

Level 3 Cambridge Technical in Engineering

05822/05823/05824/05825/05873 Unit 1: Mathematics for engineering

Time allowed: 1 hour 30 minutes

C301/2506

- You must have:**
- the Formula Booklet for Level 3 Cambridge Technical in Engineering (inside this document)
 - a ruler (cm/mm)
 - a scientific calculator



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

Last name

Date of birth

D	D	M	M	Y	Y	Y	Y
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INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Give your final answers to a degree of accuracy that is appropriate to the context.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [].
- This document has **16** pages.

ADVICE

- Read each question carefully before you start your answer.

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1

- (a) Factorise $6x + 2y$.

.....
..... [1]

- (b) Remove the brackets and simplify $4(x + 2) + (5 - x)$.

.....
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..... [2]

- (c) Express as a single fraction $\frac{2x+3}{4} + \frac{x-3}{5}$.

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..... [3]

- (d) Solve the equation $2(4x - 1) = 1 + 2x$.

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..... [3]

2

(a)

- (i) Solve the equation $x^2 - 6x + 7 = 0$. Give your answers correct to 3 significant figures.

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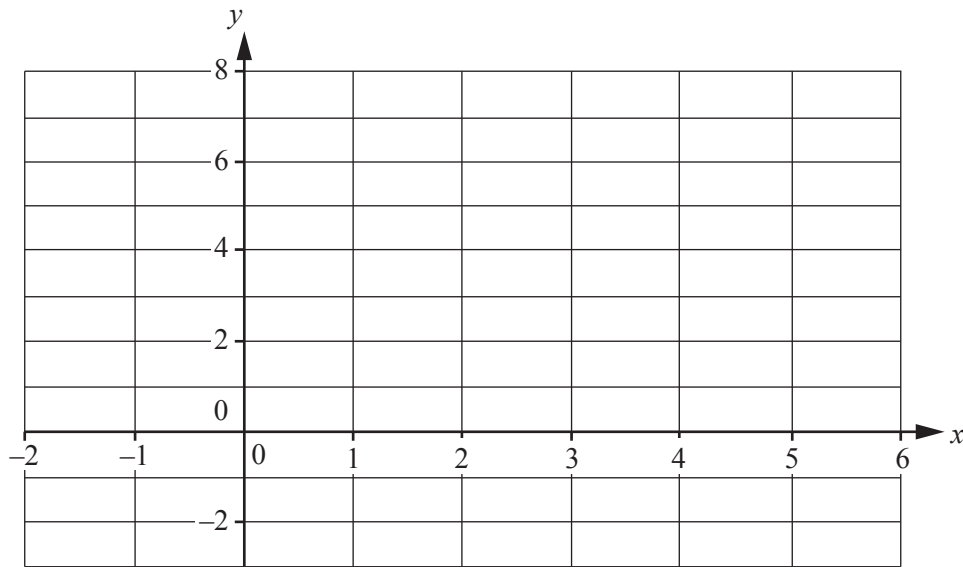
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..... [3]

- (ii) On the grid below, sketch the curve $y = x^2 - 6x + 7$. Indicate the answers to **part (a)(i)** on your sketch with circles.



[2]

- (b) In this question you must show your working.

Two points, A and B, on a coordinate system have coordinates $(-1, 3)$ and $(5, -3)$.

- (i) Determine the midpoint of AB.

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..... [2]

(ii) Determine the equation of the line AB.

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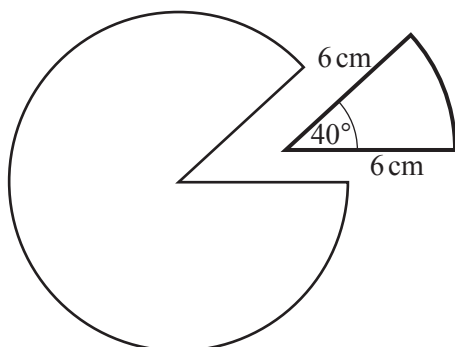
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..... [2]

- Not to scale**

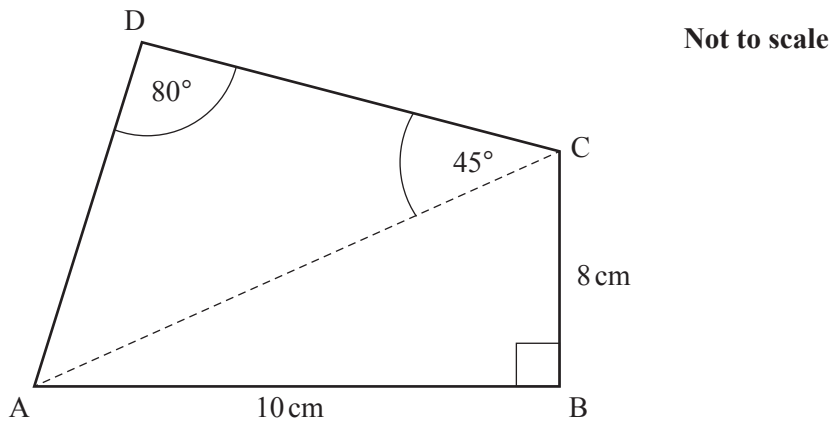


(i) the area of the sector,

[2]

- [3]

- (b)** A piece of wood ABCD is in the shape of a quadrilateral, as shown in the diagram. The angle at B is 90° and the sides AB and BC are 10 cm and 8 cm respectively.



- (i) Calculate the length of the diagonal, AC.

[2]

- (ii)** The angle ACD is 45° and the angle ADC is 80° .

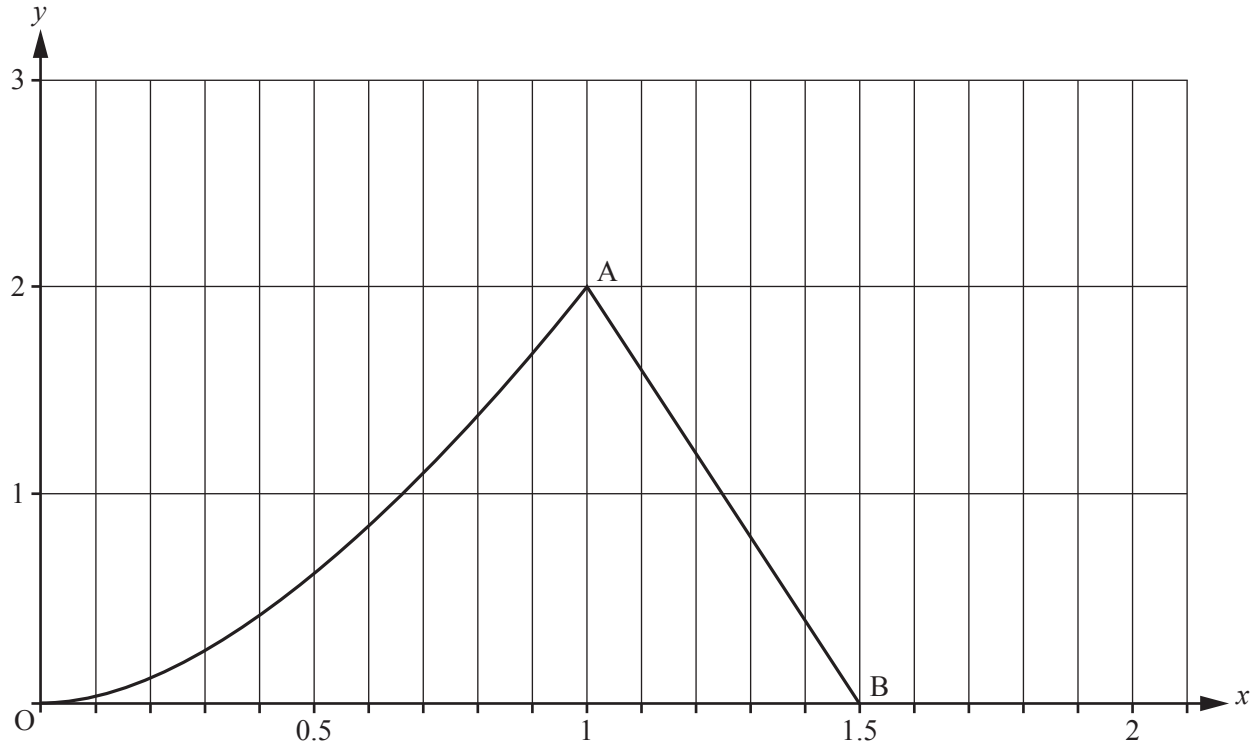
Using the sine rule, calculate the length of AD.

[3]

- 4 The diagram shows the cross section of a flood bank OAB on a coordinate system. O is the origin and A is the point (1, 2) on the curve with equation $y = 3x^2 - x^3$.

The line AB meets the x -axis at B with coordinates (1.5, 0).

The units are metres.



- (a) Using calculus, determine the gradient of the curve at the point A.

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..... [3]

- (b)** Using calculus, calculate the cross-sectional area, OAB, of the flood bank. Give the units of your answer.

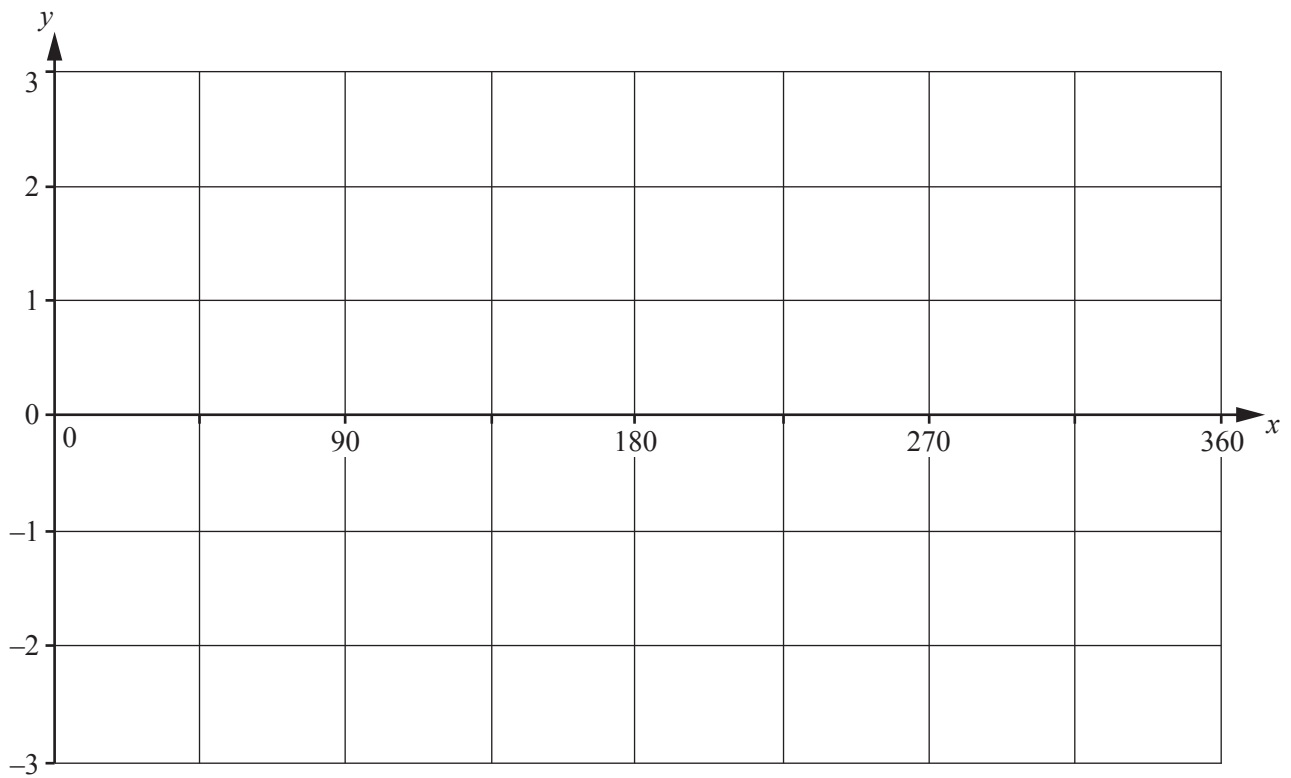
..... [6]

5

(a)

- (i) On the grid below sketch the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$.
Label your graph A.

[2]



- (ii) On the same grid sketch the graph of $y = \cos x + 1$ for $0^\circ \leq x \leq 360^\circ$.
Label your graph B.

[2]

- (b)** A shop has two packs of paintbrushes for sale.

Pack A contains 3 large and 4 small paintbrushes and costs £10.20.

Pack B contains 4 large and 2 small paintbrushes and costs £9.60.

- (i) By writing the cost of a large paintbrush as £ x and a small paintbrush as £ y , form two equations in x and y .

..... [2]

- (ii) Solve the equations to find the cost of a large paintbrush and a small paintbrush.

[4]

6

- (a) Two engineers, Jane and Jack, are given the task to make metal discs which are circular with diameter 55 mm.
A sample of 10 discs is taken from each engineer.

The data for Jane's sample are as follows.

54 54 54 55 55 55 55 56 57 57

Calculate

- (i) the mean of the sample,

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..... [2]

- (ii) the standard deviation of the sample.

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..... [3]

- (iii) The mean and standard deviation for Jack's sample were 55.2 and 1.66 respectively.

State which of the two engineers have produced more consistent discs, giving your reasoning.

.....

..... [1]

- (b) Finley throws two fair dice and notes the numbers showing.

Determine the probability that they both show the same number.

.....

.....

.....

..... [2]

- 7 The voltage across a capacitor in a circuit, which includes a battery (which applies a constant voltage) and a resistor, is given by the formula

$$V = 20(1 - e^{-0.05t})$$

where t is the time in seconds from the moment that voltage is applied.

- (a) Write down the applied voltage.

.....
..... [1]

- (b) Calculate the time when $V = 10$.

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..... [4]

END OF QUESTION PAPER

This image shows a blank sheet of white paper designed for handwriting practice. It features a solid vertical line on the left side, creating a narrow margin. The rest of the page is filled with evenly spaced horizontal dashed lines, providing a guide for letter height and placement. There are no other markings, text, or illustrations on the page.



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