vee x \geq 3$ | c. $-6 < x < 6$
d. \emptyset |
| 1-47 | a. $-10 < x < 10$
b. $x \leq -3 \vee x \geq 3$ | e. $-2 \leq x \leq 2$
f. \mathbb{R}
g. \emptyset
h. \emptyset |
| 1-48 | a. \emptyset
b. $x \neq 0$ | c. $x = 0$
d. $x \in \langle \leftarrow, -1\frac{2}{5} \rangle \cup \langle 4\frac{1}{5}, \rightarrow \rangle$ |
| 1-49 | a. $x \in \langle \leftarrow, -\frac{5}{12} \rangle \cup \langle -1\frac{1}{4}, \rightarrow \rangle$
b. $x \in \langle -1\frac{1}{2}, 4\frac{1}{2} \rangle$ | e. \mathbb{R}
f. $x \in \langle -5, 1 \rangle$
g. $x \in [-12, 20]$
h. $x \in \langle \leftarrow, -3 \rangle \cup [-\frac{1}{3}, \rightarrow)$
i. $x \in \langle \leftarrow, 2\frac{1}{2} \rangle \cup \langle 4\frac{1}{2}, \rightarrow \rangle$
j. $x \in \langle -\frac{12}{13}, \frac{2}{13} \rangle$ |
| 1-50 | a. $x \in [-6, 10]$
b. $x \in \mathbb{R}$ | k. $x \in \langle \leftarrow, -7 \rangle \cup [11, \rightarrow)$
l. $x \in \langle 1\frac{1}{2}, 6\frac{1}{2} \rangle$ |
| 1-51 | a. $\langle -3, 3 \rangle$
b. $[-10, 10]$ | m. $\langle \leftarrow, -5 \rangle \cup [5, \rightarrow)$
n. $\langle \leftarrow, -4 \rangle \cup \langle 4, \rightarrow \rangle$
o. $\langle -1, 1 \rangle$
p. $[-3, 3]$ |

1-52

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|-----------------|----------------|-----------------|
| a. \mathbb{R} | c. \emptyset | e. \mathbb{R} |
| b. $[-2, 2]$ | d. \emptyset | f. \mathbb{R} |

1-53

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|----------------|--|------------------------------------|
| a. \emptyset | c. \mathbb{R} | e. $x \neq 0$ |
| b. $x = 0$ | d. $x < 0 \vee x > 6, x \in \langle \leftarrow, 0 \rangle \cup \langle 6, \rightarrow \rangle$ | f. $1 \leq x \leq 5, x \in [1, 5]$ |

1-54

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|--|--|--|
| a. $-\frac{9}{2} < x < \frac{1}{2}, x \in \langle -\frac{9}{2}, \frac{1}{2} \rangle$ | c. $x \leq \frac{2}{3} \vee x \geq 3\frac{1}{3}; x \in \langle \leftarrow, \frac{2}{3} \rangle \cup [3\frac{1}{3}, \rightarrow)$ | e. $x \in \mathbb{R}$ |
| b. $x \in \emptyset$ | d. $1\frac{1}{4} \leq x \leq 2\frac{3}{4}; x \in [1\frac{1}{4}, 2\frac{3}{4}]$ | f. $x < 4 \vee x > 8, x \in \langle \leftarrow, 4 \rangle \cup \langle 8, \rightarrow \rangle$ |

1-55

- | | |
|--|--|
| a. $x \in \emptyset$ | c. $-1 < x < 7, x \in \langle -1, 7 \rangle$ |
| b. $x \neq 6, x \in \langle \leftarrow, 6 \rangle \cup \langle 6, \rightarrow \rangle, x \in \mathbb{R} \setminus \{6\}$ | d. $x \in \emptyset$ |

2 Irrationale getallen

2-1

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

2-2

- | | |
|------------------|-------------------|
| a. $4 + 3 = 7$ | c. $5 - 2 = 3$ |
| b. $13 - 12 = 1$ | d. $10 - 11 = -1$ |

2-3

- | | | |
|-------|-------|-------|
| a. -2 | c. -9 | e. 10 |
| b. 10 | d. 1 | f. 4 |

2-4

- | | |
|------|-------|
| a. 6 | c. -2 |
| b. 4 | d. 0 |

2-5

- | | | |
|------|-------|-------|
| a. 5 | c. 7 | e. 6 |
| b. 5 | d. 20 | f. 10 |

2-6

- | | | | |
|------|---------|------|---------|
| a. 2 | c. k.n. | e. 0 | g. k.n. |
| b. 6 | d. -6 | f. 1 | h. -1 |

2-7

a. -3

b. -2

2-8

a. $\frac{2}{3}$

b. $\frac{9}{2}$

2-9

a. $\frac{3}{2}$

b. $\frac{6}{5}$

2-10

a. $\frac{2}{5}$

b. $\frac{1}{4}$

2-11

a. 144

b. 0,01

2-12

a. 11

b. 0,9

2-13

a. 0,1

b. 0,2

2-14

a. 21

b. 0

2-15

a. 23

b. $19\frac{1}{3}$

2-16

a. 17

b. 22

2-17

a. $9\sqrt{3}$

b. $-\sqrt{11}$

2-18

a. $8\sqrt{3}$

b. 0

2-19

a. $-4\sqrt{2}$

b. 0

c. $\frac{1}{2}\sqrt{5}$

c. k.n.

d. 10

c. $\frac{1}{6}$

d. $\frac{5}{4}$

c. $\frac{5}{2}$

d. $\frac{10}{3}$

e. 2

f. -10

e. k.n.

f. $\frac{8}{9}$

e. $\frac{4}{3}$

f. $\frac{9}{2}$

c. $\frac{3}{2}$

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

e. 441

f. 0,04

e. 1,3

f. 0,3

c. 0,2

d. $-0,3$

e. 3

f. 8

c. 6

d. -69

c. -6

d. 0

g. $-\frac{1}{2}$

h. $\frac{7}{5}$

g. $\frac{7}{3}$

h. $\frac{7}{4}$

g. 4,41

h. 6,25

g. 0,6

h. 0,1

g. 5

h. -5

c. $5\sqrt{5}$

d. $\sqrt{2}$

e. $-6\sqrt{13}$

f. $-16\sqrt{6}$

c. $7\sqrt{3}$

d. 12

e. $2\sqrt{7}$

f. k.n.

d. -40

e. k.n.

f. $1\frac{1}{6}\sqrt{5}$

- | | |
|---|---|
| <p>2-20</p> <p>a. $5\sqrt{2} + 11\sqrt{3}$</p> <p>b. $-5\sqrt{2} - 3\sqrt{5}$</p> <p>c. $-\sqrt{2} - \sqrt{5}$</p> | <p>d. $3\sqrt{6} + 7\sqrt{10}$</p> <p>e. $2\sqrt{2} + \sqrt{3}$</p> <p>f. $2\sqrt{5} + 2\sqrt{3}$</p> |
| <p>2-21</p> <p>a. 5</p> <p>b. 14</p> | <p>c. 4</p> <p>d. $3 + 3\sqrt{3}$</p> |
| <p>2-22</p> <p>a. $5 + 6\sqrt{2}$</p> <p>b. $\frac{3}{4}\sqrt{2} - \frac{4}{5}\sqrt{6}$</p> <p>c. $2\sqrt{5} - 2\sqrt{3} + \sqrt[3]{5}$</p> | <p>d. $\sqrt{7} + \frac{2}{3}\sqrt{5}$</p> <p>e. $-\frac{1}{4}\sqrt{2}$</p> <p>f. $3\sqrt{7} + \sqrt[3]{10} + 2\sqrt{2}$</p> |
| <p>2-23</p> <p>a. $14\sqrt{3}$</p> <p>b. $10\sqrt{3} + 15\sqrt{7}$</p> | <p>c. $31\sqrt{7}$</p> <p>d. $6\sqrt{3} - 3\sqrt{2}$</p> |
| <p>2-24</p> <p>a. $6\sqrt{5} + 9\sqrt{2}$</p> <p>b. $9\sqrt{3} - 3\sqrt{7}$</p> | <p>c. $4\sqrt{5} - 7\sqrt{2}$</p> <p>d. $-22\sqrt{6} + 24\sqrt{3}$</p> |
| <p>2-25</p> <p>a. $\sqrt{6}$</p> <p>b. $15\sqrt{56}$ (of: $30\sqrt{14}$)</p> | <p>c. $\sqrt{10}$</p> <p>d. 6</p> |
| <p>2-26</p> <p>a. 90</p> <p>b. $15\sqrt{abc}$</p> | <p>c. $2\sqrt{14}$</p> <p>d. $8\sqrt{a^2b}$ (of: $8a\sqrt{b}$)</p> <p>e. $6\sqrt{ab}$</p> <p>f. $6\sqrt{\frac{ac}{b}}$</p> |
| <p>2-27</p> <p>a. 11</p> <p>b. 10</p> | <p>c. 4</p> <p>d. k.n.</p> <p>e. 4</p> <p>f. $3\sqrt{5}$</p> |
| <p>2-28</p> <p>a. $\sqrt{6}$</p> <p>b. $\sqrt{6}$</p> | <p>c. k.n.</p> <p>d. 1</p> <p>e. $3\sqrt{42}$</p> <p>f. 12</p> |
| <p>2-29</p> <p>a. $2\sqrt{6} + 2\sqrt{3}$</p> <p>b. \sqrt{ab}</p> | <p>c. $2 - \sqrt{5}$</p> <p>d. $\sqrt{a^2b}$ (of: $a\sqrt{b}$)</p> <p>e. 16</p> <p>f. $7\sqrt{a}$</p> |
| <p>2-30</p> <p>a. 80</p> <p>b. $\sqrt{18}$ (of: $3\sqrt{2}$)</p> | <p>c. -32</p> <p>d. 20</p> <p>e. 18</p> <p>f. 10</p> |

2-31

a. $\sqrt{2}$

b. 1

c. $\sqrt{3}$

d. $28\sqrt{15}$

e. 4

f. $40\sqrt{55}$

2-32

a. $2\sqrt{5}$

b. 3

c. $\frac{1}{2}\sqrt{3}$

d. 2

e. $\sqrt{7}$

f. 10

2-33

a. $4\sqrt{3}$

b. $\frac{1}{8}\sqrt{15}$

c. $1\frac{1}{2}\sqrt{10}$

d. $2\sqrt{7}$

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

f. $\frac{16}{5}$

2-34

a. $12 + 6\sqrt{3} + 2\sqrt{5} + \sqrt{15}$

b. $-3 - \sqrt{5}$

c. $7\sqrt{2} - 2 - 7\sqrt{5} + \sqrt{10}$

d. $2\sqrt{6} + 3\sqrt{3}$

2-35

a. -1

b. $38 - 12\sqrt{10}$

c. 1

d. $21 + 8\sqrt{5}$

2-36

a. $18 + 6\sqrt{5} + 3\sqrt{2} + \sqrt{10}$

b. $\sqrt{30} - 6\sqrt{10} - 2\sqrt{3} + 12$

d. $15 - 5\sqrt{2} + 6\sqrt{3} - 2\sqrt{6}$

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

b. a^2

c. $9^3\sqrt{3}$

d. $4x^4\sqrt{x}$

2-38

a. 6

b. $-3\sqrt{2}$

c. $3\sqrt{3} + 2\sqrt{2}$

d. $-\sqrt{6} + 3$

2-39

a. 7

b. $-\sqrt{10} - \frac{1}{9}$

c. $-3\sqrt{10}$

d. $\frac{2}{3}\sqrt{5}$

2-40

a. $2\sqrt{2}$

b. $-2\sqrt{6}$

c. $-5\frac{7}{8}$

d. $-12\sqrt{2}$

2-41

a. 6

b. 6

c. 6

d. 6

2-42

a. $2\sqrt{5}$

b. $2\sqrt{7}$

c. $2\sqrt{6}$

d. $3\sqrt{3}$

e. $4\sqrt{2}$

f. $3\sqrt{2}$

2-43

a. $2\sqrt{3}$

b. $5\sqrt{6}$

c. $10\sqrt{2}$

d. $4\sqrt{3}$

e. $2\sqrt{15}$

f. $2\sqrt{110}$

2-44

a. $2\sqrt{10}$

b. $3\sqrt{5}$

c. $\sqrt{3}$

d. $6\sqrt{6}$

e. $12\sqrt{2}$

f. $3\sqrt{6}$

g. 6

h. $6\sqrt{3}$

2-45

a. $10\sqrt{6}$

b. $12\sqrt{15}$

c. $6\sqrt{70}$

d. $30\sqrt{14}$

e. $2\sqrt{155}$

f. $36\sqrt{14}$

2-46

a. $6\sqrt[3]{7}$

b. $10\sqrt{1814}$

c. $6\sqrt[4]{24}$

d. $35\sqrt{2}$

e. $3\sqrt[3]{210}$

f. $30\sqrt{5}$

2-47

a. $6\sqrt[3]{30}$

b. $10\sqrt[4]{54}$

c. 6

d. $4\sqrt{95}$

e. $6\sqrt[3]{21}$

f. $6\sqrt{141}$

2-48

a. $a\sqrt[3]{a^2}$

b. $a\sqrt[3]{a^2b}$

c. $a\sqrt[4]{ab}$

d. $a^2\sqrt[3]{b}$

e. $a\sqrt[3]{a^2b^2}$

f. $a^2\sqrt{ab}$

2-49

a. $ab\sqrt[3]{a^2b^2}$

b. $a^2\sqrt{b}$

c. $ab\sqrt{a}$

d. $a^2b\sqrt[4]{b}$

e. $ab\sqrt[3]{a^2}$

f. $ab\sqrt[3]{a^2}$

2-50

a. \sqrt{a}

b. $\frac{b^3}{a}\sqrt{a}$

c. $ab^2\sqrt{b}$

d. $\frac{b}{a}$

e. $a\sqrt[3]{b^2}$

f. $\frac{a}{b}\sqrt{a}$

g. $b\sqrt[4]{a^3}$

h. $\frac{1}{ab}\sqrt{a}$

2-51

a. $\frac{2}{3}$

b. $\frac{3}{4}\sqrt{3}$

c. $\frac{1}{3}\sqrt{5}$

d. $\frac{1}{5}\sqrt{10}$

e. $\frac{1}{4}\sqrt{7}$

f. $\frac{1}{7}\sqrt{7}$

2-52

a. $\frac{2}{3}\sqrt{6}$

b. $\frac{1}{6}\sqrt{30}$

c. $\frac{1}{10}\sqrt{410}$

d. $\frac{3}{5}\sqrt{5}$

e. $\frac{1}{4}\sqrt{5}$

f. $\frac{7}{3}\sqrt{3}$

2-53

a. $2\frac{1}{2}\sqrt{2}$

c. $\frac{5}{7}\sqrt{7}$

e. $\sqrt{2}$

b. $\frac{8}{3}\sqrt{3}$

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

f. $\frac{3}{4}$

2-54

a. $\frac{1}{3}\sqrt{3}$

c. $\frac{1}{7}\sqrt{7}$

e. $\frac{4}{5}$

b. $\frac{5}{6}$

d. $\sqrt{3}$

f. $2\sqrt{10}$

2-55

a. $\frac{2}{10}\sqrt{10} = \frac{1}{5}\sqrt{10}$

c. $\sqrt{5}$

e. $\frac{1}{5}\sqrt{5}$

b. $\frac{1}{6}\sqrt{3}$

d. $\frac{1}{2}\sqrt{6}$

f. $\frac{1}{2}\sqrt{7}$

2-56

a. $\frac{1}{2}\sqrt{14}$

c. $\frac{1}{4}\sqrt{10}$

e. $\frac{1}{6}\sqrt{6}$

b. $\frac{1}{4}\sqrt{14}$

d. $\frac{1}{10}\sqrt{30}$

f. $\frac{2}{15}\sqrt{15}$

2-57

a. $\frac{5}{3}(2\sqrt{2} + \sqrt{5})$

c. $\frac{2\sqrt{10} - \sqrt{15}}{5}$

e. $-\frac{9 + 2\sqrt{14}}{5}$

b. $\frac{5\sqrt{a} + 5\sqrt{b}}{a - b}$

d. $-6(\sqrt{2} + \sqrt{3})$

f. $\frac{50 + 5\sqrt{3}}{97}$

2-58

a. $2 + 6\sqrt{2} + 6\sqrt{3} + \sqrt{6}$

c. $21\frac{1}{2} - 4\frac{1}{2}\sqrt{15}$

e. $\frac{3}{7}\sqrt{6} + \frac{12}{7}\sqrt{3}$

b. $7 - 3\sqrt{5}$

d. $2 + \sqrt{3}$

f. $3\sqrt{2} - 2\sqrt{3}$

2-59

a. $3\sqrt{3}$

c. $7\sqrt[3]{7}$

e. $\sqrt[3]{25}$

b. $2\sqrt[4]{4}$

d. 17

f. 125

2-60

a. a^2b

c. 81

e. $10\sqrt[5]{100}$

b. $a^2b^2\sqrt[3]{a^2}$

d. $a^3b\sqrt{b}$

f. 50

2-61

a. $\sqrt[20]{a}$

c. $\sqrt{2}\sqrt[4]{5}$

b. $\frac{2}{5}\sqrt[4]{6}\sqrt{5}$

d. $3\sqrt[6]{10}\sqrt[3]{a^2}$

2-62

$\sqrt{45} = 3\sqrt{5}, \quad \sqrt{90} = 3\sqrt{10}, \quad \sqrt{180} = 6\sqrt{5}$ en $\sqrt{60} = 2\sqrt{15}$

2-63

3, $20 - \sqrt{105}$

2-64 a. $\sqrt{51}$ b. $\sqrt{21}$

2-65 a. $\sqrt{113}$ b. 6

2-66 a. $3\sqrt{13}$ b. $\sqrt{139}$

2-67 a. $2\sqrt{5}$ b. $\sqrt{3}$

2-68 a. $\frac{8}{13}\sqrt{13}$ b. $\frac{4}{3}\sqrt{3}$

2-69 a. $\frac{5}{6}\sqrt{6}$

b. $2\sqrt{3} - 1$

2-70 a. $a^2 + 2a\sqrt{b} + b$

b. $x^2 - 2x\sqrt{y} + y$

2-71 a. $2\sqrt{6}$

b. $x - 2x\sqrt{2}$

2-72 a. $a\sqrt{a} + 6a\sqrt{b} + 12b\sqrt{a} + 8b\sqrt{b}$

b. $24 + 7\sqrt{6}$

c. $2y$

2-73 a. $3\sqrt{7} + 5$

b. 25

2-74

a. $1 + \sqrt{2}$

b. $\frac{1}{3}(\sqrt{5} - \sqrt{2})$

c. $\frac{1}{2} + \frac{1}{2}\sqrt{5}$

d. $\frac{7+\sqrt{5}}{11}$

e. $6\sqrt{5} - 12$

f. $\frac{1}{5}(9 + 2\sqrt{14})$

2-75

a. $\frac{21}{2}\sqrt{3} - 2\frac{1}{2}$

b. $\frac{103}{71} + \frac{80}{71}\sqrt{3}$

c. $\frac{2}{5}\sqrt{2} + \frac{1}{5}\sqrt{3}$

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

e. $\frac{1}{97}(-56 + 15\sqrt{10} - 6\sqrt{14} + 20\sqrt{35})$

f. $\frac{17}{2}\sqrt{10} + 27$

2-76 a. $\frac{1}{17}(9 + 5\sqrt{3} + 10\sqrt{5} + 6\sqrt{15})$

b. $2 + \frac{3}{13}\sqrt{10} - \frac{15}{13}\sqrt{3}$

c. $4 - 3\frac{1}{2}\sqrt{2}$

d. $\sqrt{3}$

2-77 a. $\frac{1}{12}(3\sqrt{2} + 2\sqrt{3} - \sqrt{30})$

b. $\frac{1}{12}(\sqrt{2} + \sqrt{3} - \sqrt{5})$

c. $\sqrt{2} + \sqrt{5} + \sqrt{6}$

d. $1 + \sqrt{3} + \sqrt{5}$

2-78 a. $-1 + \frac{1}{4}\sqrt{2} + \frac{1}{2}\sqrt{3} + \frac{3}{4}\sqrt{6}$

b. 14

c. $2 + \sqrt{2} + \sqrt{3} + \sqrt{6}$

d. $\frac{5}{24}$

2-79 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. $2 \vee 3$	c. $0 \vee 2$	e. $-7 \vee 7$
b. -2	d. $2 \vee 4$	f. $0 \vee 4$

3-2

a. $-2 \vee -4$	c. $-9 \vee 10$	e. $1 \vee 5$
b. $3 \vee 40$	d. $3 \vee 4$	f. -3

3-3

a. $2 \vee -5$	c. $-2 \vee 4$	e. $5 \vee 7$
b. $3 \vee 7$	d. $-1 \vee 3$	f. $1 \vee 5$

3-4

a. $0 \vee 3$	c. $0 \vee 12$	e. $-1 \vee 0 \vee 1$
b. $-3 \vee 9$	d. $0 \vee 13$	f. $-4 \vee 0$

3-5

3-6

a. $\pm 2\sqrt{3}$	c. ± 4	e. $\pm 0,9$
b. $\pm 0,4$	d. $\pm \frac{1}{2}$	f. $\pm \frac{3}{2}$

3-7

a. ± 2	d. geen opl.	g. 0
b. geen opl.	e. ± 8	h. ± 3
c. geen opl.	f. geen opl.	i. $\pm \frac{1}{2}$

3-8

a. $\pm\sqrt{7}$	c. $\pm\frac{3}{4}$	e. $\pm\sqrt{10}$
b. $\pm\sqrt{7}$	d. $\pm\frac{1}{3}$	f. geen opl.

3-9

a. -6	c. $-9, -3$	e. $-8, 2$
b. $-5, 13$	d. geen opl.	f. $5\frac{4}{5} \vee 6\frac{1}{5}$

3-10

- | | | |
|----------------------|-------------|--------------|
| a. ± 12 | c. ± 3 | e. geen opl. |
| b. $\pm \frac{1}{3}$ | d. ± 10 | f. ± 2 |

3-11

- | | | |
|------------------|--------------------|------------------|
| a. -2 | c. -3 | e. 5 |
| b. $\frac{3}{2}$ | d. $-\frac{23}{2}$ | f. $\frac{2}{5}$ |

3-12

- | | | |
|----------------------|----------------------|----------------------|
| a. $-5 \pm \sqrt{7}$ | c. $-4 \pm \sqrt{3}$ | e. $-3 \pm \sqrt{5}$ |
| b. $-6 \pm \sqrt{6}$ | d. $-2 \pm \sqrt{7}$ | f. $3 \pm 2\sqrt{6}$ |

3-13

- | | | |
|-----------------------|----------------------|-----------------------|
| a. $-2 \pm \sqrt{19}$ | c. $1 \pm \sqrt{14}$ | e. $-4 \pm \sqrt{14}$ |
| b. $5 \pm \sqrt{17}$ | d. $4 \pm \sqrt{15}$ | f. $-3 \pm 2\sqrt{3}$ |

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

$a = 1, b = 2, c = -1$

$$x_{1,2} = \frac{-2 \pm \sqrt{2^2 - 4 \cdot 1 \cdot (-1)}}{2 \cdot 1} = \frac{-2 \pm \sqrt{4 + 4}}{2} \quad x_{1,2} = \frac{-2 \pm 2\sqrt{2}}{2} = -1 \pm \sqrt{2}$$

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. $\frac{5 \pm \sqrt{13}}{2}$	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. $\frac{5 \pm \sqrt{33}}{4}$	e. $3 \pm \sqrt{3}$
b. $1 \vee 2\frac{1}{2}$	d. $1 \pm \sqrt{2}$	f. $\frac{2 \pm \sqrt{19}}{3}$

3-28

a. $5 \pm 5\sqrt{3}$	c. $\frac{13 \pm \sqrt{97}}{6}$
b. geen opl.	d. $\frac{1}{2} \vee 6$

3-29

a. $\frac{-7 \pm \sqrt{5}}{2}$	c. $\frac{-3 \pm \sqrt{33}}{2}$
b. $\frac{1 \pm \sqrt{21}}{10}$	d. 5

3-30

a. $-1 \pm \sqrt{2}$	c. $\frac{5 \pm 2\sqrt{15}}{5}$
b. $-5 \vee 1$	d. -1

3-31	a. 2	c. 1	e. 0
	b. 0	d. 2	f. 2
3-32	a. 2	c. 0	e. 2
	b. 0	d. 2	f. 0
3-33	a. 0		c. 1
	b. 2		d. 2
3-34	a. geen opl.		c. 6
	b. $\frac{2}{5}$		d. geen opl.
3-35	a. $-6 \vee 0$	c. $-7 \vee 1$	e. geen opl.
	b. $-3 \pm \sqrt{2}$	d. $1\frac{1}{2} \pm \frac{1}{2}\sqrt{29}$	f. $-1, 0$
3-36	a. $-3 \vee 7$	c. $-3 \vee 9$	e. 1
	b. $\frac{1}{2} \vee 1$	d. $-2\sqrt{2} \vee 0$	f. $0 \vee \frac{7}{3}$
3-37	a. $\frac{-3 \pm \sqrt{29}}{2}$	c. $3 \vee -9$	e. $-\frac{7}{3} \vee \frac{1}{2}$
	b. geen opl.	d. $\pm\frac{5}{7}$	f. geen opl.
3-38	a. $0 \vee 6$		c. $\frac{3 \pm \sqrt{5}}{2}$
	b. $\frac{3 \pm \sqrt{29}}{2}$		d. geen opl.
3-39	a. $0 \vee \frac{5}{2}$		c. $5 \pm 2\sqrt{3}$
	b. $\frac{1 \pm \sqrt{5}}{4}$		d. $-2 \vee 8$
3-40	a. $-\frac{1}{4} \vee \frac{5}{8}$		c. $-5 \pm 5\sqrt{2}$
	b. $2 \vee 30$		d. $\frac{5 \pm \sqrt{19}}{6}$
3-41	a. $-\frac{1}{3} \vee 15$		e. $\frac{49 \pm 7\sqrt{69}}{10}$
	b. $9 \pm \sqrt{7}$		f. $2\frac{2}{3} \vee 4$
	c. $\frac{1}{2} \vee \frac{1}{10}$		f. $\frac{-8 \pm 12\sqrt{2}}{7}$

3-42

a. $3 \pm \sqrt{11}$	c. $6 \pm \sqrt{6}$	e. $-1 \pm \sqrt{5}$
b. $1 \pm \sqrt{2}$	d. $4 \vee 6$	f. $\frac{2}{3} \vee \frac{3}{2}$

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

4-1

a. 4	c. 17	e. 75
b. 8	d. $\frac{17}{2}$	f. $\frac{15}{2}$

4-2

a. 0; 3

b. 45

c. $0; \frac{5}{4}$

d. 30

e. 0; 8

f. ± 9

4-3

a. $0; \frac{1}{16}$

b. $0; \frac{3}{16}$

c. $0; \frac{3}{2}$

d. 0

e. 0

f. 0

4-4

a. -2; 2

b. -5; 1

c. -2; 6

d. 5

e. -3; 3

f. 1; 5

4-5

a. 0; 2

b. k.n.

c. -3; 2

d. k.n.

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. 16

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

4-18

a. $-\frac{1}{3}$

b. k.n.

c. $-\frac{2}{21}$

d. 2

e. $\frac{2}{5}$

f. $-\frac{6}{13}$

4-19

a. $-\frac{3}{4}$

b. k.n.

c. $-\frac{5}{4}$

d. 0

e. 5

f. $x \neq -7$

4-20

a. k.n.

b. -9

c. 0

d. $2, \frac{9}{2}$

e. $-\frac{8}{5}$

f. -1, 2, -2

4-21

a. 2

b. geen opl.

c. -1, 2

d. 2, -2, 3

4-22 a. $-\sqrt{5}, \sqrt{5}, 2, -2$

b. $3, -3$

4-23 a. k.n.

b. -4

4-24 a. $0; -\frac{7}{4}$

b. $\frac{15 \pm \sqrt{193}}{4}$

4-25 a. $-1; \frac{7}{10}$

b. 0

4-26 a. 1

b. $3; \frac{5}{3}$

4-27 a. -4

b. geen opl.

4-28 a. geen opl.

b. -5

4-29 a. $x = 2 \vee x = -1$

b. $x = \pm 2 \vee x = 3$

c. $x = 0$

4-30 a. $x = \pm 3 \vee x = 1$

b. $x = \pm 2 \vee x = \pm \frac{1}{2}\sqrt{2}$

c. $x = 0 \vee x = 3$

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. $x = 4$

d. $x = 0 \vee x = 2 \vee x = \pm\sqrt{3}$

e. $x = 4$

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	31,4 cm
5-52	251 m
5-53	226 cm
5-54	12732 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	$36 - 4\frac{1}{2}\pi \approx 21,9$
5-60	$72\pi \approx 226,19$ en $24\pi \approx 75,40$
5-61	$8\pi \approx 25,13$ en $12\pi \approx 37,70$
5-62	80 cm; $1600\pi \approx 5027$ cm ² ; $6400 - 1600\pi \approx 1373$ cm ²
5-63	$18\pi - 36 \approx 20,55$; $6\pi \approx 18,85$
5-64	$64 - 8\pi \approx 38,87$; $16 + 4\pi \approx 28,57$
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	$2! = 2,$ $\frac{4!}{2!} = 12,$ $\frac{7!}{3!2!} = 420$

- 6-8 a. 12
b. 1320
c. 120
- 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. $\frac{11}{10!}$
b. $4!$
- 6-12 a. $11!$
b. $\frac{1}{4}$
- 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.
- d. $\frac{1}{12}$
e. $\frac{1}{210}$
f. 11
- c. $\frac{14}{5!}$
d. $\frac{1}{8!}$
c. $\frac{1}{11!}$
d. $\frac{91}{10!}$

6-36 Het gaat om combinaties:

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

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

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 sec = 112 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 $a^7 + 7a^6b + 21a^5b^2 + 35a^4b^3 + 35a^3b^4 + 21a^2b^5 + 7ab^6 + b^7$
- | | |
|--|--|
| <p>6-59</p> <p>a. $1 + 9x + 27x^2 + 27x^3$</p> <p>b. $10^5 + 10^5 + 4 \cdot 10^4 + 8 \cdot 10^3 + 80 \cdot 10 + 32 = 248832$</p> | <p>c. $16 - 32y + 24y^2 - 8y^3 + y^4$</p> <p>d. $4x^2 + 12xy + 9y^2$</p> |
|--|--|
- | | |
|---|-----------------------------------|
| <p>6-60</p> <p>a. 1111</p> <p>b. 11101010</p> | <p>c. 10110</p> <p>d. 1000100</p> |
|---|-----------------------------------|
- | | |
|--------------------------------------|---------------------------|
| <p>6-61</p> <p>a. 5</p> <p>b. 54</p> | <p>c. 28</p> <p>d. 27</p> |
|--------------------------------------|---------------------------|
- | | |
|--|-----------------------------------|
| <p>6-62</p> <p>a. 1110</p> <p>b. 10001</p> | <p>c. 1100</p> <p>d. 11110101</p> |
|--|-----------------------------------|
- | | |
|---|--|
| <p>6-63</p> <p>a. 101101</p> <p>b. 111100</p> | <p>c. 100011</p> <p>d. 11110111100</p> |
|---|--|

7 Meetkunde

- 7-1 60 cm³; 30 cm³; 6 cm²; ja
- 7-2 32; 40; 36
- 7-3 36 cm³; 54 cm³
- 7-4 2,2 m³
- 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 cm^3 ; $42\frac{2}{3}$; $41\frac{2}{3}$ 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 m^3
7-21	740
7-22	a. 216; b. $\sqrt{4,5^2 + 8^2} \approx 9,1788$ c. 166
7-23	$94,2 \text{ cm}^3$
7-24	$0,177 \text{ km}^3$
7-25	a. $18,84 \text{ cm}^3$; 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; $25 \times$
7-38	$3,25 \text{ cm}^2$
7-39	26 cm^2
7-40	8 l
7-41	175
7-42	225 g
7-43	4492 m^2
7-44	9; $k=3$
7-45	$k = \sqrt{8}$; $k = \sqrt{12}$; $k = \frac{25}{15} = \frac{5}{3}$, 417 cm^2
7-46	5,4
7-47	45×30 ; 15×10
7-48	a. $4,8 \text{ m}^2$; b. 1,31; c. 3,67 m bij 1,53 m
7-49	9; 3; 27
7-50	262 l; 32 dm^2 ; 8,1 dm

7-51	29 ml
7-52	9375 ml, minder; 100
7-53	1,7; 4,0 l; 510 cm ²
7-54	$\frac{3}{4}$; 19 ml; 88 ml; 94 cm ²
7-55	37,5 m, 12,8 m; 1181,3 m ³ ; 405 m ² ; 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 cm ²
7-59	1,19; 17,3 cm
7-60	1,19; 2,15 m ² ; 101,2 cm
7-61	96 cm ³ ; 40 cm ³ ; 16 cm ³
7-62	25π cm ³
7-63	91.000 cm ³ =91 l; 1838 cm ²
7-64	948 cm ³ =0,948 dm ³ ; 0,65 kg; 81 g
7-65	1,4; 17,6 cm ² ; 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 $O' = k^2O \Rightarrow 100 = k^2 \cdot 4 \times 16 \rightarrow k^2 = \frac{100}{64} \rightarrow k = \frac{5}{4}$
- 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 $8\times$ zo groot

7-135	$\frac{1}{4} \text{ m}^2$
7-136	a. $27 \times$
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 cm^2
7-5	1,26; 4,4 cm; 4,29; $0,65 \text{ cm}^2$
7-6	$874,32 \text{ m}^3$
7-1	6
7-2	81°
7-3	6; 20; 14
7-4	60° ; 75° ; $82,5^\circ$
7-5	12 cm
7-6	66°
7-7	25
7-8	$11,5^\circ$
7-9	3:8
7-10	$13,5^\circ$
7-11	18
7-12	71,25
7-13	20
7-14	42°
7-15	45
7-16	$115,5^\circ$
7-17	28
7-18	51°
7-19	28
7-20	51°
7-21	9
7-22	$61,5^\circ$

- 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. $\frac{AC}{BC} = \frac{B'C'}{AB} = \frac{AB}{AB'}$

c. $\frac{B'C'}{AB'} = \frac{BC}{AB} \Leftrightarrow BC \cdot AB' = AB \cdot B'C' \Leftrightarrow \frac{BC}{AB} = \frac{B'C'}{AB'}$

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. $\frac{BD}{BC}$	h. $\frac{CD}{BC}$
c. $\frac{CD}{AD}$	f. $\frac{CD}{BD}$	i. $\frac{BD}{CD}$

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

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

d. 0

e. -1

f. 0

g. -1

h. 0

i. b.n.

8-62 a. 0,940

b. -0,643

c. -0,781

d. 0,438

e. -0,988

f. 0,017

g. -0,087

h. -0,921

i. -0,649

8-63

a. $\frac{1}{2}\sqrt{2}$

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

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

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

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

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

8-64

a. $\alpha \approx 17^\circ \vee \alpha \approx 163^\circ$

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

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

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

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

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

8-65

a. $\alpha = 0^\circ \vee \alpha = 180^\circ$

b. $\alpha = 90^\circ$

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

d. $\alpha = 135^\circ$

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: k; 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)
 C(1, -3) en D(5, 5)
 9-13 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 l	n ⊥ 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 l	n ⊥ 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 = $h_C \cap h_B = (2, -1)$

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

$$\boxed{9-63} \quad \mathbf{a.} \quad y = 2x + \dots \quad \mathbf{b.} \quad y = -\frac{1}{2}x + \dots$$

$\boxed{9-64}$ ja, nee

$\boxed{9-65}$ (2, 3)

$\boxed{9-66}$ (3, 5)

$\boxed{9-67}$ **a.** (2, -1)

$\boxed{9-68}$ l : $y = -x + 5$; m : $y = \frac{1}{2}x + 3\frac{1}{2}$; n : $y = -2x - 4$

$\boxed{9-69}$ l : $y = 0, 3x + 7$; m : $y = -\frac{1}{10}x$; n : $y = \frac{1}{5}x + 2$

$\boxed{9-70}$ m : $y = 3x + 3$; n : $y = -x + 4$

$\boxed{9-71}$ $\text{rico}_k = 2$; $\text{rico}_l = -1$; $\text{rico}_m = 3$;

$\boxed{9-75}$ A: nee; B: ja

$\boxed{9-76}$ P: nee; B: ja

$\boxed{9-77}$ **a.** k : $y = 6x + 19$; **b.** $(-3\frac{1}{6}, 0)$; **c.** (0, 19)

$\boxed{9-78}$ **a.** m : $y = -3x + 2$; **b.** $(\frac{2}{3}, 0)$; **c.** (0, 2)

$\boxed{9-79}$ $k \cap m = (-2, 2)$ ligt niet op l

$\boxed{9-80}$ $k \cap l = (2, 3)$ ligt op m

$\boxed{9-81}$ **a.** $y = -1\frac{1}{3}x + 5\frac{1}{3}$; **b.** $y = -1\frac{1}{3}x - 4$

$\boxed{9-82}$ 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

$\boxed{9-83}$ 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

$\boxed{9-84}$ 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

$\boxed{10-1}$ E

$\boxed{10-2}$ C

$\boxed{10-3}$ C

$\boxed{10-4}$ E

$\boxed{10-5}$ C

$\boxed{10-6}$ A

10-7	E	10-45	C
10-8	B	10-46	B
10-9	B	10-47	D
10-10	E	10-48	E
10-11	B	10-49	D
10-12	E	10-50	D
10-13	B	10-51	B
10-14	D	10-52	C
10-15	E	10-53	C
10-16	A	10-54	D
10-17	C	10-55	D
10-18	C	10-56	D
10-19	B	10-57	D
10-20	B	10-58	A
10-21	C	10-60	E
10-22	A	10-61	A
10-23	E	10-62	D
10-24	B	10-63	C
10-25	C	10-64	C
10-26	C	10-65	E
10-27	D	10-66	E
10-28	D	10-67	C
10-29	E	10-68	E
10-30	C	10-69	B
10-31	D	10-70	C
10-32	B	10-71	D
10-33	C	10-72	E
10-34	B	10-73	D
10-35	C	10-74	B
10-36	E	10-75	D
10-37	A	10-76	D
10-38	C	10-77	E
10-39	B	10-78	A
10-40	C	10-79	C
10-41	C	10-80	B
10-42	C	10-81	E
10-43	B	10-82	B
10-44	A	10-83	E

10-84 D
 10-85 D
 10-86 A
 10-87 D
 10-88 E
 10-89 B
 10-90 A
 10-91 A

10-92 A
 10-93 E
 10-94 D
 10-95 D
 10-96 E
 10-98 E
 10-99 C
 10-100 C