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General Certificate of Secondary Education
November 2004

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

Friday 5 November 2004 9.00 am to 11.00 am

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

H

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

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.

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	

3301/1H

Formulae Sheet: Higher Tier

You may need to use the following formulae:

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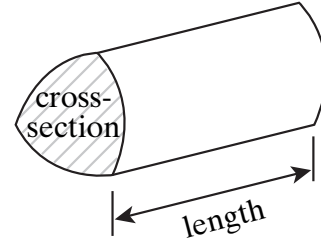
Volume of sphere = $\frac{4}{3}\pi r^3$

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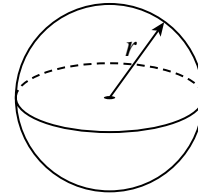
Volume of cone = $\frac{1}{3}\pi r^2 h$

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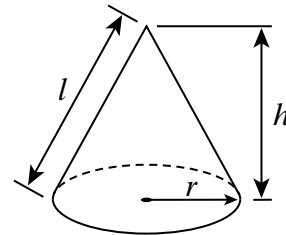
In any triangle ABC

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 $\quad a^2 = b^2 + c^2 - 2bc \cos A$
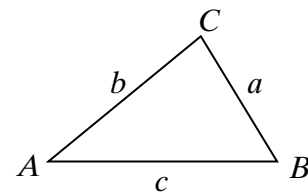
The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

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

1 A spinner has a red sector (R) and a yellow sector (Y).
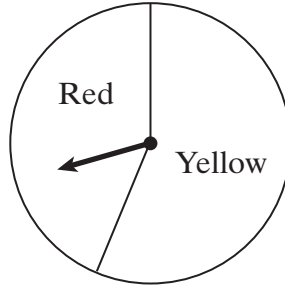
The arrow is spun 1000 times.
The table shows the relative frequency of a red after different numbers of spins.

Number of spins	Relative frequency of a red
50	0.42
100	0.36
200	0.34
500	0.3
1000	0.32

(a) How many times was a red obtained after 200 spins?

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Answer .... *(2 marks)*

(b) Which relative frequency gives the best estimate of the probability of a red?
Explain your answer.

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(2 marks)

4

Turn over ▶

2 Hannah, Gemma and Jo use their calculators to work out the value of

$$\frac{28.78}{4.31 \times 0.47}$$

Hannah gets 142.07, Gemma gets 14.207 and Jo gets 3.138

Use approximations to show which one of them is correct.
You **must** show your working.

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Answer ....   *(3 marks)*

3 Tom is investigating the equation $y = x^2 - x + 5$
He starts to complete a table of values of y for some integer values of x.

x			–2	–1	0	1	2	3			
y			11	7	5	5	7	11			

Tom says, "When x is an integer, y is **always** a prime number".
Find a counter-example to show that Tom is wrong.
Explain your answer.

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(2 marks)

4 In the diagram, the sides of triangle *ABC* are tangents to the circle.
   D, *E* and *F* are the points of contact.
   AE = 5 cm and *EC* = 4 cm

Not to scale
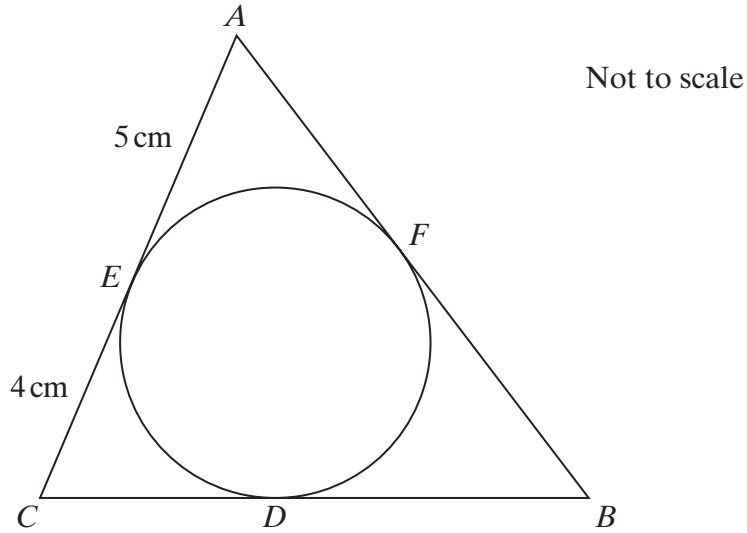
(a) Write down the length of *CD*.

   Answer .... cm   *(1 mark)*

(b) The perimeter of the triangle is 32 cm.

   Calculate the length of *DB*.

   ....

   ....

   ....

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

Turn over ▶

APW/Nov04/3301/1H

5 (a) Write 28 as the product of its prime factors.
Give your answer in index form.

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Answer ....   *(3 marks)*

(b) Find the least common multiple (LCM) of 28 and 42.

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Answer ....   *(2 marks)*

6 56 boys and 52 girls took an English test.
The box plots show the distributions of their marks.
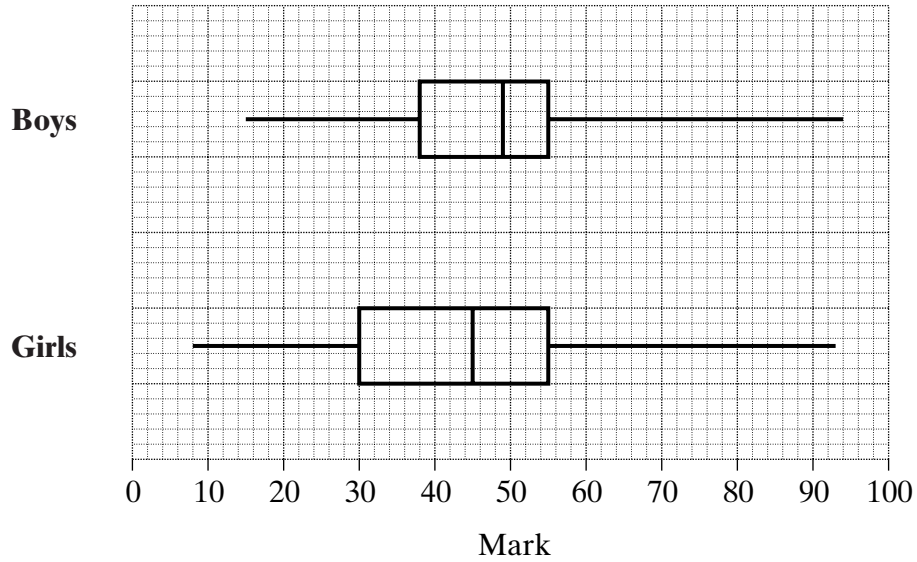
Give **two** differences between the boys' marks and the girls' marks.

Difference 1 ....

....

....

Difference 2 ....

....

....

(2 marks)

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

7 Find the nth term of the following sequences.

(a) 1, 4, 9, 16, 25, …

....

Answer .... *(1 mark)*

(b) –2, 1, 6, 13, 22, …

....

....

Answer .... *(1 mark)*

8 (a) Solve the inequality $4x - 3 < 5$

....

....

Answer .... *(2 marks)*

(b) Expand $4x(x^2 + 5)$

....

....

Answer .... *(2 marks)*

(c) Simplify

(i) $d^3 \times d^2$

....

Answer .... *(1 mark)*

(ii) $\dfrac{e}{e^8}$

....

Answer .... *(1 mark)*

(iii) $(2g^2h^4) \times (3g^3h)$

....

Answer .... *(2 marks)*

(d) (i) Factorise $\qquad\qquad\qquad x^2 - 13x + 36$

....

....

Answer .... *(2 marks)*

(ii) Hence, or otherwise, solve the equation $x^2 - 13x + 36 = 0$

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....

Answer .... *(1 mark)*

$\dfrac{}{13}$

Turn over ▶

9 On the grid below there are two shapes, *A* and *B*.
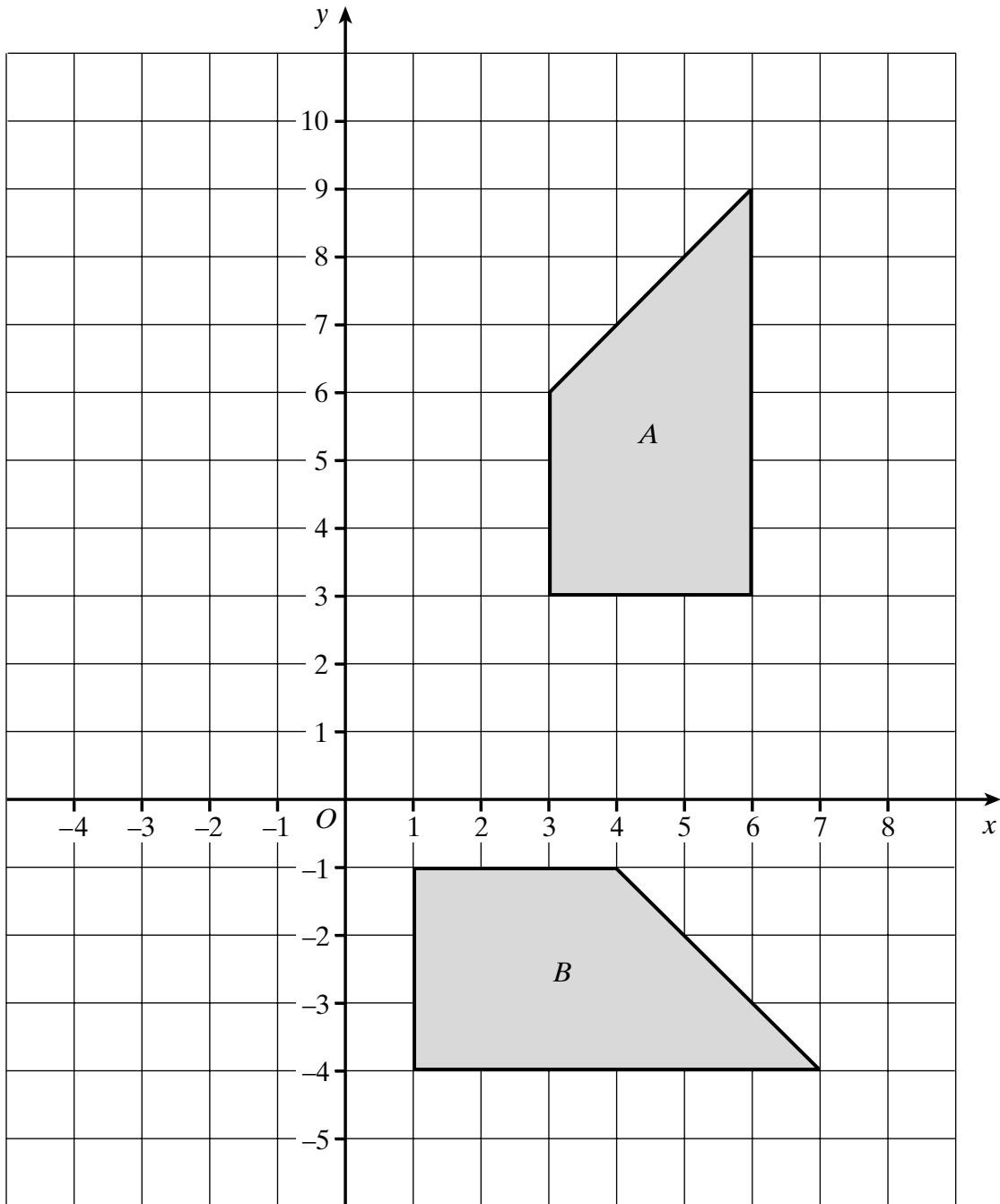
(a) Describe fully the **single** transformation that takes shape *A* to shape *B*.

....

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(3 marks)

(b) Draw the enlargement of shape *A* with scale factor $\frac{1}{3}$ and centre of enlargement $(0, 0)$.

(2 marks)

10 Triangles *ABC* and *ACD* are similar.
$AB = 5\,\text{cm}$ and $AC = 6\,\text{cm}$.

Not drawn accurately

B　　　　　*C*

D

5 cm　　6 cm

A

Calculate the length of *AD*.

....
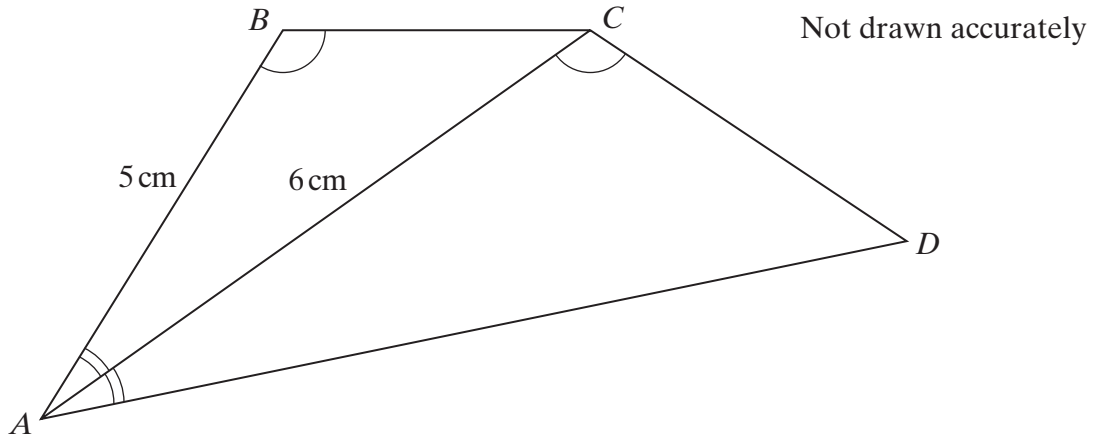
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Answer .... cm　　*(3 marks)*

11 (a) Expand and simplify　　　　$(x + y)(x - y)$

....

....

Answer ....　　*(2 marks)*

(b) Using your answer to part (a), or otherwise, find the exact value of

$$780^2 - 220^2$$

....

....

Answer ....　　*(2 marks)*

Turn over ▶

12 (a) Work out $(3 \times 10^2) \times (4 \times 10^5)$

Give your answer in standard form.
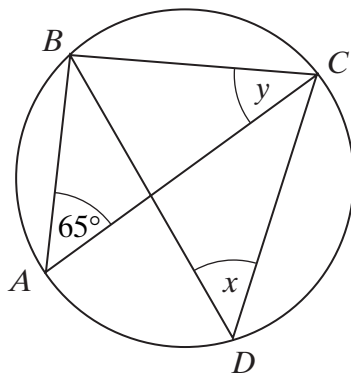
....

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Answer .... *(2 marks)*

(b) Work out $(3 \times 10^2) \div (4 \times 10^5)$

Give your answer in standard form.

....

....

....

Answer .... *(2 marks)*

13 *A*, *B*, *C* and *D* are points on the circumference of a circle.
AC is a diameter of the circle.
Angle *BAC* = 65°

Not drawn accurately

(a) Write down the value of *x*.

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

(b) Calculate the value of *y*.

....

....

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

14 Prove that the recurring decimal $1.207207207\ldots$ is equal to the fraction $1\frac{23}{111}$

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(3 marks)

15 *M* and *G* are positive quantities.
M is inversely proportional to *G*.
When $M = 90$, $G = 40$.

Find the value of *M* when $G = M$.

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Answer *M* = ... *(4 marks)*

16 (a) Find the value of $64^{\frac{1}{3}}$

....

Answer .... *(1 mark)*

(b) Find the value of $8x^{0}$

....

Answer .... *(1 mark)*

Turn over ▶

17   The graph of $y = x^2 - 4x + 8$ is shown below.
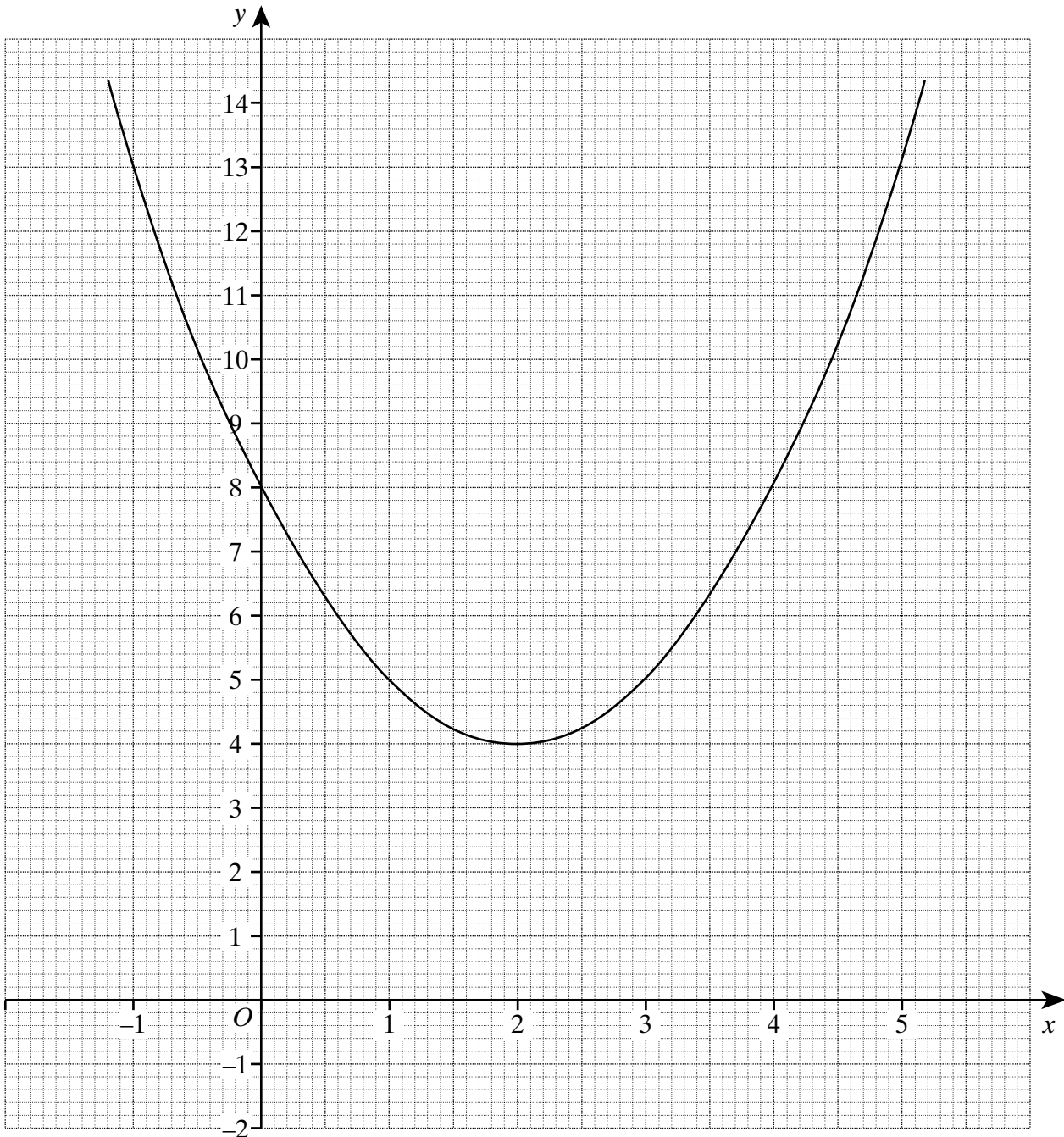
(a)   (i)   By drawing the graph of an appropriate straight line, solve the equation

$$x^2 - 4x + 8 = 3x - 2$$

....

....

....

Answer ....   *(3 marks)*

(ii) Hence, or otherwise, solve $x^2 - 7x + 10 = 0$

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Answer .... *(1 mark)*

(b) The graph of $y = x^2 - 4x + 8$ is to be used to solve the equation $x^2 - 5x + 4 = 0$
What straight line graph would need to be drawn?
(You do not need to draw it, just state its equation.)

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Answer $y = $ .... *(2 marks)*

18 A school has 600 students.
The school has 20 classes.
Each class has 30 students.

(a) Describe a method that could be used to obtain a random sample of 60 students from the school.

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(1 mark)

(b) Give two factors that need to be considered if a stratified sample of 60 students is to be taken.

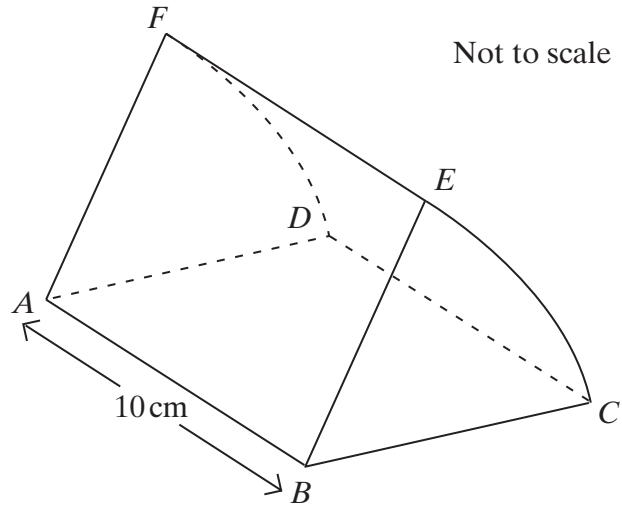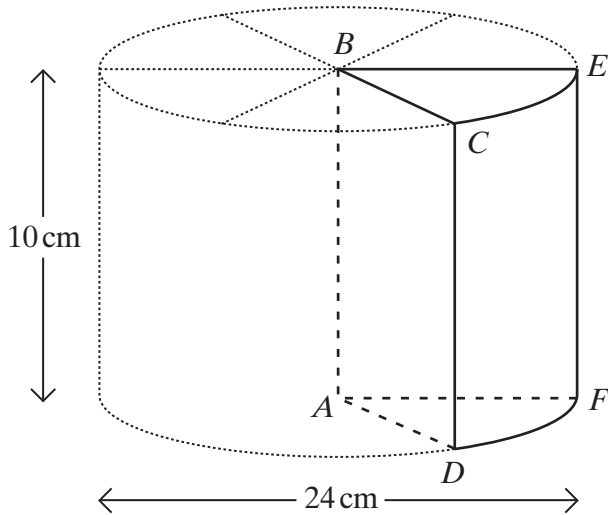Factor 1 ....

....

Factor 2 ....

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(2 marks)

Turn over ▶

9

19 The first diagram shows a cylindrical block of wood of diameter 24 cm and height 10 cm.
It is cut into six equal prisms as shown.
One of the prisms is shown in the second diagram.

Not to scale

(a) Calculate the area of sector *BEC*, the cross-section of the prism.
Give your answer in terms of π.

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....

Answer .... cm² *(2 marks)*

(b) Calculate the area of *CDFE*, the curved surface of the prism.
Give your answer in terms of π.

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Answer .... cm² *(3 marks)*

(c) Calculate the volume of the prism.
Give your answer in terms of π.

....

....

Answer .... *(3 marks)*

20 The area of this rectangle is $30 \, \text{cm}^2$.

$3\sqrt{2} \, \text{cm}$

$x \, \text{cm}$
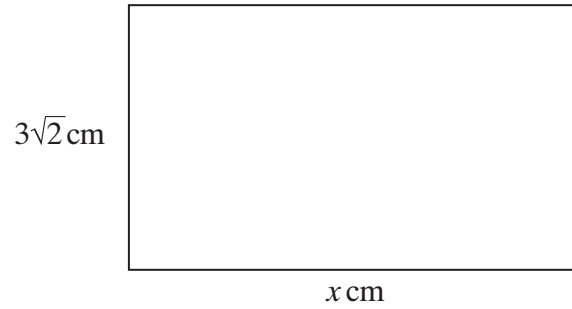
Find the value of x, writing your answer in the form $a\sqrt{b}$ where a and b are integers.

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Answer .... cm   *(3 marks)*

TURN OVER FOR THE NEXT QUESTION

11

Turn over ▶

21   The sketch below is of the graph of $y = x^2$
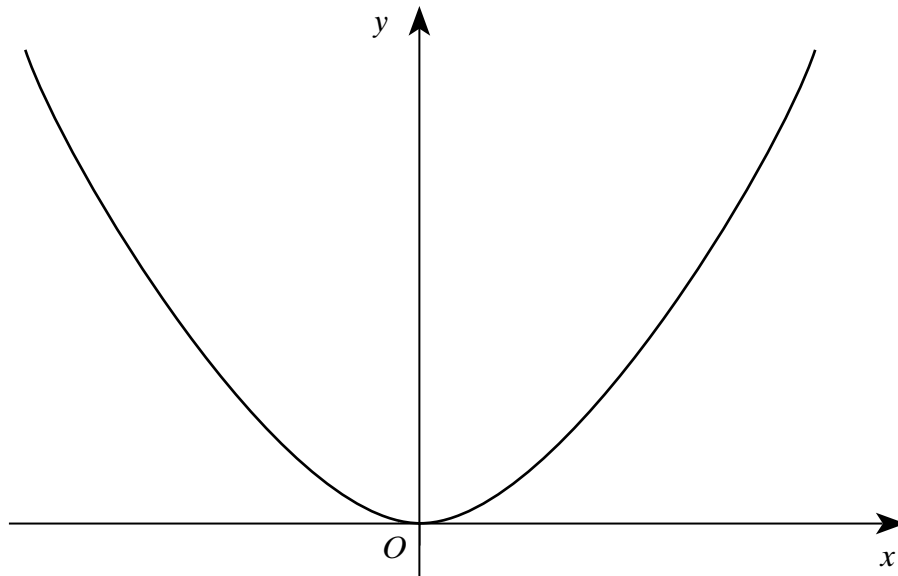
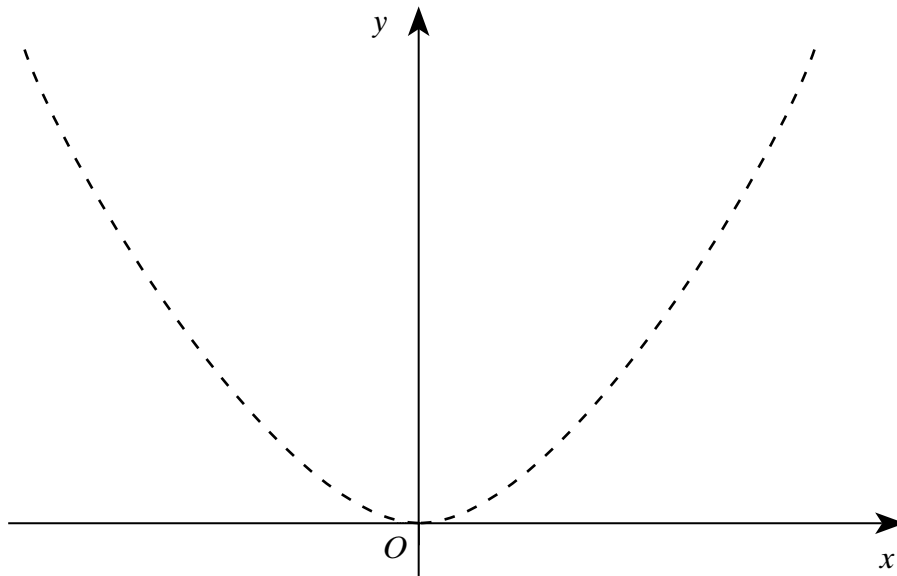On the axes provided, sketch the following graphs.
The graph of $y = x^2$ is shown dotted on each set of axes to act as a guide.
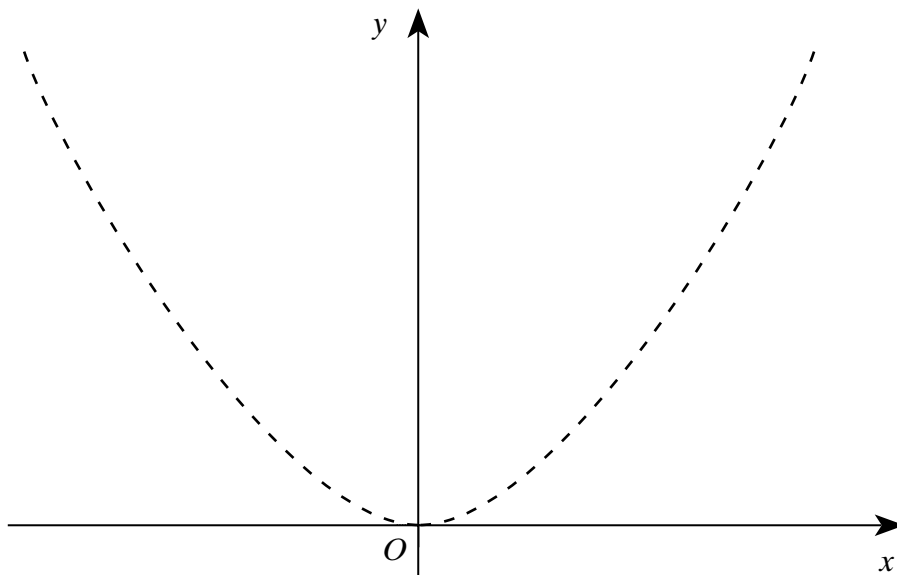
(a) $y = x^2 + 2$
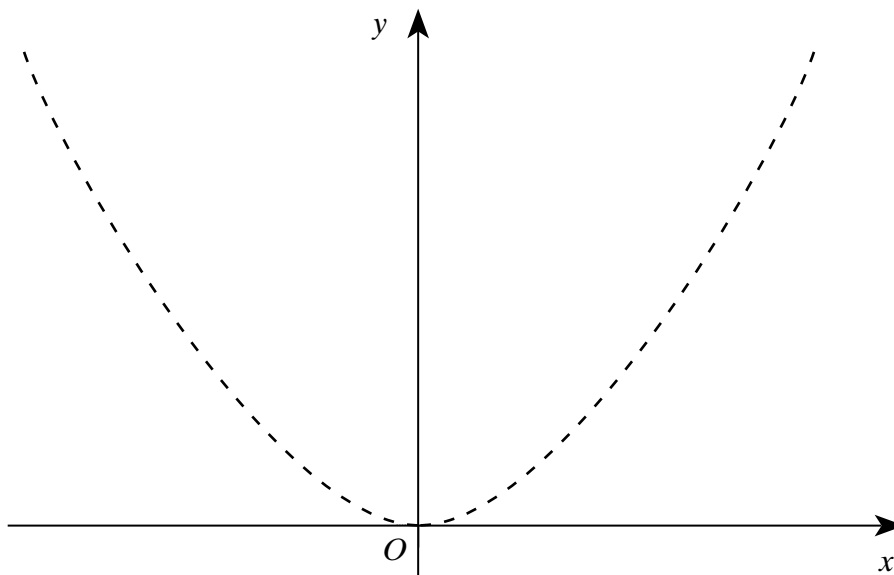
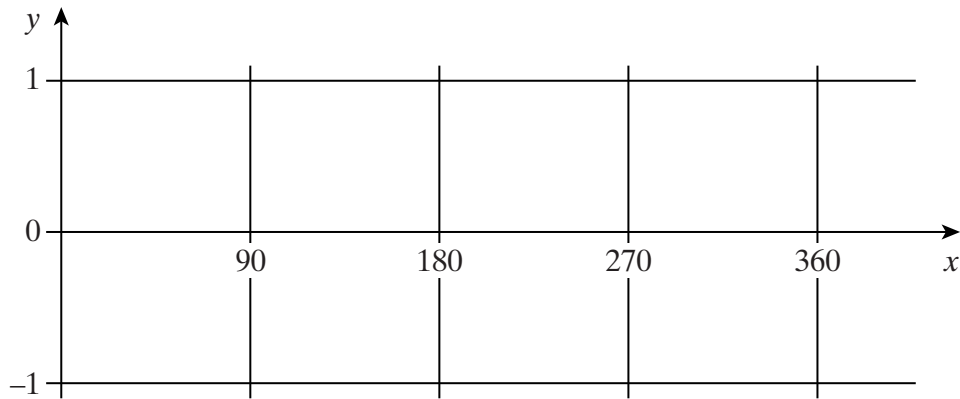
(1 mark)

(b) $y = (x - 2)^2$

(1 mark)

(c) $y = \frac{1}{2}x^2$

(1 mark)

Turn over ▶

$\dfrac{\quad}{3}$

22 (a) Sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$ on the axes below.

(1 mark)

(b) You are given that $\cos 27° = 0.891$

(i) Solve the equation $\cos x = 0.891$ for $180° \leqslant x \leqslant 360°$

....

Answer $x = $ .... degrees   *(1 mark)*

(ii) Solve the equation $\cos x = -0.891$ for $0° \leqslant x \leqslant 360°$

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....

....

Answer $x = $ .... degrees   *(2 marks)*

(iii) State a solution of the equation $\cos (x - 90°) = 0.891$ for $0° \leqslant x \leqslant 360°$

....

....

Answer $x = $ .... degrees   *(1 mark)*

(iv) State a solution of the equation $\sin x = 0.891$ for $0° \leqslant x \leqslant 360°$

....

....

Answer $x = $ .... degrees   *(1 mark)*

23 The diagram shows the circle $x^2 + y^2 = 2$ and the line $y = 2x - 1$
The line and the circle intersect at the points A and B.

Not drawn accurately
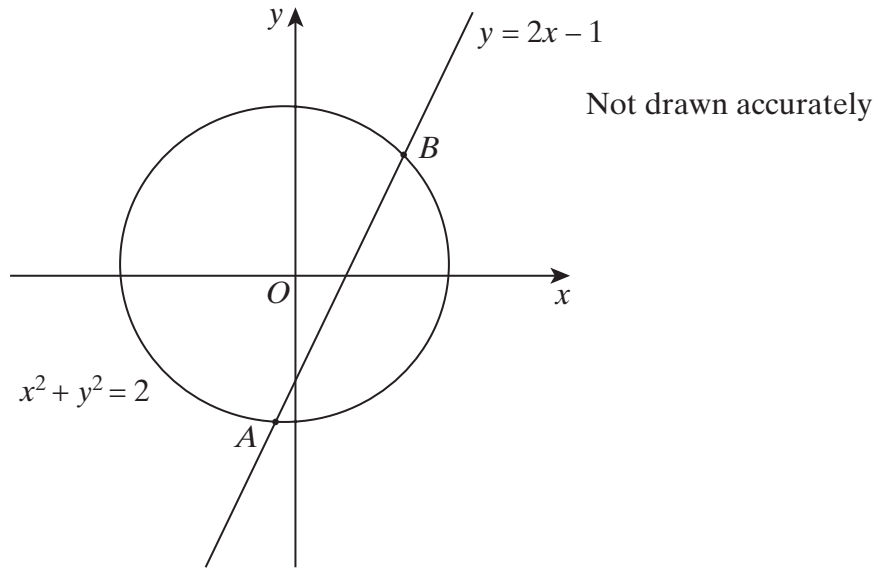
(a) Show that the x-coordinates of A and B satisfy the equation $5x^2 - 4x - 1 = 0$

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(3 marks)

(b) Hence find the coordinates of A and B.

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Answer A (........ , ...) B (........ , ...)   *(3 marks)*

Turn over ▶

12

24 Charlie is inspecting chocolates at his chocolate factory.
He rejects chocolates that are the wrong size and also those that are the wrong shape.
The probability that a chocolate is the **correct size** is p.
The probability that a chocolate is the **correct shape** is q.
The size and shape of a chocolate are independent events.

(a) Complete the probabilities in the table.

Event	Probability
Chocolate is the correct size and the correct shape.	
Chocolate is the correct size and the wrong shape.	$p(1 - q)$
Chocolate is the wrong size and the correct shape.	
Chocolate is the wrong size and the wrong shape.	

(2 marks)

(b) Show clearly that these probabilities have a total of 1.

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(2 marks)

(c) The probability that a chocolate is both the correct size and the correct shape is 0.765
The probability that a chocolate is the correct size is 0.9
What is the probability that a chocolate is the correct shape?

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Answer .... *(2 marks)*

END OF QUESTIONS

6

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THERE ARE NO QUESTIONS PRINTED ON THIS PAGE