UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
in collaboration with
THE MINISTRY OF EDUCATION, SINGAPORE

General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS 4018/2

PAPER 2

SPECIMEN PAPER FOR 2002 2 hours

Additional materials:
- Answer paper
- Graph paper
- Mathematical tables

Time 2 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all** questions.

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

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 80.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

MCS-UCW187a-A05607

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1.$$
$$\sec^2 A = 1 + \tan^2 A.$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A.$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$
$$a^2 = b^2 + c^2 - 2bc \cos A.$$
$$\Delta = \frac{1}{2} bc \sin A.$$

1 Given that $\mathbf{A} = \begin{pmatrix} 4 & 7 \\ 3 & 4 \end{pmatrix}$, find $\mathbf{A}^{-1}$ and hence solve the equations

$$4x + 7y = -2$$
$$3x + 4y = 1.$$

[4]

2 Solve the equation $4x^3 + 4x^2 - 19x - 10 = 0$. [5]

3 Find the range of values of k for which the line $y + kx + 9 = 0$ does not intersect the curve $y = x^2 - 2x$. [5]

4 A curve has the equation $y = \dfrac{2x - 4}{x + 1}$ and P is the point on the curve where $x = 2$.
Find the angle that the tangent to the curve at P makes with the x-axis. [5]

5 Given that $y = e^x(\cos x - \sin x)$, show that $\dfrac{dy}{dx} = -2e^x \sin x$.

Hence evaluate $\int_0^{\pi} e^x \sin x \, dx$, correct to one decimal place.

[5]

6 The two shorter sides of a right-angled triangle are of length $(\sqrt{a} + \sqrt{b})$ m and $(\sqrt{a} - \sqrt{b})$ m respectively. Given that the length of the hypotenuse is L m and that the area of the triangle is A m^2, find, in terms of a and b, an expression for L and for A.

Given further that $A = 11$ and $L = 8$, evaluate a and b.

[5]

7 The function f is defined, for $0° \leqslant x \leqslant 360°$, by

$$f(x) = 3 \sin 2x - 1.$$

(i) State the amplitude and period of f.

(ii) Sketch the graph of f.

[5]

8 Given that $u = \log_9 x$, find, in terms of u,

(i) x,

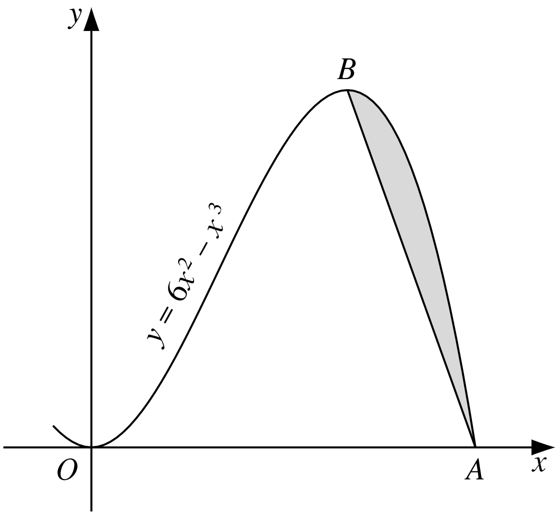
(ii) $\log_3 x$,

(iii) $\log_9(27x)$,

(iv) $\log_x 81$.

[7]

9



The diagram shows part of the curve $y = 6x^2 - x^3$. This curve has a minimum point at O, a maximum point at B and crosses the x-axis at A. Find the area of the shaded region which is bounded by the line AB and the arc of the curve between A and B.

[8]

10 Functions f and g are defined, for $x \in \mathbb{R}$, by

$$f : x \mapsto \frac{14}{3 - x}, \quad x \neq 3,$$

$$g : x \mapsto 9 - 2x.$$

Solve the equation

(i) $fg(x) = g^2(x)$,

(ii) $f^{-1}(x) = g^{-1}(17)$.

[8]

11 Two canoeists, A and B, each paddle in still water at 5 ms^{-1}. They both leave at the same time from the same point on a river bank. The river flows at 3 ms^{-1} between straight parallel banks, 240 m apart.

Canoeist A paddles in the direction that enables him to cross the river in the shortest distance. Canoeist B paddles in such a direction that he lands 240 m downstream of the point where A lands.

Determine, with full working, whether A or B lands first [11]

12 Answer only **one** of the following two alternatives.

EITHER

A car moves along a straight horizontal road so that, t seconds after passing a fixed point A with a speed of 5 ms^{-1}, its acceleration, a ms^{-2}, is given by $a = 8 - 2t$.

On reaching its greatest speed, the brakes are applied and the car decelerates at a constant rate of 3 ms^{-2}, coming to rest at point B.

For the journey from A to B

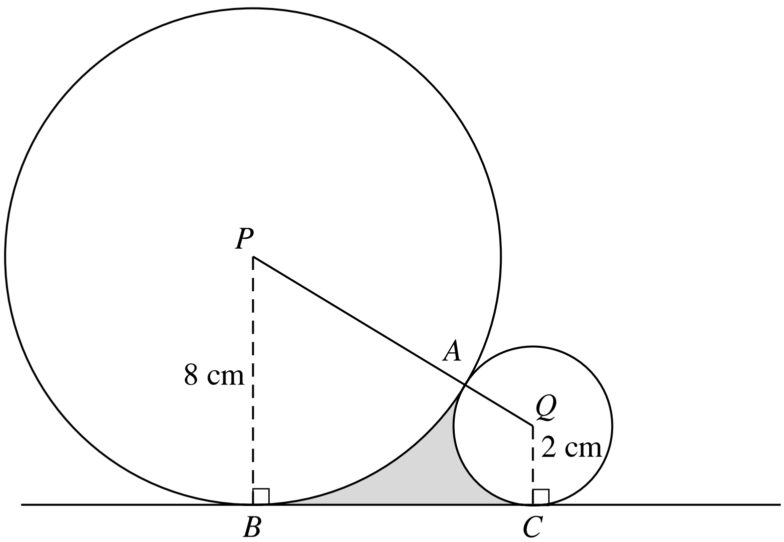
(i) sketch the velocity-time graph,

(ii) find the time taken,

(iii) find the distance travelled.

[12]

OR



The diagram shows two circles, centres P and Q, of radius 8 cm and 2 cm respectively, touching at point A. A common tangent touches the circles at B and at C.

(i) Find, in radians, the angle APB.

For the shaded region ABC, find, correct to one decimal place,

(ii) the perimeter,

(iii) the area.

[12]