

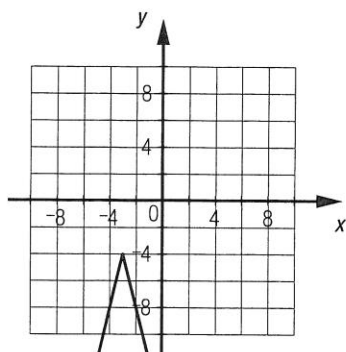
**Practice 1.3**

1. a) 1) 0.5 and -0.5. 2) (7, 2)  
 d) 1) -4 and 4. 2) (-3, -4)

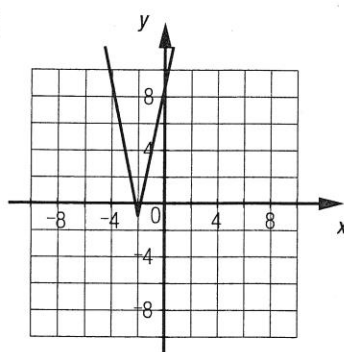
- b) 1) -3 and 3. 2) (-4, -5)  
 e) 1) 5 and -5. 2) (-2, -1)

- c) 1) 1 and -1. 2) (-2, -1)  
 f) 1) -6 and 6. 2) (1.5, 7)

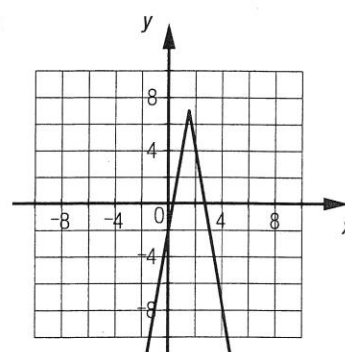
2. a)



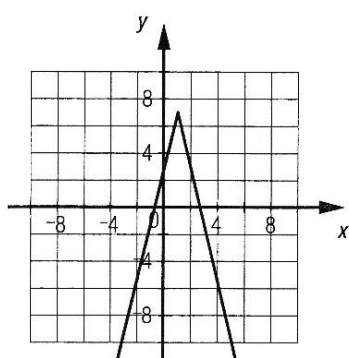
b)



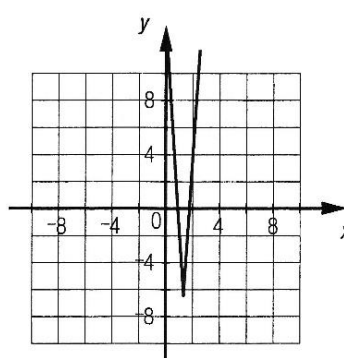
c)



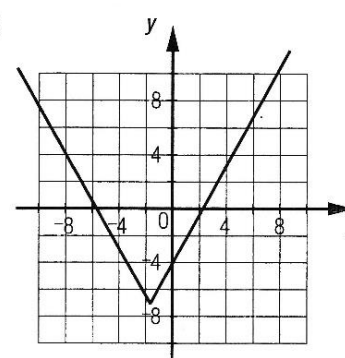
d)



e)



f)



3. a)  $f(x) = -2.5|x - 8.5| - 2$   
 d)  $f(x) = -3.5|x + 9.4| + 2$

- b)  $f(x) = 6|x| - 8$   
 e)  $f(x) = 10|x - 2| - 8.5$

- c)  $f(x) = 2|x + 3| + 5$   
 f)  $f(x) = -9|x - 7| - 6.5$

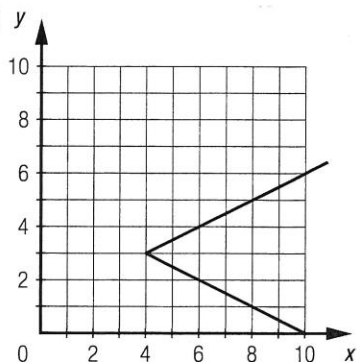
## Practice 1.3 (cont'd)

4. a) 1) 12                      2) 48                      3) 10                      4) 36                      5) 9  
       6) 42                      7) 5                      8) 2                      9)  $\frac{-1}{2}$

b)  $|a|^2 = |a| \times |a| = |a \times a| = |a^2|$

5. a)  $f(x) = 2|x - 3|$                       b)  $f(x) = 4|x + 1|$                       c)  $f(x) = -3|x + 3| - 2$   
       d)  $f(x) = 2|x - 4| + 5$                       e)  $f(x) = -4|x - 2| + 1$                       f)  $f(x) = 6\left|x - \frac{2}{3}\right| + 3$   
 6. a)  $x = 0$  and  $x = -12$ .                      b) No solution.                      c)  $x = -4$   
       d)  $x = 0$                       e)  $x = 1.5$  and  $x = -1.5$ .                      f) No solution.  
       g) No solution.                      h)  $x = -17$  and  $x = -27$ .                      i)  $x = \frac{5}{7}$  and  $x = \frac{13}{7}$ .

7. a) b) No, because certain values of the independent variable are associated with more than one value of the dependent variable.



## Practice 1.3 (cont'd)

8. a) 1)  $\mathbb{R}$                       2)  $[4, +\infty[$                       3) This function does not have any zeros.  
       4) This function is increasing over  $[2, +\infty[$  and decreasing over  $]-\infty, 2]$ .  
       5) This function is positive over the entire domain.  
 b) 1)  $\mathbb{R}$                       2)  $]-\infty, 6]$                       3) The zeros are  $-14$  and  $22$ .  
       4) This function is increasing over  $]-\infty, 4]$  and decreasing  $[4, +\infty[$ .  
       5) This function is negative over  $]-\infty, -14]$  and over  $[22, +\infty[$ , positive over  $[-14, 22]$  and zero at  $x = -14$  and at  $x = 22$ .  
 c) 1)  $\mathbb{R}$                       2)  $[5, +\infty[$                       3) This function does not have any zeros.  
       4) This function is increasing over  $[4, +\infty[$  and decreasing over  $]-\infty, 4]$ .  
       5) This function is positive over the entire domain.  
 d) 1)  $\mathbb{R}$                       2)  $[-3, +\infty[$                       3) The zeros are  $1.625$  and  $2.375$ .  
       4) This function is increasing over  $[2, +\infty[$  and decreasing over  $]-\infty, 2]$ .  
       5) This function is positive over  $]-\infty, 1.625]$  and over  $[2.375, +\infty[$ , negative over  $[1.625, 2.375]$  and zero at  $x = 1.625$  and at  $x = 2.375$ .

- e) 1)  $\mathbb{R}$                       2)  $]-\infty, 1]$                       3) The zeros are  $x = 1.75$  and  $x = 2.25$ .  
 4) This function is increasing over  $]-\infty, 2]$  and decreasing over  $[2, +\infty[$ .  
 5) This function is negative over  $]-\infty, 1.75]$  and over  $[2.25, +\infty[$ , positive over  $[1.75, 2.25]$  and zero at  $x = 1.75$  and at  $x = 2.25$ .
- f) 1)  $\mathbb{R}$                       2)  $\mathbb{R}_+$                       3) The zero is  $x = 2$ .  
 4) This function is decreasing over  $[2, +\infty[$  and decreasing over  $]-\infty, 2]$ .  
 5) This function is positive over the entire domain and zero at  $x = 2$ .

9. a)  $(h, k) = (-8, -8)$

Point  $(-16, 8)$

$$y = a|x + 8| - 8$$

$$8 = |-8|a - 8$$

$$8 = 8a - 8$$

$$a = 2$$

$$f(x) = 2|x + 8| - 8$$

b) The coordinates of the intersection point of lines BC and CD are  $(1, 10)$ . Using this point and point  $(-8, 8)$ , you have:

$$y = a|x - 1| + 10$$

$$-8 = a|-8 - 1| + 10$$

$$9a = -18$$

$$a = -2$$

$$f(x) = -2|x - 1| + 10$$

c)  $(h, k) = (10, -8)$

$$C(x, y) = (1, 10)$$

$$y = a|x - 10| + 8$$

$$10 = a|1 - 10| - 8$$

$$9a = 18$$

$$a = 2$$

$$f(x) = 2|x - 10| - 8$$

10. a)  $x \in ]-1, 5[$

d)  $x \in ]-\infty, -4] \cup [14, +\infty[$

g)  $x \in ]-\infty, -4.8] \cup [6.4, +\infty[$

b)  $x \in ]-\infty, -2.6] \cup [1.4, +\infty[$

e)  $x \in [-3, 2]$

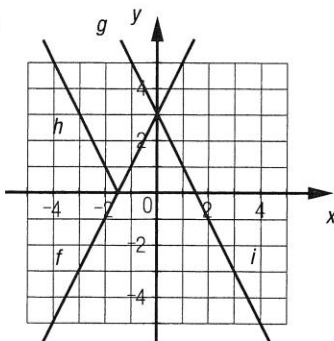
h)  $x \in ]-\infty, 5] \cup [31, +\infty[$

c)  $x \in ]-\infty, -10[ \cup ]-8, +\infty[$

f)  $\mathbb{R}$

i)  $x \in ]-\infty, -1.4] \cup [3, +\infty[$

11. a)



b) Each of these curves is partially superimposed onto that of function  $f$ .

12. a)  $f(x) = 2|x + 1| + 2$

b)  $f(x) = -5|x + 12|$

c)  $f(x) = 3|x - 2| - 2$

**Practice 1.3 (cont'd)**

13. Determine the coordinates of  $(h, k)$ .

$$0.25x + 16 = -0.25x - 7$$

$$0.5x = -13$$

$$x = -26$$

When  $x = -26$ ,  $y = \frac{26}{4} + 6 = -0.5$ . The coordinates are  $(-26, -0.5)$ .

$$y = 0.25|x + 26| - 0.5 \text{ and } y = -0.25|x + 26| - 0.5.$$

14. No. The intersection of these two lines cannot result in a pair of symmetric lines in relation to a vertical axis.

15. a) 1)  $f + g = 2|x - 4| - 4$       2)  $f - g = 8$       3)  $g - f = -8$

b) 1) Domain:  $\mathbb{R}$ , range:  $[-4, +\infty[$ .      2) Domain:  $\mathbb{R}$ , range: 8.      3) Domain:  $\mathbb{R}$ , range: -8.

16. The rule of the function is:  $y = \frac{-8}{5}|x - 5| + 8$

A(x, 1):  $1 = \frac{-8}{5}|x - 5| + 8$       B(x, 3):  $3 = \frac{-8}{5}|x - 5| + 8$

$x = \frac{5}{8}$        $x = \frac{15}{8}$

C(x, 5):  $5 = \frac{-8}{5}|x - 5| + 8$       D(x, 7):  $7 = \frac{-8}{5}|x - 5| + 8$

$x = \frac{25}{8}$        $x = \frac{35}{8}$

E(x, 6): The slope is  $\frac{-8}{5}$  and the points of the coordinates (5, 8) and (x, 6) are located on the curve. You have:

$$\frac{8 - 6}{5x} = \frac{-8}{5}$$

$$5 - x = \frac{-5}{4}$$

$$x = \frac{25}{4}$$

$$x = 6.25$$

For a variation of 2 units for y, the variation for x is 1.25. You can therefore deduce the coordinates of points F and G as follows:

F = (x, 4) : (6.25 + 1.25, 4) = (7.5, 4)

G = (8.75, 2)

The coordinates of the seven points are: A(0.625, 1), B(1.875, 3), C(3.125, 5), D(4.375, 7), E(6.25, 6), F(7.5, 4), G(8.75, 2).

17. a)  $|x - 7| \times |x + 5| = 28$       b)  $x = 1$

$$|(x - 7)(x + 5)| = 28$$

$$|x^2 - 2x - 35| = 28$$

$$x^2 - 2x - 35 = 28 \quad -x^2 + 2x + 35 = 28$$

$$x^2 - 2x - 63 = 0 \quad x^2 + 2x + 7 = 0$$

$$x = 9 \text{ and } x = -7. \quad x \approx -1.83 \text{ and } x \approx 3.83.$$

c)  $|2x^2 + 4x - 6| = 64$

$$2x^2 + 4x - 6 = 64$$

$$2x^2 + 4x - 70 = 0$$

$$(2x + 14)(x - 5) = 0$$

$$x = -7 \text{ and } x = 5.$$

d)  $|x + 4| = \sqrt{36}$

$$|x + 4| = 6$$

$$-4 - x = 6$$

$$x + 4 = 6$$

$$x = -10$$

$$x = 2$$

18. a)  $f(x) = |x - 2| - 7$

b)  $f(x) = -2|x + 1| + 6$

c)  $f(x) = 3|x - 5| + 1$

d)  $f(x) = 1.5|x + 4| - 9$

e)  $f(x) = 4|x - 6| - 3$

f)  $f(x) = -6|x + 3| + 8$

### Practice 1.3 (cont'd)

19. a)  $f(x) = \begin{cases} -0.75x + 9.5 & \text{if } x \leq 10 \\ 0.75x - 5.5 & \text{if } x \geq 10 \end{cases}$

b)  $f(x) = \begin{cases} 1.8x & \text{if } x \leq 10 \\ -1.8x + 36 & \text{if } x \geq 10 \end{cases}$

c)  $f(x) = \begin{cases} -1.5x + 18 & \text{if } x \leq 12 \\ 1.5x - 18 & \text{if } x \geq 12 \end{cases}$

d)  $f(x) = \begin{cases} -2.6x + 15.7 & \text{if } x \geq -5.5 \\ 2.6x + 44.3 & \text{if } x \leq -5.5 \end{cases}$

20. a)  $y = 2.5|x - 6| - 1$

b)  $y = -2.5|x - 4| - 2$

c)  $y = 2.5|x + 4| + 2$

d)  $y = 2.5|x - 4| + 2$

21.  $y = 2|x - 1.75| + 2.5$ ,  $y = -2|x - 1.75| + 2.5$ ,  $y = 2|x + 0.75| - 2.5$ ,  $y = -2|x + 0.75| - 2.5$ ,

$$y = 1.5\left|x - \frac{2}{3}\right| + 2, y = -1.5\left|x - \frac{2}{3}\right| + 2$$

22.  $(h, k) = (5, 9)$  and  $(x, y) = (0, -5)$ .

$$-3 = a|0 - 5| + 9$$

$$a = \frac{12}{5}$$

The rule of the function is  $y = \frac{12}{5}|x - 5| + 9$ .

$$\frac{12}{5}|x - 5| + 9 \geq 0$$

$$|x - 5| \geq -3.75$$

$$x - 5 \geq -3.75$$

$$x \geq 1.25$$

$$5 - x \geq -3.75$$

$$x \leq 8.75 \Rightarrow 7.5 \text{ days}$$

The temperature was greater than or equal to the freezing point during 7.5 days.

23. a)  $(h, k) = (8, 12)$ , then:

$$-1.5|x - 8| + 12 = 6.3$$

$$x - 8 = 3.8 \quad \text{and} \quad 8 - x = 3.8$$

$$x = 11.8$$

$$x = 4.2$$

Base of the triangle: 7.6

Height of the triangle:  $12 - 6.3 = 5.7$

$$\text{Area of the triangle: } \frac{7.6(5.7)}{2} = 21.66 \text{ u}^2$$

b)  $(h, k) = (10, 1)$ , then:

$$2|x - 10| + 1 = 15.02$$

$$|x - 10| = 7.01$$

$$x = 17.01 \text{ and } x = 2.99$$

Base of the triangle:  $17.01 - 2.99 = 14.02$

Height of the triangle: 14.02

$$\text{Area of the triangle: } \approx 98.28 \text{ u}^2$$

24.  $-0.25|t - 4| + 6 \geq 5$

$$-0.25|t - 4| \geq -1$$

$$|t - 4| \leq 4$$

$$t - 4 \leq 4$$

$$\text{and } 4 - t \leq 4$$

$$t \leq 8$$

$$t \geq 0$$

This waterway is navigable for 8 days.

25.  $1.25|n - 8| - 5 < 0$

$$1.25|n - 8| < 5$$

$$|n - 8| < 4$$

$$n - 8 < 4$$

$$\text{and } 8 - n < 4$$

$$n < 12$$

$$n > 4$$

The temperature was greater than the freezing point for 8 h.

26. • Determine how many days the humidity rate is less than or equal to 25%.

$$25 \geq 1.2|x - 6| + 20$$

$$25 = 1.2|x - 6| + 20$$

$$10.1\bar{6} = x \text{ and } 1.8\bar{3} = x$$

The humidity rate was less than or equal to 25% during  $10.1\bar{6} - 1.8\bar{3} = 8.3$  h.

The sprinkler was in use during 8 h and 20 min.

• Calculate the amount of water used for the watering.

The system consumed 12 L/h for  $8.3$  h, which is equal to 100 L.

27. a) 15 000 turns/min.

b) At 30 s.

c) 1)  $1000 < -500|t - 30| + 15\,000$

$$t = 2 \text{ and } t = 58.$$

The speed is greater than 1000 turns/min when  $2 < x < 58$ .

The speed is greater than 1000 turns/min during 56 s.

2)  $10\,000 < -500|t - 30| + 15\,000$

$$t = 20 \text{ and } t = 40.$$

The speed is greater than 10 000 turns/min when  $20 < x < 40$ .

The speed is greater than 10 000 turns/min for less than 20 s.

3)  $12\,000 < -500|t - 30| + 15\,000$

$t = 24$  and  $t = 36$ .

The speed is greater than 12 000 turns/min when  $24 < x < 36$ .

The speed is greater than 12 000 turns/min for less than 12 s.

28.  $14.3 \leq -1.5|x - 12| + 17$

$13.8 = x$  and  $10.2 = x$

The voltage is greater than or equal to 14.3 V if  $10.2 \leq x \leq 13.8$ .

The voltage is greater than or equal to 14.3 during  $13.8 - 10.2 = 3.6$  h.

The circuit is cut for 3.6 h.