



EXAM PAPERS PRACTICE

Boost your performance and confidence with these topic-based exam questions

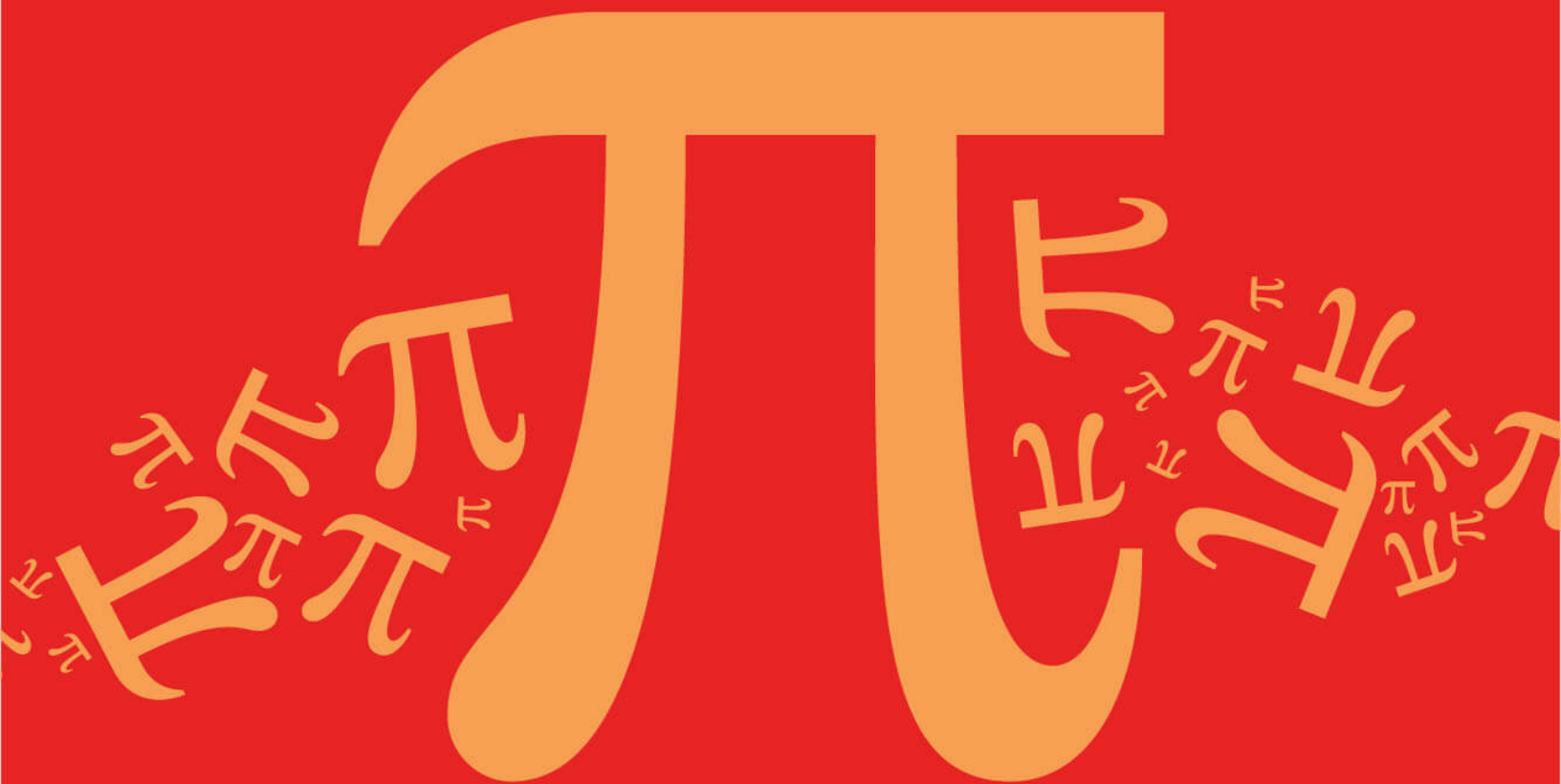
Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

2.1 Linear Functions & Graphs



IB Maths - Revision Notes

AA HL



2.1.1 Equations of a Straight Line

Equations of a Straight Line

How do I find the gradient of a straight line?

- Find two points that the line passes through with coordinates (x_1, y_1) and (x_2, y_2)
- The gradient between these two points is calculated by

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

- This is given in the **formula booklet**
- The gradient of a straight line measures its **slope**
 - A line with gradient 1 will go up 1 unit for every unit it goes to the right
 - A line with gradient -2 will go down two units for every unit it goes to the right

What are the equations of a straight line?

- $y = mx + c$
 - This is the **gradient-intercept form**
 - It clearly shows the gradient m and the y -intercept $(0, c)$
- $y - y_1 = m(x - x_1)$
 - This is the **point-gradient form**
 - It clearly shows the gradient m and a point on the line (x_1, y_1)
- $ax + by + d = 0$
 - This is the **general form**
 - You can quickly get the x -intercept $\left(-\frac{d}{a}, 0\right)$ and y -intercept $\left(0, -\frac{d}{b}\right)$

How do I find an equation of a straight line?

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- You will need the gradient
 - If you are given two points then first find the gradient
- It is easiest to start with the **point-gradient form**
 - then rearrange into whatever form is required
 - multiplying both sides by any denominators will get rid of fractions
- You can check your answer by using your GDC
 - Graph your answer and check it goes through the point(s)
 - If you have two points then you can enter these in the **statistics mode** and find the regression line $y = ax + b$

Exam Tip

- A sketch of the graph of the straight line(s) can be helpful, even if not demanded by the question
 - Use your GDC to plot them
- Ensure you state equations of straight lines in the format required
 - Usually $y = mx + c$ or $ax + by + d = 0$
 - Check whether coefficients need to be integers (they usually are for $ax + by + d = 0$)



Worked example

The line l passes through the points $(-2, 5)$ and $(6, -7)$.

Find the equation of l , giving your answer in the form $ax + by + d = 0$ where a , b and c are integers to be found.

Find the gradient between $(-2, 5)$ and $(6, -7)$

Formula booklet

$$m = \frac{-7 - 5}{6 - -2} = -\frac{3}{2}$$

Gradient formula	$m = \frac{y_2 - y_1}{x_2 - x_1}$
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Use the point-gradient formula

Formula booklet

Equations of a straight line	$y - y_1 = m(x - x_1)$
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$$(x_1, y_1) = (-2, 5) \quad m = -\frac{3}{2}$$

$$y - 5 = -\frac{3}{2}(x - -2) \quad \text{Simplify}$$

$$y - 5 = -\frac{3}{2}(x + 2)$$

$$2(y - 5) = -3(x + 2) \quad \text{Multiply by denominator}$$

$$2y - 10 = -3x - 6 \quad \text{Expand}$$

$$3x + 2y - 4 = 0 \quad \text{Rearrange}$$

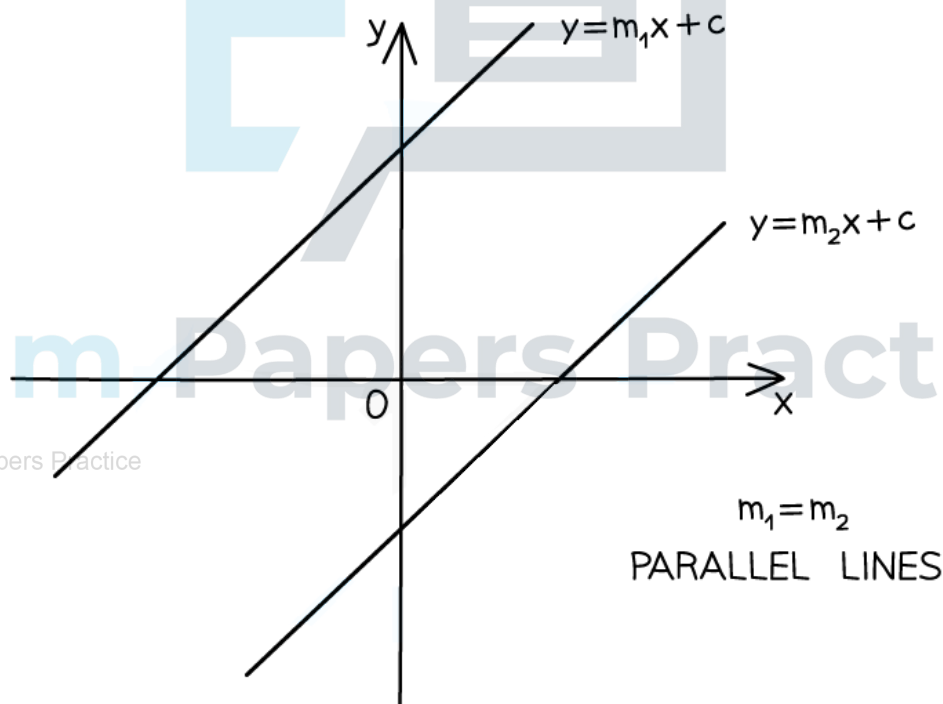
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Parallel Lines

How are the equations of parallel lines connected?

- **Parallel lines** are always equidistant meaning they never intersect
- Parallel lines have the same gradient
 - If the gradient of line l_1 is m_1 and gradient of line l_2 is m_2 then...
 - $m_1 = m_2 \Rightarrow l_1 \text{ \& } l_2$ are parallel
 - $l_1 \text{ \& } l_2$ are parallel $\Rightarrow m_1 = m_2$
- To determine if two lines are parallel:
 - Rearrange into the gradient-intercept form $y = mx + c$
 - Compare the coefficients of x
 - If they are equal then the lines are parallel



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 **Worked example**

The line l passes through the point $(4, -1)$ and is parallel to the line with equation $2x - 5y = 3$.

Find the equation of l , giving your answer in the form $y = mx + c$.

Rearrange into $y = mx + c$ to find the gradient

$$5y = 2x - 3 \Rightarrow y = \frac{2}{5}x - \frac{3}{5} \therefore \text{gradient} = \frac{2}{5}$$

Parallel lines $\Rightarrow m_1 = m_2$

$$m = \frac{2}{5}$$

Use the point-gradient formula

Formula booklet

Equations of a straight line

$$y - y_1 = m(x - x_1)$$

$$(x_1, y_1) = (4, -1) \quad m = \frac{2}{5}$$

$$y + 1 = \frac{2}{5}(x - 4)$$

$$y + 1 = \frac{2}{5}x - \frac{8}{5}$$

$$y = \frac{2}{5}x - \frac{13}{5}$$

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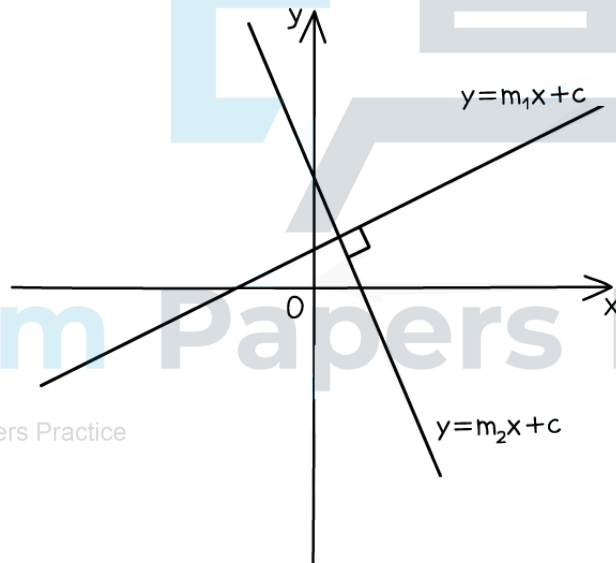
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Perpendicular Lines

How are the equations of perpendicular lines connected?

- **Perpendicular lines** intersect at right angles
- The gradients of two perpendicular lines are negative reciprocals
 - If the gradient of line l_1 is m_1 and gradient of line l_2 is m_2 then...
 - $m_1 \times m_2 = -1 \Rightarrow l_1 \text{ \& } l_2$ are perpendicular
 - $l_1 \text{ \& } l_2$ are perpendicular $\Rightarrow m_1 \times m_2 = -1$
- To determine if two lines are perpendicular:
 - Rearrange into the gradient-intercept form $y = mx + c$
 - Compare the coefficients of x
 - If their product is -1 then they are perpendicular
- Be careful with horizontal and vertical lines
 - $x = p$ and $y = q$ are perpendicular where p and q are constants



$$m_1 \times m_2 = -1$$

PERPENDICULAR LINES

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Worked example

The line l_1 is given by the equation $3x - 5y = 7$.

The line l_2 is given by the equation $y = \frac{1}{4} - \frac{5}{3}x$.

Determine whether l_1 and l_2 are perpendicular. Give a reason for your answer.

Rearrange l_1 into $y = mx + c$ form

$$5y = 3x - 7 \Rightarrow y = \frac{3}{5}x - \frac{7}{5}$$

Identify gradients

$$m_1 = \frac{3}{5} \quad m_2 = -\frac{5}{3}$$

$m_1 \times m_2 = -1 \Rightarrow$ Perpendicular lines

$$\frac{3}{5} \times -\frac{5}{3} = -1$$

l_1 and l_2 are perpendicular as $m_1 \times m_2 = -1$

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