



CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

0606/13

May/June 2021

2 hours

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

DC (LK/FC) 202076/2
© UCLES 2021

[Turn over

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

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

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

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY*Identities*

$$\begin{aligned}\sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A\end{aligned}$$

Formulae for $\triangle ABC$

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

- 1 Find the possible values of the constant k such that the equation $kx^2 + 4kx + 3k + 1 = 0$ has two different real roots. [4]

2 **(a)** Find $\frac{d}{dx}(x^2 e^{3x})$. [3]

(b) (i) Find $\frac{d}{dx}(3x^2 + 4)^{\frac{1}{3}}$. [2]

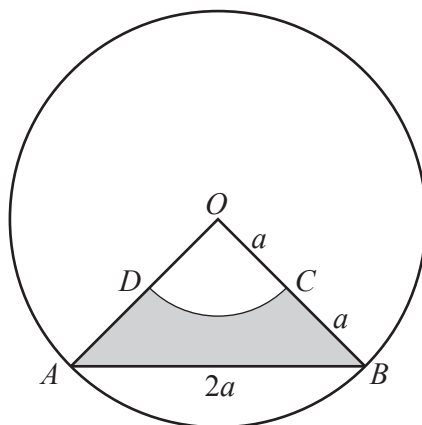
(ii) Hence find $\int_0^2 x(3x^2 + 4)^{-\frac{2}{3}} dx$. [3]

- 3 Solve the equation $\operatorname{cosec}^2 \theta + 2 \cot^2 \theta = 2 \cot \theta + 9$, where θ is in radians and $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$. [5]

- 4 (a) Find the first three non-zero terms in the expansion of $\left(2 - \frac{x^2}{4}\right)^6$ in ascending powers of x . Simplify each term. [3]

- (b) Hence find the term independent of x in the expansion of $\left(2 - \frac{x^2}{4}\right)^6 \left(3 - \frac{1}{x^2}\right)^2$. [3]

- 5 When e^y is plotted against x^2 a straight line graph passing through the points (2.24, 5) and (4.74, 10) is obtained. Find y in terms of x . [5]



The diagram shows a circle, centre O , radius $2a$. The points A and B lie on the circumference of the circle. The points C and D are the mid-points of the lines OB and OA respectively. The arc DC is part of a circle centre O . The chord AB is of length $2a$.

(a) Find angle AOB , giving your answer in radians in terms of π . [1]

(b) Find, in terms of a and π , the perimeter of the shaded region $ABCD$. [2]

(c) Find, in terms of a and π , the area of the shaded region $ABCD$. [3]

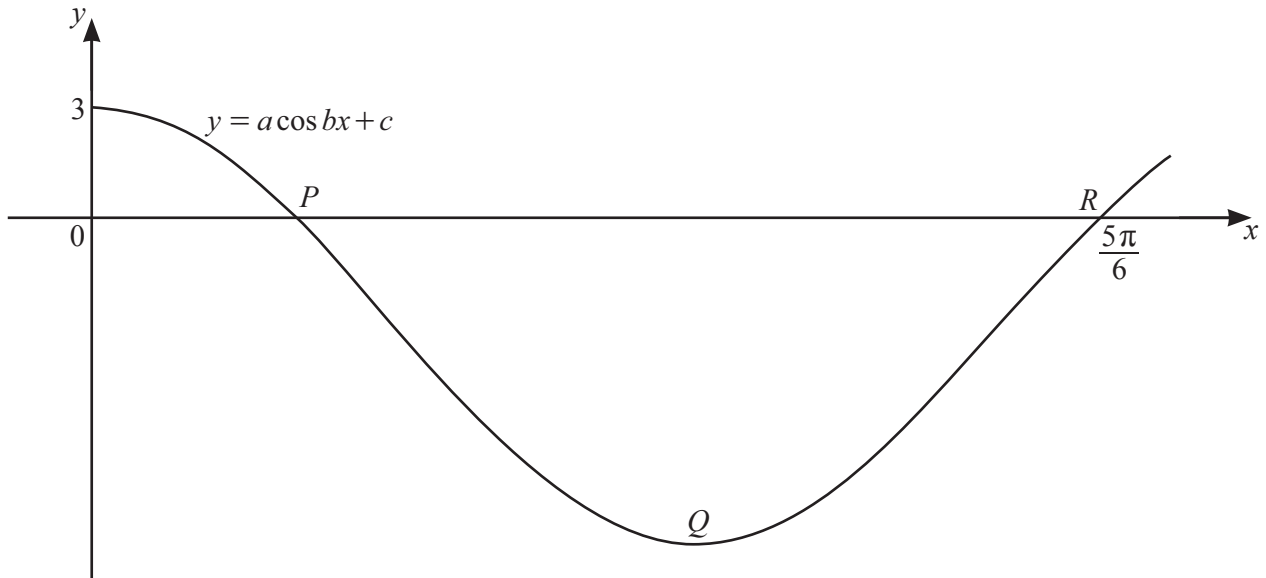
- 7 (a) A committee of 8 people is to be formed from 5 teachers, 4 doctors and 3 police officers. Find the number of different committees that could be chosen if

(i) all 4 doctors are on the committee, [2]

(ii) there are at least 2 teachers on the committee. [3]

(b) Given that ${}^nP_5 = 6 \times {}^{n-1}P_4$, find the value of n . [3]

8



The graph shows the curve $y = a \cos bx + c$, for $0 \leq x \leq 2.8$, where a , b and c are constants and x is in radians. The curve meets the y -axis at $(0, 3)$ and the x -axis at the point P and point $R\left(\frac{5\pi}{6}, 0\right)$.

The curve has a minimum at point Q . The period of $a \cos bx + c$ is π radians.

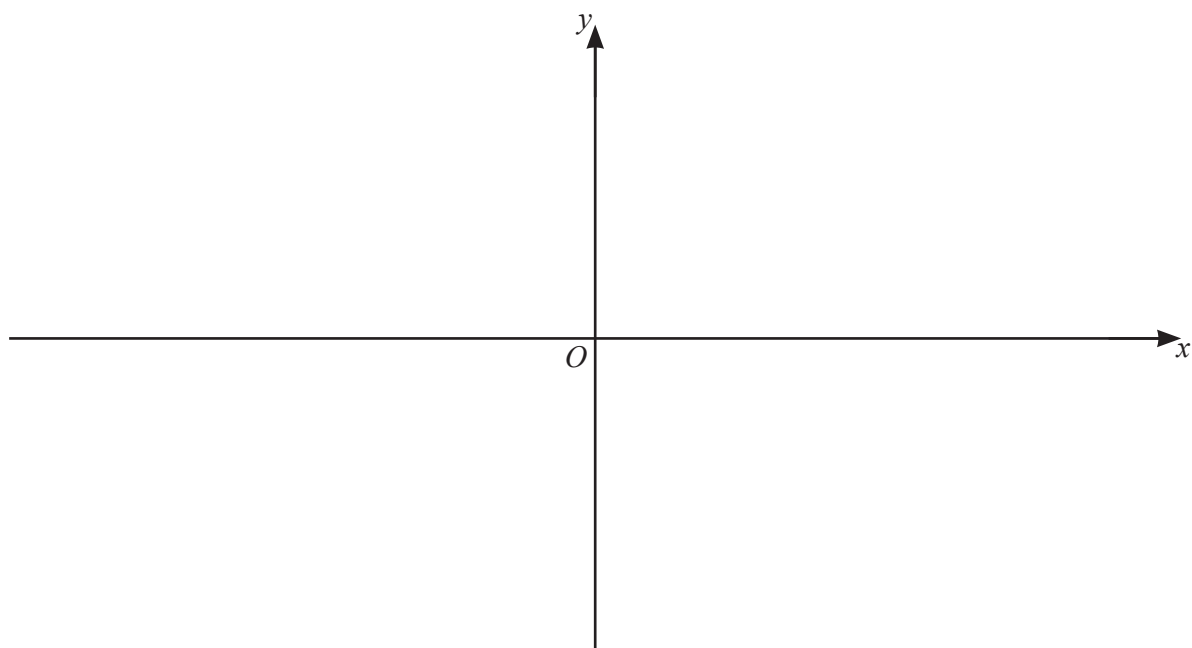
(a) Find the value of each of a , b and c . [4]

(b) Find the coordinates of P . [1]

(c) Find the coordinates of Q . [2]

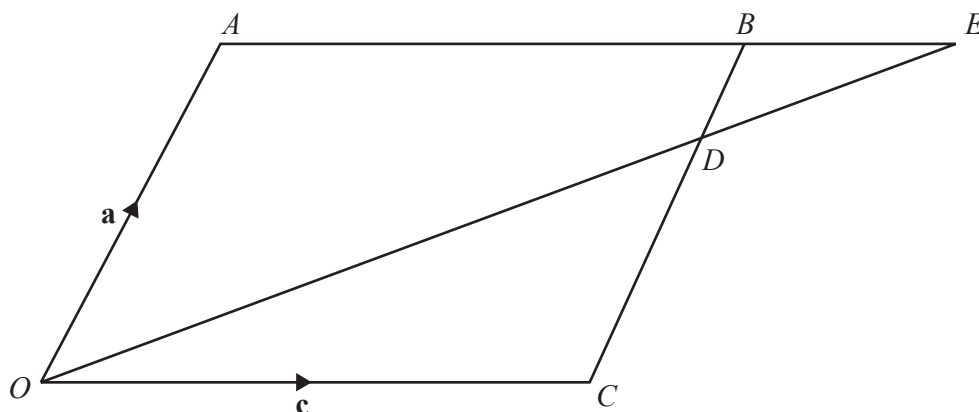
- 9 (a) Show that the equation of the curve $y = (x^2 - 4)(x - 2)$ can be written as $y = x^3 + ax^2 + bx + 8$, where a and b are integers. Hence find the exact coordinates of the stationary points on the curve. [4]

- (b) On the axes, sketch the graph of $y = |(x^2 - 4)(x - 2)|$, stating the intercepts with the coordinate axes. [4]



- (c) Find the possible values of the constant k for which $|(x^2 - 4)(x - 2)| = k$ has exactly 4 different solutions. [2]

10



The diagram shows the parallelogram $OABC$, such that $\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$. The point D lies on CB such that $CD:DB = 3:1$. When extended, the lines AB and OD meet at the point E . It is given that $\vec{OE} = h\vec{OD}$ and $\vec{BE} = k\vec{AB}$, where h and k are constants.

(a) Find $\vec{DE}$ in terms of $\mathbf{a}$, $\mathbf{c}$ and h .

[4]

(b) Find $\overrightarrow{DE}$ in terms of $\mathbf{a}$, $\mathbf{c}$ and k . [1]

(c) Hence find the value of h and of k . [4]

- 11** The line $x + 2y = 10$ intersects the two lines satisfying the equation $|x + y| = 2$ at the points A and B .
- (a)** Show that the point $C(-5, 20)$ lies on the perpendicular bisector of the line AB . [8]

- (b) The point D also lies on this perpendicular bisector. M is the mid-point of AB . The distance CD is three times the distance of CM . Find the possible coordinates of D . [4]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.