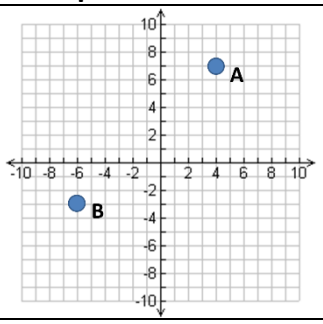
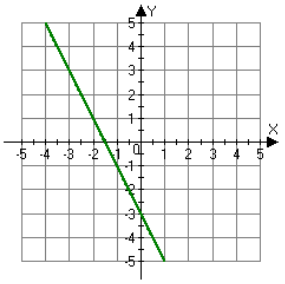
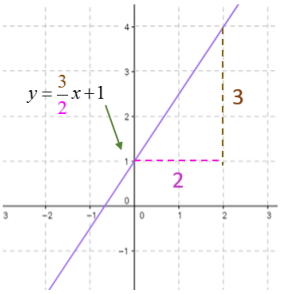
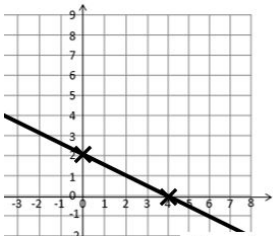
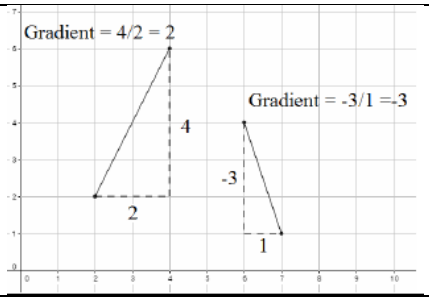
Topic: Coordinates and Linear Graphs

Topic/Skill	Definition/Tips	Example
1. Coordinates	Written in **pairs**. The **first** term is the **x-coordinate** (movement **across**). The **second** term is the **y-coordinate** (movement **up or down**)	 A: (4,7) B: (-6,-3)
2. Midpoint of a Line	Method 1: **add the x coordinates and divide by 2, add the y coordinates and divide by 2** $\text{Midpoint} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ Method 2: Sketch the line and find the values half-way between the two x and two y values.	Find the midpoint between (2,1) and (6,9) $\frac{2+6}{2} = 4$ and $\frac{1+9}{2} = 5$ So, the midpoint is (4,5)
3. Linear Graph	**Straight line** graph. The general equation of a linear graph is $\boldsymbol{y = mx + c}$ where $\boldsymbol{m}$ **is the gradient** and c **is the y-intercept**. The **equation** of a linear graph can contain an **x-term**, a **y-term** and a **number**.	Example:  Other examples: $x = y$ $y = 4$ $x = -2$ $y = 2x - 7$ $y + x = 10$ $2y - 4x = 12$
4. Plotting Linear Graphs	Method 1: **Table of Values** Construct a table of values to calculate coordinates. Method 2: **Gradient-Intercept Method** (use when the equation is in the form $y = mx + c$) 1. Plots the y-intercept 2. Using the gradient, plot a second point. 3. Draw a line through the two points plotted. Method 3: **Cover-Up Method** (use when the equation is in the form $ax + by = c$) 1. Cover the x term and solve the resulting equation. Plot this on the $x - axis$. 2. Cover the y term and solve the resulting equation. Plot this on the $y - axis$. 3. Draw a line through the two points plotted.	<table><tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y= x +3</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr></table>   $2x + 4y = 8$

5. Gradient	The gradient of a line is how **steep** it is. $$\text{Gradient} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$ The gradient can be positive (sloping upwards) or negative (sloping downwards)	
6. Finding the Equation of a Line <u>given a point and a gradient</u>	**Substitute** in the **gradient (m)** and **point (x,y)** in to the equation $\boldsymbol{y = mx + c}$ and **solve for c**.	Find the equation of the line with gradient 4 passing through (2,7). $y = mx + c$ $7 = 4 \times 2 + c$ $c = -1$ So we get $y = 4x - 1$
7. Finding the Equation of a Line <u>given two points</u>	Use the two points to **calculate the gradient**. Then **repeat the method above** using the gradient and either of the points.	Find the equation of the line passing through (6,11) and (2,3) Find gradient: $m = \frac{11-3}{6-2} = 2$ $y = mx + c$ $11 = 2 \times 6 + c$ $c = -1$ $y = 2x - 1$
8. Parallel Lines	If two lines are **parallel**, they will have the **same gradient**. The value of m will be the same for both lines. You may need to rearrange equations of lines to compare gradients (they need to be in the form $y = mx + c$)	Are the lines $y = 3x - 1$ and $2y - 6x + 10 = 0$ parallel? **Answer**: Rearrange the second equation $2y - 6x + 10 = 0 \rightarrow y = 3x - 5$ Since the two gradients are equal (3), the lines are parallel.
9. Perpendicular Lines	If two lines are **perpendicular**, the **product** of their **gradients** will always equal **-1**. The gradient of one line will be the **negative reciprocal** of the gradient of the other line. If one line has gradient **m**, a perpendicular line will have gradient $\frac{-1}{m}$. For gradient = $\frac{a}{b}$, perpendicular = $\frac{-b}{a}$	Find the equation of the line perpendicular to $y = 3x + 2$ which passes through (6,5) **Answer**: As they are perpendicular, the gradient of the new line will be $-\frac{1}{3}$ as this is the negative reciprocal of 3. Substitute the gradient and coordinates into $y = mx + c$ $5 = -\frac{1}{3} \times 6 + c$ $c = 7$ So we get: $y = -\frac{1}{3}x + 7$ Or $3x + x - 7 = 0$