Worksheet - Straight-line graphs

Year: Year 10 · 20

Show your working.

Question 1

Question 1 – Plotting a straight line *(Section A · Skills practice)*

Complete the table of values for $y = 2x - 3$, plot the points and draw the line.

x	-1	0	1	2	3
y	?	?	?	?	?

a. Complete the table.
b. Write down the gradient and the y-intercept.
c. Where does the line cross the x-axis?
d. Does the point $(5, 8)$ lie on the line?

Question 2

Question 2 – Finding a gradient *(Section A · Skills practice)*

Work out the gradient of the line through each pair of points. Use $m = \dfrac{y_2 - y_1}{x_2 - x_1}$.

a. $(1, 3)$ and $(4, 12)$
b. $(-2, 5)$ and $(2, -3)$
c. $(0, 4)$ and $(5, 4)$
d. What can you say about a vertical line through $(3, 1)$ and $(3, 7)$?

Question 3

Question 3 – Equation of a line *(Section A · Skills practice)*

Find the equation of each line in the form $y = mx + c$.

a. gradient 3, passes through $(0, -2)$
b. gradient $-\frac{1}{2}$, passes through $(4, 1)$
c. passes through $(1, 5)$ and $(3, 11)$
d. passes through $(0, 6)$ and $(3, 0)$

Question 4

Question 4 – Parallel lines *(Section A · Skills practice)*

Parallel lines have the same gradient.

a. Which of these lines are parallel to $y = 3x - 4$? $y = 3x + 5$, $y = \frac{1}{3}x$, $y = 2x - 4$, $2y = 6x + 1$
b. Find the equation of the line parallel to $y = 3x - 4$ passing through $(2, 7)$.
c. Find the equation of the line parallel to $y = -2x + 1$ passing through $(1, 1)$.
d. Write $3x + y = 9$ in the form $y = mx + c$ and state its gradient.

Question 5

Question 5 – Midpoints and lengths *(Section A · Skills practice)*

Find the midpoint and length of each line segment AB.

a. A$(2, 3)$ and B$(8, 11)$
b. A$(-1, 2)$ and B$(4, 14)$
c. A$(0, 0)$ and B$(5, 12)$
d. A$(-3, -1)$ and B$(5, 5)$

Question 6

Question 6 – Points on a line *(Section A · Skills practice)*

The line L has equation $y = 4x - 5$.

a. Does $(3, 7)$ lie on L?
b. Does $(2, 4)$ lie on L?
c. Find y when $x = -1$ and x when $y = 11$.
d. Find where L crosses both axes.

Question 7

Question 7 – Taxi graph *(Section B · Real-life practice)*

The cost C pounds of a taxi journey of d miles is $C = 2.5 + 1.2d$.

d (miles)	0	5	10
C (£)	2.50	8.50	14.50

a. What does the y-intercept 2.5 represent?
b. What does the gradient 1.2 represent?
c. Find the cost of a 7.5 mile journey.
d. Find the distance travelled when the cost is £20.50.

Question 8

Question 8 – Distance-time graph *(Section B · Real-life practice)*

Jade cycles to a friend's house. Her journey is described below.

Time	Distance from home
09:00	0 km
09:30	8 km
09:45	8 km
10:30	17 km

a. Find her speed for the first part in km/h.
b. What happens between 09:30 and 09:45?
c. Find her speed in the last part in km/h.
d. Find her average speed for the whole journey including the stop.

Question 9

Question 9 – Filling a tank *(Section B · Real-life practice)*

A water tank is filled steadily. After 2 minutes it holds 30 litres and after 6 minutes it holds 70 litres.

a. Find the rate of filling in litres per minute (the gradient).
b. Find the equation giving the volume V litres after t minutes.
c. How much water was in the tank at the start?
d. When will the tank hold 150 litres?

Question 10

Question 10 – Exchange rate graph *(Section B · Real-life practice)*

The graph of pounds (P) against euros (E) is a straight line through the origin. £50 is worth €58.

a. Find the gradient of the line $E = mP$.
b. Write a formula for E in terms of P.
c. Convert £325 into euros.
d. Convert €200 into pounds to the nearest penny.

Question 11

Question 11 – Road gradients *(Section B · Real-life practice)*

A road sign warns of a hill with a gradient of 12%. This means a rise of 12 m for every 100 m travelled horizontally.

a. Write 12% as a fraction in its simplest form.
b. How high does the road rise over a horizontal distance of 450 m?
c. A road rises 36 m over 400 m horizontally. Find its percentage gradient.
d. Is the road in part (c) steeper than the 12% hill?

Question 12

Question 12 – Temperature graph *(Section B · Real-life practice)*

Degrees Fahrenheit and degrees Celsius are related by the straight line $F = 1.8C + 32$.

a. What is the gradient and the F-intercept?
b. Find F when $C = 20$.
c. Find C when $F = 95$.
d. Where does the line $F = 1.8C + 32$ cross the line $F = C$?

Question 13

Question 13 – Hiring a hall *(Section B · Real-life practice)*

Hall A costs £40 plus £5 per hour. Hall B costs £15 per hour with no fixed charge. Let h be hours.

a. Write the cost lines $y = \ldots$ for each hall.
b. Find where the lines cross.
c. Which hall is cheaper for a 3-hour party and for a 6-hour party?
d. Explain what the crossing point means.

Question 14

Question 14 – Buying petrol *(Section B · Real-life practice)*

Petrol costs £1.50 per litre. A graph of cost against litres is a straight line.

a. Does the line pass through the origin? Explain.
b. Write a formula for the cost C of L litres.
c. What is the gradient?
d. Mia pays £63 for petrol. How many litres did she buy?

Question 15

Question 15 – Perpendicular lines and the right angle *(Section C · Problem solving)*

Higher tier. Perpendicular lines have gradients whose product is -1.

a. Find the gradient of a line perpendicular to $y = 2x + 3$.
b. Find the equation of the line perpendicular to $y = 2x + 3$ through $(4, 1)$.
c. Find where the two lines meet.
d. Show that the lines $y = 3x - 1$ and $3y + x = 6$ are perpendicular.

Question 16

Question 16 – Equation from a table *(Section C · Problem solving)*

The table shows values for a straight line.

x	2	4	6
y	5	13	21

a. Show that the points lie on a straight line by finding the gradient between each pair.
b. Find the equation of the line.
c. Find y when $x = 10$.
d. Find x when $y = -3$.

Question 17

Question 17 – Shapes on a grid *(Section C · Problem solving)*

Triangle ABC has vertices A$(1, 2)$, B$(7, 2)$ and C$(4, 8)$.

a. Find the midpoint of each side.
b. Find the length of AC to 1 decimal place and say what kind of triangle ABC is.
c. Find the area of the triangle.
d. Find the equation of the line AC.

Question 18

Question 18 – Is it a parallelogram? *(Section C · Problem solving)*

The points P$(0, 0)$, Q$(4, 1)$, R$(6, 5)$ and S$(2, 4)$ are the corners of a quadrilateral.

a. Find the gradients of PQ and SR.
b. Find the gradients of QR and PS.
c. Explain why PQRS is a parallelogram.
d. Show that its diagonals PR and QS have the same midpoint.

Question 19

Question 19 – Triangle between two lines *(Section C · Problem solving)*

The lines $y = x$ and $y = 6 - x$ and the y-axis enclose a triangle.

a. Find the point where the two lines cross.
b. Find where each line meets the y-axis.
c. Find the area of the triangle.
d. Find the perimeter to 1 decimal place.

Question 20

Question 20 – Challenge: parallel and perpendicular *(Section D · Challenge)*

Two lines are $kx + 2y = 8$ and $3x - y = 1$.

a. Write each in the form $y = mx + c$ and state the gradients.
b. Find k so that the lines are parallel.
c. Find k so that the lines are perpendicular.
d. For $k = 2$, find where the lines cross.