Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

3081135600

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 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.

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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 $\binom{n}{r} = \dfrac{n!}{(n-r)!\,r!}$

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

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

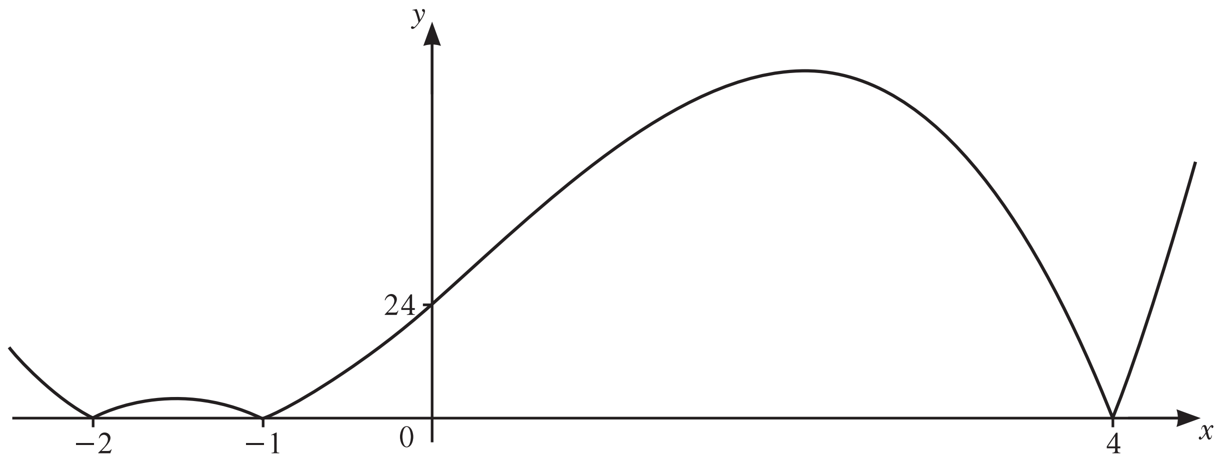
Formulae for ΔABC

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

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

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

1

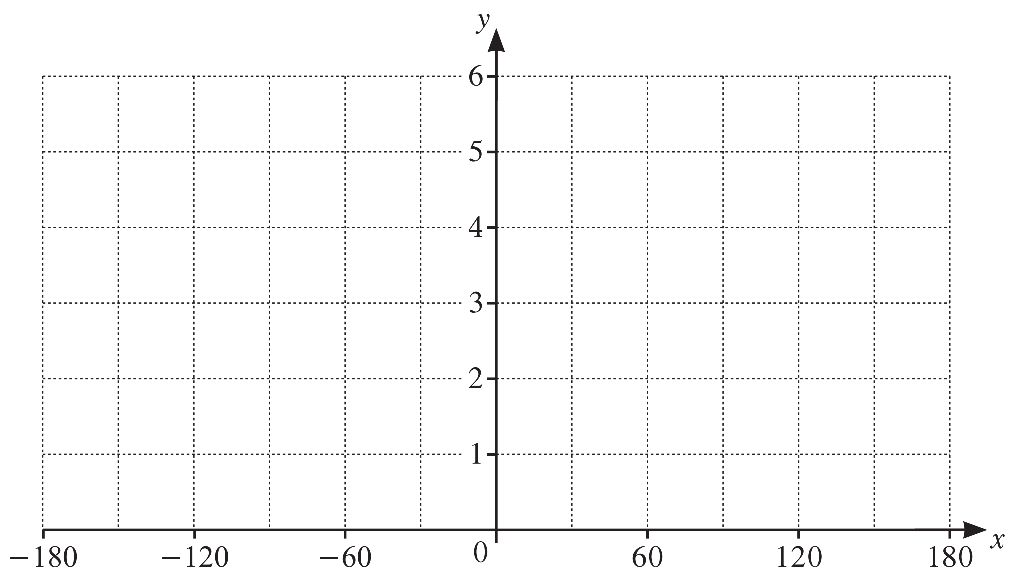


The diagram shows the graph of $y = |p(x)|$, where $p(x)$ is a cubic function. Find the two possible expressions for $p(x)$. [3]

2 **(a)** Write down the amplitude of $1 + 4\cos\left(\frac{x}{3}\right)$. [1]

(b) Write down the period of $1 + 4\cos\left(\frac{x}{3}\right)$. [1]

(c) On the axes below, sketch the graph of $y = 1 + 4\cos\left(\frac{x}{3}\right)$ for $-180° \leqslant x° \leqslant 180°$.



[3]

3 **(a)** Write $\dfrac{\sqrt{p}\left(qr^2\right)^{\frac{1}{3}}}{\left(q^3p\right)^{-1}r^3}$ in the form $p^a q^b r^c$, where a, b and c are constants. [3]

(b) Solve $6x^{\frac{2}{3}} - 5x^{\frac{1}{3}} + 1 = 0$. [3]

4 It is given that $y = \dfrac{\tan 3x}{\sin x}$.

(a) Find the exact value of $\dfrac{dy}{dx}$ when $x = \dfrac{\pi}{3}$. [4]

(b) Hence find the approximate change in y as x increases from $\dfrac{\pi}{3}$ to $\dfrac{\pi}{3} + h$, where h is small. [1]

(c) Given that x is increasing at the rate of 3 units per second, find the corresponding rate of change in y when $x = \dfrac{\pi}{3}$, giving your answer in its simplest surd form. [2]

5 **(a)** **(i)** Find how many different 4-digit numbers can be formed using the digits 1, 3, 4, 6, 7 and 9. Each digit may be used once only in any 4-digit number. [1]

(ii) How many of these 4-digit numbers are even and greater than 6000? [3]

(b) A committee of 5 people is to be formed from 6 doctors, 4 dentists and 3 nurses. Find the number of different committees that could be formed if

(i) there are no restrictions, [1]

(ii) the committee contains at least one doctor, [2]

(iii) the committee contains all the nurses. [1]

6 A particle P is initially at the point with position vector $\begin{pmatrix} 30 \\ 10 \end{pmatrix}$ and moves with a constant speed of $10\,\text{ms}^{-1}$ in the same direction as $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$.

(a) Find the position vector of P after t s. [3]

As P starts moving, a particle Q starts to move such that its position vector after t s is given by $\begin{pmatrix} -80 \\ 90 \end{pmatrix} + t\begin{pmatrix} 5 \\ 12 \end{pmatrix}$.

(b) Write down the speed of Q. [1]

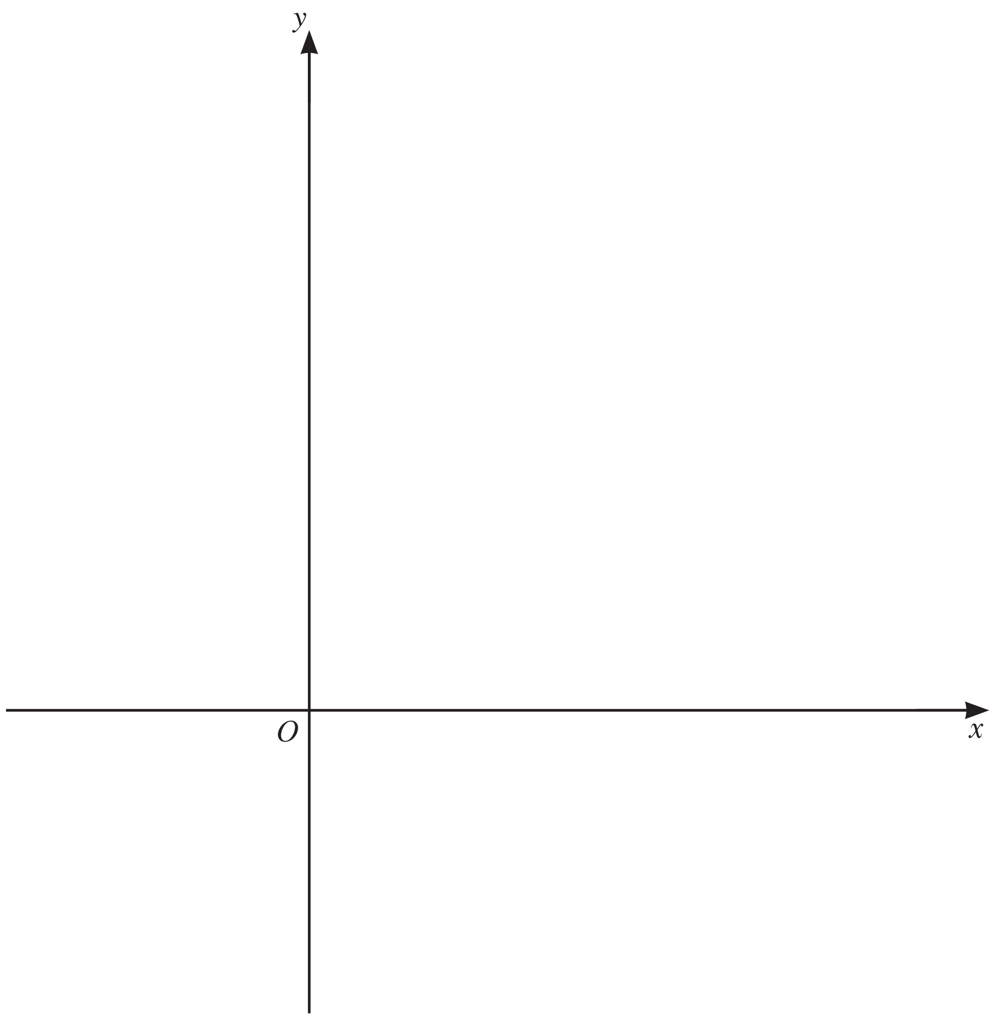
(c) Find the exact distance between P and Q when $t = 10$, giving your answer in its simplest surd form. [3]

7 It is given that $f(x) = 5\ln(2x+3)$ for $x > -\frac{3}{2}$.

(a) Write down the range of f. [1]

(b) Find f^{-1} and state its domain. [3]

(c) On the axes below, sketch the graph of $y = f(x)$ and the graph of $y = f^{-1}(x)$. Label each curve and state the intercepts on the coordinate axes.



[5]

8 **(a)** **(i)** Show that $\dfrac{1}{(1+\operatorname{cosec}\theta)(\sin\theta-\sin^2\theta)}=\sec^2\theta$. [4]

(ii) Hence solve $(1+\operatorname{cosec}\theta)(\sin\theta-\sin^2\theta)=\dfrac{3}{4}$ for $-180° \leqslant \theta \leqslant 180°$. [4]

(b) Solve $\sin\left(3\phi + \frac{2\pi}{3}\right) = \cos\left(3\phi + \frac{2\pi}{3}\right)$ for $0 \leqslant \phi \leqslant \frac{2\pi}{3}$ radians, giving your answers in terms of π. [4]

9 **(a)** Given that $\int_1^a \left(\frac{1}{x} - \frac{1}{2x+3}\right) \mathrm{d}x = \ln 3$, where $a > 0$, find the exact value of a, giving your answer in simplest surd form. [6]

(b) Find the exact value of $\int_0^{\frac{\pi}{3}} \left(\sin\left(2x + \frac{\pi}{3}\right) - 1 + \cos 2x\right) dx$. [5]

10 **(a)** An arithmetic progression has a second term of 8 and a fourth term of 18. Find the least number of terms for which the sum of this progression is greater than 1560. [6]

(b) A geometric progression has a sum to infinity of 72. The sum of the first 3 terms of this progression is $\frac{333}{8}$.

(i) Find the value of the common ratio. [5]

(ii) Hence find the value of the first term. [1]

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