

General Certificate of Education
January 2009
Advanced Subsidiary Examination



MATHEMATICS
Unit Pure Core 2

MPC2

Tuesday 13 January 2009 9.00 am to 10.30 am

For this paper you must have:

- an 8-page answer book
 - the blue AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is MPC2.
- Answer **all** questions.
- Show all necessary working; otherwise marks for method may be lost.

Information

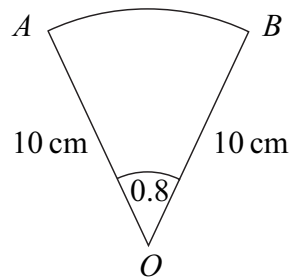
- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

Answer **all** questions.

- 1 The diagram shows a sector OAB of a circle with centre O and radius 10 cm.



The angle AOB is 0.8 radians.

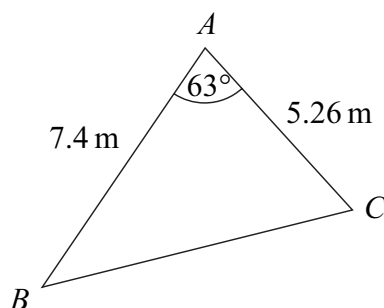
- (a) Find the area of the sector. (2 marks)
- (b) (i) Find the perimeter of the sector OAB . (3 marks)
- (ii) The perimeter of the sector OAB is equal to the perimeter of a square. Find the area of the square. (2 marks)
- 2 (a) Use the trapezium rule with four ordinates (three strips) to find an approximate value for

$$\int_{1.5}^6 x^2 \sqrt{x^2 - 1} \, dx$$

giving your answer to three significant figures. (4 marks)

- (b) State how you could obtain a better approximation to the value of the integral using the trapezium rule. (1 mark)

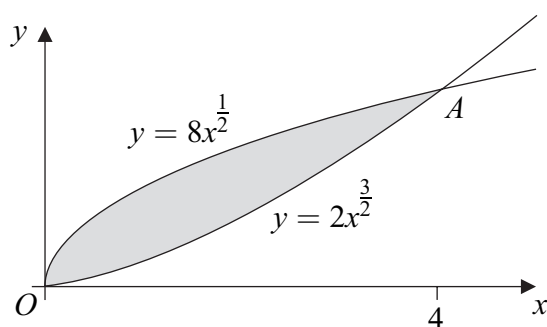
3 The diagram shows a triangle ABC .



The size of angle A is 63° , and the lengths of AB and AC are 7.4 m and 5.26 m respectively.

- Calculate the area of triangle ABC , giving your answer in m^2 to three significant figures. (2 marks)
- Show that the length of BC is 6.86 m, correct to three significant figures. (3 marks)
- Find the value of $\sin B$ to two significant figures. (2 marks)

4 The diagram shows a sketch of the curves with equations $y = 2x^{\frac{3}{2}}$ and $y = 8x^{\frac{1}{2}}$.



The curves intersect at the origin and at the point A , where $x = 4$.

- For the curve $y = 2x^{\frac{3}{2}}$, find the value of $\frac{dy}{dx}$ when $x = 4$. (2 marks)
 - Find an equation of the normal to the curve $y = 2x^{\frac{3}{2}}$ at the point A . (4 marks)
- Find $\int 8x^{\frac{1}{2}} dx$. (2 marks)
 - Find the area of the shaded region bounded by the two curves. (4 marks)
- Describe a single geometrical transformation that maps the graph of $y = 2x^{\frac{3}{2}}$ onto the graph of $y = 2(x + 3)^{\frac{3}{2}}$. (2 marks)

Turn over ►

- 5 (a) By using the binomial expansion, or otherwise, express $(1 + 2x)^4$ in the form

$$1 + ax + bx^2 + cx^3 + 16x^4$$

where a , b and c are integers.

(4 marks)

- (b) Hence show that $(1 + 2x)^4 + (1 - 2x)^4 = 2 + 48x^2 + 32x^4$.

(3 marks)

- (c) Hence show that the curve with equation

$$y = (1 + 2x)^4 + (1 - 2x)^4$$

has just one stationary point and state its coordinates.

(4 marks)

- 6 (a) Write each of the following in the form $\log_a k$, where k is an integer:

(i) $\log_a 4 + \log_a 10$;

(1 mark)

(ii) $\log_a 16 - \log_a 2$;

(1 mark)

(iii) $3 \log_a 5$.

(1 mark)

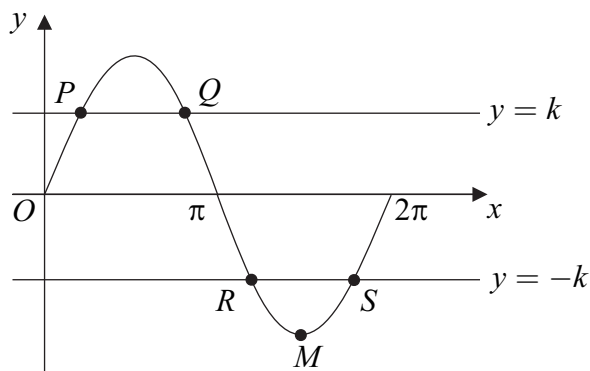
- (b) Use logarithms to solve the equation $(1.5)^{3x} = 7.5$, giving your value of x to three decimal places.

(3 marks)

- (c) Given that $\log_2 p = m$ and $\log_8 q = n$, express pq in the form 2^y , where y is an expression in m and n .

(3 marks)

- 7 (a) Solve the equation $\sin x = 0.8$ in the interval $0 \leq x \leq 2\pi$, giving your answers in radians to three significant figures. (3 marks)
- (b) The diagram shows the graph of the curve $y = \sin x$, $0 \leq x \leq 2\pi$ and the lines $y = k$ and $y = -k$.



The line $y = k$ intersects the curve at the points P and Q , and the line $y = -k$ intersects the curve at the points R and S .

The point M is the minimum point of the curve.

- (i) Write down the coordinates of the point M . (2 marks)
- (ii) The x -coordinate of P is α .
Write down the x -coordinate of the point Q in terms of π and α . (1 mark)
- (iii) Find the length of RS in terms of π and α , giving your answer in its simplest form. (2 marks)
- (c) Sketch the graph of $y = \sin 2x$ for $0 \leq x \leq 2\pi$, indicating the coordinates of points where the graph intersects the x -axis and the coordinates of any maximum points. (5 marks)

- 8 The 25th term of an arithmetic series is 38.

The sum of the first 40 terms of the series is 1250.

- (a) Show that the common difference of this series is 1.5. (6 marks)
- (b) Find the number of terms in the series which are less than 100. (3 marks)

END OF QUESTIONS

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