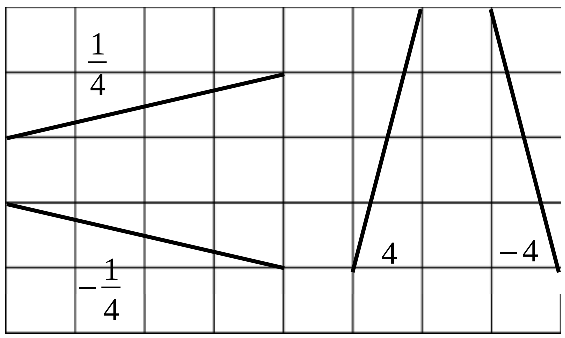
Grade 9

Linear Relations: Slopes and the Equation of a Line

Answers:

1. $m_{AB} = \frac{-7}{7} = -1$; $m_{AC} = \frac{-3}{7}$; $m_{AD} = \frac{0}{7} = 0$; $m_{AE} = \frac{1}{7}$; $m_{AF} = \frac{2}{7}$

2.



3. a. $-\frac{4}{5}$ b. $\frac{1}{4}$ c. 0 d. undefined

4. a. positive b. positive c. 0 d. negative

5. a. 0 b. undefined c. 3 d. -4 e. -4 f. $\frac{4}{3}$

6. a. -2 b. 4 c. 19 d. 42 e. -12 f. 6

7. a.
$$m = \frac{8-0}{-2-0} = \frac{8}{-2} = -4$$
$y = -4x + b$, using $(0,0)$
$$0 = -4(0) + b$$
$$b = 0$$
$$y = -4x$$

b.
$$m = \frac{-1-2}{8-4} = -\frac{3}{4}$$
$y = -\frac{3}{4}x + b$, using $(4, 2)$
$$2 = -\frac{3}{4}(4) + b$$
$$2 = -3 + b$$
$$b = 5$$
$$y = -\frac{3}{4}x + 5$$

c.
$$m = \frac{-19-21}{-10-10} = \frac{-40}{-20} = 2$$
$y = 2x + b$, using $(10, 21)$
$$21 = 2(10) + b$$
$$21 = 20 + b$$
$$b = 1$$
$$y = 2x + 1$$

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d. $m = \dfrac{60-(-17)}{-9-2} = \dfrac{77}{-11} = -7$

$y = -7x + b$, using $(2, -17)$
$-17 = -7(2) + b$
$-17 = -14 + b$
$b = -3$
$y = -7x - 3$

e. $m = \dfrac{5-25}{4-(-6)} = \dfrac{-20}{10} = -2$

$y = -2x + b$, using $(-6, 25)$
$25 = -2(-6) + b$
$25 = 12 + b$
$b = 13$
$y = -2x + 13$

f. $m = \dfrac{2-(-1)}{-9-(-8)} = \dfrac{3}{-1} = -3$

$y = -3x + b$, using $(-8, -1)$
$-1 = -3(-8) + b$
$-1 = 24 + b$
$b = -25$
$y = -3x - 25$

8. a. $m = 3$

$y = 3x + b$, using $(9, 6)$
$6 = 3(9) + b$
$6 = 27 + b$
$b = -21$
$y = 3x - 21$

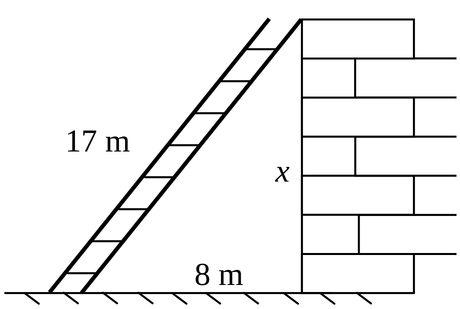
b. $m = -\dfrac{7}{4}$

$y = -\dfrac{7}{4}x + b$, using $(9, 6)$
$6 = -\dfrac{7}{4}(9) + b$
$6 = -\dfrac{63}{4} + b$
$b = \dfrac{87}{4}$
$y = -\dfrac{7}{4}x + \dfrac{87}{4}$

c. $m = \dfrac{4}{3}$

$y = \dfrac{4}{3}x + b$, using $(9, 6)$
$6 = \dfrac{4}{3}(9) + b$
$6 = 12 + b$
$b = -6$
$y = \dfrac{4}{3}x - 6$

9. The ladder whose base is closer to the wall would have a greater slope because of the greater rise. Thus, the second ladder has the greater slope. To find the distance that the ladder goes up the wall, we use the Pythagorean Theorem:



$8^2 + x^2 = 17^2$
$64 + x^2 = 289$
$x^2 = 289 - 64$
$x^2 = 225$
$x = 15$

The ladder goes 15m up the wall.

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10. a. To find the length of the diagonal *AB*, use the Pythagorean Theorem.

$$\begin{aligned} AB^2 &= 36^2 + 48^2 \\ AB^2 &= 1296 + 2304 \\ AB^2 &= 3600 \\ AB &= 60 \end{aligned}$$

Therefore, the diagonal *AB* is 60 cm.

b. Use the Pythagorean Theorem to find the length of the longest item that can be placed in the crate.

$$\begin{aligned} AC^2 &= 45^2 + 60^2 \\ AC^2 &= 2025 + 3600 \\ AC^2 &= 5625 \\ AC &= 75 \end{aligned}$$

The length of the item is 75 cm.

11. a. $-\frac{1}{2}$ b. $\frac{1}{4}$ c. -3 d. $\frac{7}{2}$ e. $-\frac{7}{9}$ f. undefined (vertical line)

12. a. $m = -\frac{1}{3}$

$y = -\frac{1}{3}x + b$

Using the point (9, 6)

$$\begin{aligned} 6 &= -\frac{1}{3}(9) + b \\ 6 &= -3 + b \\ b &= 9 \\ y &= -\frac{1}{3}x + 9 \end{aligned}$$

b. $m = \frac{4}{7}$

$y = \frac{4}{7}x + b$

Using the point (9, 6)

$$\begin{aligned} 6 &= \frac{4}{7}(9) + b \\ 6 &= \frac{36}{7} + b \\ b &= \frac{6}{7} \\ y &= \frac{4}{7}x + \frac{6}{7} \end{aligned}$$

c. $m = -\frac{3}{4}$

$y = -\frac{3}{4}x + b$

Using the point (9, 6)

$$\begin{aligned} 6 &= -\frac{3}{4}(9) + b \\ 6 &= -\frac{27}{4} + b \\ b &= \frac{51}{4} \\ y &= -\frac{3}{4}x + \frac{51}{4} \end{aligned}$$

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13. a. We know the slope is 4, so the equation is $y = 4x + b$.

Substitute the point $(3,-5)$ into the equation to find:

$$-5 = 4(3) + b$$
$$-5 = 12 + b$$
$$b = -17$$

Therefore, the equation for line A is $y = 4x - 17$.

b. B is perpendicular to A, so we find the negative reciprocal of the slope of A to be $-\frac{1}{4}$.

This gives us the equation $y = -\frac{1}{4}x + b$. We use the point $(3,-5)$ to find the

y- intercept:
$$-5 = -\frac{1}{4}(3) + b$$
$$-5 = -\frac{3}{4} + b$$
$$b = -\frac{17}{4}$$

Therefore, the equation for line B is $y = -\frac{1}{4}x - \frac{17}{4}$ or $x + 4y + 17 = 0$.

14. The truck from A took 45 minutes, or 0.75 hours, to go from town A to point C with a speed of 45 km/h. Thus, the distance from A to C is $0.75\,\text{h} \times 45\,\text{km/h} = 33.75\,\text{km}$.

It took the truck from town B 20 minutes, or $\frac{1}{3}$ hours, to cover the distance from A to C.

Therefore, the speed of the truck from B is $33.75\,\text{km} \div \frac{1}{3}\text{h} = 101.25\,\text{km/h}$.

15. The slope of the distance-time graph is the same as the speed on a speed-time graph. On a time-distance graph, the time is on the horizontal axis, and the distance is on he vertical axis. So, the slope of the graph would be $\frac{\text{rise}}{\text{run}} = \frac{\text{units of distance}}{\text{units of time}}$. Notice that these are the same units that speed is measured in (e.g. km/h, m/s, etc…).