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ADDITIONAL MATHEMATICS

0606/11

Paper 1

May/June 2020

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- 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.

INFORMATION

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

This document has **16** pages. Blank pages are indicated.

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*

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

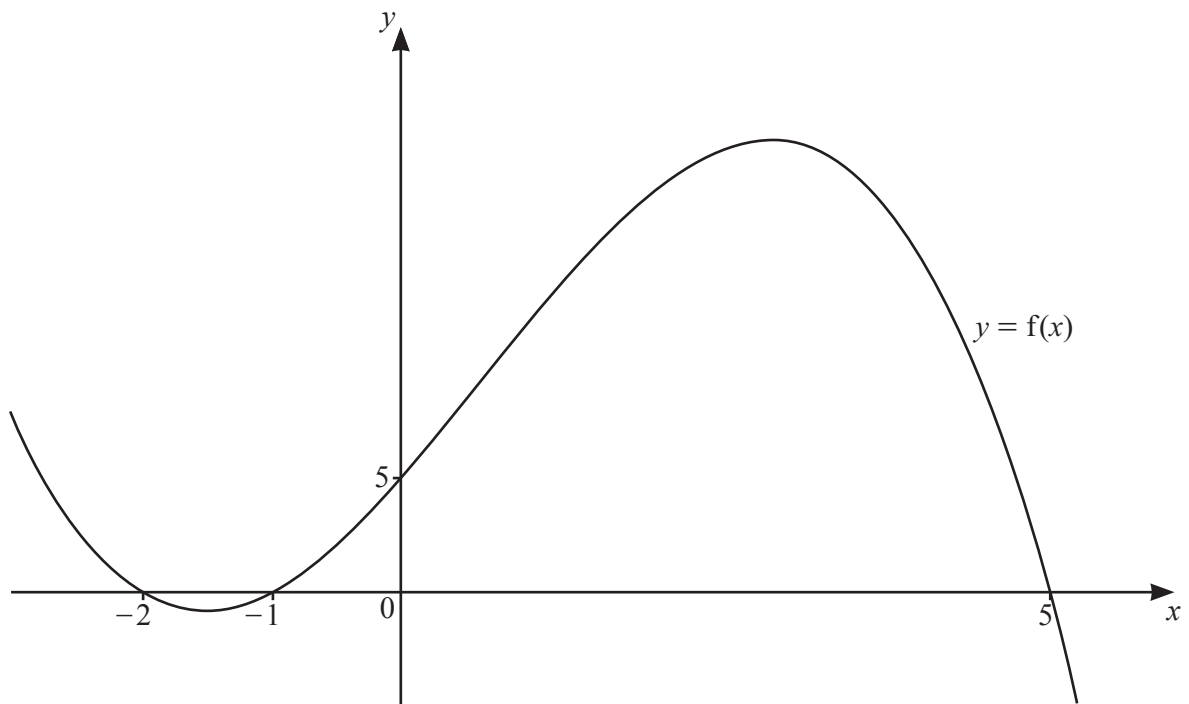
Formulae for $\triangle ABC$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

- 1 The diagram shows the graph of a cubic curve $y = f(x)$.



- (a) Find an expression for $f(x)$.

[2]

- (b) Solve $f(x) \leq 0$.

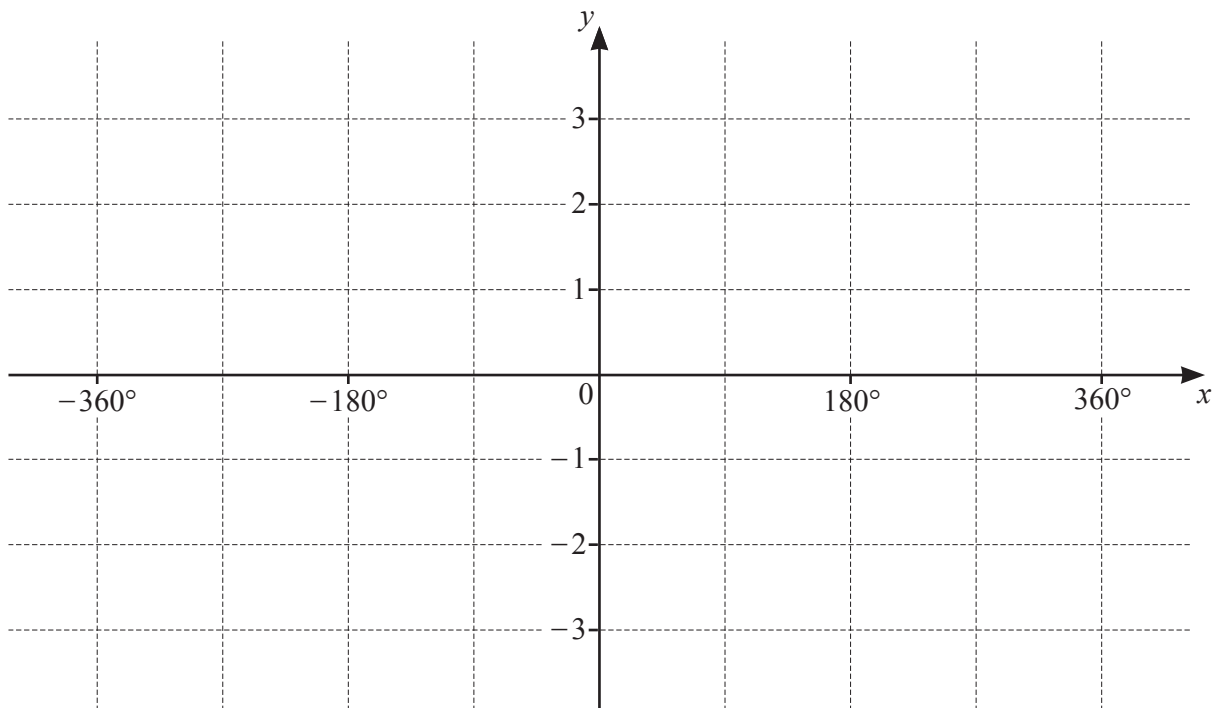
[2]

2 (a) Write down the period of $2 \cos \frac{x}{3} - 1$.

[1]

(b) On the axes below, sketch the graph of $y = 2 \cos \frac{x}{3} - 1$ for $-360^\circ \leq x \leq 360^\circ$.

[3]



- 3 The radius, r cm, of a circle is increasing at the rate of 5 cm s^{-1} . Find, in terms of π , the rate at which the area of the circle is increasing when $r = 3$. [4]

4 DO NOT USE A CALCULATOR IN THIS QUESTION.

Find the positive solution of the equation $(5 + 4\sqrt{7})x^2 + (4 - 2\sqrt{7})x - 1 = 0$, giving your answer in the form $a + b\sqrt{7}$, where a and b are fractions in their simplest form. [5]

- 5 Find the equation of the tangent to the curve $y = \frac{\ln(3x^2 - 1)}{x + 2}$ at the point where $x = 1$. Give your answer in the form $y = mx + c$, where m and c are constants correct to 3 decimal places. [6]

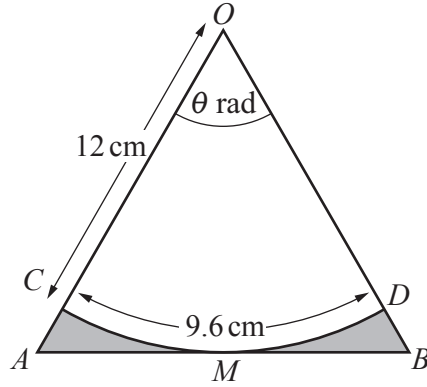
6 The line $y = 5x + 6$ meets the curve $xy = 8$ at the points A and B .

(a) Find the coordinates of A and of B .

[3]

(b) Find the coordinates of the point where the perpendicular bisector of the line AB meets the line $y = x$.

[5]



The diagram shows an isosceles triangle OAB such that $OA = OB$ and angle $AOB = \theta$ radians. The points C and D lie on OA and OB respectively. CD is an arc of length 9.6 cm of the circle, centre O , radius 12 cm. The arc CD touches the line AB at the point M .

(a) Find the value of θ . [1]

(b) Find the total area of the shaded regions. [4]

(c) Find the total perimeter of the shaded regions. [3]

8 (a) Show that $\frac{3}{2x-3} + \frac{3}{2x+3}$ can be written as $\frac{12x}{4x^2-9}$. [2]

(b) Hence find $\int \frac{12x}{4x^2-9} dx$, giving your answer as a single logarithm and an arbitrary constant. [3]

- (c) Given that $\int_2^a \frac{12x}{4x^2-9} dx = \ln 5\sqrt{5}$, where $a > 2$, find the exact value of a . [4]

- 9 (a) An arithmetic progression has a second term of -14 and a sum to 21 terms of 84. Find the first term and the 21st term of this progression. [5]

(b) A geometric progression has a second term of $27p^2$ and a fifth term of p^5 . The common ratio, r , is such that $0 < r < 1$.

(i) Find r in terms of p . [2]

(ii) Hence find, in terms of p , the sum to infinity of the progression. [3]

(iii) Given that the sum to infinity is 81, find the value of p . [2]

10 (a) (i) Show that $\frac{1}{\sec\theta-1} - \frac{1}{\sec\theta+1} = 2\cot^2\theta$. [3]

(ii) Hence solve $\frac{1}{\sec 2x-1} - \frac{1}{\sec 2x+1} = 6$ for $-90^\circ < x < 90^\circ$. [5]

(b) Solve $\operatorname{cosec}\left(y + \frac{\pi}{3}\right) = 2$ for $0 \leq y \leq 2\pi$ radians, giving your answers in terms of π . [4]

Question 11 is printed on the next page.

- 11 A curve is such that $\frac{d^2y}{dx^2} = 5 \cos 2x$. This curve has a gradient of $\frac{3}{4}$ at the point $\left(-\frac{\pi}{12}, \frac{5\pi}{4}\right)$. Find the equation of this curve. [8]

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