Surname		Other Names	
Centre Number			Candidate Number					
Candidate Signature									

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General Certificate of Secondary Education
June 2005

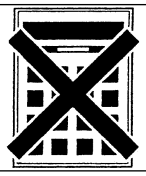
ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Tuesday 7 June 2005 1.30 pm to 3.30 pm

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.

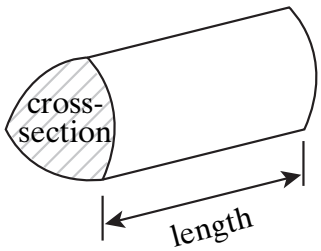
Advice
- In all calculations, show clearly how you work out your answer.

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	

Formulae Sheet: Higher Tier

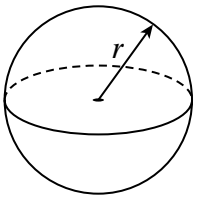
You may need to use the following formulae:

Volume of prism = area of cross-section × length



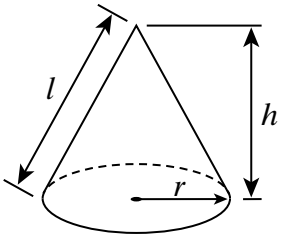
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



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

Curved surface area of cone = $\pi r l$

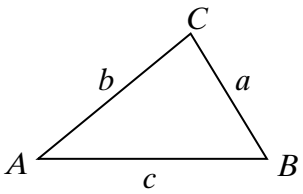


In any triangle ABC

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

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

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$



The Quadratic Equation

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

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

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

1 Amy, Beth and Chloe share a £5000 lottery win in the ratio 11 : 8 : 6
How much does each of them receive?

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Answer Amy £ ..... , Beth £ ..... , Chloe £ ..... *(3 marks)*

2 (a) Solve the inequality $7y < 3y + 6$

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

(b) Make r the subject of the formula $p = 3 + 2r$

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

(c) Solve the equation $\frac{1}{2}x - 5 = \frac{1}{4}x + 3$

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Answer $x =$ ..... *(3 marks)*

10

Turn over ▶

3 (a) Complete this table of values for $y = (2 + x)(3 - x)$

x	–2	–1	0	1	2	3	4
y		4	6	6	4	0	

.....

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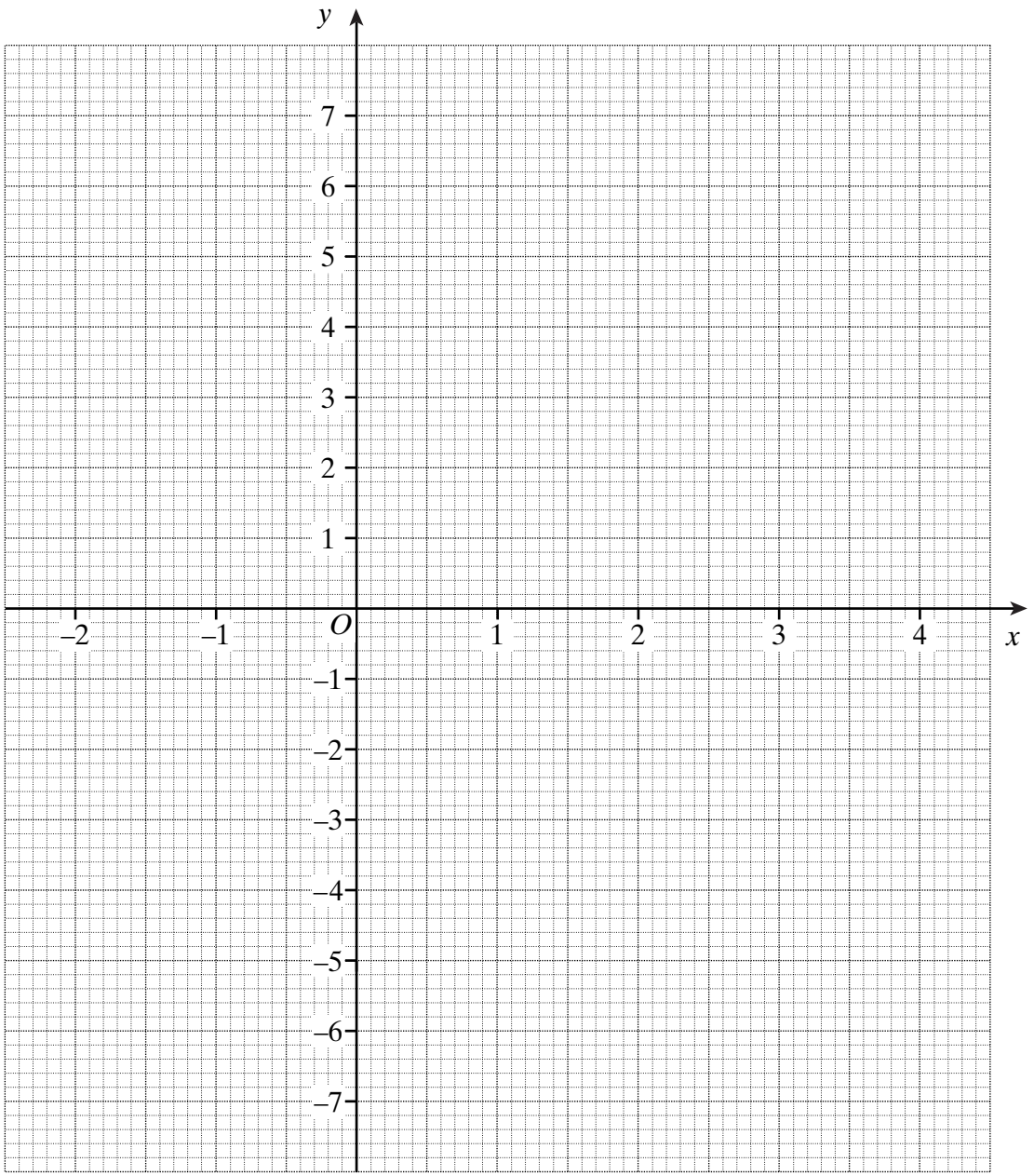
(2 marks)

(b) On the grid, draw the graph of $y = (2 + x)(3 - x)$ for values of x from –2 to +4.



(2 marks)

4 A box contains a number of counters.

Each counter is coloured red (**R**) or white (**W**).

Each counter is also numbered **1** or **2**.

The table shows the probabilities of picking the different colours and numbers when a counter is picked at random from the box.

Colour \ Number	**1**	**2**
R	$\frac{1}{5}$	$\frac{1}{10}$
W	$\frac{1}{4}$	$\frac{9}{20}$

(a) Sam says that there are 50 counters in the box.
Explain why Sam must be wrong.

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(1 mark)

(b) Show that the probability of picking a red counter (**R**) at random from the box is $\frac{3}{10}$

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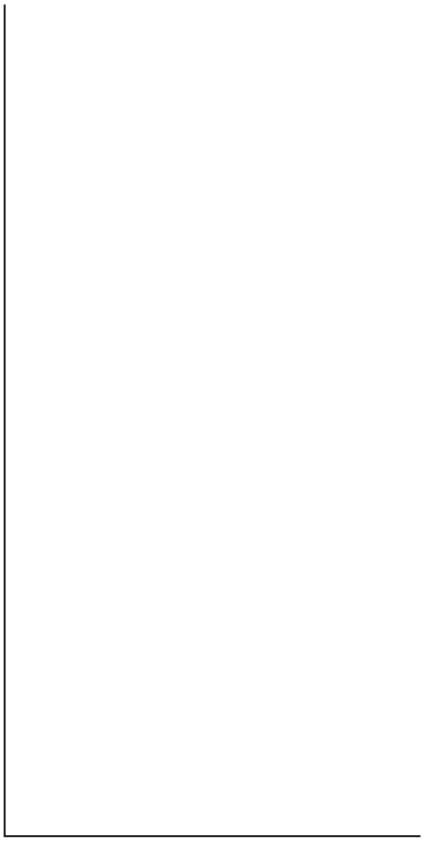
(2 marks)

7

5 The diagram shows an L shape.



Draw the locus of all points 2 cm from the L shape.

(3 marks)

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6 Some large numbers are written below.

$$1 \text{ million} = 10^6$$
$$1 \text{ billion} = 10^9$$
$$1 \text{ trillion} = 10^{12}$$

(a) How many millions are there in one trillion?

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

(b) Write 8 billion in standard form.

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

(c) Work out 8 billion multiplied by 3 trillion.
Give your answer in standard form.

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

7 On Monday Joe drinks $2\frac{1}{3}$ pints of milk.
On Tuesday he drinks $1\frac{3}{4}$ pints of milk.
Work out the total amount of milk that Joe drinks on Monday and Tuesday.

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Answer ..... pints *(3 marks)*

10

8 In a test there are 30 questions.
All candidates start with 25 marks.
Every correct answer scores 4 marks, but for every wrong answer 1 mark is deducted.

(a) Jack attempts every question, getting x of them correct.
Write down an expression, in x, for the number of questions he got wrong.

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

(b) Write down an expression for Jack's total mark.
(Remember that he starts with 25 marks).

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

(c) Jack scores 80 marks in the test.
Use your answer to part (b) to calculate the value of x, the number of questions he got correct.

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

LEAVE MARGIN BLANK

9 A sprinter runs 200 metres in 20.42 seconds.
Estimate his average speed in kilometres per hour.
You **must** show your working.

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Answer ..... km/h *(4 marks)*

10 An inspector visits a large company to check their vehicles.
The company has 4 large-load vehicles, 136 light vans and 21 cars.
The inspector decides to sample 10% of the vehicles.
Each type of vehicle is to be represented in the sample.

(a) What is this kind of sampling procedure called?

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

(b) How many of each type of vehicle should be inspected?

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Answer ..... large-load

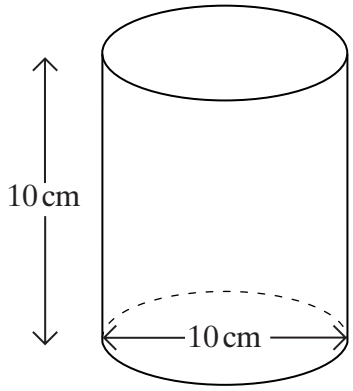
..... light vans

..... cars

(3 marks)

14

11 The diagram shows a cylinder.
The diameter of the cylinder is 10 cm.
The height of the cylinder is 10 cm.



Not drawn accurately

(a) Work out the volume of the cylinder.
Give your answer in terms of π.

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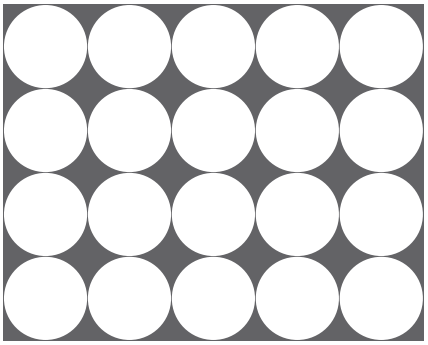
Answer ..... cm^3 *(3 marks)*

(b) Twenty of the cylinders are packed in a box of height 10 cm.
The diagram shows how the cylinders are arranged inside the box.
The shaded area is the space between the cylinders.



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Work out the volume inside the box that is **not** filled by the cylinders.
Give your answer in terms of π.

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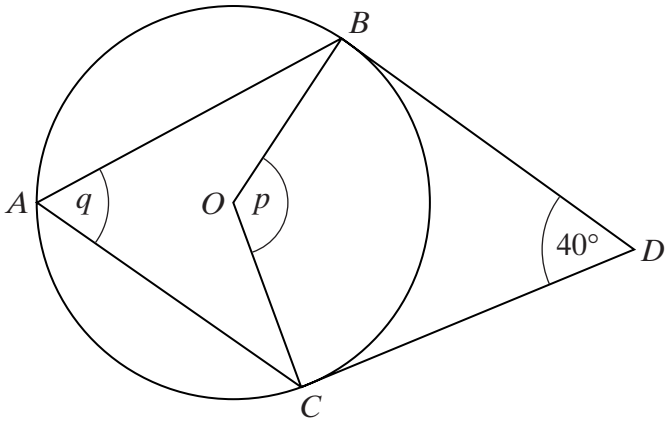
Answer ..... cm^3 *(4 marks)*

7

12 A, B and C are points on the circumference of a circle with centre O.
BD and CD are tangents.
Angle $BDC = 40°$

Not drawn accurately



(a) (i) Work out the value of p.

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Answer ..... degrees *(2 marks)*

(ii) Hence write down the value of q.

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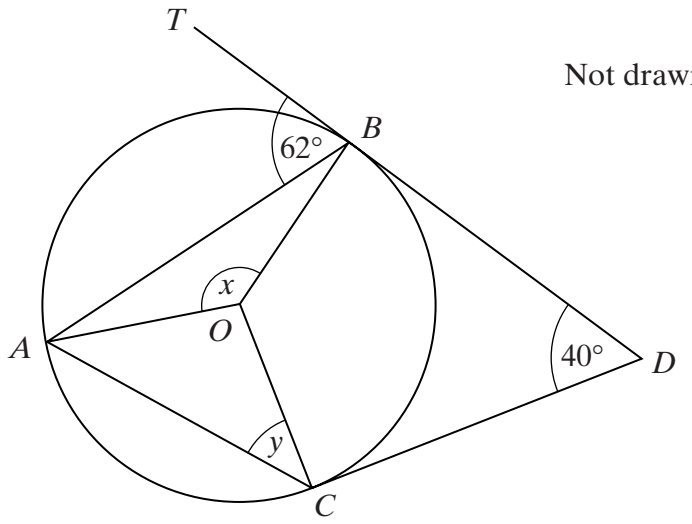
Answer ..... degrees *(1 mark)*

(b) The tangent DB is extended to T.
The line AO is added to the diagram.
Angle $TBA = 62°$



Not drawn accurately

(i) Work out the value of x.

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Answer ..... degrees *(2 marks)*

(ii) Work out the value of y.

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Answer ..... degrees *(2 marks)*

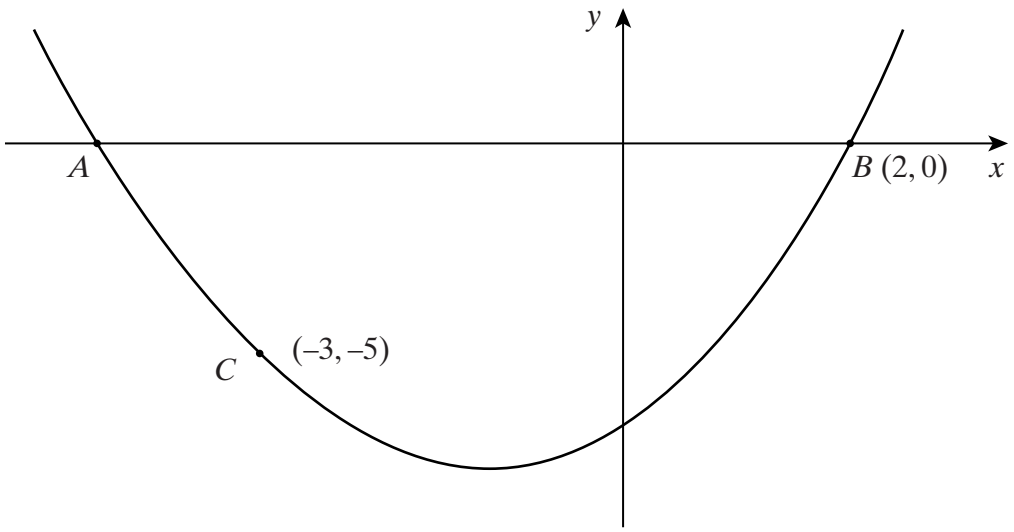
7

13 The diagram shows the graph of the equation $y = x^2 + px + q$

The graph crosses the x-axis at A and B (2, 0).

C (–3, –5) also lies on the graph.

Not drawn accurately



(a) Find the values of p and q.

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Answer $p =$ ..... $q =$ ..... *(4 marks)*

(b) Hence work out the coordinates of A.

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Answer (..... , ...) *(2 marks)*

14 Express the recurring decimal 0.4272727..... as a fraction.

Give your answer in its simplest form.

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Answer ..... *(4 marks)*

15 (a) Simplify $(2x^4y)^3$

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

(b) Factorise fully $2x^2 - 50y^2$

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

15

16 (a) (i) Show that $\sqrt{20} = 2\sqrt{5}$

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(1 mark)

(ii) Expand and simplify $(\sqrt{2} + \sqrt{10})^2$

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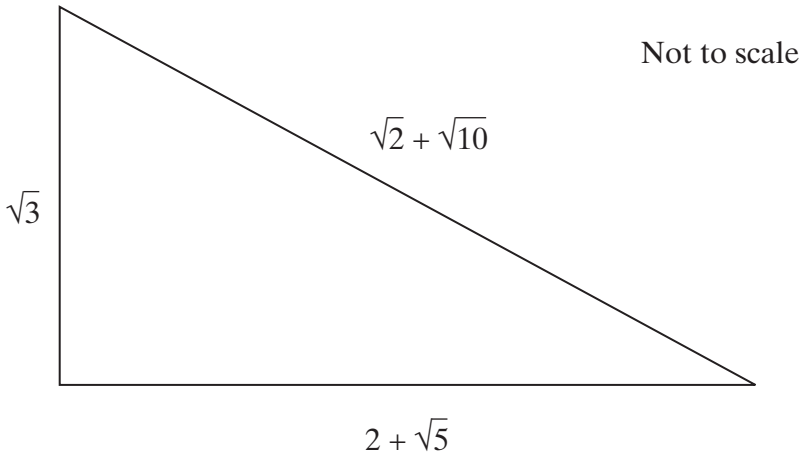
Answer ..... *(2 marks)*

(b) Is this triangle right-angled?



You **must** show your working.

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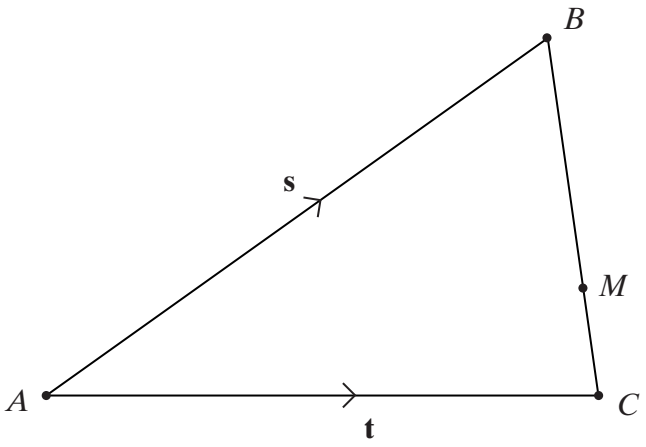
(3 marks)

LEAVE MARGIN BLANK

17 In triangle ABC, M lies on BC such that $BM = \frac{3}{4} BC$.

$\overrightarrow{AB} = \mathbf{s}$ and $\overrightarrow{AC} = \mathbf{t}$



Not drawn accurately

Find $\overrightarrow{AM}$ in terms of **s** and **t**.

Give your answer in its simplest form.

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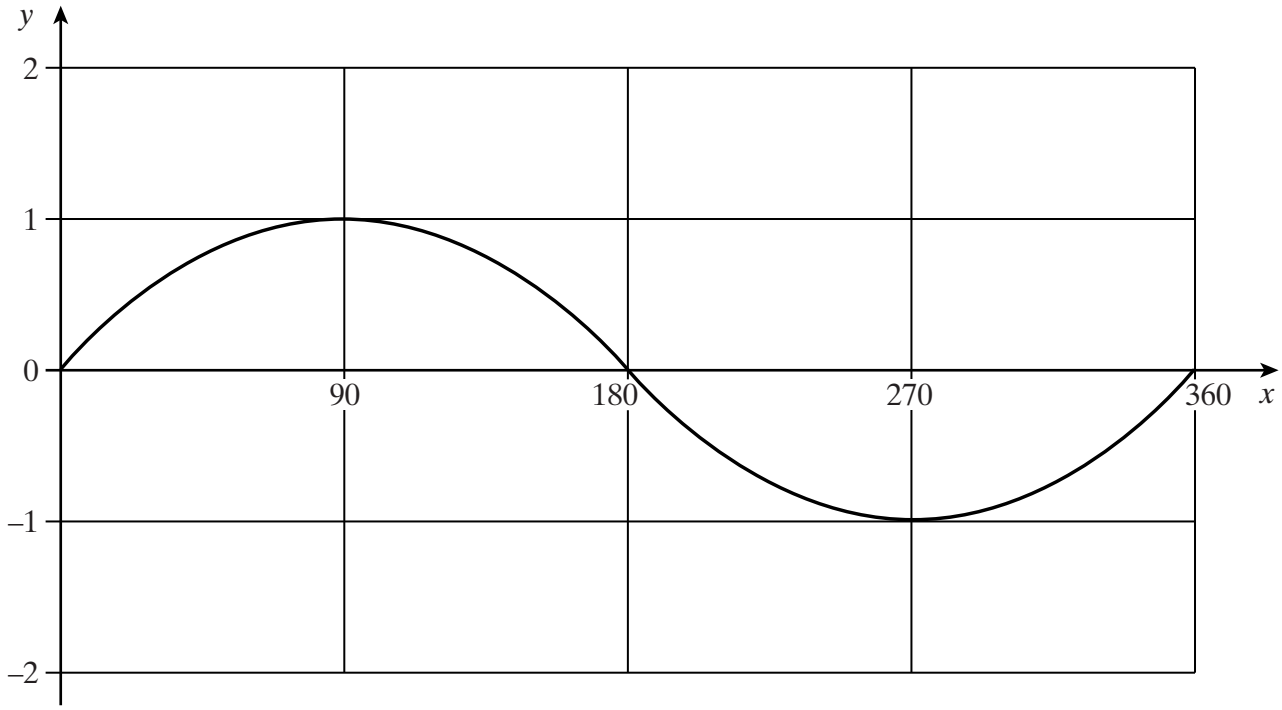
Answer ..... *(3 marks)*

TURN OVER FOR THE NEXT QUESTION

9

18 The sketch shows the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$



You are given that $\sin 70° = 0.9397$

(a) Write down another solution of the equation $\sin x = 0.9397$

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

(b) Solve the equation $\sin x = -0.9397$ for $0° \leqslant x \leqslant 360°$

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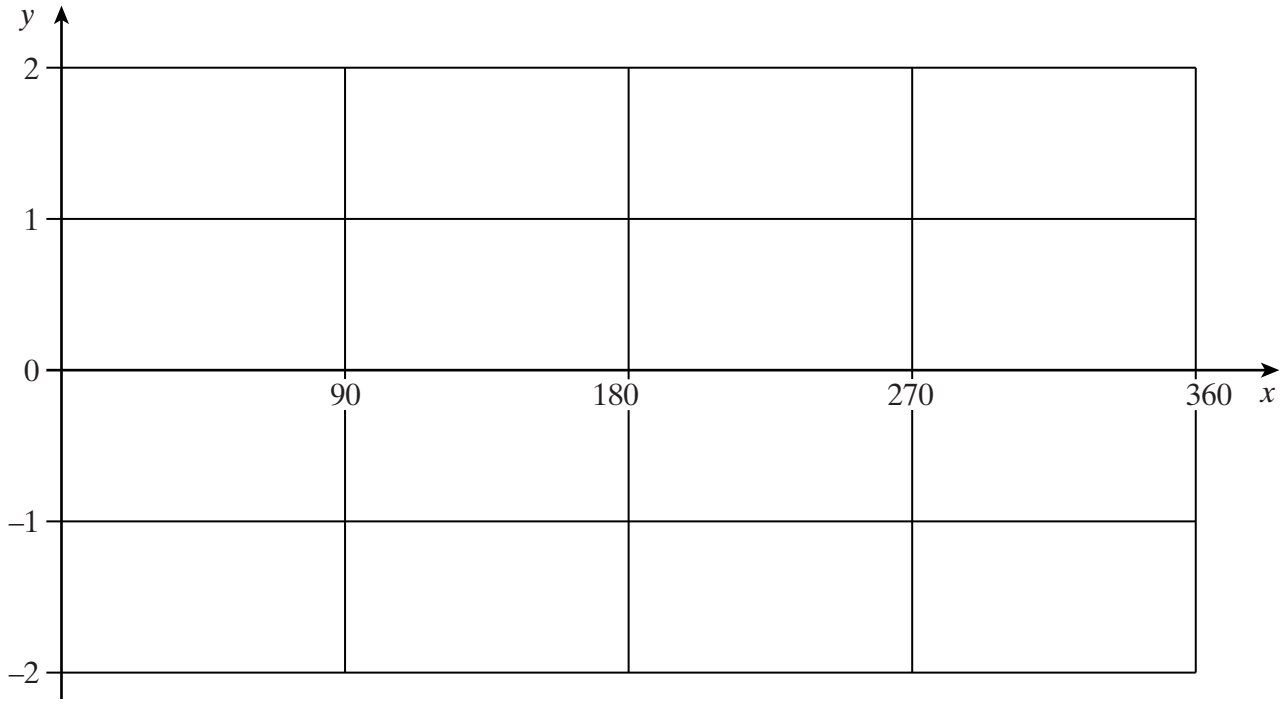
Answer ..... degrees

..... degrees

(2 marks)

(c) On the axes below sketch the graph of $y = \sin 2x$ for $0° \leqslant x \leqslant 360°$



(2 marks)

(d) Hence write down the **four** solutions of the equation $\sin 2x = 0.9397$

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Answer ..... degrees

..... degrees

..... degrees

..... degrees

(3 marks)

8

Turn over ▶

19 A straight line has the equation $y = 2x - 3$

A curve has the equation $y^2 = 8x - 16$

(a) Solve these simultaneous equations to find any points of intersection of the line and the curve.
Do **not** use trial and improvement.
You **must** show all your working.

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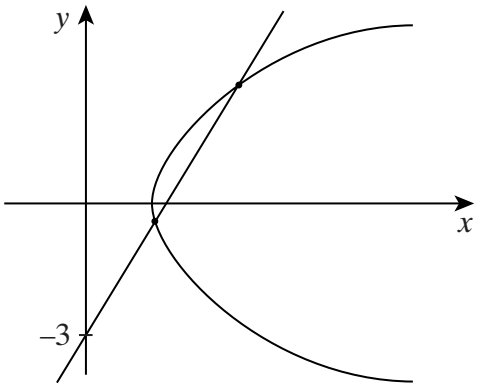
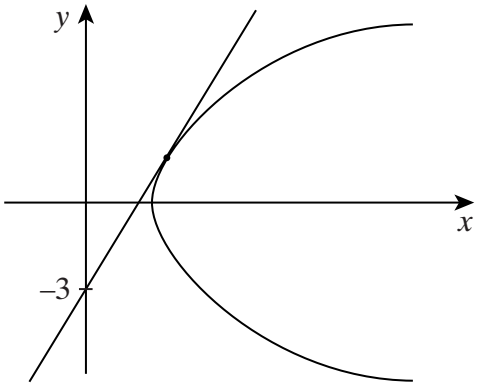
Answer ..... *(5 marks)*

(b) Here are three sketches showing the curve $y^2 = 8x - 16$ and three possible positions of the line $y = 2x - 3$

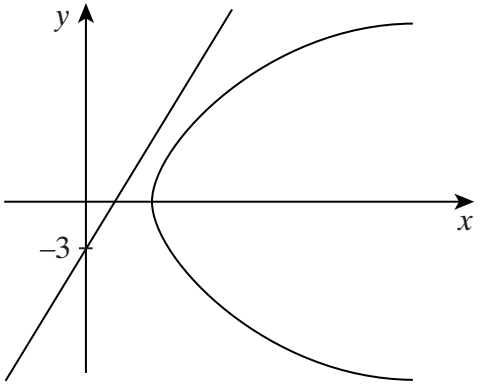
Sketch 1



Sketch 2



Sketch 3



Which is the correct sketch?

You **must** explain your answer.

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(2 marks)

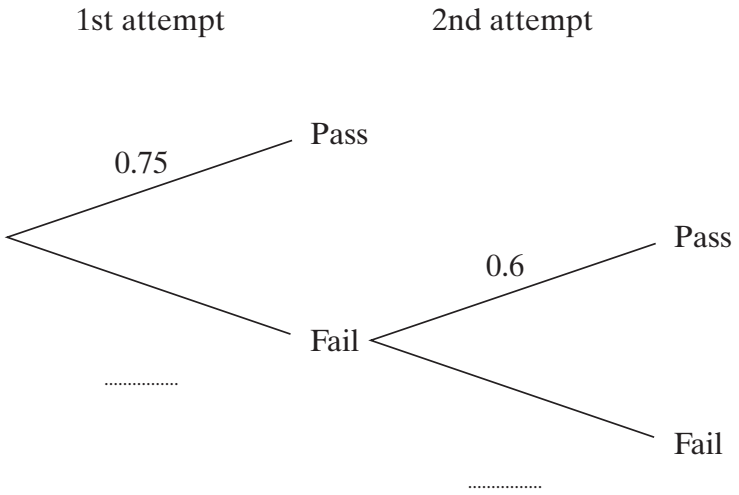
7

Turn over ▶

20 At the end of a training programme students have to pass an exam to gain a certificate.
The probability of passing the exam at the first attempt is 0.75
Those who fail are allowed to re-sit.
The probability of passing the re-sit is 0.6
No further attempts are allowed.

The tree diagram below shows all the possible outcomes.

(a) (i) Complete the tree diagram.



(1 mark)

(ii) What is the probability that a student fails to gain a certificate?

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

(b) Three students take the exam.
What is the probability that all of them gain a certificate?

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

END OF QUESTIONS

6

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THERE ARE NO QUESTIONS PRINTED ON THIS PAGE