# Worksheet - Straight-line graphs

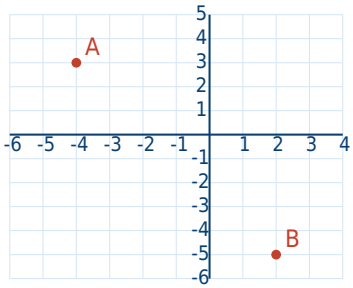
Year: Year 8 · 20

Show your working.

## Question 1

**Question 1 – Coordinates and midpoints** *(Section A · Skills practice)*

Points $A(-4, 3)$ and $B(2, -5)$ are plotted on a coordinate grid.




a. In which quadrant is each point?
b. Find the midpoint of $AB$.
c. Find the horizontal and vertical distance between $A$ and $B$.
d. Find the length of $AB$ to 1 decimal place.

## Question 2

**Question 2 – Table of values** *(Section A · Skills practice)*

Complete a table of values for each equation for $x = -2, -1, 0, 1, 2$.

a. $y = 2x + 1$
b. $y = 3 - x$
c. $y = x^2$ is not a line, but complete it anyway and say what shape the points make.
d. Which of the three equations gives a straight line?

## Question 3

**Question 3 – Gradient from two points** *(Section A · Skills practice)*

Use gradient $= \dfrac{\text{change in } y}{\text{change in } x}$.

a. Find the gradient of the line through $(1, 2)$ and $(4, 11)$.
b. Find the gradient of the line through $(-2, 5)$ and $(2, -3)$.
c. Find the gradient of the line through $(0, 4)$ and $(6, 4)$.
d. A line has gradient $\dfrac{3}{4}$ and passes through $(0, 1)$ and $(8, k)$. Find $k$.

## Question 4

**Question 4 – Equation of a line: y = mx + c** *(Section A · Skills practice)*

Write down the gradient and the $y$-intercept of each line.

a. $y = 4x - 3$
b. $y = -\frac{1}{2}x + 6$
c. $y = 2 - 5x$
d. $2y = 6x + 8$ (rearrange first)
e. $x + y = 7$ (rearrange first)

## Question 5

**Question 5 – Finding the 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 $-2$, passes through $(1, 5)$.
c. Passes through $(0, 1)$ and $(2, 7)$.
d. Passes through $(1, 4)$ and $(3, 10)$.

## Question 6

**Question 6 – Parallel lines and special lines** *(Section A · Skills practice)*

Look at these equations: $y = 2x + 3$, $y = 2x - 5$, $y = -x + 3$, $2y = 4x + 1$, $y = 7$, $x = -2$.

a. Which lines are parallel to $y = 2x + 3$?
b. Which line is horizontal and which is vertical?
c. Write the equation of a line parallel to $y = -x + 3$ that passes through $(0, 6)$.
d. Write the equation of a line parallel to $y = 2x + 3$ through $(1, 0)$.

## Question 7

**Question 7 – The taxi fare graph** *(Section B · Real-life practice)*

A taxi company charges £3 plus £2 for each mile. The fare $F$ pounds for $m$ miles is given by $F = 2m + 3$.

| Miles $m$ | 0 | 2 | 4 | 6 |
|---|---|---|---|---|
| Fare $F$ | 3 | 7 | 11 | 15 |

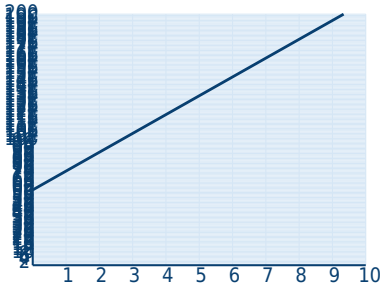
a. Check the table values using the formula.
b. What are the gradient and the $F$-intercept? What do they mean in this context?
c. Use the formula to find the fare for 9.5 miles.
d. Sam paid £21. How far did he travel?

e. A second company charges $F = 1.5m + 5$. For what distance are the two fares equal?

## Question 8

**Question 8 – Filling a water tank** *(Section B · Real-life practice)*

A water tank contains 60 litres. Water is added at a steady rate of 15 litres per minute, so after $t$ minutes the volume is $V = 15t + 60$.

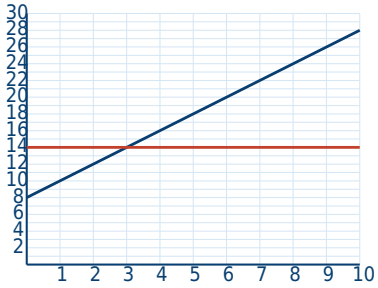



a. How much water is in the tank after 4 minutes?
b. How long until it contains 150 litres?
c. What does the gradient represent? What does the intercept represent?
d. The tank holds 300 litres. How long until it is full?

## Question 9

**Question 9 – Mobile phone costs** *(Section B · Real-life practice)*

The graph shows the monthly cost $C$ (£) for $d$ gigabytes (GB) of data on plan A: $C = 2d + 8$. Plan B costs a fixed £14 whatever the data.




a. Find the cost on plan A for 5 GB.
b. For what amount of data are the plans equal?
c. Which plan is cheaper for 2 GB? For 8 GB?
d. Explain what the gradient of plan B tells you.

## Question 10

**Question 10 – Temperature conversion line** *(Section B · Real-life practice)*

The formula $F = 1.8C + 32$ changes Celsius to Fahrenheit.

a. Find $F$ when $C = 0$, $C = 10$ and $C = 100$.
b. Write down the gradient and the intercept.
c. Use the formula to convert $-40$°C and comment on the result.
d. At what temperature are the two scales equal? Solve $C = 1.8C + 32$.

## Question 11

**Question 11 – Bike hire graph** *(Section B · Real-life practice)*

A bike hire shop charges £8 for the first hour and £4 for each extra hour. Write $C = 4h + 4$ for $h$ hours ($h \geq 1$).

| Hours $h$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Cost $C$ | 8 | 12 | 16 | 20 | 24 |

a. Check the formula against the table.
b. Find the cost of a 7-hour hire.
c. Maya paid £44. How many hours did she hire the bike?
d. A rival shop charges $C = 5h$. Where do the two lines cross?

## Question 12

**Question 12 – Pocket money plan** *(Section B · Real-life practice)*

Hamid saves £5 each week and started with £12. The graph of his savings $S = 5w + 12$ is a straight line.

a. What are the gradient and $y$-intercept in context?
b. After how many weeks does he have £62?
c. His friend Lola starts with £40 and saves £3 each week. Write her equation.
d. When do they have the same amount?

## Question 13

**Question 13 – Hiking up a hill** *(Section B · Real-life practice)*

A walker climbs a hill. After $t$ hours her height above sea level is $h = 150t + 300$ metres.

a. What is her starting height?
b. How fast does she climb in metres per hour?
c. At what time has she climbed 450 m from the start?
d. The summit is at 1 200 m. How long does she take to reach it?

## Question 14

**Question 14 – Car park charges** *(Section B · Real-life practice)*

A town centre car park charges £1.50 per hour plus a £2 entry fee. The cost is $C = 1.5h + 2$ for $h$ hours.

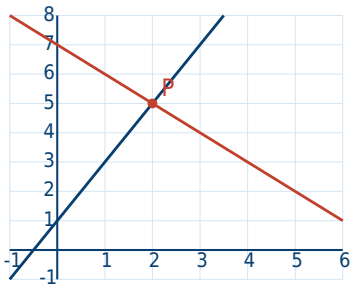
| Hours $h$ | 1 | 2 | 4 | 6 |
|---|---|---|---|---|
| Cost $C$ | 3.50 | 5 | 8 | 11 |

a. Check the table using the formula.
b. Find the cost of parking for 5 hours.
c. A shopper pays £12.50. How long did she park?
d. The other car park charges £2.50 per hour with no entry fee. When do the two car parks cost the same?

## Question 15

**Question 15 – Where two lines meet** *(Section C · Problem solving)*

Two lines have equations $y = 2x + 1$ and $y = -x + 7$.

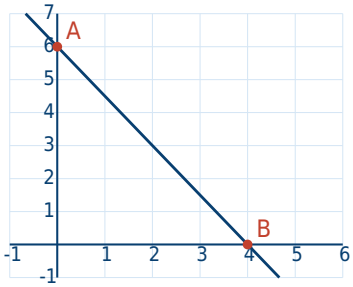



a. Complete a table of values for both lines for $x = 0, 1, 2, 3$.
b. Find the coordinates of the point $P$ where they cross.
c. Check your answer by solving $2x + 1 = -x + 7$.
d. Use the lines to describe a real situation, such as a shop and its charges, in which this crossing point would matter.

## Question 16

**Question 16 – Triangle on the axes** *(Section C · Problem solving)*

The line $y = -\frac{3}{2}x + 6$ crosses the $y$-axis at $A$ and the $x$-axis at $B$. $O$ is the origin.




a. Write down the coordinates of $A$.

b. Find the coordinates of $B$ by setting $y = 0$.
c. Find the area of triangle $OAB$.
d. Find the length of $AB$ to 1 decimal place.
e. Write the equation of the line through $O$ parallel to $AB$.

## Question 17

**Question 17 – Real-life graph interpretation** *(Section C · Problem solving)*

Two friends cycle. Tom's distance from home is $d = 12t$ (km, $t$ in hours). Zara starts 6 km ahead and goes at 8 km/h, so $d = 8t + 6$.

a. How far apart are they at the start?
b. Find when Tom catches up with Zara.
c. How far from home are they then?
d. Who is ahead after 3 hours, and by how much?
e. Explain what the two gradients mean.

## Question 18

**Question 18 – Spot the mistake** *(Section C · Problem solving)*

Four pupils found the equation of the line through $(2, 7)$ and $(4, 13)$.

| Pupil | Answer |
|---|---|
| Ali | $y = 3x + 1$ |
| Bea | $y = 3x - 1$ |
| Cal | $y = \frac{1}{3}x + 6$ |
| Dev | $y = 6x - 5$ |

a. Work out the gradient.
b. Find the correct equation.
c. Which pupil is correct?
d. Find the mistake each of the others made.

## Question 19

**Question 19 – Fair taxi** *(Section C · Problem solving)*

Two taxi firms charge as follows: Firm A: £4 plus £1.50 per mile. Firm B: £2.50 plus £2 per mile.

a. Write the equation of each fare.
b. Find where the two fares are equal.
c. Which firm is cheaper for a 5-mile journey?
d. Draw (describe) the graphs and explain which is cheaper after the crossing point.

## Question 20

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

Two lines are perpendicular if the product of their gradients is $-1$. Line $L_1$ is $y = 2x + 1$.

a. Find the gradient of a line perpendicular to $L_1$.
b. Find the equation of the perpendicular through $(0, 5)$.
c. Find where this line meets $L_1$.
d. Find the shortest distance from $(0, 5)$ to $L_1$ to 1 decimal place.