MATHEMATICS   4722

Core Mathematics 2

Specimen Paper

Additional materials:
    Answer booklet
    Graph paper
    List of Formulae (MF 1)

TIME   1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your Name, Centre Number and Candidate Number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.
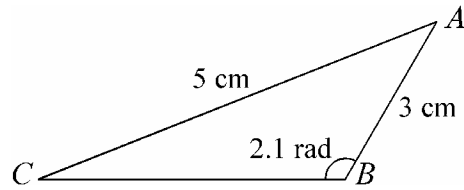- You are permitted to use a graphic calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.
- Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
- **You are reminded of the need for clear presentation in your answers.**

This question paper consists of 4 printed pages.

1 Expand $(1-2x)^4$ in ascending powers of x, simplifying the coefficients. [5]

2 **(i)** Find $\int \dfrac{1}{x^2}\,\mathrm{d}x$. [3]

    (ii) The gradient of a curve is given by $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{1}{x^2}$. Find the equation of the curve, given that it passes through the point $(1,3)$. [3]

3 **(a)** Express each of the following in terms of $\log_2 x$:

      (i) $\log_2(x^2)$, [1]

      (ii) $\log_2(8x^2)$. [3]

    (b) Given that $y^2 = 27$, find the value of $\log_3 y$. [3]

4 Records are kept of the number of copies of a certain book that are sold each week. In the first week after publication 3000 copies were sold, and in the second week 2400 copies were sold. The publisher forecasts future sales by assuming that the number of copies sold each week will form a geometric progression with first two terms 3000 and 2400. Calculate the publisher's forecasts for

    (i) the number of copies that will be sold in the 20th week after publication, [3]

    (ii) the total number of copies sold during the first 20 weeks after publication, [2]

    (iii) the total number of copies that will ever be sold. [2]

5 **(i)** Show that the equation $15\cos^2\theta° = 13+\sin\theta°$ may be written as a quadratic equation in $\sin\theta°$. [2]

    (ii) Hence solve the equation, giving all values of θ such that $0 \leqslant \theta \leqslant 360$. [6]

6

The diagram shows triangle *ABC*, in which $AB = 3\,\text{cm}$, $AC = 5\,\text{cm}$ and angle $ABC = 2.1$ radians. Calculate
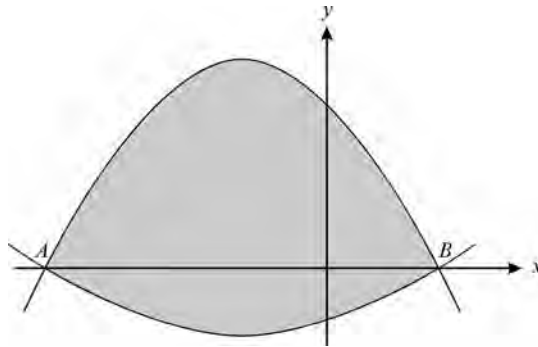
  (i) angle *ACB*, giving your answer in radians, [2]

 (ii) the area of the triangle. [3]

An arc of a circle with centre *A* and radius 3 cm is drawn, cutting *AC* at the point *D*.

 (iii) Calculate the perimeter and the area of the sector *ABD*. [4]
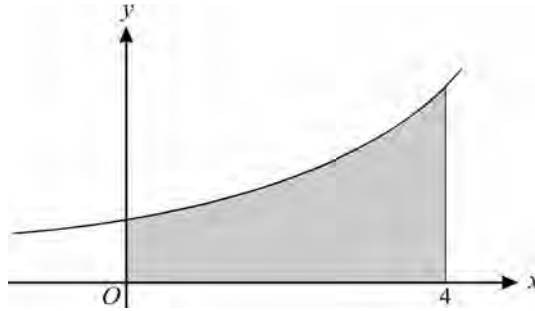
7

The diagram shows the curves $y = -3x^2 - 9x + 30$ and $y = x^2 + 3x - 10$.

  (i) Verify that the curves intersect at the points $A\,(-5, 0)$ and $B\,(2, 0)$. [2]

 (ii) Show that the area of the shaded region between the curves is given by $\int_{-5}^{2}(-4x^2 - 12x + 40)\,dx$. [2]

 (iii) Hence or otherwise show that the area of the shaded region between the curves is $228\frac{2}{3}$. [5]

8

The diagram shows the curve $y = 1.25^x$.

(i) A point on the curve has y-coordinate 2. Calculate its x-coordinate. [3]

(ii) Use the trapezium rule with 4 intervals to estimate the area of the shaded region, bounded by the curve, the axes, and the line $x = 4$. [4]

(iii) State, with a reason, whether the estimate found in part **(ii)** is an overestimate or an underestimate. [2]

(iv) Explain briefly how the trapezium rule could be used to find a more accurate estimate of the area of the shaded region. [1]

9 The cubic polynomial $x^3 + ax^2 + bx - 6$ is denoted by $f(x)$.

(i) The remainder when $f(x)$ is divided by $(x-2)$ is equal to the remainder when $f(x)$ is divided by $(x+2)$. Show that $b = -4$. [3]

(ii) Given also that $(x-1)$ is a factor of $f(x)$, find the value of a. [2]

(iii) With these values of a and b, express $f(x)$ as a product of a linear factor and a quadratic factor. [3]

(iv) Hence determine the number of real roots of the equation $f(x) = 0$, explaining your reasoning. [3]