



Cambridge O Level

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--



MATHEMATICS (SYLLABUS D)

4024/21

Paper 2

May/June 2020

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. Blank pages are indicated.

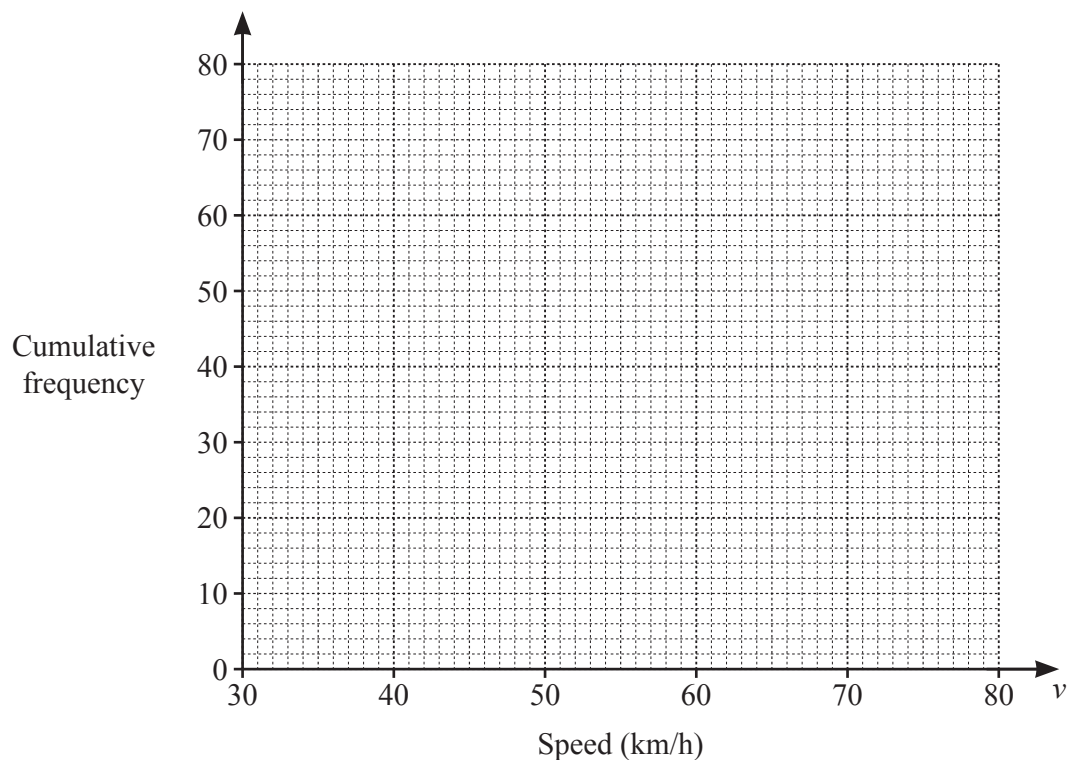
- 1 The speeds, v km/h, of 80 vehicles travelling along a road were recorded. The results are shown in the table.

Speed (v km/h)	Frequency
$30 < v \leq 40$	10
$40 < v \leq 50$	18
$50 < v \leq 60$	27
$60 < v \leq 70$	19
$70 < v \leq 80$	6

- (a) Calculate an estimate of the mean speed of the vehicles.

..... km/h [3]

- (b) Draw the cumulative frequency diagram.



[3]

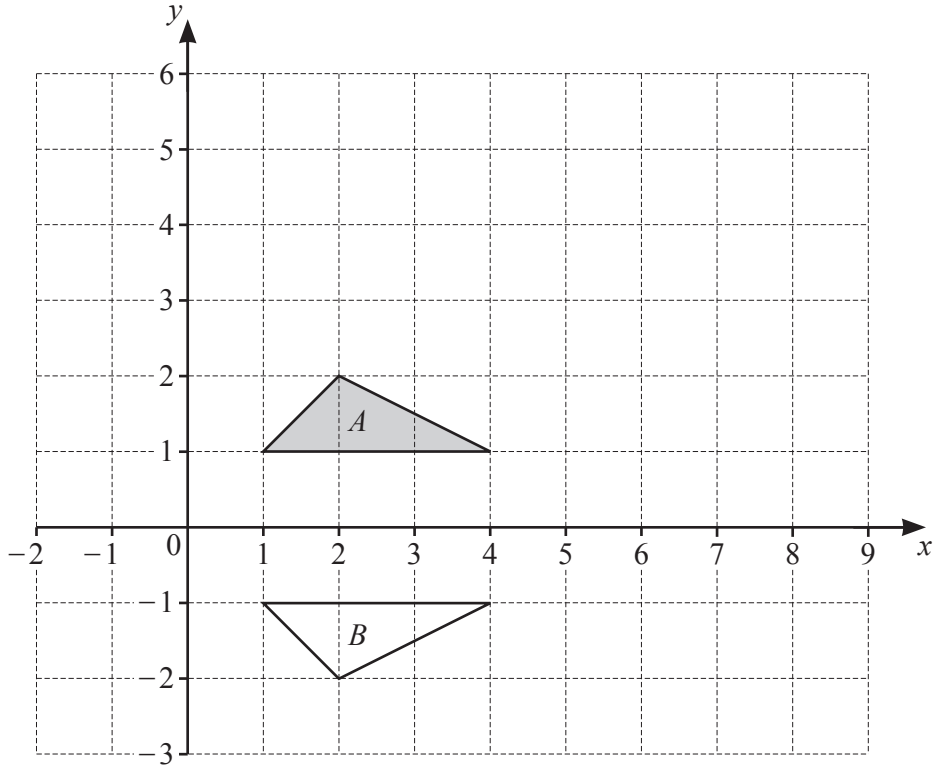
(c) Use your cumulative frequency diagram to find an estimate for

(i) the median,

..... km/h [1]

(ii) the interquartile range.

..... km/h [2]



(a) Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

..... [2]

(b) Triangle *A* is mapped onto triangle *C* by a rotation 90° anticlockwise about $(1, 1)$.

Draw triangle *C*. [2]

(c) Triangle *A* is mapped onto triangle *D* by the **single** transformation *P*.

The matrix representing *P* is $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.

Describe fully the **single** transformation *P*.

..... [3]

- 3 (a) Rearrange $m = 4n - 3$ to make n the subject.

$$n = \dots\dots\dots [2]$$

- (b) Solve these simultaneous equations.
Show your working.

$$\begin{aligned} 10x + 7y &= -3 \\ 5x - y &= 3 \end{aligned}$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [3]$$

- (c) Solve the equation $5x^2 + 3x - 1 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- 4 Anton invests \$6000 in an account for 5 years.
The account has a compound interest rate of 2.5% per year.
At the end of 5 years, he spends \$4200 of this money on a family holiday to Malaysia.

(a) How much money is left in the account?

\$ [3]

- (b) Anton changes \$800 into Malaysian Ringgits (MYR) for his trip.
The exchange rate is \$1 = 3.16 MYR.
He spends 2250 MYR and then changes the remaining money back into dollars (\$).
The exchange rate on his return is \$1 = 3.27 MYR.

How many dollars does he receive on his return?
Give your answer correct to the nearest dollar.

\$ [3]

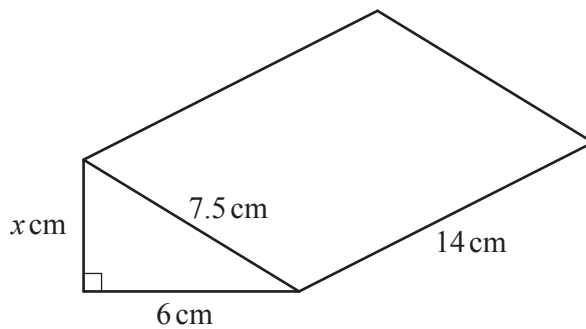
- (c) Anton invests \$1500 in another account.
The account has a compound interest rate of $p\%$ per year.
At the end of 3 years, there is \$1598.85 in the account.

Calculate p .

Give your answer correct to 2 decimal places.

$p = \dots\dots\dots$ [3]

- 5 A company makes and packages chocolate bars.



This box contains a chocolate bar.
The box is in the shape of a triangular prism.

- (a) Show that $x = 4.5$.

[2]

- (b) These boxes are packed into cartons.
Each carton is a cuboid with internal dimensions 30 cm by 28 cm by h cm.
80 boxes fill one carton exactly.

- (i) Calculate the value of h .

$$h = \dots\dots\dots [3]$$

- (ii) One day, the company packs 37 500 of these boxes into cartons.

How many complete cartons are packed that day?

..... [2]

(c) The company sells the chocolate bars to shops for \$0.70 each bar.

(i) The company makes 40% profit on each bar it sells.

Work out the cost to the company of producing each bar.

\$ [2]

(ii) A shop buys one carton of chocolate bars.

- They sell $\frac{3}{5}$ of the bars at a profit of 30% .
- They sell each of the remaining bars at \$0.84 .

Calculate the overall percentage profit made by the shop from selling all 80 bars.

..... % [5]

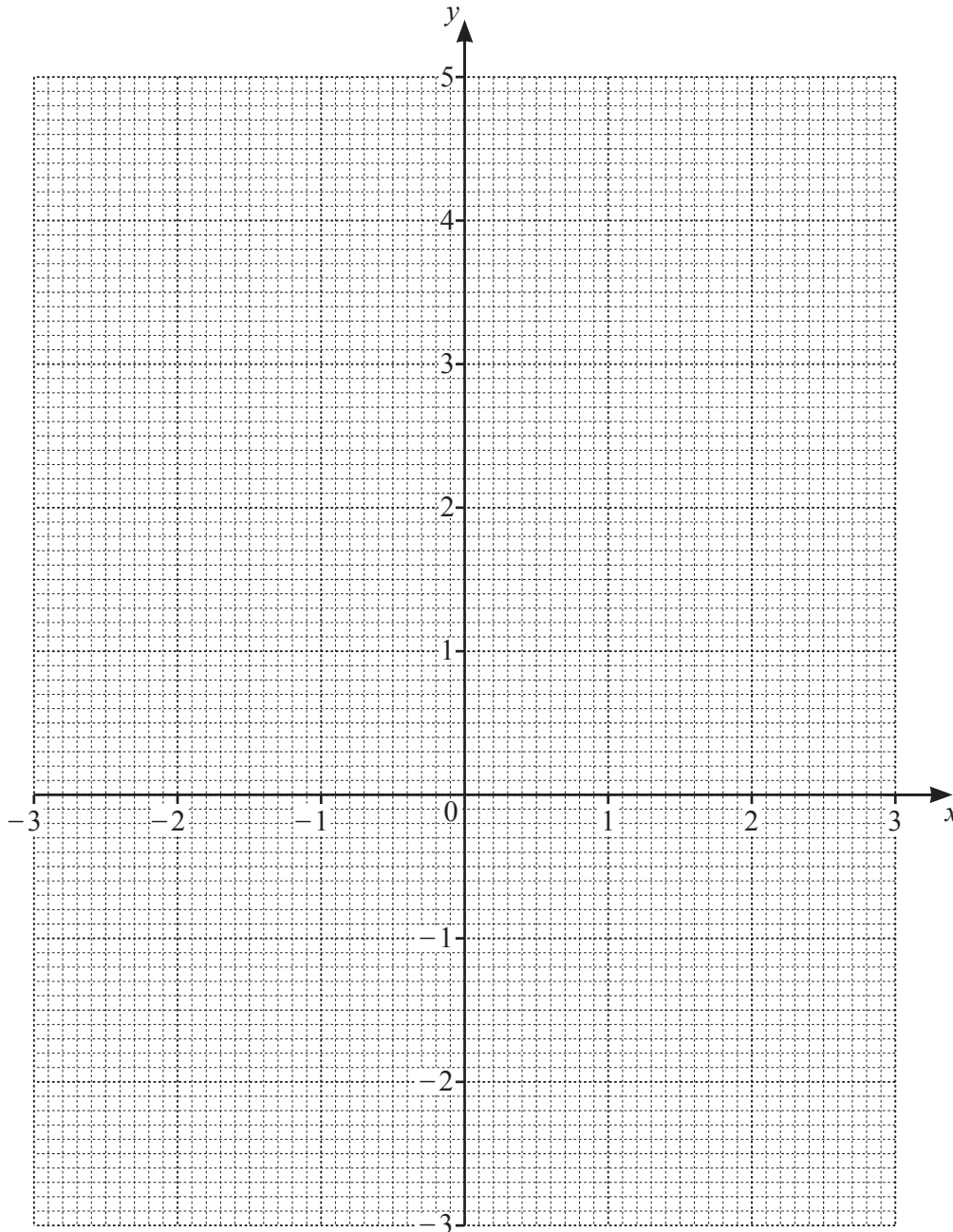
- 6 (a) The table shows some values for $y = \frac{x^3}{4} - x + 1$.

x	-3	-2	-1	0	1	2	3
y	-2.75	1	1.75	1	0.25	1	

(i) Complete the table.

[1]

- (ii) Draw the graph of $y = \frac{x^3}{4} - x + 1$ for $-3 \leq x \leq 3$.



[3]

(iii) (a) On the same grid, draw the graph of $y = \frac{1}{3}x + 1$. [2]

(b) Use your graph to find all the values of x where $y = \frac{1}{3}x + 1$ crosses $y = \frac{x^3}{4} - x + 1$.
..... [2]

(c) The values of x where $y = \frac{1}{3}x + 1$ crosses $y = \frac{x^3}{4} - x + 1$ are the solutions of the equation $Ax^3 = Bx$.

Given that A and B are integers, find A and B .

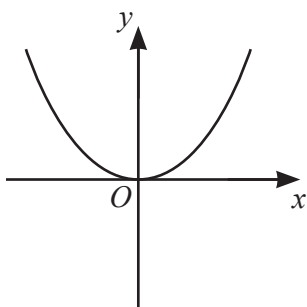
$A = \dots\dots\dots B = \dots\dots\dots$ [2]

(b) Here are four equations.

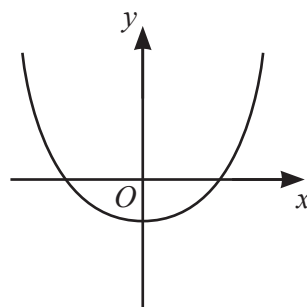
$y = x^2 - 2x$ $y = 2x^2 - 2$ $y = x^2 + 2x$ $y = 2x^2$

The graphs of three of these equations are sketched below.

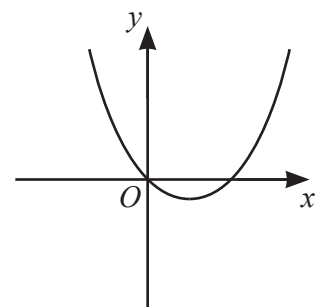
Write the correct equation below each graph.



.....

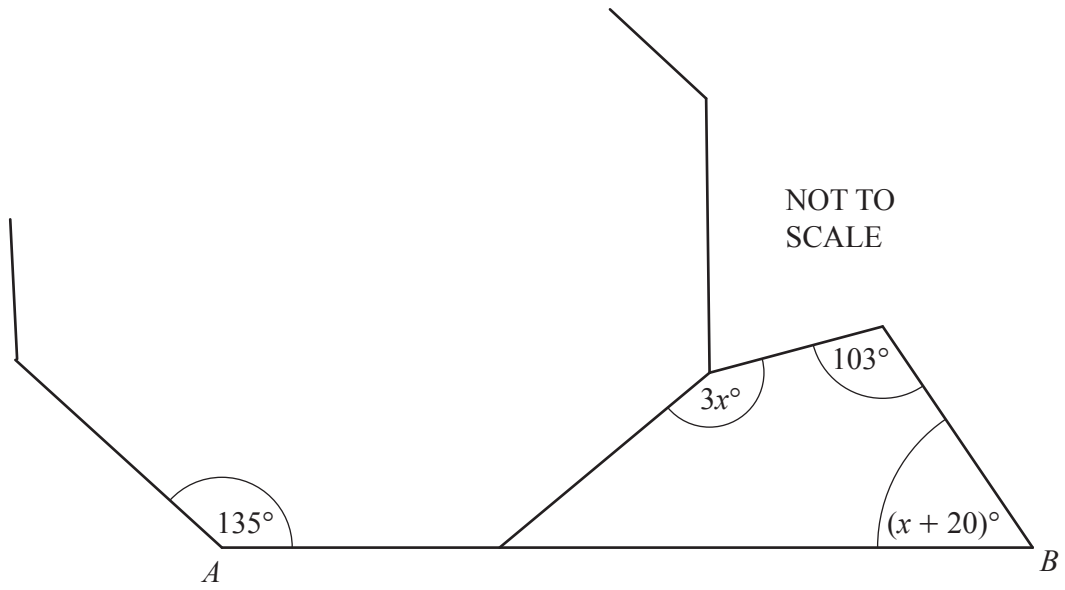


.....



..... [2]

7 (a)

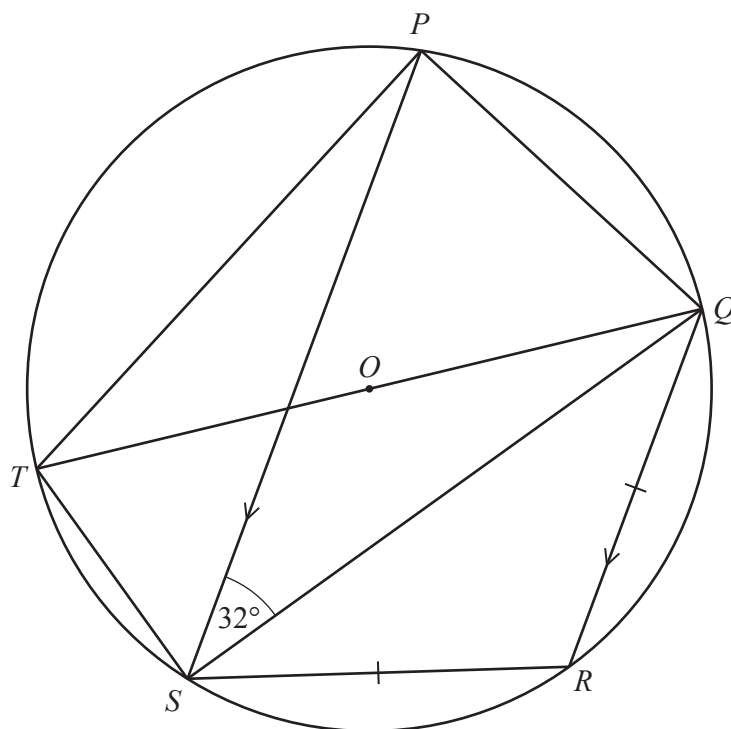


The diagram shows a quadrilateral and part of a regular octagon.
 AB is a straight line.

Form an equation in x and solve it to find x .

$x = \dots\dots\dots [3]$

(b)



NOT TO SCALE

P, Q, R, S and T are points on the circumference of a circle, centre O .
 $\widehat{PSQ} = 32^\circ$ and O lies on TQ .
 PS is parallel to QR and $QR = RS$.

- (i) Find \widehat{PQT} .
Give a reason for each step of your working.

.....

$\widehat{PQT} = \dots\dots\dots [3]$

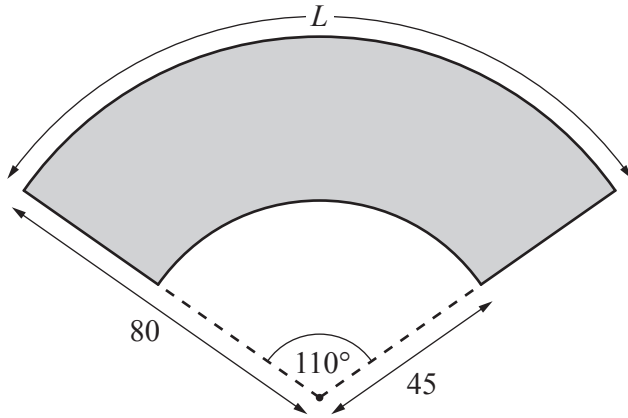
- (ii) Find \widehat{QRS} .

$\widehat{QRS} = \dots\dots\dots [2]$

- (iii) Find \widehat{TQS} .

$\widehat{TQS} = \dots\dots\dots [1]$

8 (a)



NOT TO SCALE

A display notice is made by removing a sector of a circle from a larger sector. Both sectors have an angle of 110° . The radii of the sectors are 80 cm and 45 cm.

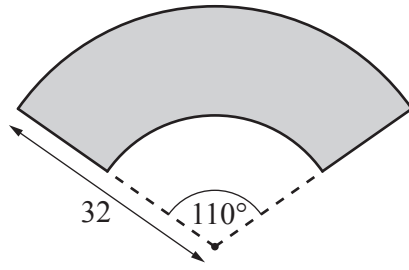
(i) Calculate arc length L .

$L = \dots\dots\dots$ cm [2]

(ii) Calculate the area of this display notice.

$\dots\dots\dots$ cm^2 [3]

(b)



NOT TO
SCALE

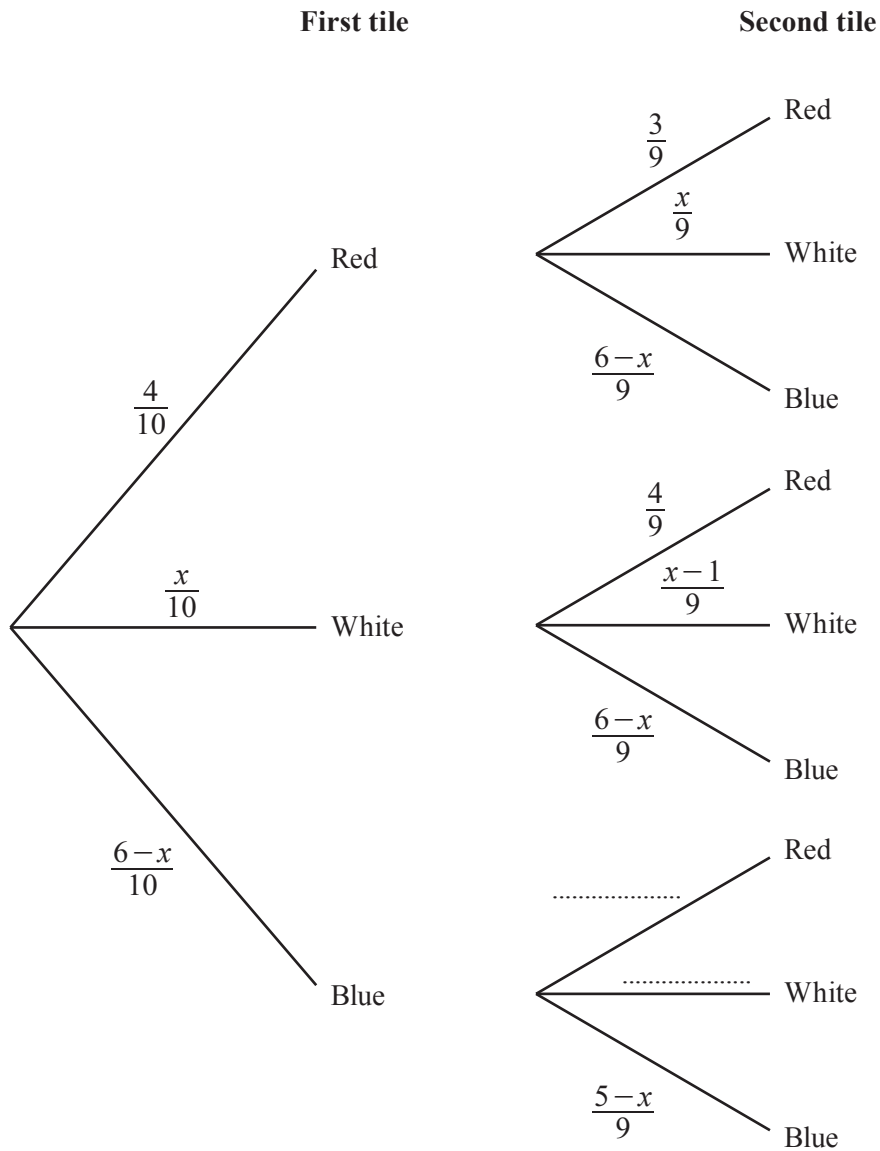
This diagram shows a display notice mathematically similar to the one in **part (a)**.
The radius of the larger sector is 32 cm.

Calculate the area of this display notice.

..... cm² [2]

- 9 A bag contains 10 tiles.
There are 4 red tiles, x white tiles and the rest are blue.
Two tiles are taken at random, without replacement, from the bag.

(a) Complete the tree diagram.



[2]

- (b) Calculate the probability that both the tiles are red.

..... [1]

- (c) (i) Show that the probability that the tiles are both the same colour is $\frac{x^2 - 6x + 21}{45}$.

[4]

- (ii) The probability the tiles are both the same colour is $\frac{16}{45}$.

Show that $x^2 - 6x + 5 = 0$.

[1]

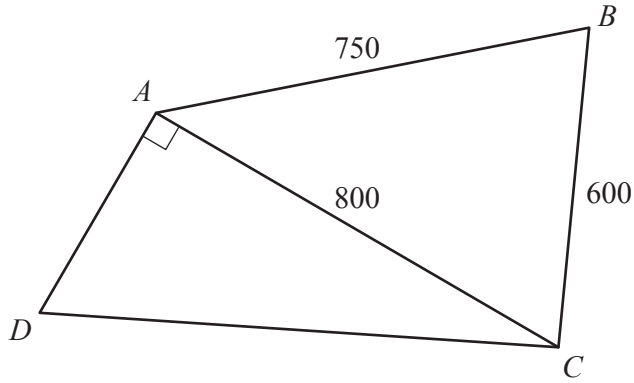
- (iii) Solve $x^2 - 6x + 5 = 0$.

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [2]$$

- (iv) There are more red tiles than white tiles in the bag.

Find the probability that the first tile taken from the bag is blue.

..... [2]



NOT TO
SCALE

$ABCD$ is a field with $AB = 750$ m and $BC = 600$ m.
Inside the field is a straight path, AC , of length 800 m and $\hat{DAC} = 90^\circ$.

(a) Show that $\hat{ACB} = 62.9^\circ$, correct to 1 decimal place.

[3]

(b) The area of the field is $375\,000\text{ m}^2$.

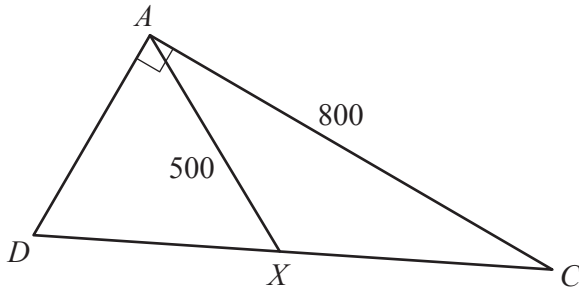
Calculate AD .

$AD = \dots\dots\dots$ m [4]

(c) Calculate $\hat{A}CD$.

$\hat{A}CD = \dots\dots\dots$ [2]

(d) X is a point on DC and $AX = 500$ m.



NOT TO SCALE

Calculate the obtuse angle $\hat{A}XC$.

$\hat{A}XC = \dots\dots\dots$ [4]

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.