Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3574984631

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **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.

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

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

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

Formulae for ΔABC

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

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

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

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1 Variables x and y are such that, when $\sqrt[4]{y}$ is plotted against $\frac{1}{x}$, a straight line graph passing through the points (0.5, 9) and (3, 34) is obtained. Find y as a function of x. [4]

$\sqrt[4]{y} = m\left(\frac{1}{x}\right) + C$ $\quad (0.5, 9) \quad , \quad (3, 34)$

$m = \frac{34-9}{3-0.5} = \frac{25}{2.5} = 10$ $\quad \rightarrow \sqrt[4]{y} = 10\left(\frac{1}{x}\right) + C$

Sub $(0.5, 9)$ $\rightarrow 9 = 10(0.5) + C$

$\rightarrow C = 4$

$\rightarrow \sqrt[4]{y} = \frac{10}{x} + 4$

$\rightarrow y = \left(\frac{10}{x} + 4\right)^4$

2 (a) Write $9x^2 - 12x + 5$ in the form $p(x-q)^2 + r$, where p, q and r are constants. [3]

$y = 9x^2 - 12x + 5 \rightarrow \frac{y}{9} = x^2 - \frac{4}{3}x + \frac{5}{9}$ $\quad \left(\frac{4}{3} \div 2\right)^2 = \frac{4}{9}$

$\rightarrow \frac{y}{9} = \underbrace{x^2 - \frac{4}{3}x + \frac{4}{9}} - \frac{4}{9} + \frac{5}{9} \rightarrow \frac{y}{9} = \left(x - \frac{2}{3}\right)^2 + \frac{1}{9}$

$\rightarrow y = 9\left(x - \frac{2}{3}\right)^2 + 1$

(b) Hence write down the coordinates of the minimum point of the curve $y = 9x^2 - 12x + 5$. [1]

Min$\left(\frac{2}{3}, 1\right)$

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3 **DO NOT USE A CALCULATOR IN THIS QUESTION.**

$$p(x) = 15x^3 + 22x^2 - 15x + 2$$

(a) Find the remainder when $p(x)$ is divided by $x+1$. [2]

$R = P(-1) = 15(-1)^3 + 22(-1)^2 - 15(-1) + 2$

$= -15 + 22 + 15 + 2 \rightarrow R = 24$

(b) **(i)** Show that $x+2$ is a factor of $p(x)$. [1]

$R = P(-2) = 15(-2)^3 + 22(-2)^2 - 15(-2) + 2 = -120 + 88 + 30 + 2$

$\rightarrow R = 0$

$\therefore (x+2)$ is a factor of $P(x)$.

(ii) Write $p(x)$ as a product of linear factors. [3]

$$\begin{array}{r|l} & 15x^2 - 8x + 1 \\ \hline x+2 & 15x^3 + 22x^2 - 15x + 2 \\ & 15x^3 + 30x^2 \\ \hline & -8x^2 - 15x + 2 \\ & -8x^2 - 16x \\ \hline & x + 2 \\ & x + 2 \\ \hline & 0 \end{array}$$

$P(x) = (x+2)(15x^2 - 8x + 1)$

$= (x+2)(5x-1)(3x-1)$

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