Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

ADDITIONAL MATHEMATICS **0606/23**

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.

© UCLES 2020

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

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

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

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

© UCLES 2020

1 **Solutions to this question by accurate drawing will not be accepted.**

Find the equation of the perpendicular bisector of the line joining the points $(4, -7)$ and $(-8, 9)$. [4]

View solution

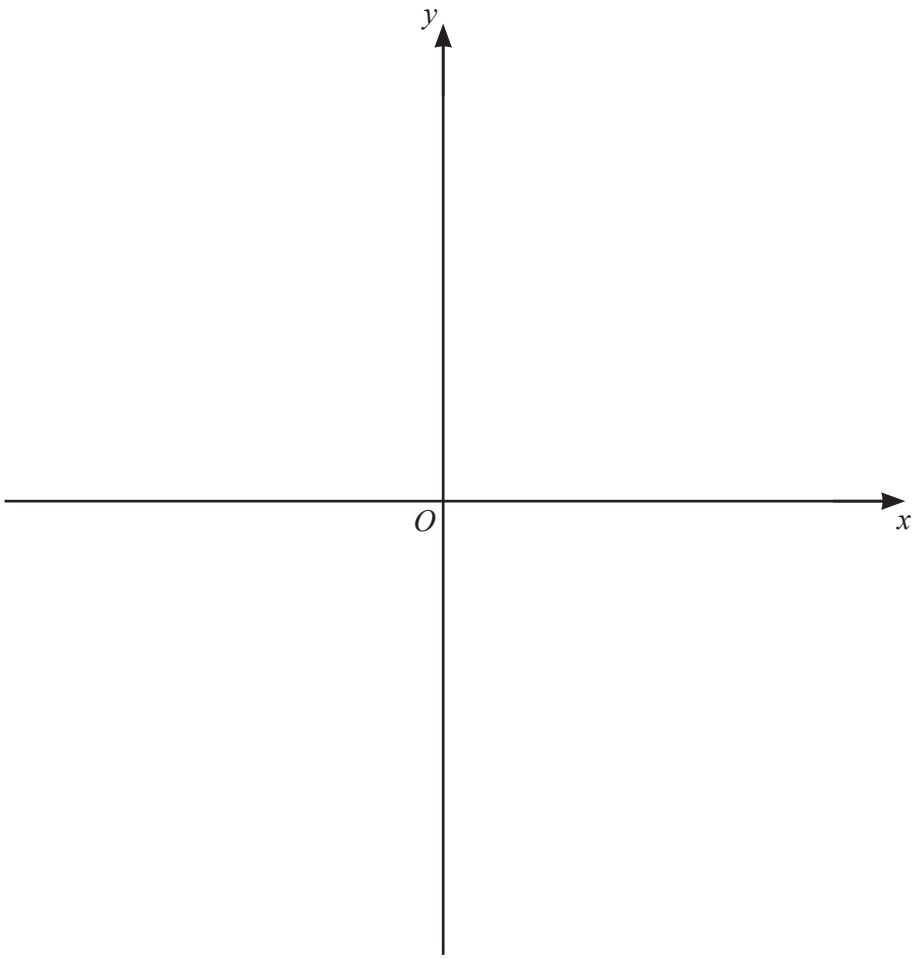
2 Find the set of values of k for which $4x^2 - 4kx + 2k + 3 = 0$ has no real roots. [5]

View solution

© UCLES 2020

3 **(a)** On the axes below, sketch the graph of $y = -(x+2)(x-1)(x-6)$, showing the coordinates of the points where the graph meets the coordinate axes.

View solution



[2]

(b) Hence solve $-(x+2)(x-1)(x-6) \leqslant 0$. [2]

View solution

4 **(a)** **(i)** Find how many different 5-digit numbers can be formed using five of the eight digits 1, 2, 3, 4, 5, 6, 7, 8 if each digit can be used once only. [2]

View solution

(ii) Find how many of these 5-digit numbers are greater than 60 000. [2]

View solution

(b) A team of 3 people is to be selected from 4 men and 5 women. Find the number of different teams that could be selected which include at least 2 women. [2]

View solution

© UCLES 2020

5 DO NOT USE A CALCULATOR IN THIS QUESTION.

(a) Simplify $\dfrac{\sqrt{128}}{\sqrt{72}}$. [2]

View solution

(b) Simplify $\dfrac{1}{1+\sqrt{3}} - \dfrac{\sqrt{3}}{3+2\sqrt{3}}$, giving your answer as a fraction with an integer denominator. [4]

View solution

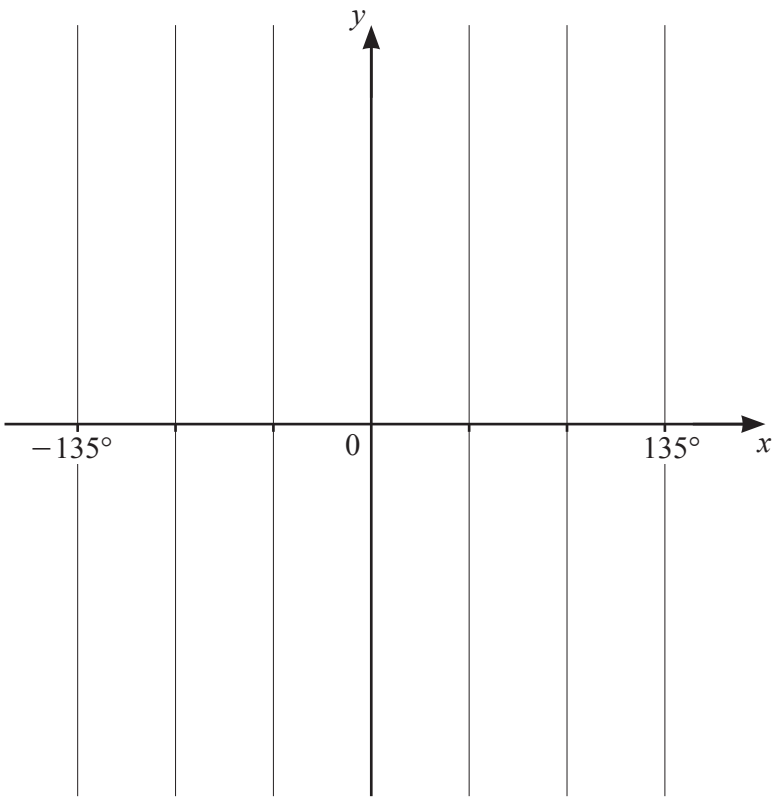
© UCLES 2020

6 **(a)** The curve $y = a\sin bx + c$ has a period of 180°, an amplitude of 20 and passes through the point (90°, −3). Find the value of each of the constants a, b and c. [3]

View solution

(b) The function g is defined, for $-135° \leqslant x \leqslant 135°$, by $g(x) = 3\tan\frac{x}{2} - 4$. Sketch the graph of $y = g(x)$ on the axes below, stating the coordinates of the point where the graph crosses the y-axis. [2]

View solution



7 Variables x and y are connected by the relationship $y = Ax^n$, where A and n are constants.

(a) Transform the relationship $y = Ax^n$ to straight line form. [2]

View solution

When $\ln y$ is plotted against $\ln x$ a straight line graph passing through the points (0, 0.5) and (3.2, 1.7) is obtained.

(b) Find the value of n and of A. [4]

View solution

(c) Find the value of y when $x = 11$. [2]

View solution

© UCLES 2020

8 **(a)** Differentiate $y = \tan(x+4) - 3\sin x$ with respect to x. [2]

View solution

(b) Variables x and y are such that $y = \dfrac{\ln(2x+5)}{2e^{3x}}$. Use differentiation to find the approximate change in y as x increases from 1 to $1 + h$, where h is small. [6]

View solution

© UCLES 2020

9 DO NOT USE A CALCULATOR IN THIS QUESTION.

(a) Find the term independent of x in the binomial expansion of $\left(3x-\frac{1}{x}\right)^6$. [2]

View solution

(b) In the expansion of $\left(1+\frac{x}{2}\right)^n$ the coefficient of x^4 is half the coefficient of x^6. Find the value of the positive constant n. [6]

View solution

© UCLES 2020

10 Solve the equation

(a) $5\sec^2 A + 14\tan A - 8 = 0$ for $0° \leqslant A \leqslant 180°$, [4]

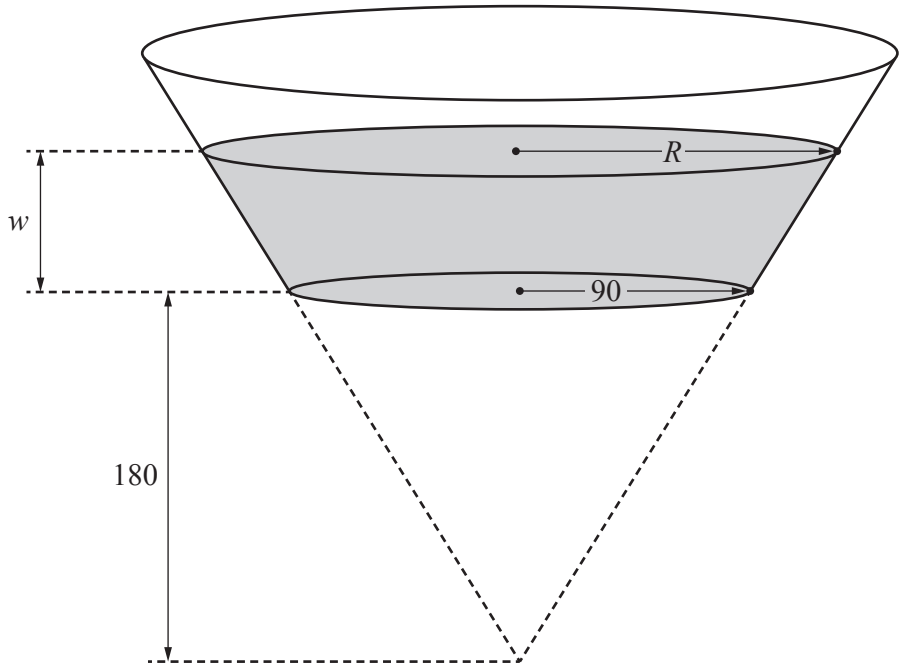
View solution

(b) $5\sin\left(4B - \frac{\pi}{8}\right) + 2 = 0$ for $-\frac{\pi}{4} \leqslant B \leqslant \frac{\pi}{4}$ radians. [4]

View solution

11 In this question all lengths are in centimetres.

The volume, V, of a cone of height h and base radius r is given by $V = \frac{1}{3}\pi r^2 h$.



The diagram shows a large hollow cone from which a smaller cone of height 180 and base radius 90 has been removed. The remainder has been fitted with a circular base of radius 90 to form a container for water. The depth of water in the container is w and the surface of the water is a circle of radius R.

(a) Find an expression for R in terms of w and show that the volume V of the water in the container is given by $V = \frac{\pi}{12}(w+180)^3 - 486000\pi$. [3]

View solution

(b) Water is poured into the container at a rate of 10 000 $cm^3 s^{-1}$. Find the rate at which the depth of the water is increasing when $w = 10$. [4]


View solution

© UCLES 2020

12 **(a)** **(i)** Given that $f(x) = \frac{1}{\cos x}$, show that $f'(x) = \tan x \sec x$. [3]

View solution

(ii) Hence find $\int \left(3 \tan x \sec x - \sqrt[4]{e^{3x}}\right) dx$. [3]

View solution

(b) Given that $\int_2^5 \frac{p}{px+10}\mathrm{d}x = \ln 2$, find the value of the positive constant p. [5]

View solution

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.

© UCLES 2020