

General Certificate of Secondary Education
2010

Additional Mathematics

Paper 1
Pure Mathematics

[G0301]



MONDAY 17 MAY, AFTERNOON

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet and the Supplementary Answer Booklet provided.

Answer **all eleven** questions.

At the conclusion of this examination attach the Supplementary Answer Booklet to your Answer Booklet using the treasury tag supplied.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use a calculator.

A copy of the formulae list is provided.

Answer **all eleven** questions

- 1 (i) Using the axes and scales in **Fig. 1** in your Supplementary Answer Booklet, **sketch** the graph of $y = 2 \sin x$ for $-360^\circ \leq x \leq 360^\circ$. [2]

- (ii) Using the axes and scales in **Fig. 2** in your Supplementary Answer Booklet, **sketch** the graph of $y = \sin \left(\frac{1}{2} x\right)$ for $-360^\circ \leq x \leq 360^\circ$. [2]

- 2 (i) Solve the equation

$$\tan x = 3$$

for $-180^\circ < x \leq 180^\circ$. [2]

- (ii) **Hence** solve the equation

$$\tan \left(\frac{x}{2} - 10^\circ\right) = 3$$

for $-360^\circ < x \leq 360^\circ$. [3]

- 3 (i) Find \mathbf{A}^{-1} where $\mathbf{A} = \begin{bmatrix} 4 & -3 \\ -6 & 5 \end{bmatrix}$ [2]

- (ii) **Hence**, using a matrix method, solve the following simultaneous equations for x and y .

$$4x - 3y = 18$$

$$-6x + 5y = -29$$
 [4]

4 (a) Find $\frac{dy}{dx}$ when $y = 2x^5 - \frac{2}{5x^2}$ [2]

(b) Find $\int \left(6x^2 - \frac{3}{x^4} + 1\right) dx$. [4]

5 Fig. 3 shows a sketch of the graph of $y = 2x^3 + 4x - 7$

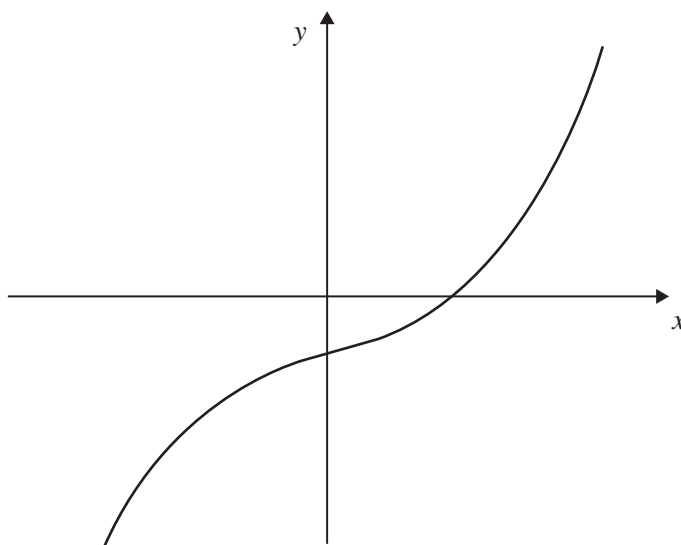


Fig. 3

P is the point on this curve whose x -coordinate is 1

(i) Find the equation of the tangent to this curve at P. [4]

(ii) Find the coordinates of the other point on this curve at which the gradient is the same as the gradient at P. [3]

6 (i) Show that

$$\frac{x+2}{2x+3} - \frac{x-1}{3x-1}$$

can be written as

$$\frac{x^2 + 4x + 1}{6x^2 + 7x - 3} \quad [4]$$

(ii) Hence, or otherwise, solve the equation

$$\frac{x+2}{2x+3} - \frac{1}{2} = \frac{x-1}{3x-1} \quad [4]$$

7 (a) Solve the equation

$$9^{\left(\frac{2}{5}x - 3\right)} = 7 \quad [4]$$

(b) If $\log_y 5 = 0.5$ what is the value of y ? [1]

(c) If $\log_3 5 = a$ and $\log_3 8 = b$ express the following in terms of a and b .

(i) $\log_3 1.6$ [1]

(ii) $\log_3 120$ [2]

- 8 Julie's house J is 3.00 km from a helipad H. Ken's house K is 1.00 km from Julie's house. H, J and K all lie in a straight line on horizontal ground.

A helicopter is descending towards the helipad along a flight path FH which is at a constant angle to the horizontal. This flight path passes directly over Ken's house and also over Julie's house.

When the helicopter is at a position X, Julie measures the angle of elevation of the helicopter as 21.20° from her house J and Ken measures it as 32.90° from his house K, as shown in Fig. 4.

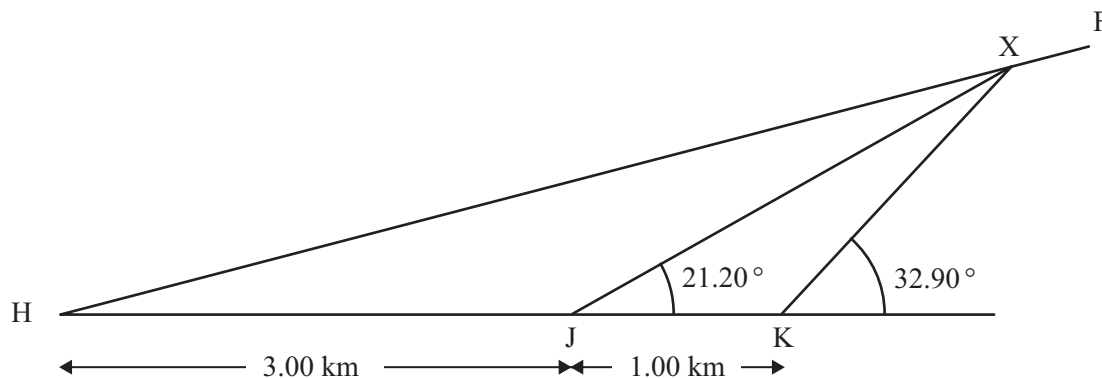


Fig. 4

- (i) Write down the sizes of the angles \hat{JKX} and \hat{JXK} . [1]
- (ii) Calculate the distance JX. [3]
- (iii) Write down the size of the angle \hat{HJX} . [1]
- (iv) Calculate the distance HX. [3]
- (v) Calculate the size of the angle \hat{XHJ} . [2]
- (vi) Calculate the height of the helicopter as it passes over Julie's house. [2]

- 9 Lesley recorded the price P , in pounds, and the number of days D for five different holidays at a given hotel. The details are given in **Table 1**.

Table 1

Price P (£)	Days D
79.50	2
150.98	5
262.19	11
355.60	17
398.44	20

She believes that a relationship of the form

$$P = aD^b$$

exists between P and D , where a and b are constants.

- (i) Using **Fig. 5** in your Supplementary Answer Booklet, verify this relationship by drawing a suitable straight line graph, using values correct to 3 decimal places. **Label the axes clearly.** [6]
- (ii) Hence, or otherwise, obtain values for a and b . Give your answers correct to 1 decimal place. [4]
- (iii) Use the formula $P = aD^b$ with the values you obtained for a and b to calculate the price of a **4 week** holiday in this hotel. Give your answer correct to the nearest penny. **State any assumption which you make.** [2]
- (iv) Monica has saved £330 and wants to book a holiday at this hotel. Use the formula $P = aD^b$ to calculate the maximum number of complete days she can stay. [2]

- 10 Alison had twelve £2 coins, eight £1 coins and twenty 20p coins. The total mass of the coins was 320 g.

Let x , y and z represent the masses, in grams, of a £2 coin, a £1 coin and a 20p coin respectively.

- (i) Show that x , y and z satisfy the equation

$$3x + 2y + 5z = 80 \quad [1]$$

Brian had twenty-five £2 coins, thirty £1 coins and fifteen 20p coins. The total mass of these coins was 660 g.

- (ii) Show that x , y and z also satisfy the equation

$$5x + 6y + 3z = 132 \quad [1]$$

Christine had eighteen 50p coins, twelve £1 coins and twenty-seven 20p coins. The total mass of these coins was 393 g.

The mass of a 50p coin is $\frac{2}{3}$ that of a £2 coin.

- (iii) Show that x , y and z also satisfy the equation

$$4x + 4y + 9z = 131 \quad [2]$$

- (iv) Solve these equations to find the masses of **all four** coins, i.e. a £2 coin, a £1 coin, a 50p coin and a 20p coin. Show clearly each stage of your solution. [8]

David had twenty £2 coins, some of which were counterfeit. Each counterfeit coin has a mass of 10 g. The total mass of David's coins was 228 g.

- (v) Calculate how many counterfeit coins David had. [2]

11 A curve is defined by the equation

$$y = 14x + 3x^2 - 2x^3$$

- (i) Find the coordinates of the points where this curve crosses the x -axis. [2]
- (ii) Find the coordinates of the turning points, giving your answers correct to 2 decimal places. [6]
- (iii) Identify each turning point as either a maximum or a minimum point. You **must** show working to justify your answer. [2]
- (iv) Using your answers from parts (i) to (iii), **sketch** this curve using **Fig. 6** in your Supplementary Answer Booklet. [3]
- (v) Find the area enclosed between this curve and the **negative** x -axis. [3]

THIS IS THE END OF THE QUESTION PAPER



Rewarding Learning

Centre Number

71

Candidate Number

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**SUPPLEMENTARY
ANSWER BOOKLET**

1 (i) Sketch the graph of $y = 2 \sin x$ on the axes in Fig. 1 below.

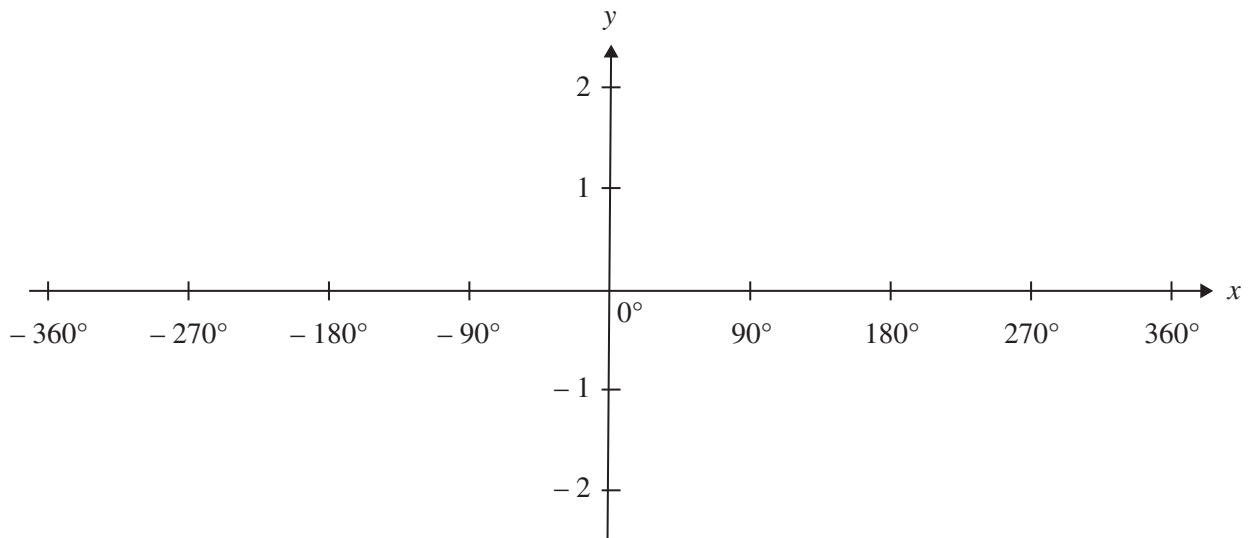


Fig. 1

(ii) Sketch the graph of $y = \sin \left(\frac{1}{2}x\right)$ on the axes in Fig. 2 below.

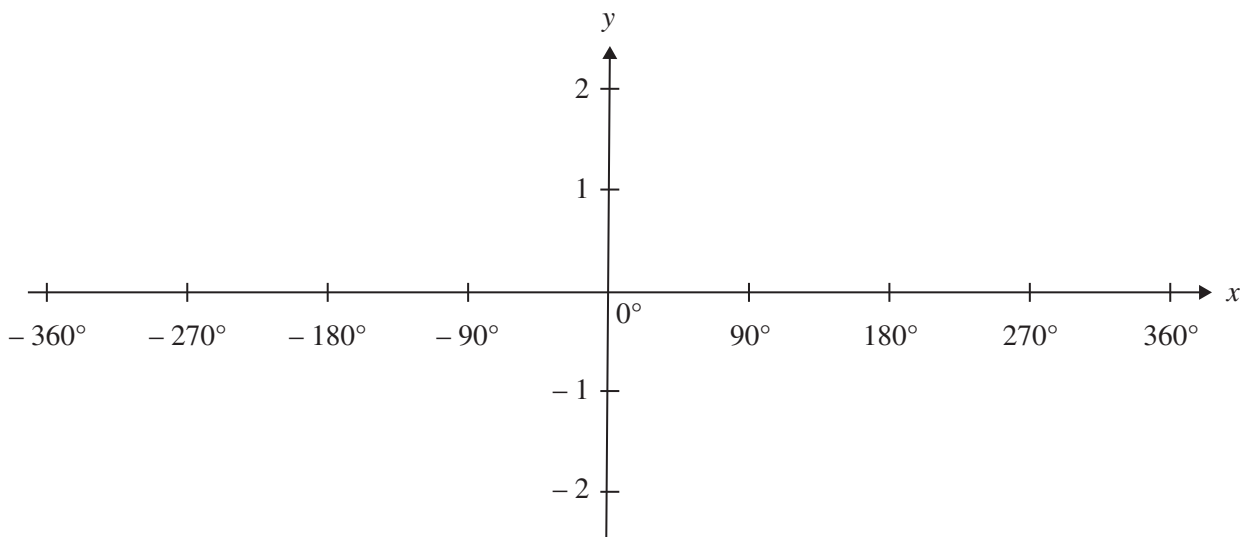


Fig. 2

- 9 Draw a suitable straight line graph using the axes and scales in **Fig. 5** below.
Label the axes.

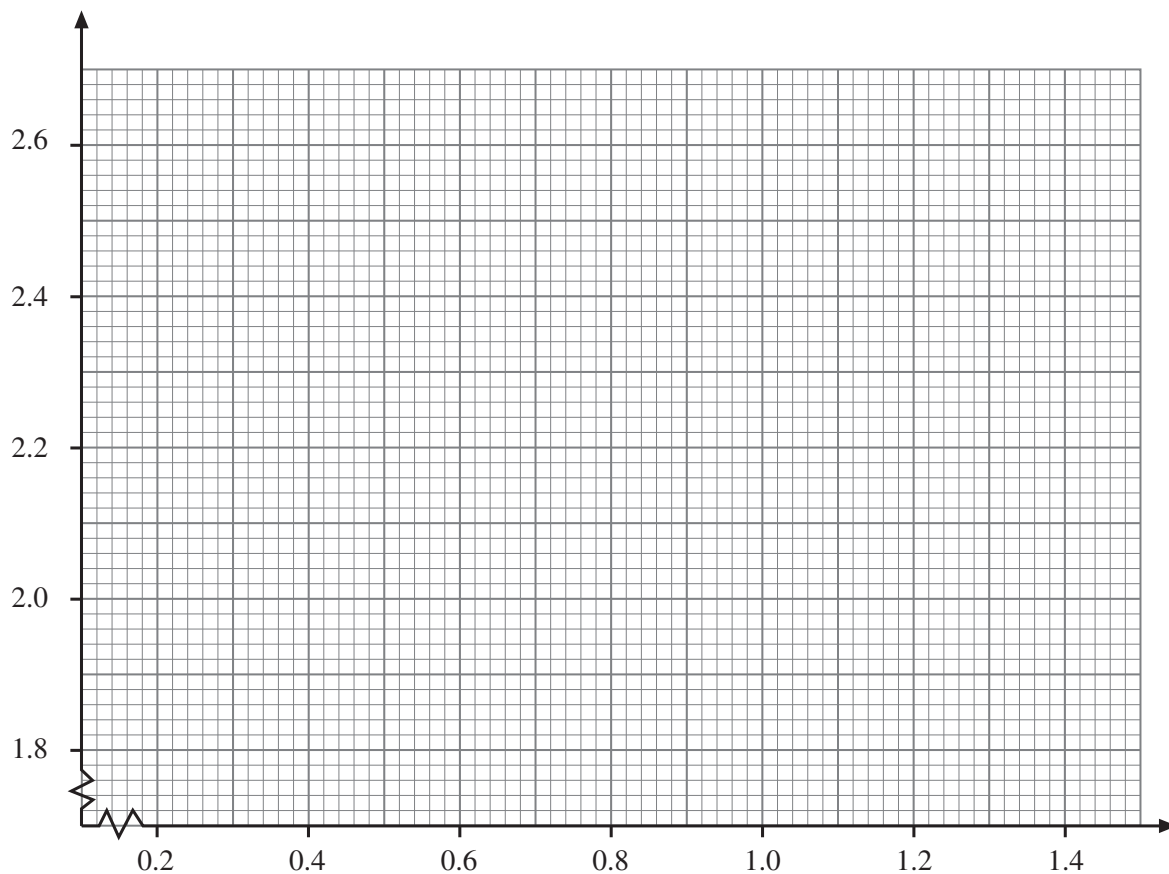


Fig. 5

11 Sketch the graph of $y = 14x + 3x^2 - 2x^3$ in Fig. 6.

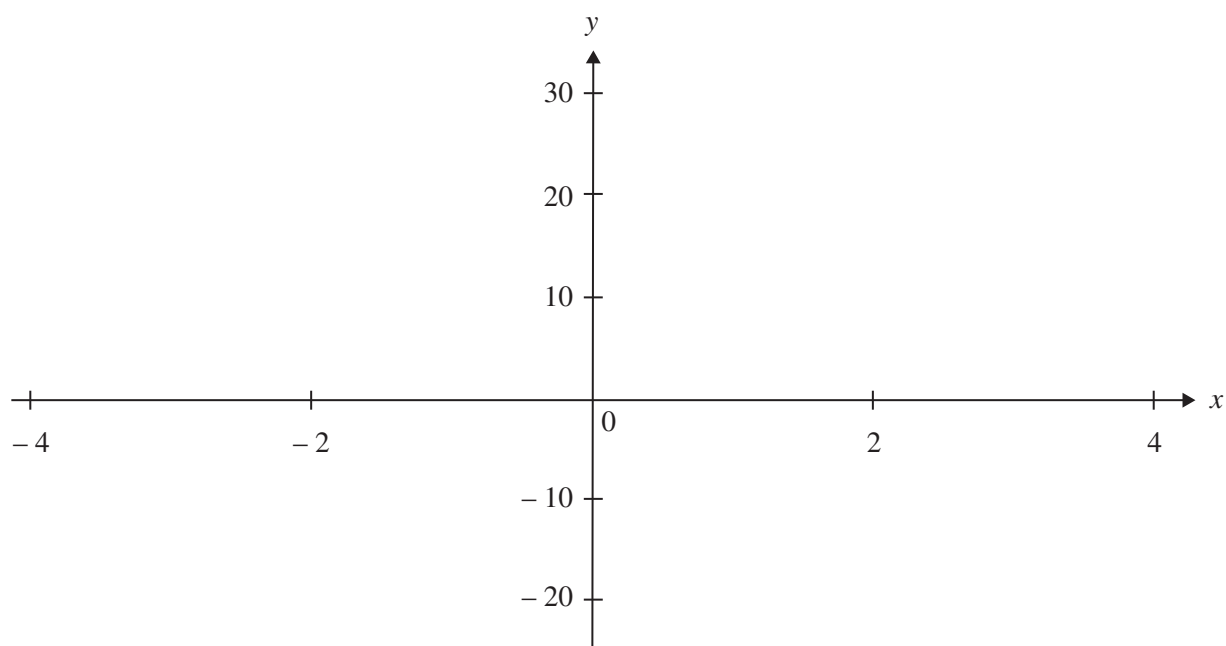


Fig. 6

