Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9028404839

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **October/November 2023**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

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 may use tracing paper.
- You must show all necessary working clearly.
- 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.
- For π, use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages.

© UCLES 2023

1 **(a)** Idris repairs computers.
This is how he calculates the charge for a repair.

\$56 for the first hour Then \$12.25 for each additional 15 minutes

(i) Work out the amount Idris charges for a repair that takes him 2 hours.

\$ ..... [2]

(ii) Idris charges \$166.25 for another repair.
He starts work on the repair at 2.30 pm.

Find the time when he completes the repair.

..... [3]

(b) Idris invests \$6200 in an account paying compound interest at a rate of 1.7% per year.

Calculate the total amount of interest earned at the end of 4 years.

\$ ..... [3]

© UCLES 2023

(c) The exchange rate between dollars ($) and euros (€) is $1 = €0.84 .

Idris buys some equipment from a website that charges in euros.
The equipment costs €760.
Idris must pay 2.5% tax on this cost.

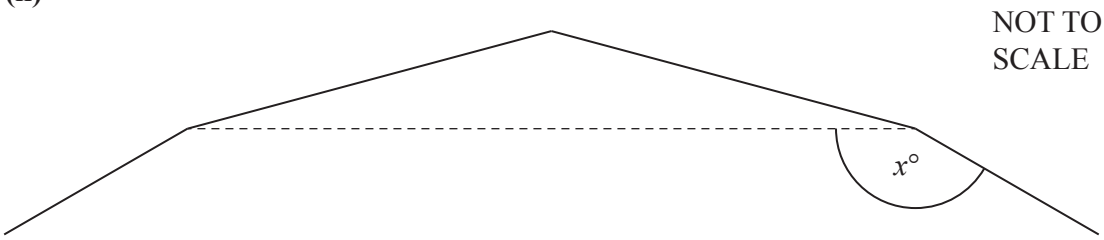
Work out the amount Idris pays for the equipment including tax.
Give your answer in dollars.

$ ..... [3]

2 **(a)** **(i)** Find the size of one interior angle of a regular 15-sided polygon.

..... [2]

(ii)



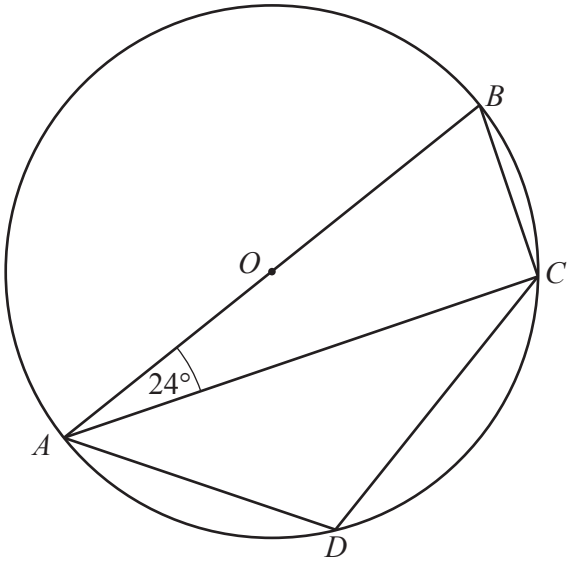
The diagram shows part of a regular 15-sided polygon.

Find the value of x.

$x =$ ..... [2]

© UCLES 2023

(b)



NOT TO SCALE

A, B, C and D are points on the circle, centre O.
AB is a diameter of the circle.
Angle $BAC = 24°$.

Find angle ADC.
Give a reason for each step of your working.

.....

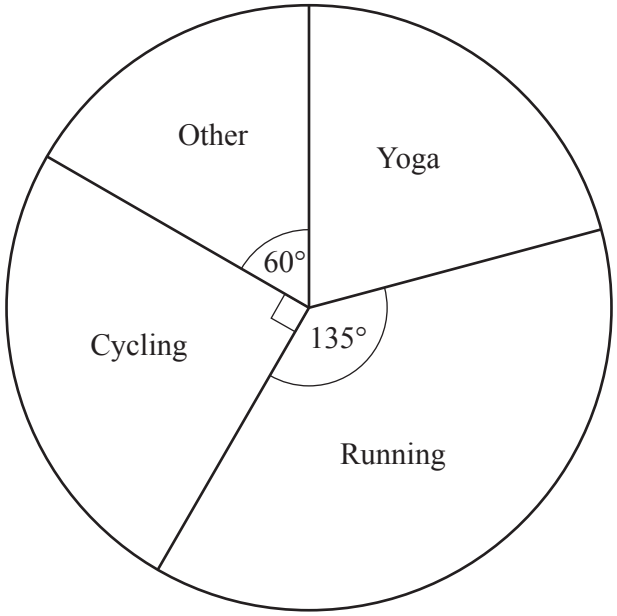
.....

.....

.....

Angle $ADC =$ ..... [4]

3 **(a)** Laila asks a group of people what type of exercise they prefer.
The results are shown in the pie chart.



(i) 90 people prefer running.

Calculate the total number of people Laila asks.

..... [2]

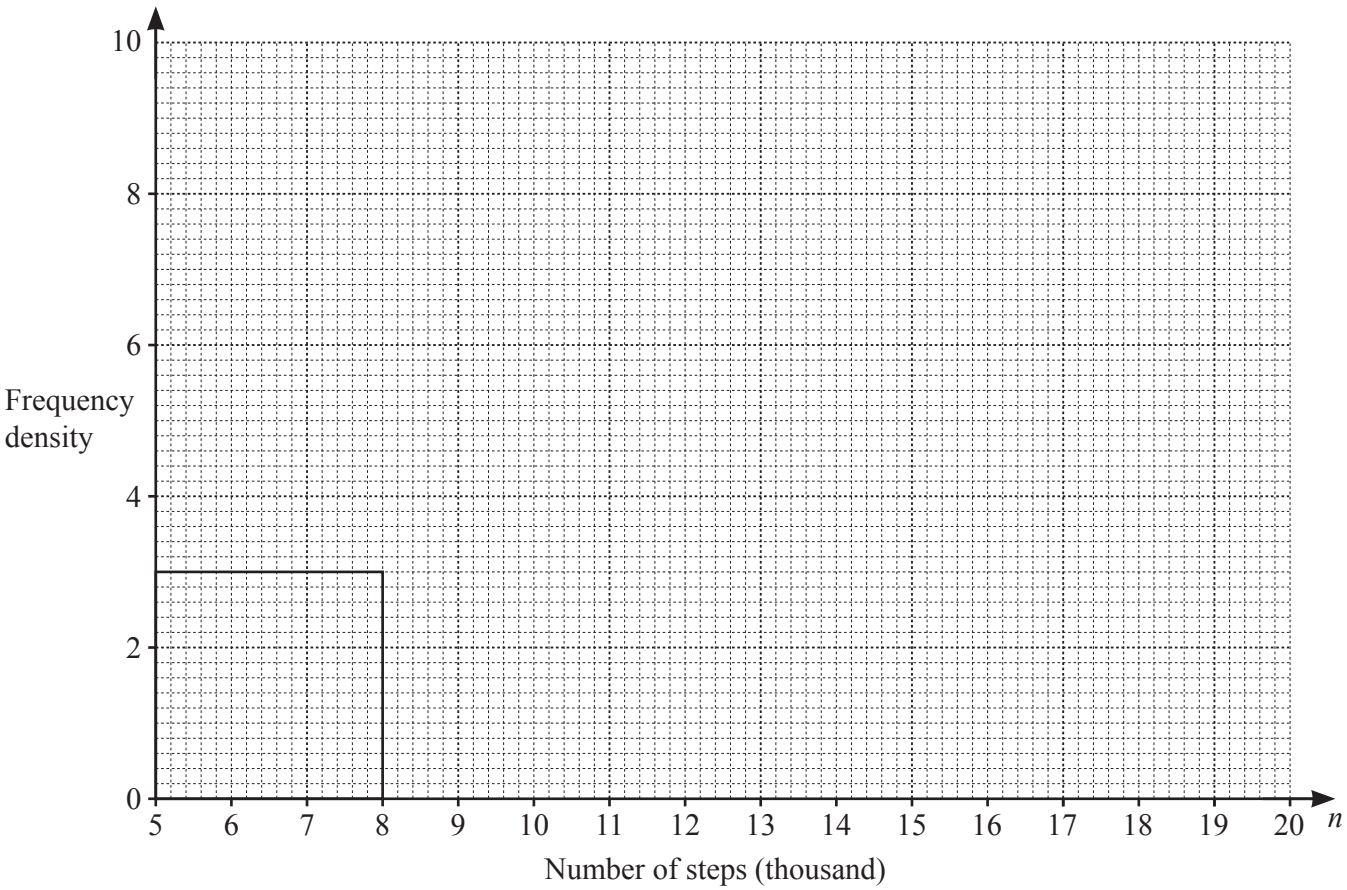
(ii) Work out the fraction of the group who prefer yoga.
Write your answer in its simplest form.

..... [2]

(b) Laila records the number of steps she walks each day for 60 days.
The table shows the results.

Number of steps (n thousand)	$5 < n \leqslant 8$	$8 < n \leqslant 10$	$10 < n \leqslant 12$	$12 < n \leqslant 15$	$15 < n \leqslant 20$
Frequency	9	16	14	15	6

(i) Complete the histogram to represent the data.



[3]

(ii) Laila has a target of 11 000 steps every day.

Find an estimate for the percentage of these 60 days that Laila met her target.

..... % [2]

4 **(a)** Solve.

$5x + 6 = 3x$

$x =$ ..... [2]

(b) The mass of a plum is n grams.
The mass of an apple is twice the mass of the plum.
The mass of a banana is 50 grams more than the mass of the apple.

The total mass of the plum, the apple and the banana is 450 grams.

Form an equation in n and solve it to find the mass of the plum.

..... g [3]

(c) Solve by factorisation.

$x^2 - 4x - 21 = 0$

$x =$ ..... or $x =$ ..... [3]

© UCLES 2023

5 **(a)** A bag contains 40 balls.
28 of the balls are red and the rest are green.
Aisha takes a ball from the bag at random, notes its colour and replaces it.

(i) Find the probability that this ball is green.

..... [1]

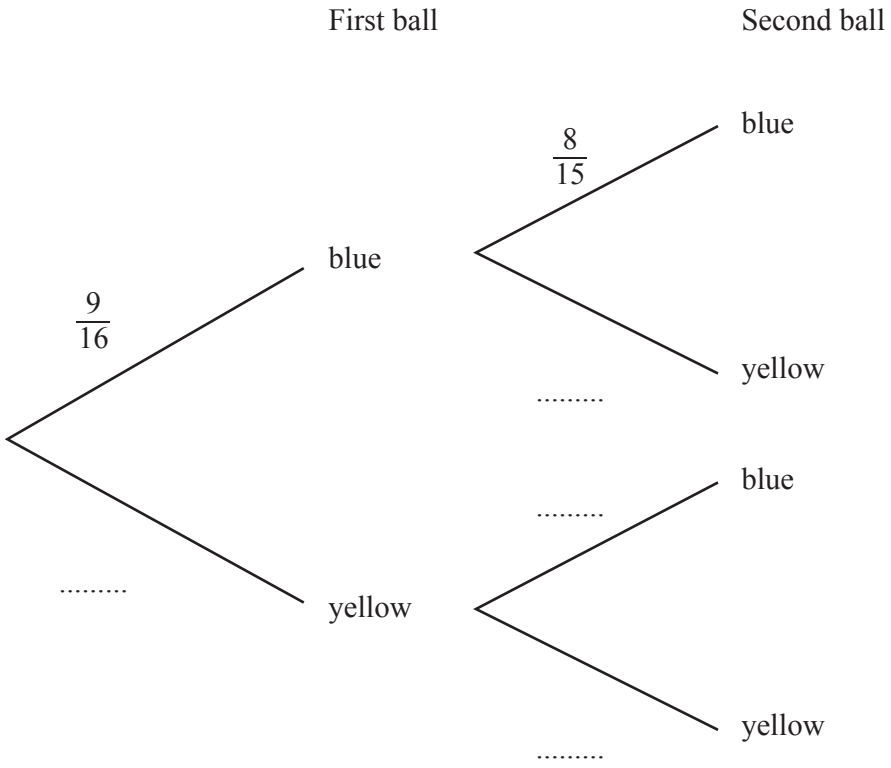
(ii) Aisha repeats this 200 times.

Work out the number of times she expects to take a green ball.

..... [1]

(b) A bag contains 9 blue balls and 7 yellow balls.
Sergio takes two balls from the bag at random without replacement.

(i) Complete the tree diagram.



[2]

(ii) Find the probability that the two balls are the same colour.

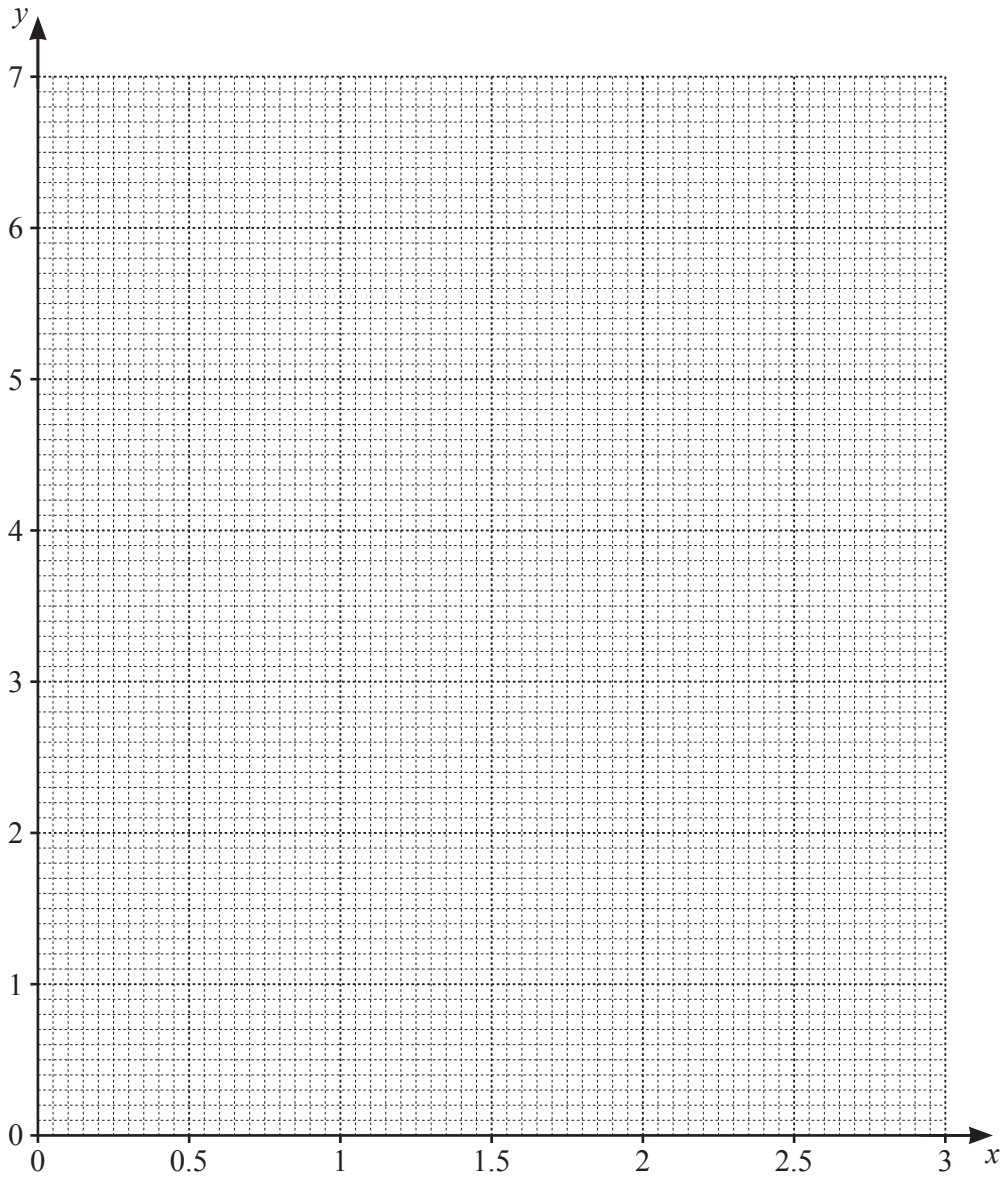
..... [2]

6 **(a)** **(i)** Complete the table for $y = \frac{4^x}{10}$.

x	0	0.5	1	1.5	2	2.5	3
y		0.2	0.4	0.8	1.6	3.2	6.4

[1]

(ii) Draw the graph of $y = \frac{4^x}{10}$ for $0 \leqslant x \leqslant 3$.



[3]

© UCLES 2023

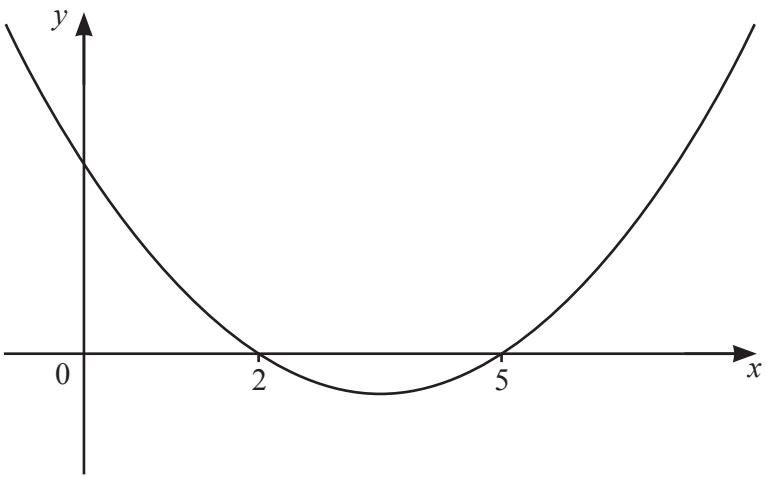
(iii) Use your graph to solve the equation $\frac{4^x}{10} = 5$.

$x =$ ..... [1]

(iv) By drawing a tangent, estimate the gradient of $y = \frac{4^x}{10}$ when $x = 2$.

..... [2]

(b)



NOT TO SCALE

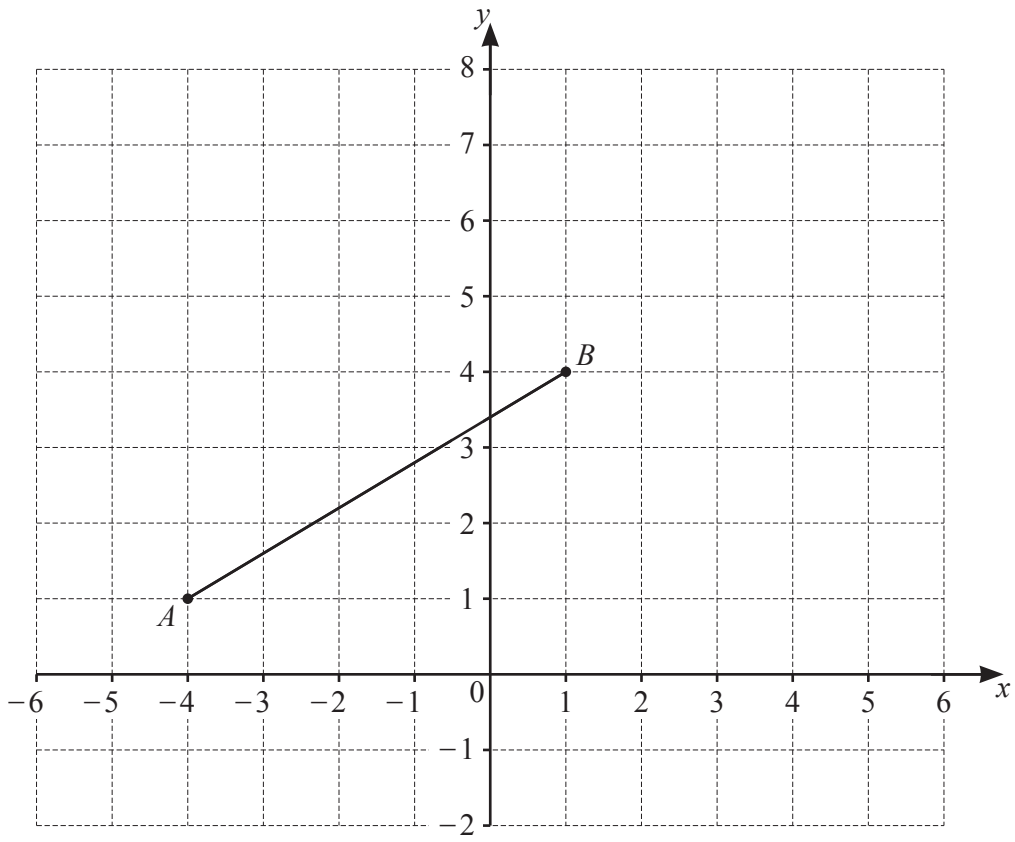
This is a sketch of the graph of $y = x^2 + ax + b$.

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [3]

7 (a)



Point A and point B are shown on a centimetre square grid.

(i) ABC is a triangle.

Here are five possible coordinates for point C.

$(-2, 4)$ $(-2, -1)$ $(-1, -2)$ $(6, 1)$ $(-4, 6)$

Tick (✓) the **two** coordinates from the list that make ABC an isosceles triangle. [2]

(ii) Find the column vector $\overrightarrow{AB}$.

$\overrightarrow{AB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(iii) A is the midpoint of the line DB.

Find $\left|\overrightarrow{DB}\right|$.

$\left|\overrightarrow{DB}\right| =$ ..... [3]

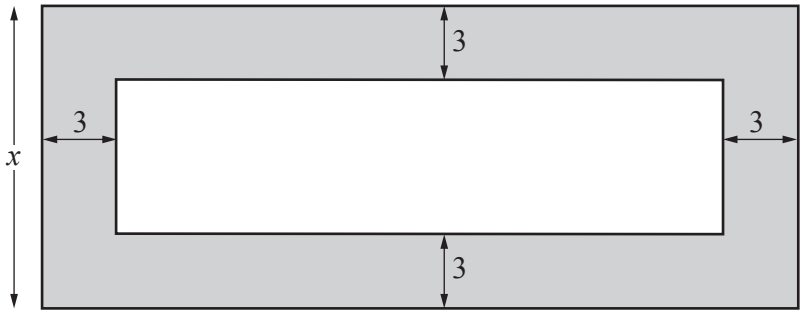
© UCLES 2023

(b) The equation of line P is $y = 4x - 3$.
Line L is perpendicular to line P.
Line L passes through the point (6, 4).

Find the coordinates of the point where line L crosses the x-axis.

(..... , ...) [4]

8



NOT TO SCALE

The diagram shows a small rectangle inside a large rectangle.

The height of the large rectangle is x cm.
The length of the large rectangle is 4 times its height.
The width of the shaded border is 3 cm.

The area of the **small** rectangle is 80 cm^2.

(a) Form an equation in x and show that it simplifies to $2x^2 - 15x - 22 = 0$.

[4]

(b) Solve the equation $2x^2 - 15x - 22 = 0$.
Show your working and give your answers correct to 2 decimal places.

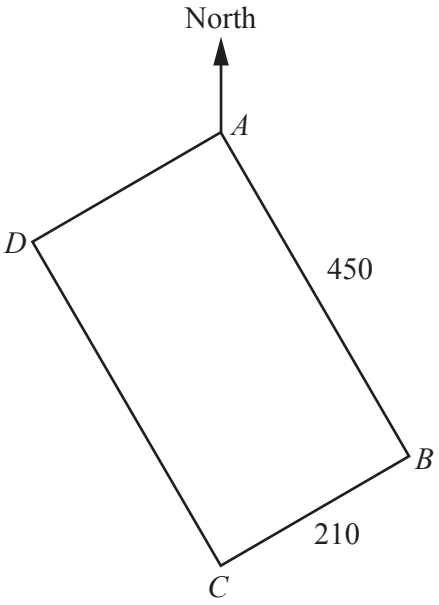
$x =$ ..... or $x =$ ..... [3]

© UCLES 2023

(c) Calculate the shaded area.

..... cm^2 [2]

9 (a)



NOT TO SCALE

ABCD is a rectangular field.
C is due south of *A*.
$AB = 450\,\text{m}$ and $BC = 210\,\text{m}$.

(i) Martha walks at an average speed of 5.2 km/h.

Calculate the time Martha takes to walk once around the perimeter of the field.
Give your answer correct to the nearest minute.

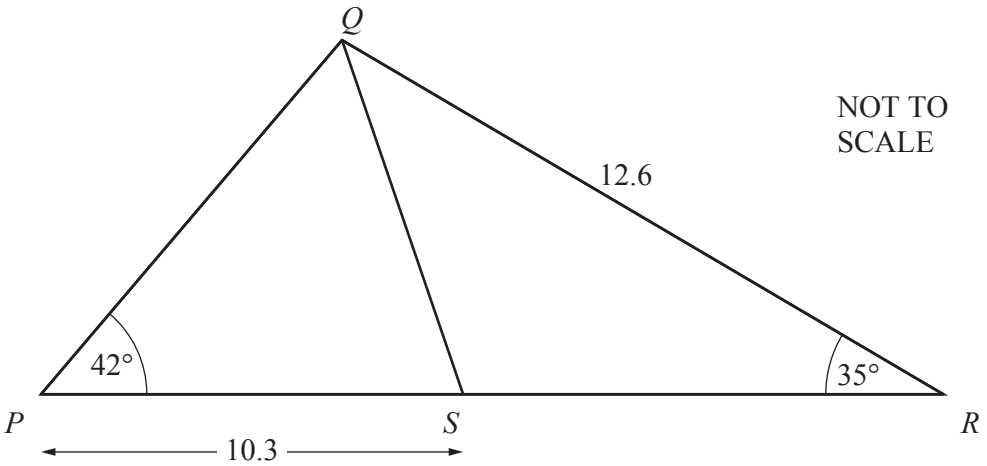
..... minutes [3]

(ii) Show that the bearing of *D* from *A* is 245°, correct to 3 significant figures.

[3]

© UCLES 2023

(b)



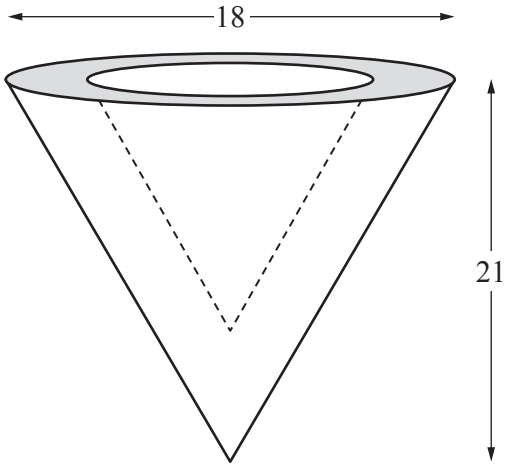
PQR is a triangle and S is a point on PR.
$PS = 10.3\text{cm}$, $QR = 12.6\text{cm}$, $Q\hat{P}S = 42°$ and $Q\hat{R}S = 35°$.

Calculate QS.

..... cm [5]

10 (a) **[Volume of a cone $= \frac{1}{3}\pi r^2 h$]**

[Curved surface area of a cone $= \pi rl$]



A solid is formed from a large cone with a small cone removed from the centre.
The small cone is mathematically similar to the large cone.
The vertex of the large cone is vertically below the vertex of the small cone.

The height of the large cone is 21 cm and the diameter of the top is 18 cm.
The height of the small cone is 14 cm.

(i) Show that the volume of the solid is $399\pi\,\text{cm}^3$.

[3]

(ii) Calculate the total surface area of the solid.

..... cm^2 [6]

(b) The height of a cylinder is 13 cm, correct to the nearest centimetre.
The radius of the base of the cylinder is 4.5 cm, correct to the nearest 0.1 centimetre.

Calculate the upper bound of the volume, in cm^3, of the cylinder.

..... cm^3 [3]

Question 11 is printed on the next page.

11 $f(x) = 4x + 1 \qquad g(x) = 2x - 3$

(a) Find $f(-3)$.

..... [1]

(b) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(c) Simplify $\dfrac{2}{f(x)} + \dfrac{1}{g(x)}$.

Give your answer as a single fraction, in terms of x, in its simplest form.

..... [3]

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2023