Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

MATHEMATICS (SPECIFICATION A)   3301/1H
Higher Tier
Paper 1 Non-Calculator

Wednesday 4 June 2003 1.30 pm to 3.30 pm

H

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

In addition to this paper you will require:
    mathematical instruments.
You must **not** use a calculator.

For Examiner's Use	
Pages	**Mark**
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22	
TOTAL	
Examiner's Initials	

Time allowed: 2 hours

Instructions

- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.

Information

- The maximum mark for this paper is 100.
- Mark allocations are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued
  on request and must be tagged securely to this answer booklet.
- The use of a calculator is **not** permitted.

Advice

- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

You may need to use the following formulae:

Volume of prism = area of cross section × length
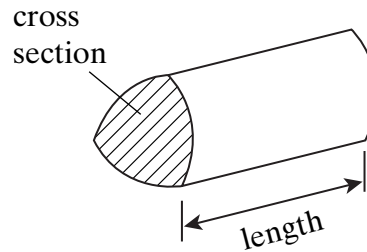
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$
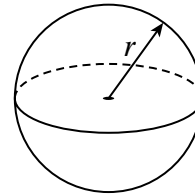
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$
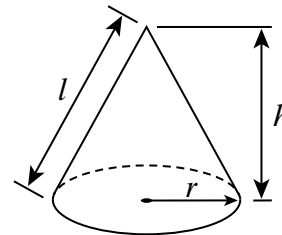
In any triangle ABC

Area of triangle = $\frac{1}{2} ab \sin C$

Sine rule $\quad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule $\quad a^2 = b^2 + c^2 - 2bc \cos A$
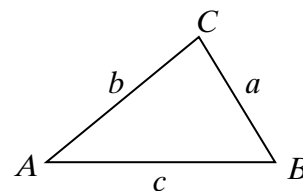
The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Answer **all** questions in the spaces provided.

1 The diagram shows part of a regular polygon.

Each interior angle is 162°.

Not drawn accurately

162°
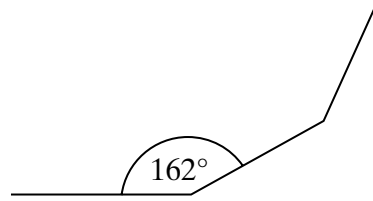
Calculate the number of sides of the polygon.

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Answer .... *(3 marks)*

2 Find an approximate value of $\dfrac{48.8 \times 5.22}{(10.13)^2}$

You **must** show all your working.

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Answer .... *(3 marks)*

3 Triangle *T* and triangles *A*, *B*, *C*, *D* and *E* are not drawn accurately.
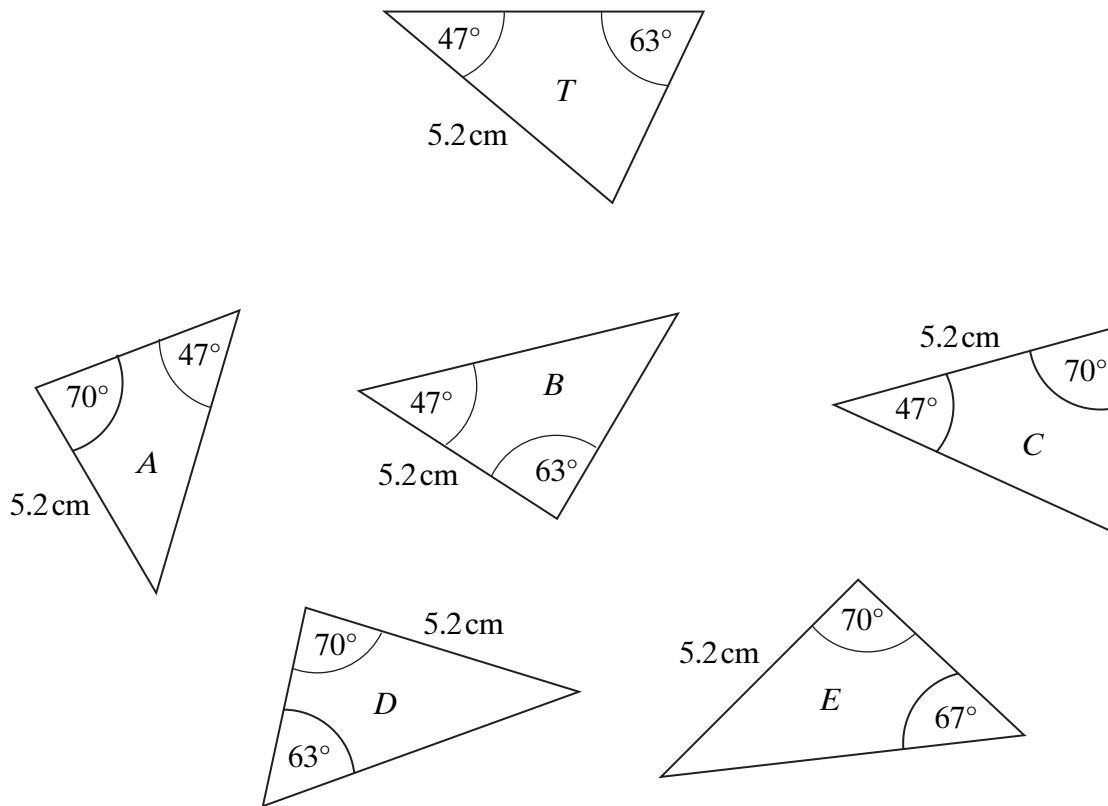
Which two of triangles *A*, *B*, *C*, *D* and *E* are congruent to triangle *T*?

Answer   Triangle ....   and   Triangle ....   *(2 marks)*

4 The map below shows three boats, *A*, *B* and *C*, on a lake.
Along one edge of the lake there is a straight path.

Treasure lies at the bottom of the lake.

The treasure is:
  between 150 m and 250 m from *B*,
  nearer to *A* than *C*,
  more than 100 m from the path.

Scale: 1 cm represents 50 m

Path

A ●

B ●

C ●
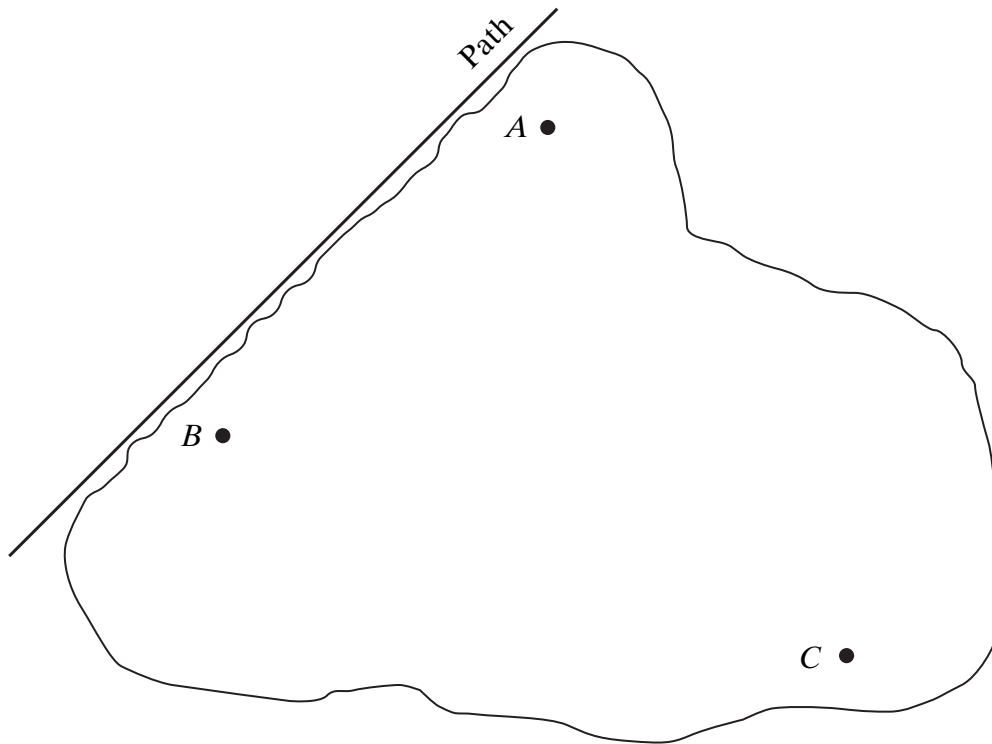
Using a ruler and compasses only, shade the region in which the treasure lies.

You **must** show clearly all your construction arcs.

(5 marks)

Turn over ▶

5 (a) Factorise completely $12y^2 - 8y$

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Answer .... *(2 marks)*

(b) n is an integer.
List the values of n such that

$$-6 \leqslant 3n < 13$$

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Answer .... *(3 marks)*

(c) Simplify $(2xy^2)^3$

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Answer .... *(2 marks)*

6 (a) a and b are prime numbers.

$ab^3 = 54$

Find the values of a and b.

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Answer $a = $ .... , $b = $ .... *(2 marks)*

(b) Find the Highest Common Factor (HCF) of 54 and 135.

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Answer .... *(2 marks)*

7 Chandni wants to survey pupils in her school about their reading habits.

(a) Write a question that would help Chandni to investigate how often pupils in her school read for pleasure.

Include a response section.

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(2 marks)

(b) There are 1000 pupils in Chandni's school.

Chandni samples 50 pupils at random and asks them to complete her survey.
She finds that 16 of the pupils in the sample read comics.
Estimate the number of pupils in the school who read comics.

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Answer ....   *(2 marks)*

Turn over ▶

8 A builder has 7200 kg of sand.

(a) Write 7200 kg in grams.
Give your answer in standard form.

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Answer ....g   *(2 marks)*

(b) One grain of this sand weighs 0.0006 g.
Write the weight of one grain of sand in standard form.

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Answer ....g   *(1 mark)*

(c) How many grains of sand are there in 7200 kg of sand?
Give your answer in standard form.

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Answer ....   *(2 marks)*

9 (a) Expand and simplify $4(m + 3) + 3(2m - 5)$

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Answer .... *(2 marks)*

(b) Solve the simultaneous equations:

$$2x + 3y = 9$$
$$3x + 2y = 1$$

You **must** show all your working.
Do **not** use trial and improvement.

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Answer $x =$ .... , $y =$ .... *(4 marks)*

(c) (i) Factorise $x^2 + 6x - 16$

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Answer .... *(2 marks)*

(ii) Hence solve the equation $x^2 + 6x - 16 = 0$

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Answer .... *(1 mark)*

Turn over ▶

10 The diagram shows a spinner.

When the arrow is spun the probability of scoring 2 is 0.3

The arrow is spun twice and the scores are added.

(a) Complete the tree diagram.

First spin   Second spin

                                                       0.3

2

0.3

3

....

2

....

2

3

....

3

(1 mark)

(b) What is the probability that the total score is 4?

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               Answer .... *(2 marks)*

11 (a) Write down the value of 11^0

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Answer   ....   *(1 mark)*

(b) Find the value of $8^{\frac{2}{3}}$

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Answer   ....   *(2 marks)*

(c) Simplify $6^{-2} \times 144^{0.5}$

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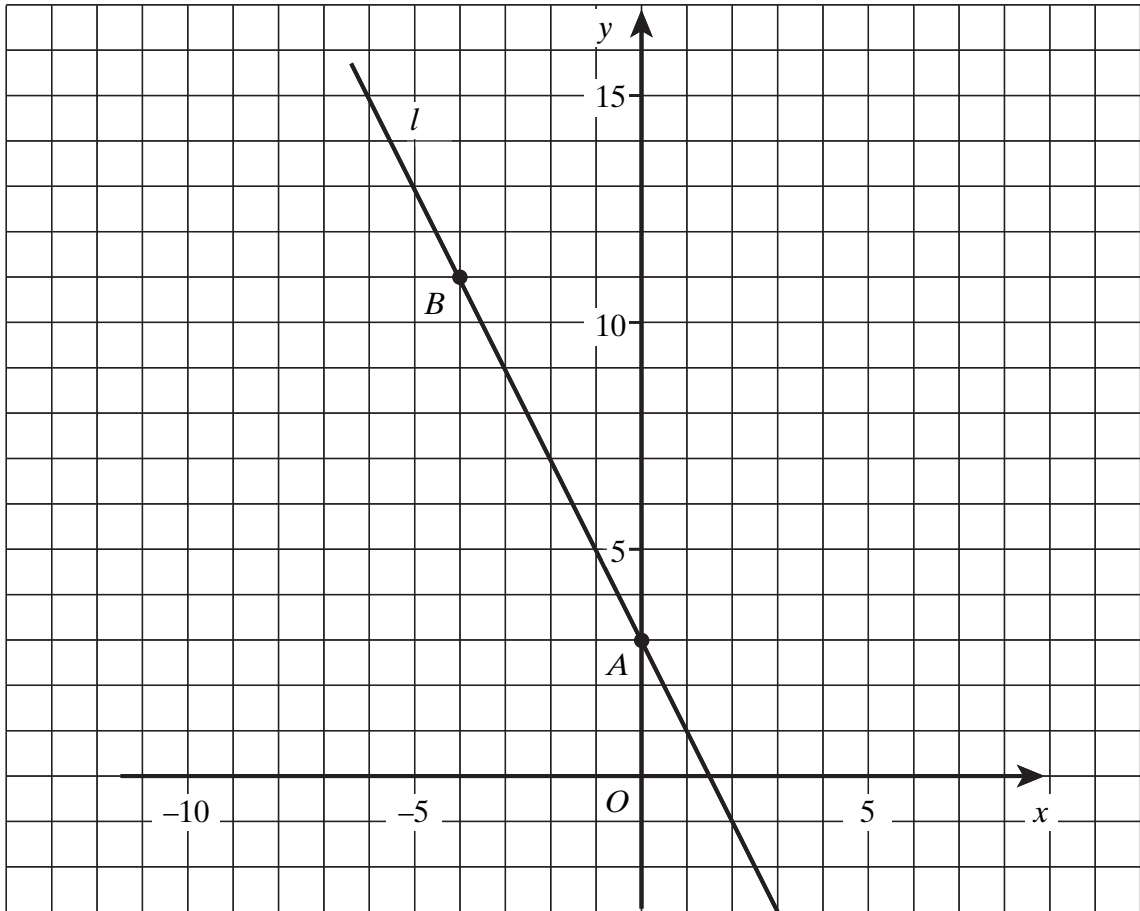Answer   ....   *(3 marks)*

TURN OVER FOR THE NEXT QUESTION

12 The line *l* on the graph passes through the points *A* (0, 3) and *B* (−4, 11).

(a) Calculate the gradient of the line *l*.

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Answer .... *(2 marks)*

(b) Write down the equation of the line *l*.

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Answer .... *(1 mark)*
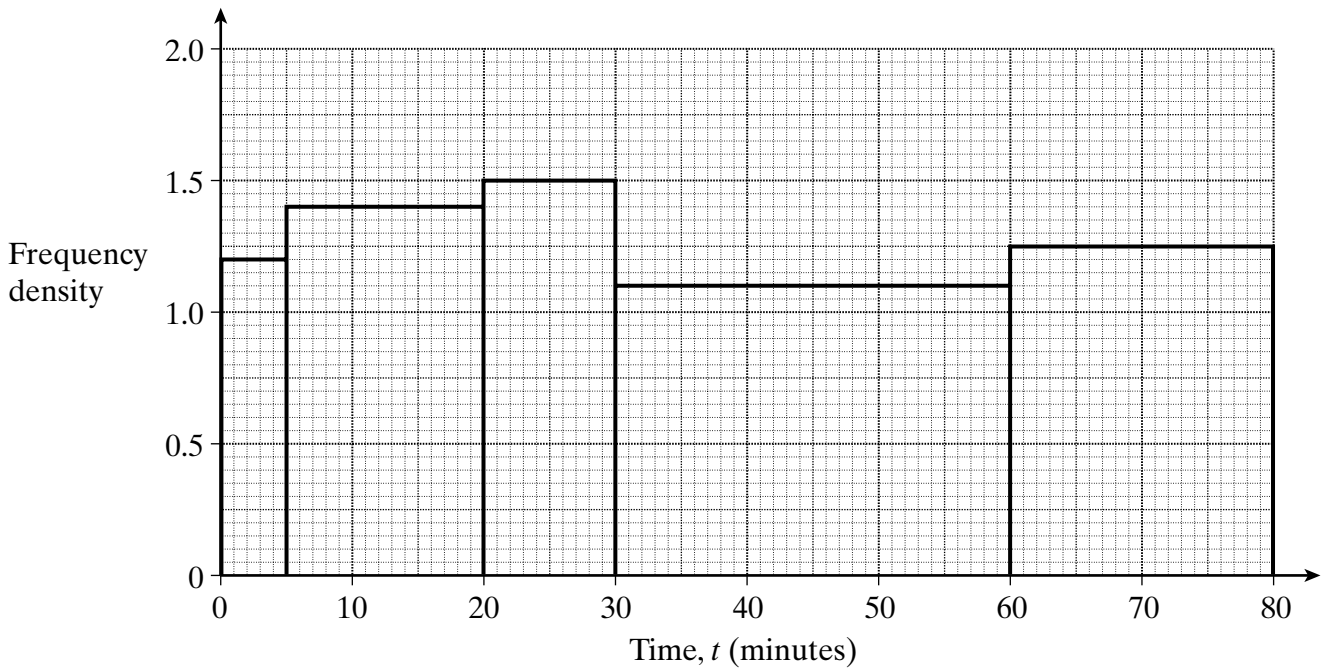
(c) Write down the equation of the line which also passes through the point (0, 3) but is perpendicular to line *l*.

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Answer .... *(2 marks)*

13 The histogram shows information about how much time was spent in a supermarket by 100 shoppers.

(a) Complete this frequency table:

Time, t (minutes)	$0 < t \leqslant 5$	$5 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 60$	$60 < t \leqslant 80$
Number of shoppers	6		15		25

(2 marks)

(b) 20% of the shoppers are in the supermarket for more than T minutes.
Calculate an estimate of the value of T.

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Answer .... *(2 marks)*

14 (a)
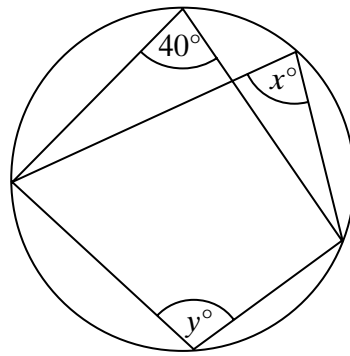
Not drawn accurately

(i) Write down the value of x.

Answer .... degrees   *(1 mark)*

(ii) Calculate the value of y.

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Answer .... degrees   *(1 mark)*

(b) A and C are points on the circumference of a circle centre B.
AD and CD are tangents.
Angle $ADB = 40°$.
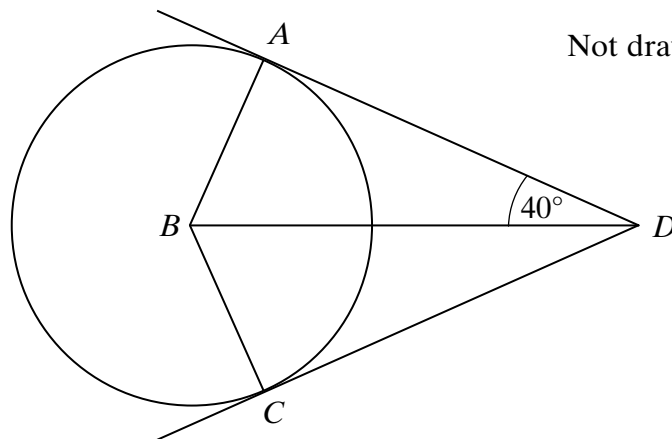
Not drawn accurately

Explain why angle ABC is 100°.

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(2 marks)

(c)   *ABCD* is a cyclic quadrilateral.

PAQ is a tangent to the circle at *A*.

BC = CD.

AD is parallel to *BC*.

Angle *BAQ* = 32°.
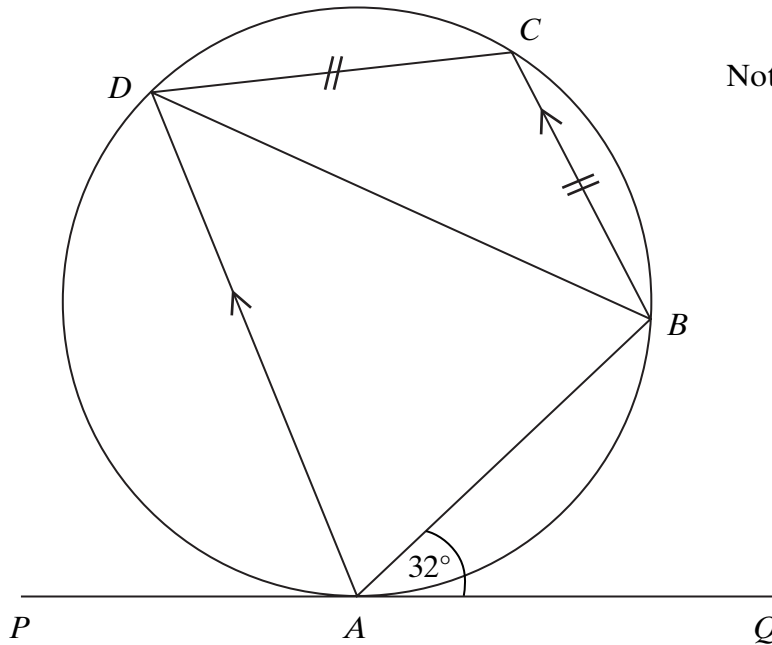
Not drawn accurately

Find the size of angle *BAD*.

You **must** show all your working.

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Answer   Angle *BAD* = ... degrees   *(5 marks)*

15 *W* and *P* are both positive quantities.

W is directly proportional to the square root of *P*.

When *W* = 12, *P* = 16.

(a) Express *W* in terms of *P*.

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Answer .... *(3 marks)*

(b) What is the value of *W* when *P* = 25?

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Answer .... *(1 mark)*

(c) What is the value of *P* when *W* = 21?

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Answer .... *(2 marks)*

16 (a) You are given that $\sqrt{12} + \sqrt{27} = a\sqrt{3}$ where a is an integer.

Find the value of a.

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Answer .... *(2 marks)*

(b) Find the value of $(m + p)^2$ when $m = \sqrt{2}$ and $p = \sqrt{8}$

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Answer .... *(2 marks)*

17 A bag of sweets contains 5 toffees, 3 chocolates and 2 mints.

Emmie and Sophie each pick one sweet at random.
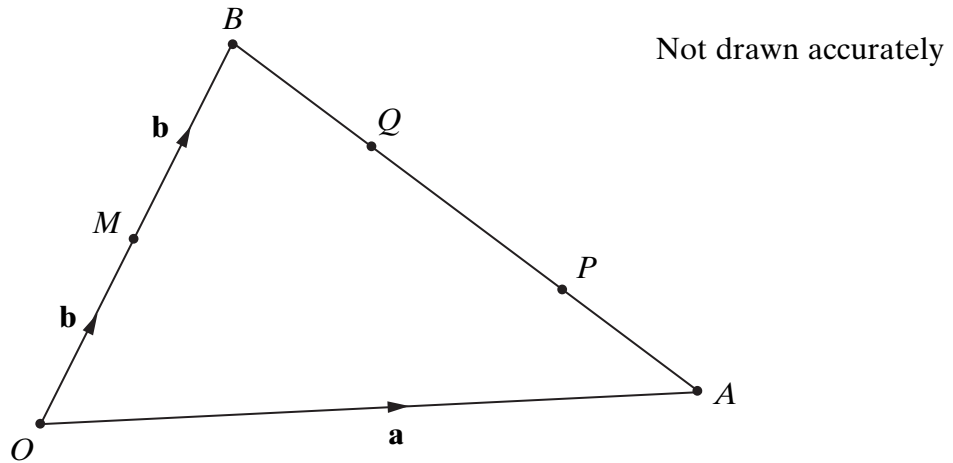
What is the probability that they pick sweets of the same kind?

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Answer .... *(4 marks)*

Turn over ▶

14

18

Not drawn accurately

OAB is a triangle where M is the mid-point of OB.

P and Q are points on AB such that $AP = PQ = QB$.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = 2\mathbf{b}$

(a)   Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, expressions for

(i) $\overrightarrow{BA}$

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Answer ....   *(1 mark)*

(ii) $\overrightarrow{MQ}$

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Answer ....   *(2 marks)*

(iii) $\overrightarrow{OP}$

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Answer ....   *(2 marks)*

(b)   What can you deduce about quadrilateral *OMQP*?
      Give a reason for your answer.

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(2 marks)

19   A firm makes cone shaped containers out of card.
      The card is in the shape of a sector of a circle of radius 12 cm.
      The angle of the sector is 270°.
      The straight edges are brought together to make the cone.
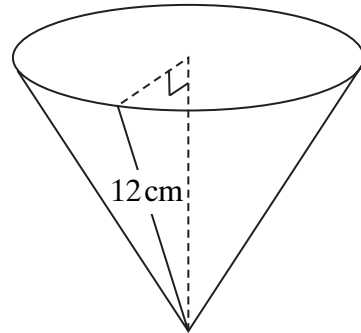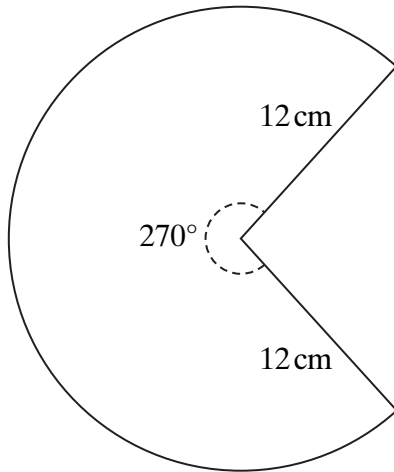
(a)   Find the arc length of the card used to make the cone.
      Give your answer in terms of π.

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Answer   ....cm   *(2 marks)*

(b)   Calculate the radius of the base of the cone.

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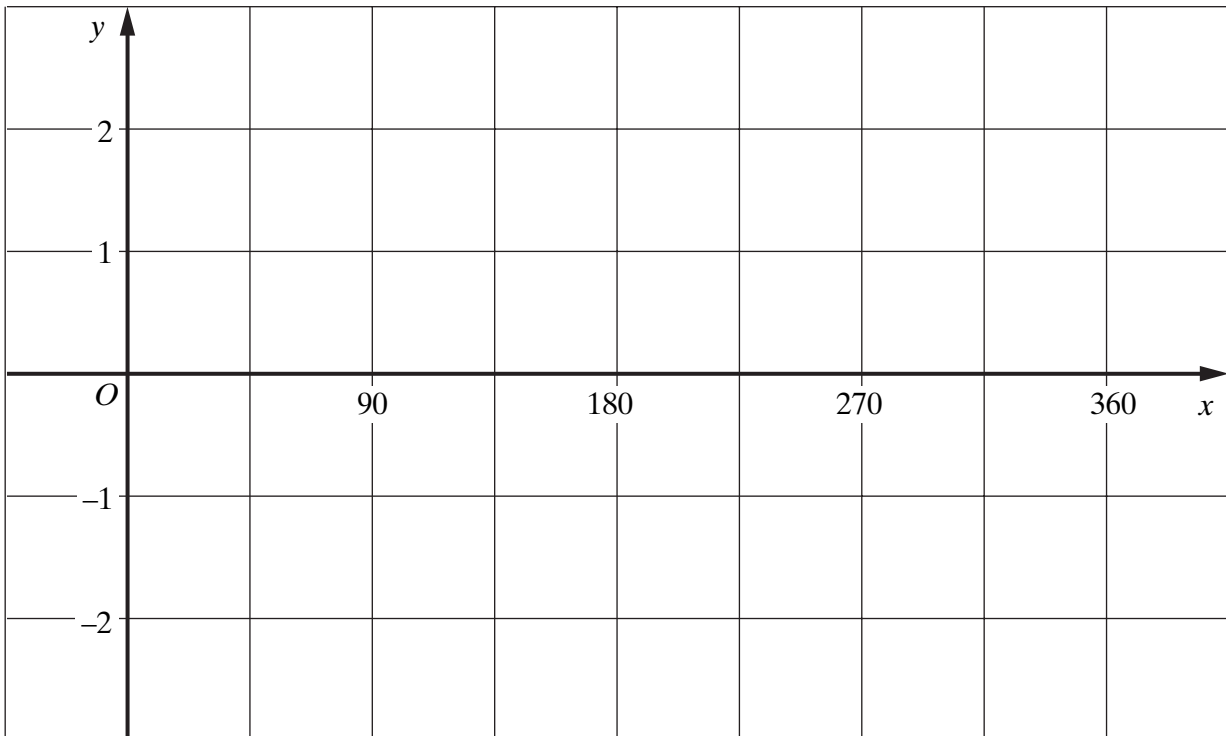Answer   ....cm   *(2 marks)*

11

Turn over ▶

20 The graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$ is shown on the grid below.
The point $P(90, 1)$ lies on the curve.
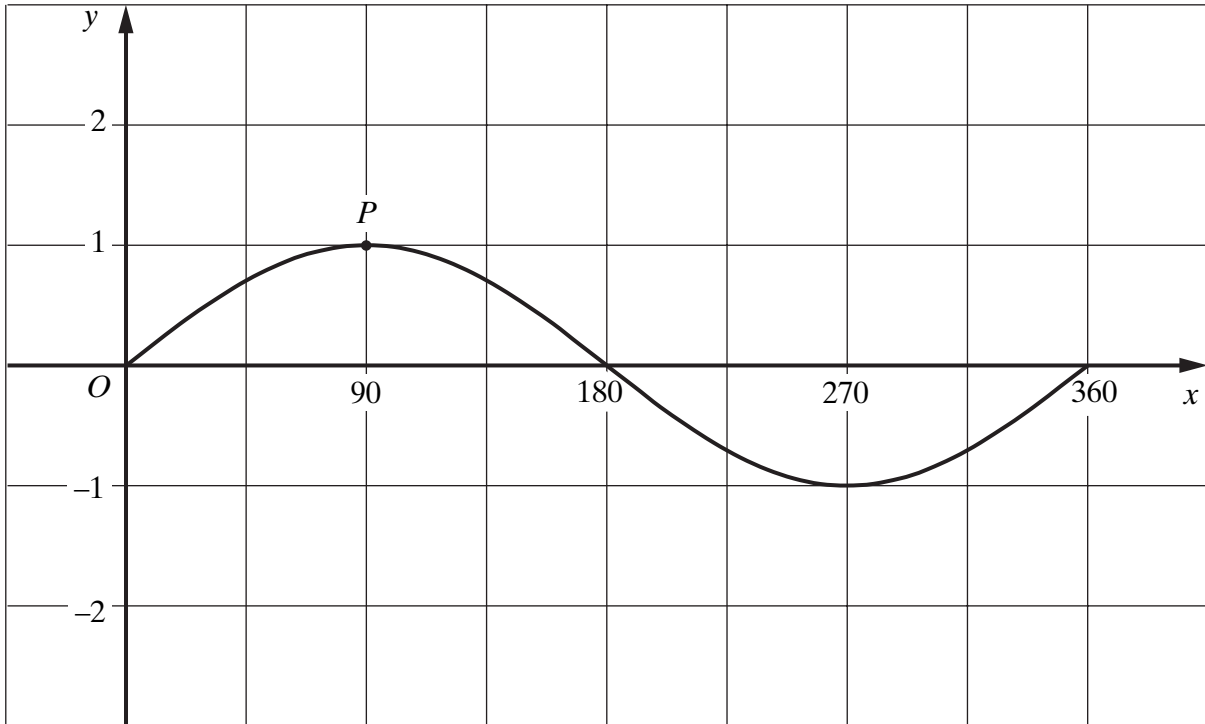
On both of the grids that follow, sketch the graph of the transformed function.
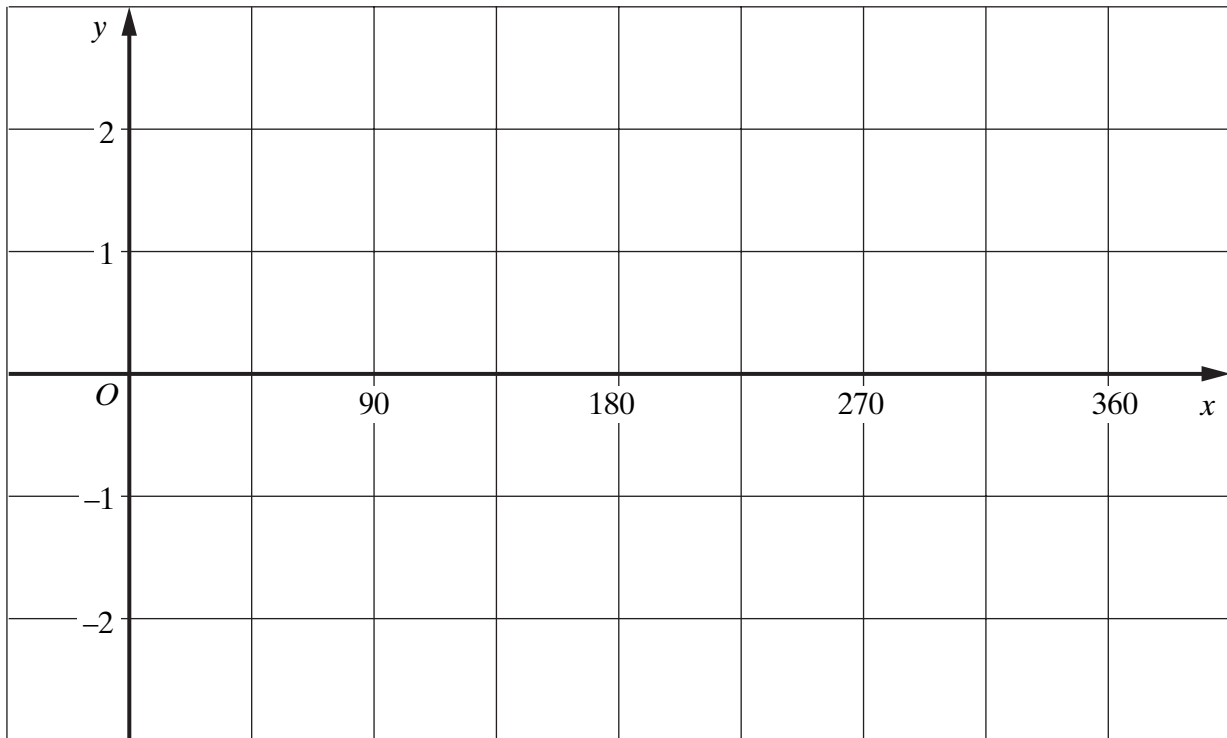In both cases write down the coordinates of the transformed point P.

(a) $y = \sin (x - 45)$

P (................ , ...)

(2 marks)

APW/6K03/3301/1H

(b) $y = 2\sin x$

P (................ , ...)

(2 marks)

TURN OVER FOR THE NEXT QUESTION

21 Find the values of *a* and *b* such that

$$x^2 - 10x + 18 = (x - a)^2 + b$$

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Answer   *a* = ... ,   *b* = ...   *(2 marks)*

END OF QUESTIONS

2