Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0123456789

ADDITIONAL MATHEMATICS **4037/01**

Paper 1 **For examination from 2020**

SPECIMEN PAPER **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

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

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

The polynomial $p(x) = 2x^3 - 3x^2 + qx + 56$ has a factor $x - 2$.

(a) Show that $q = -30$. [1]

(b) Factorise $p(x)$ completely and hence state all the solutions of $p(x) = 0$. [4]

2 Variables x and y are related by the equation $y = x\sqrt{x}$.

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

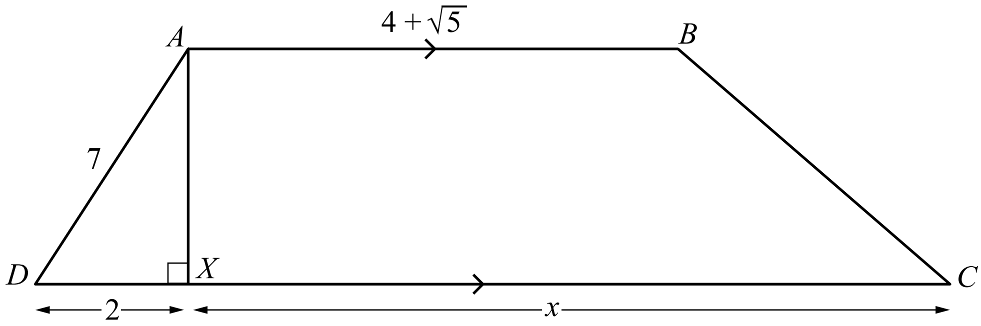
(b) Hence find the approximate change in x when y increases from 8 by the small amount 0.015 . [3]

  [Turn over

3 **(a)** Express $12x^2 - 6x + 5$ in the form $p(x - q)^2 + r$, where p, q and r are constants to be found. [3]

(b) Hence find the greatest value of $(12x^2 - 6x + 5)^{-1}$ and state the value of x at which this occurs. [2]

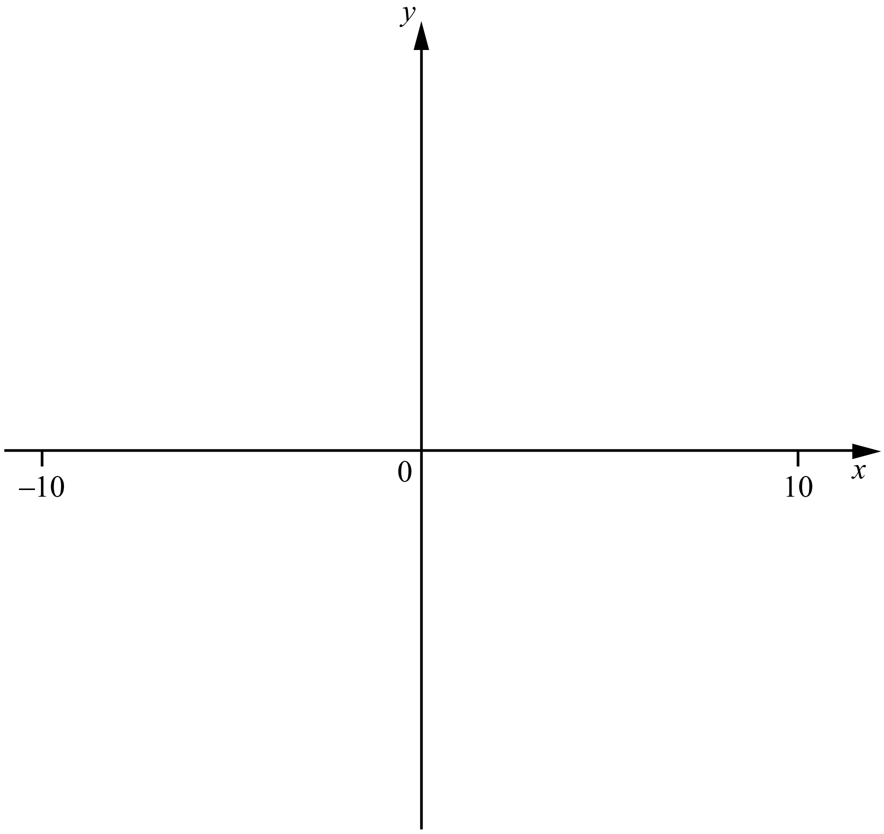
4 DO NOT USE A CALCULATOR IN THIS QUESTION.



The diagram shows a trapezium $ABCD$ in which $AD = 7$ cm and $AB = (4 + \sqrt{5})$ cm. AX is perpendicular to DC with $DX = 2$ cm and $XC = x$ cm.

Given that the area of trapezium $ABCD$ is $15(\sqrt{5} + 2)\,\text{cm}^2$, obtain an expression for x in the form $a + b\sqrt{5}$, where a and b are integers. [6]

5 **(a)** On the axes below, sketch the graph of $y = |2x + 5|$ and the graph of $y = |2 - x|$, stating the coordinates of the points where each graph meets the coordinate axes. [4]

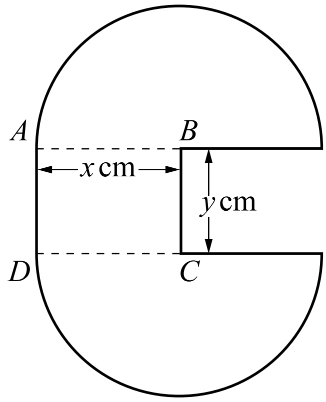


(b) Solve $|2x + 5| \leqslant |2 - x|$. [3]

6 Find the equation of the normal to the curve $y = \dfrac{2x - 1}{\sqrt{x^2 + 5}}$ at the point where $x = 2$.

Give your answer in the form $ax + by = c$, where a, b and c are integers. [8]

7



The diagram shows a badge, made of thin sheet metal, consisting of two semi-circular pieces, centres B and C, each of radius x cm. They are attached to each other by a rectangular piece of thin sheet metal, $ABCD$, such that AB and CD are the radii of the semicircular pieces and $AD = BC = y$ cm.

(a) Given that the area of the badge is $20\,\text{cm}^2$, show that the perimeter, P cm, of the badge is given by

$$P = 2x + \frac{40}{x}.$$ [4]

(b) Given that x can vary, find the minimum value of P, justifying that this value is a minimum. [5]

8 **(a)** Giving your answer in its simplest form, find the exact value of

(i) $\int_{0.2}^{1} e^{5x-1} dx$, [4]

(ii) $\int_{1}^{2} \left(x + \frac{1}{x^2}\right)^2 dx$. [5]

(b) Find $\int \sin \frac{x}{6} dx$. [2]

9 DO NOT USE A CALCULATOR IN THIS QUESTION.

In the expansion of $(1 + 2x)^n$, the coefficeint of x^4 is ten times the coefficient of x^2.

Find the value of the positive integer n. [6]

10 **(a)** An arithmetic progression has a first term of 5 and a common difference of –3.

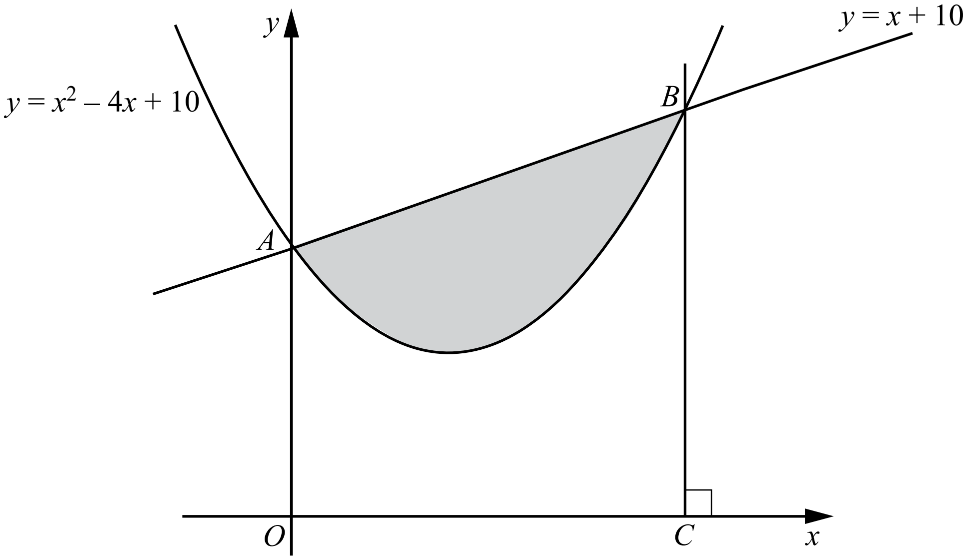
Find the number of terms such that the sum to n terms is first less than –200. [4]

(b) A geometric progression is such that its 3rd term is equal to $\frac{81}{64}$ and its 5th term is equal to $\frac{729}{1024}$.

(i) Find the first term of this progression and the positive common ratio of this progression. [5]

(ii) Hence find the sum to infinity of this progression. [1]

11



The graph of $y = x^2 - 4x + 10$ cuts the y-axis at point A. The graphs of $y = x^2 - 4x + 10$ and $y = x + 10$ intersect one another at the points A and B. The line BC is perpendicular to the x-axis. Calculate the area of the shaded region enclosed by the curve and the line AB. [8]

Continuation of working space for **question 11**.

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