Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

5771040124

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.

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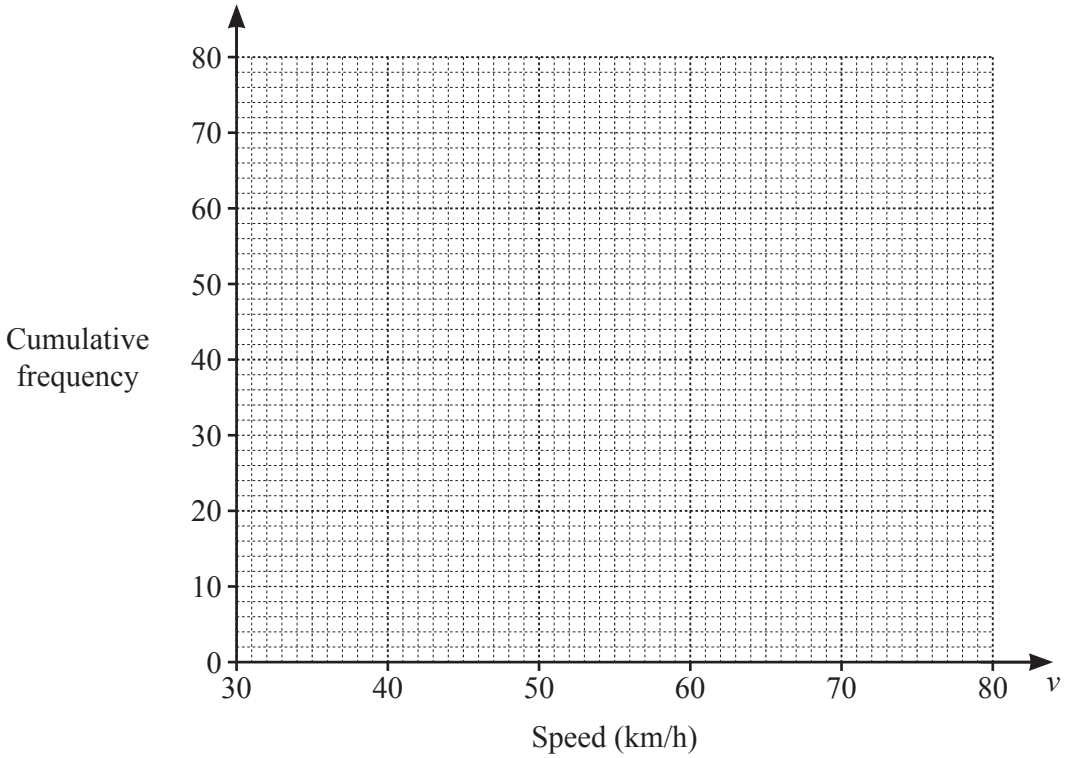
1 The speeds, v km/h, of 80 vehicles travelling along a road were recorded.
The results are shown in the table.

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

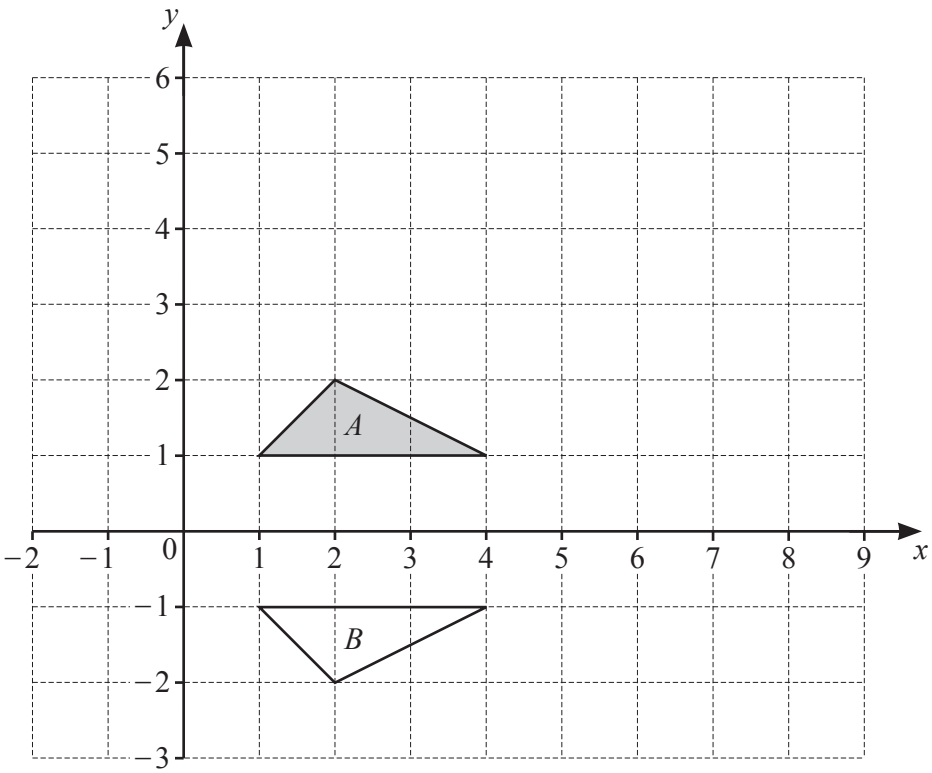
(i) the median,

..... km/h [1]

(ii) the interquartile range.

..... km/h [2]

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.

$n =$ ..... [2]

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

$$10x + 7y = -3$$
$$5x - y = 3$$

$x =$ .....

$y =$ ..... [3]

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

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

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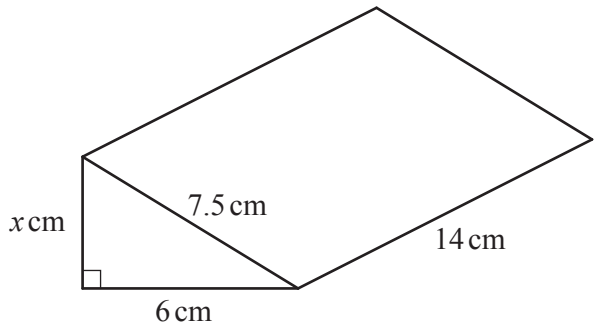
(c) Anton invests \$1500 in another account.
The account has a compound interest rate of p% per year.
At the end of 3 years, there is \$1598.85 in the account.

Calculate p.
Give your answer correct to 2 decimal places.

$p =$ ..... [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.

$h =$ ..... [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.

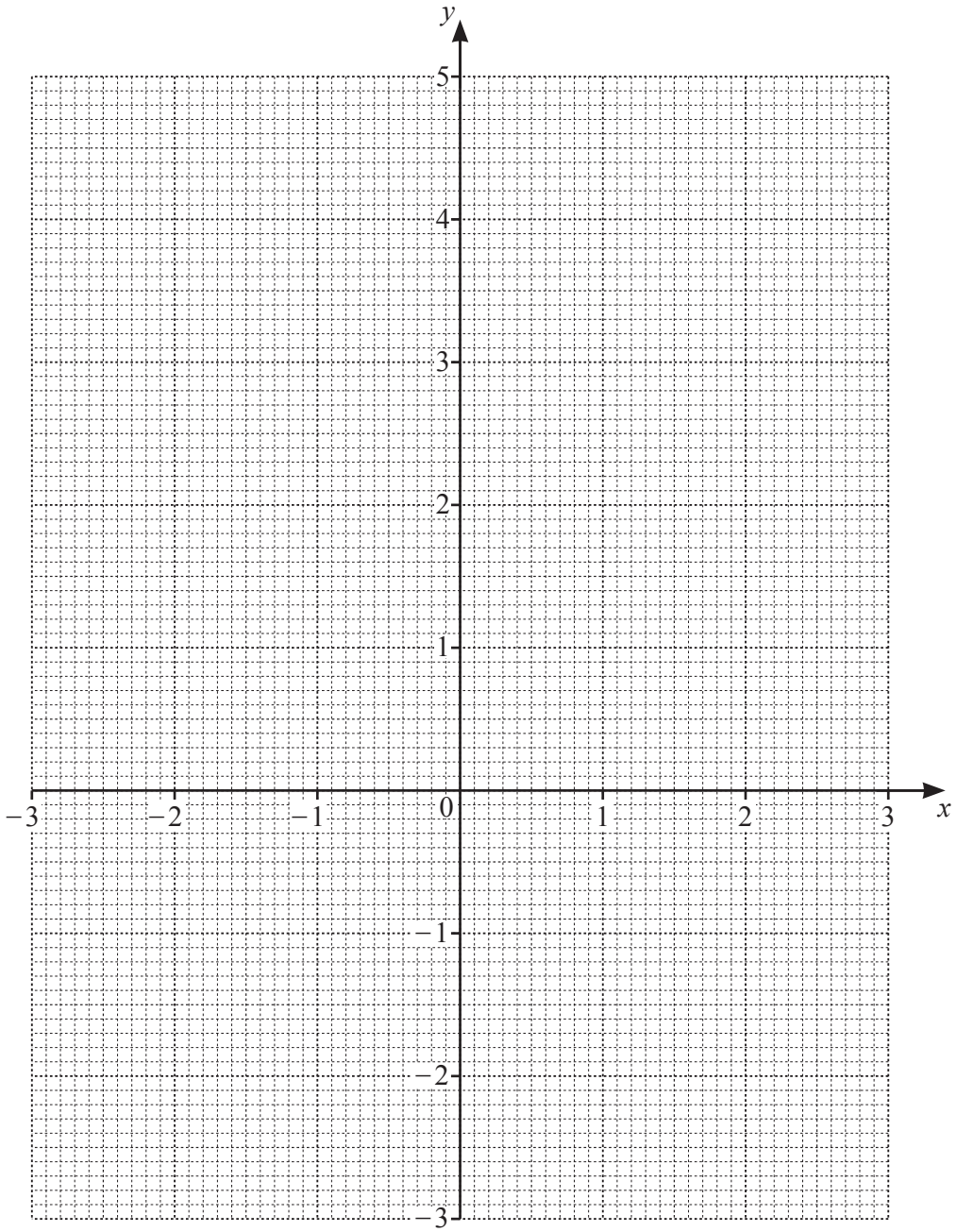
..... % [5]

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 $-3 \leqslant x \leqslant 3$.



[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.

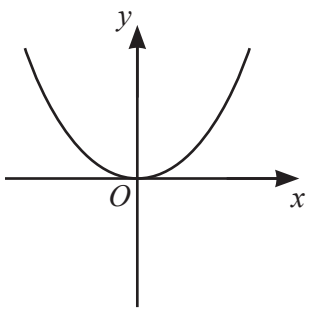
$A =$ ..... $B =$ ..... [2]

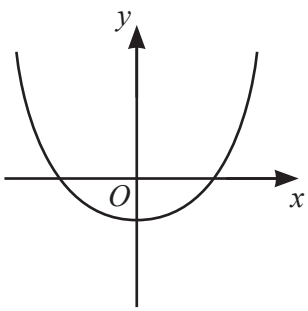
(b) Here are four equations.

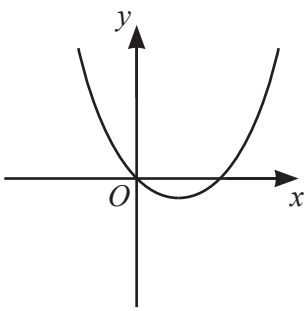
$y = x^2 - 2x$ $\quad$ $y = 2x^2 - 2$ $\quad$ $y = x^2 + 2x$ $\quad$ $y = 2x^2$

The graphs of three of these equations are sketched below.

Write the correct equation below each graph.

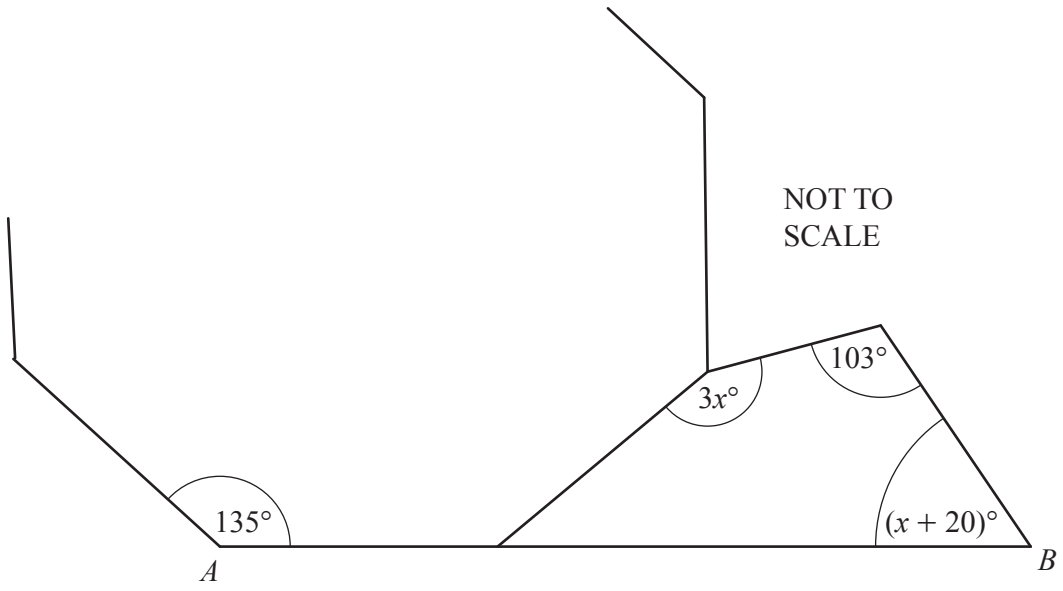






.... [2]

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.

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

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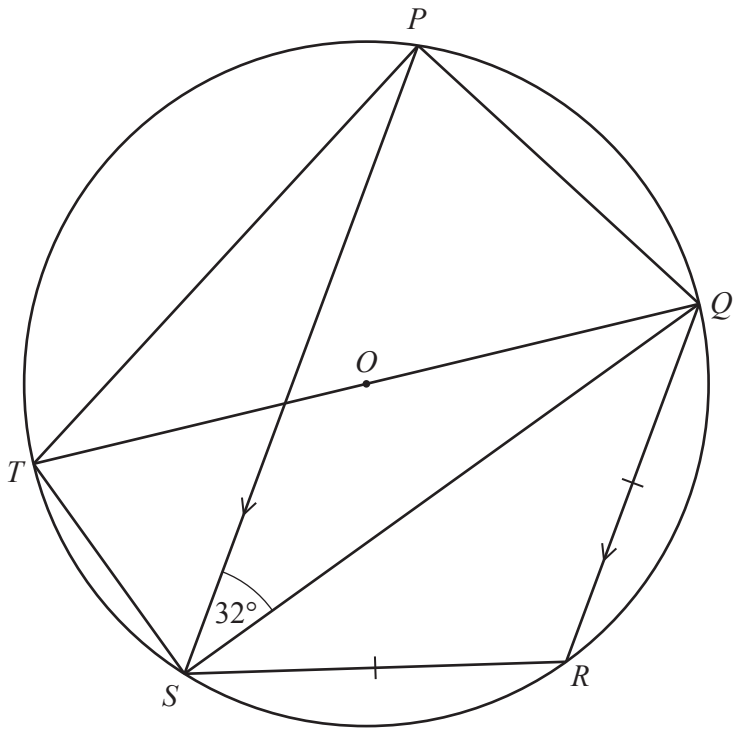
(b)



NOT TO SCALE

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

(i) Find $P\hat{Q}T$.
Give a reason for each step of your working.

.....

.....

.....

$P\hat{Q}T =$ ..... [3]

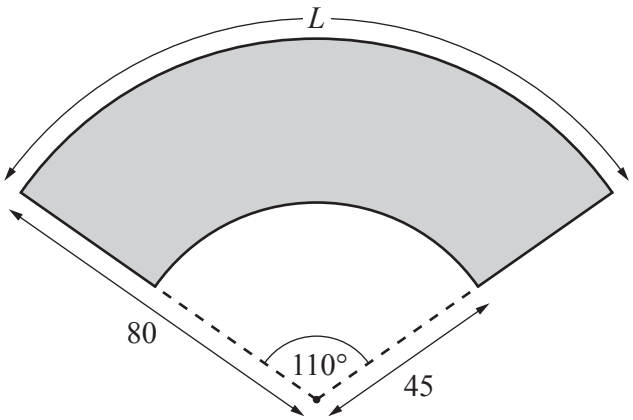
(ii) Find $Q\hat{R}S$.

$Q\hat{R}S =$ ..... [2]

(iii) Find $T\hat{Q}S$.

$T\hat{Q}S =$ ..... [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.

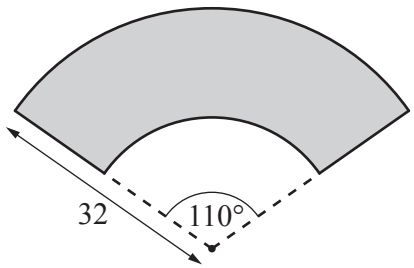
(i) Calculate arc length L.

$L =$ ..... cm [2]

(ii) Calculate the area of this display notice.

..... cm^2 [3]

(b)



NOT TO SCALE

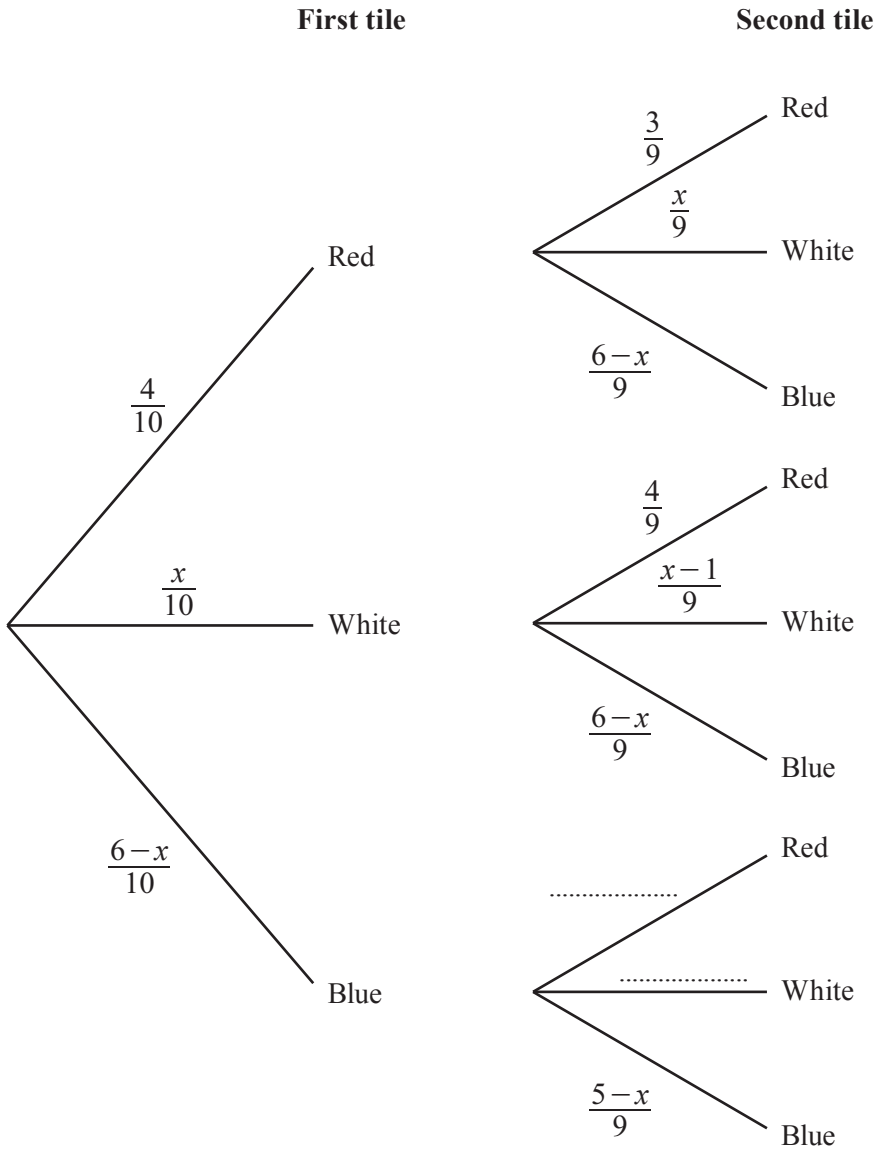
This diagram shows a display notice mathematically similar to the one in **part (a)**.
The radius of the larger sector is 32 cm.

Calculate the area of this display notice.

..... cm^2 [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 $x^2 - 6x + 5 = 0$.

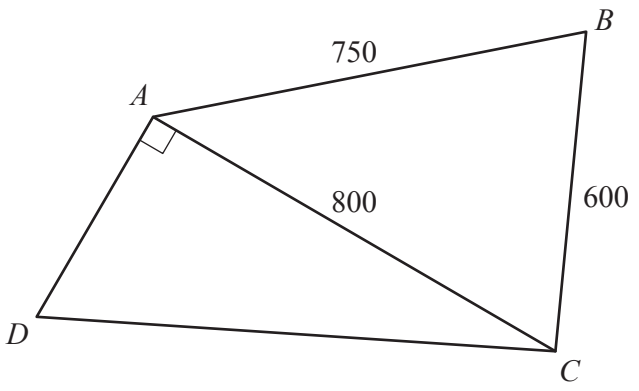
$x =$ ..... or $x =$ ..... [2]

(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]

10



NOT TO SCALE

$ABCD$ is a field with $AB = 750\,\text{m}$ and $BC = 600\,\text{m}$.
Inside the field is a straight path, AC, of length 800 m and $D\hat{A}C = 90°$.

(a) Show that $A\hat{C}B = 62.9°$, correct to 1 decimal place.

[3]

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

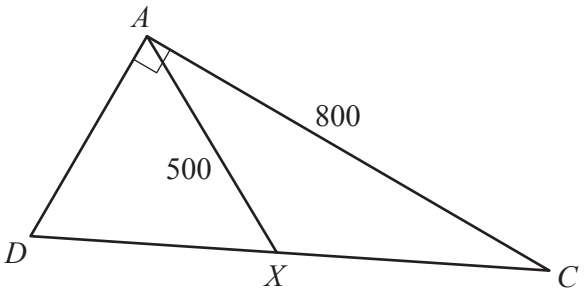
Calculate AD.

$AD =$ ..... m [4]

(c) Calculate $A\hat{C}D$.

$A\hat{C}D =$ ..... [2]

(d) X is a point on DC and $AX = 500\,\text{m}$.



NOT TO SCALE

Calculate the obtuse angle $A\hat{X}C$.

$A\hat{X}C =$ ..... [4]

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