

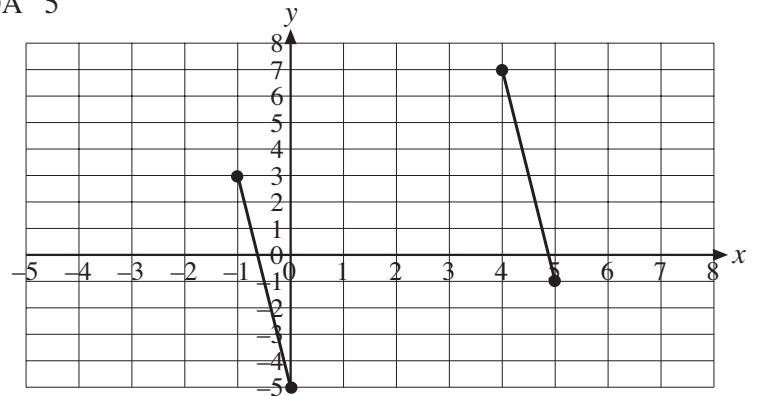
Straight Lines

Answers

1 Gradient

1. 3
2. AB : 1, CD : 2, EF : 4
3. AB : -1, CD : $-\frac{2}{3}$, EF : 0
4. (a) CD, AB, KL, GH (b) EF, IJ, MN
(c) AB : 1, CD : $\frac{1}{3}$, EF : $-\frac{1}{2}$, GH : 2, IJ : -3, KL : $\frac{3}{2}$, MN : $-\frac{2}{5}$
5. $\frac{2}{10} = \frac{1}{5}$ (= 0.2)
6. 2, 1, $\frac{1}{5}$
7. (a) $\frac{1}{2}$ (b) 5 (c) 4 (d) $\frac{4}{5}$ (e) 1 (f) 7
8. AB $-\frac{1}{3}$; BC 0; CD $-\frac{6}{5}$; DA 5

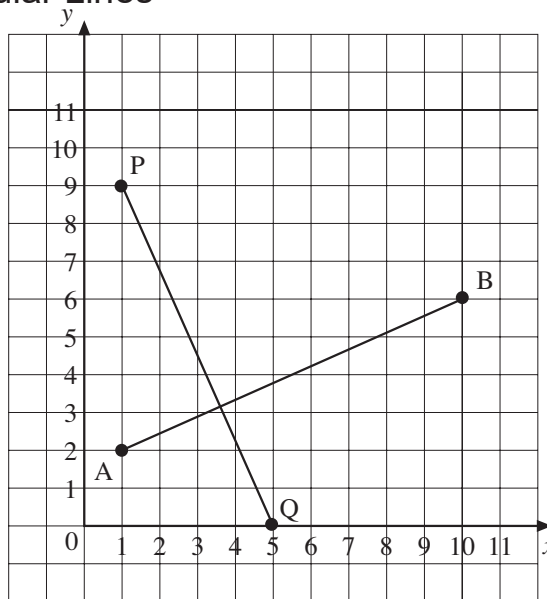
9. (a) and (b) See diagram
(c) Yes
(d) They both have gradient -8.



10. (a) Gradient = $-\frac{1}{5}$
(b) Gradient = $-\frac{1}{5}$ (c) Yes
11. (a) Yes Gradient of AB = gradient of CD = 1
(b) No Gradient of AB = -3 Gradient of CD = $-\frac{1}{2}$
(c) No Gradient of AB = 8 Gradient of CD = 1
(d) Yes Gradient of AB = gradient of CD = -2.5
12. (a) Gradient of AB = $\frac{1}{2}$; Gradient of BC = -4
Gradient of CD = $\frac{1}{2}$; Gradient of DA = -4
(b) Length of AB = $\sqrt{20}$; Length of BC = $\sqrt{68}$
Length of CD = $\sqrt{20}$; Length of DA = $\sqrt{68}$
(c) This type of quadrilateral is a parallelogram.
13. (a) Gradient = -2 (b) D = (4, -11) or D = (-8, 13)
14. (c) 3 (d) gradient of $y = 4x - 1$ is 4; gradient of line $y = 5x + 1$ is 5
(e) coefficient of x is the gradient of a straight line (f) 7

2 Gradients of Perpendicular Lines

1. (a) Diagram



(b) Yes, the lines are perpendicular.

(c) Gradient $AB = \frac{4}{9}$

(d) Gradient $PQ = -\frac{9}{4}$

(e) Gradient of $AB \times$ Gradient of $PQ = \frac{4}{9} \times \left(-\frac{9}{4}\right) = -1$

2. (a) Gradient of $AB = \frac{1}{4}$ Gradient of $PQ = -4$

The lines are perpendicular.

(b) Gradient of $AB = 3$ Gradient of $PQ = 3$

The lines are parallel.

(c) Gradient of $AB = \frac{2}{3}$ Gradient of $PQ = -\frac{3}{2}$

The lines are perpendicular.

(d) Gradient of $AB = \frac{1}{2}$ Gradient of $PQ = -\frac{1}{2}$

The lines are neither parallel nor perpendicular.

3. (a) Gradient $PQ = \frac{1}{4}$; Gradient $QR = 3$; Gradient $RS = \frac{1}{4}$; Gradient $SP = 3$

(b) Yes (c) No

4. Gradient of $AB = 1$ Gradient of $BC = \frac{1}{3}$ Gradient of $AC = -1$

Gradient of $AB \times$ Gradient of $AC = 1 \times -1 = -1$.

\therefore AB is perpendicular to AC $\therefore \triangle ABC$ is right-angled ($\angle BAC = 90^\circ$)

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$$5. \quad \text{Gradient of AB} = \frac{-5}{4} \qquad \text{Gradient of BC} = -1 \qquad \text{Gradient of AC} = \frac{-4}{3}$$

$$\text{Gradient of AB} \times \text{Gradient of BC} = \frac{5}{4} \neq -1 \quad \therefore \text{AB is not perpendicular to BC.}$$

$$\text{Gradient of AB} \times \text{Gradient of AC} = \frac{5}{3} \neq -1 \quad \therefore \text{AB is not perpendicular to AC.}$$

$$\text{Gradient of AC} \times \text{Gradient of BC} = \frac{4}{3} \neq -1 \quad \therefore \text{AC is not perpendicular to BC.}$$

$\therefore \triangle ABC$ is not right-angled.

$$6. \quad \text{Gradient of AB} = \frac{-1}{3} \qquad \text{Gradient of BC} = 3$$

$$\text{Gradient of CD} = \frac{-1}{3} \qquad \text{Gradient of DA} = 3$$

\therefore AB is perpendicular to BC, BC is perpendicular to CD and CD is perpendicular to DA.

\therefore ABCD is a rectangle.

$$AB = \sqrt{(0-3)^2 + (1-0)^2} = \sqrt{10} \qquad BC = \sqrt{(1-0)^2 + (4-1)^2} = \sqrt{10}$$

$$CD = \sqrt{(4-1)^2 + (3-4)^2} = \sqrt{10} \qquad DA = \sqrt{(3-4)^2 + (0-3)^2} = \sqrt{10}$$

$$\therefore AB = BC = CD = DA$$

\therefore ABCD is a square.

$$7. \quad \text{Gradient of AB} = \frac{-2}{3} \qquad \text{Gradient of BC} = -4$$

$$\text{Gradient of CD} = \frac{-2}{3} \qquad \text{Gradient of DA} = -4$$

$$(a) \quad \text{Gradient of AB} \times \text{Gradient of BC} = \frac{8}{3} \neq -1 \quad \therefore \text{AB is not perpendicular to BC.}$$

\therefore ABCD is not a rectangle.

$$(b) \quad \text{Gradient of AB} = \text{Gradient of CD} \quad \therefore \text{AB is parallel to CD.}$$

$$\text{Gradient of BC} = \text{Gradient of DA} \quad \therefore \text{BC is parallel to DA.}$$

\therefore ABCD is a parallelogram.

$$8. \quad q = 1$$

*Straight Lines***Answers****3 Applications of Graphs**

1. (a) 2.7 kg (b) 3.6 kg (c) 11 lbs (d) 6.6 lbs
2. (a) 22.5 litres (b) 6.7 gallons
3. (a) 3 (b) AB: 20 m/s ; CD: 5 m/s ; EF: 10 m/s ; GH: 10 m/s
(c) AB
4. (a) 150 s (b) AB and CD; 5 m/s (c) EF; $\frac{10}{3}$ m/s
5. $16 + 88 + 4 = 108$ metres
6. (a) 20 m (b) 80 m (c) 120 m
7. (a) 7 m/s ; 2 m/s (b) 4.78 m/s
8. Both girls ran initially at constant speeds. Janice ran faster for the first 10 s but then slowed down until Zoe caught up at the end of the school field. While Zoe rested, Janice returned at a constant speed until reaching the starting point, whilst Zoe (after her rest) ran faster, reaching the starting point at the same time.
9. (a) 12.5 miles (b) 56.25 miles (c) 6600 mm (d) 2100 m
10. (a) 75 km/hour; 20.83 m/s (b) 0.4375 mm/s; 0.04375 m/s
(c) 60 m/hour ; $\frac{1}{60}$ m/s (d) 0.5 m/min ; $\frac{1}{120}$ m/s
11. (a) 48 seconds from the start (b) 8.5 m (c) Vincent – steeper slope
12. (a) 10.45 a.m (b) 220 km (c) $73\frac{1}{3}$ km/h
13. (a) 7 km/h (b) rested (zero velocity) (c) $9\frac{1}{3}$ km/h

4 The Equation of a Straight Line

1. (a) $y = 2x + 4$ (b) $y = 3x - 5$ (c) $y = \frac{1}{2}x + 2$
(d) $y = -2x + 1$ (e) $y = \frac{3}{4}x - 3$
2. (a) gradient = 2, y-intercept = 3 (b) gradient = 4, y-intercept = -2
(c) gradient = $\frac{1}{2}$, y-intercept = 1 (d) gradient = $\frac{2}{3}$, y-intercept = -4
(e) gradient = 4, y-intercept = 8 (f) gradient = 3, y-intercept = -21
(g) gradient = $\frac{1}{2}$, y-intercept = $\frac{5}{2}$ (h) gradient = $\frac{1}{4}$, y-intercept = $-\frac{5}{2}$
3. (a) 1 (b) -1 (c) $y = x - 1$

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4. A: $y = x + 7$ B: $y = x + 6$ C: $y = 2x + 2$
 D: $y = \frac{5}{8}x + 2$ E: $y = \frac{3}{10}x + 1$ F: $y = \frac{1}{4}x + 1$
5. (a) 2, (0, -8) (b) -3, (0, 2) (c) 4, (0, -3) (d) $\frac{1}{2}$, (0, 2)
 (e) -2, (0, 8) (f) -3, (0, 4) (g) -1, (0, 8) (h) -3, (0, 15)
6. (a) $y = 2 + 2x$ (b) $y = \frac{1}{2}x$ (c) $y = 6 - \frac{1}{3}x$ (d) $y = 6 - 2x$
7. (a) $y = 4.5x$ (c) $y = \frac{11}{20}x$ ($y =$ litres, $x =$ pints)
8. A: $y = 5 - \frac{1}{2}x$ B: $y = 4 + \frac{4}{3}x$ C: $y = -3 + 2x$
 D: $y = -2 - \frac{2}{5}x$ E: $y = -7 + x$ F: $y = -5 + \frac{2}{5}x$
9. (b) $y = 20 - 10x$ ($y =$ velocity, $t =$ time) (c) 20 ms^{-1}
10. (a) $c = 3$ (b) $c = -12$ (c) $m = 5$
11. (a) £32.50 (b) (i) $\frac{1}{2}$ (ii) increase in charge for unit increases in time
 (c) $c = 10 + \frac{1}{2}t$ (d) 148 minutes
12. (b) (i) 32.5°C (ii) 67.6 grams (c) (i) $a = 0.4$, $b = 50$ (ii) 88 grams
13. (a) $y = \frac{2}{3}x + 7$ (b) Both have gradient $\frac{2}{3}$
14. (a) (i) £70 (ii) £51 (b) 100 km (c) £20 (d) $\frac{1}{5}$
 (e) $y = \frac{1}{5}x + 20$ (f) £86
15. $y = 4x - 18$