Exercise walk-through

2.4.1
Lines

AQA · GCSE · Mathematics

Straight-line graphs

- Every straight line, except a vertical one, has an equation $y = mx + c$.
- The number m is the **gradient**, the steepness: how far y goes up when x increases by 1.
- The number c is the y-intercept, where the line crosses the y-axis.
- Between two points,

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Solving equations

- **Linear equations.** Collect the letters on one side and the numbers on the other. **Worked example 8.** $7x - 22 = 4x + 29$.
- Subtract $4x$: $3x - 22 = 29$.
- Add 22: $3x = 51$, so $x = 17$.
- **Quadratic equations by factorising.** Make one side zero and factorise.

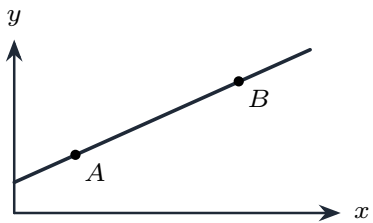
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Inequalities

- Solve a linear inequality like an equation, but if you multiply or divide by a negative number, turn the sign round: from $-2x < 6$ you get $x > -3$.
- On a number line, an open circle means the end value is not included ($<$ or $>$) and a filled circle means it is ($\leq$ or $\geq$).
- **Worked example 15.** Find the integers n with $-3 < 2n + 1 \leq 9$.
- Subtract 1: $-4 < 2n \leq 8$.

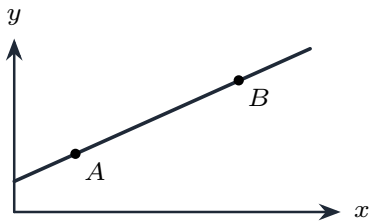
Exercise 2.1

2.1 Write down the gradient and the y-intercept of $y = 4x - 7$. [2]



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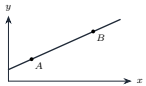


2.1

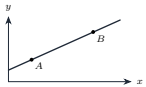
- gradient **4**; y-intercept $\mathbf{-7}$, the point $(0, -7)$

Exercise 2.2

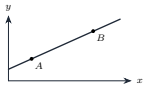
2.2 Work out the gradient of the line through $(1, 2)$ and $(4, 8)$. [2]



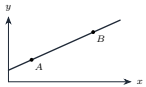
2.3 Rearrange $2y = 6x + 10$ into the form $y = mx + c$ and write down the gradient. [2]



2.4 Which two of these lines are parallel? $y = 2x + 1$, $y = 3x + 2$, $y = 2x - 5$, $y = 5 - 2x$ [1]

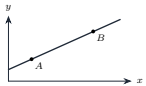


2.5 Find the coordinates where $y = 3x - 6$ crosses (a) the y-axis (b) the x-axis. [2]

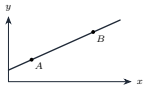


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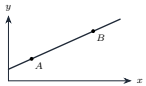
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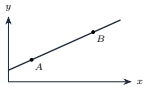
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2.2

- $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{8 - 2}{4 - 1} = \dfrac{6}{3} = \mathbf{2}$

2.3

- divide every term by 2: $y = 3x + 5$

Full solution on next slide

Full solution 2.2

2.2

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2.3

- divide every term by 2: $y = 3x + 5$
- gradient $\mathbf{3}$

2.4

- same gradient 2: $\boldsymbol{y = 2x + 1}$ and $\boldsymbol{y = 2x - 5}$

2.5

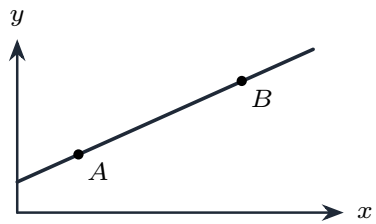
(a) $x = 0$: $y = -6$, so $(\mathbf{0}, \mathbf{-6})$

(b) $y = 0$: $3x - 6 = 0$, so $x = 2$: $(\mathbf{2}, \mathbf{0})$

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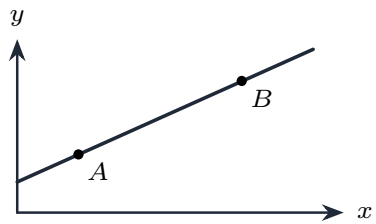
Exercise 3.1

3.1 Ben says the gradient of the line through $(0, 6)$ and $(3, 0)$ is 2. Is he correct? Give a reason. [2]



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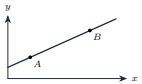


3.1

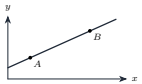
- $m = \dfrac{0-6}{3-0} = -2$
- **No**: the line slopes **down**, so the gradient is -2, not 2

Exercise 3.2

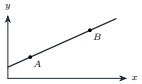
3.2 Find the equation of the line parallel to $y = 5x + 2$ that passes through $(1, 9)$. [2]



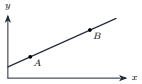
3.3 Find the equation of the line through $(-2, 7)$ and $(4, -5)$. [3]



3.4 *(H)* Find the equation of the line perpendicular to $y = 2x + 3$ that passes through $(4, 1)$. [3]

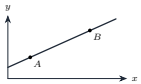


3.5 *(H)* A is $(1, 3)$ and B is $(7, 5)$. Find the equation of the perpendicular bisector of AB. [4]

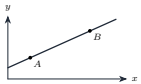


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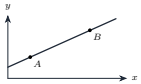
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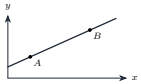
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3.2

- parallel, so gradient 5: $y = 5x + c$, and $9 = 5 \times 1 + c$
- $c = 4$: $\boldsymbol{y = 5x + 4}$

3.3

Full solution on next slide

Full solution 3.2 (1/2)

3.2

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- $c = 4$: $\boldsymbol{y = 5x + 4}$

3.3

- $m = \dfrac{-5 - 7}{4 - (-2)} = \dfrac{-12}{6} = -2$
- substitute $(-2, 7)$: $7 = -2 \times (-2) + c$, so $c = 3$
- $\boldsymbol{y = -2x + 3}$

3.4

Full solution 3.2 (2/2)

- perpendicular gradient: $m_1 m_2 = -1$, so $m_2 = -\frac{1}{2}$
- substitute $(4, 1)$: $1 = -\frac{1}{2} \times 4 + c$, so $c = 3$
- $\boldsymbol{y = -\frac{1}{2}x + 3}$

3.5

- midpoint: $\left(\frac{1+7}{2}, \frac{3+5}{2}\right) = (4, 4)$
- gradient of AB: $\frac{5-3}{7-1} = \frac{1}{3}$, so the perpendicular gradient is -3
- substitute $(4, 4)$: $4 = -3 \times 4 + c$, so $c = 16$
- $\boldsymbol{y = -3x + 16}$