Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

* 4 9 0 8 4 1 9 3 7 3 *

ADDITIONAL MATHEMATICS **0606/23**

Paper 2 **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 $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

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

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

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

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

1 Solve $|3x-2| = 4+x$. [3]

2 Solve the simultaneous equations.

$$x^2 + 3xy = 4$$
$$2x + 5y = 4$$

[5]

3 Find the values of k for which the equation $x^2 + (k+9)x + 9 = 0$ has two distinct real roots. [4]

4 It is given that $y = \ln(1 + \sin x)$ for $0 < x < \pi$.

(a) Find $\frac{dy}{dx}$. [2]

(b) Find the value of $\frac{dy}{dx}$ when $x = \frac{\pi}{6}$, giving your answer in the form $\frac{1}{\sqrt{a}}$, where a is an integer. [2]

(c) Find the values of x for which $\frac{dy}{dx} = \tan x$. [5]

5 Solve the following simultaneous equations.

$$3^x \times 9^{y-1} = 243$$

$$8 \times 2^{y-\frac{1}{2}} = \frac{2^{2x+1}}{4\sqrt{2}}$$

[5]

6 A 4-digit code is to be formed using 4 different numbers selected from 1, 2, 3, 4, 5, 6, 7, 8 and 9. Find how many different codes can be formed if

(a) there are no restrictions, [1]

(b) only prime numbers are used, [1]

(c) two even numbers are followed by two odd numbers, [2]

(d) the code forms an even number. [2]

7 A curve has equation $y = x\cos x$.

(a) Find $\dfrac{dy}{dx}$. [2]

(b) Find the equation of the normal to the curve at the point where $x = \pi$, giving your answer in the form $y = mx + c$. [4]

(c) Using your answer to **part (a)**, find the exact value of $\int_0^{\frac{\pi}{6}} x \sin x \, dx$. [5]

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

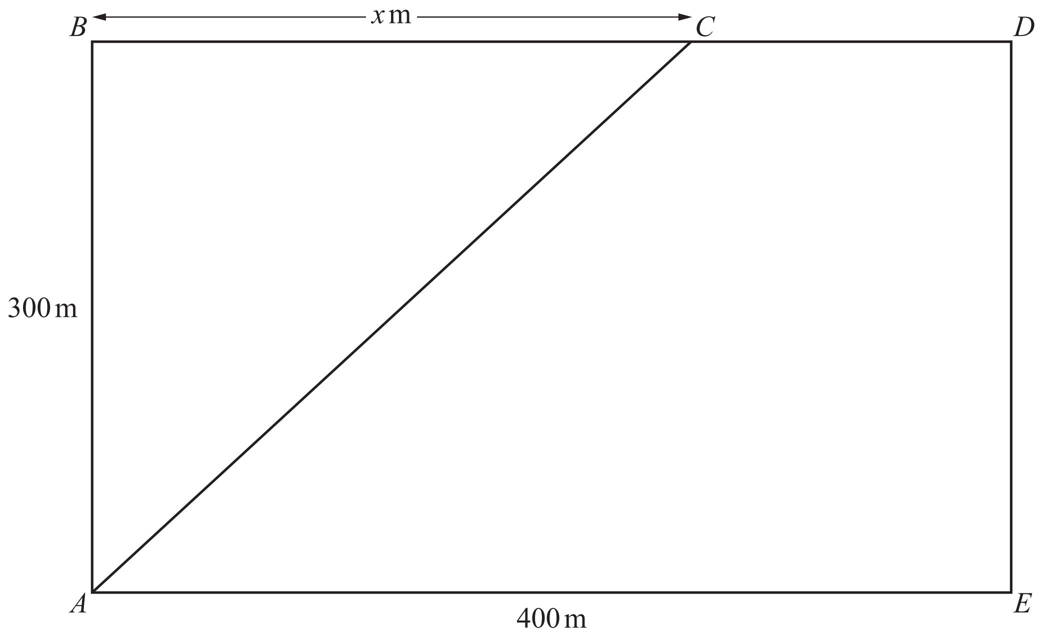
$$\log_2(y+1) = 3 - 2\log_2 x$$
$$\log_2(x+2) = 2 + \log_2 y$$

(a) Show that $x^3 + 6x^2 - 32 = 0$. [4]

(b) Find the roots of $x^3 + 6x^2 - 32 = 0$. [4]

(c) Give a reason why only one root is a valid solution of the logarithmic equations. Find the value of y corresponding to this root. [2]

9



The rectangle $ABCDE$ represents a ploughed field where $AB = 300$ m and $AE = 400$ m. Joseph needs to walk from A to D in the least possible time. He can walk at $0.9\,\text{ms}^{-1}$ on the ploughed field and at $1.5\,\text{ms}^{-1}$ on any part of the path BCD along the edge of the field. He walks from A to C and then from C to D. The distance $BC = x$ m.

(a) Find, in terms of x, the total time, T s, Joseph takes for the journey. [3]

(b) Given that x can vary, find the value of x for which T is a minimum and hence find the minimum value of T. [6]

10 **(a)** The sum of the first 4 terms of an arithmetic progression is 38 and the sum of the next 4 terms is 86. Find the first term and the common difference. [5]

(b) The third term of a geometric progression is 12 and the sixth term is -96. Find the sum of the first 10 terms of this progression. [6]

Question 11 is printed on the next page.

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

Solve the quadratic equation $\left(\sqrt{7}-2\right)x^2-4x+\left(\sqrt{7}+2\right)=0$, giving each of your answers in the form $a+b\sqrt{7}$, where a and b are constants. [7]