Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

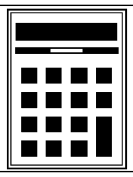
General Certificate of Secondary Education
November 2008

MATHEMATICS (SPECIFICATION A) **4301/2H**
Higher Tier
Paper 2 Calculator

H

Wednesday 12 November 2008 9.00 am to 11.00 am

For this paper you must have:
- a calculator
- mathematical instruments.



Time allowed: 2 hours

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book.

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You may ask for more answer paper, graph paper and tracing paper. This must be tagged securely to this answer booklet.

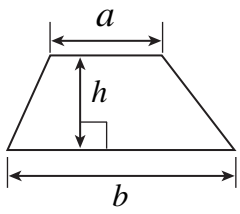
Advice

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

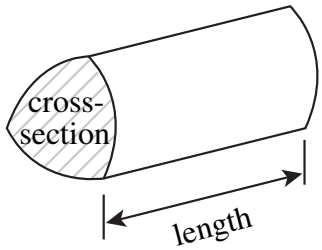
For Examiner's Use	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$

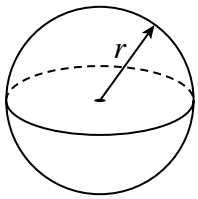


Volume of prism = area of cross-section × length



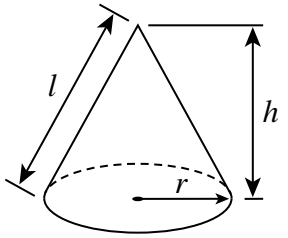
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

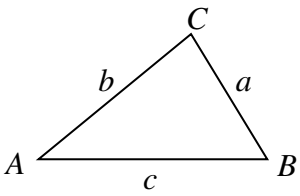
Curved surface area of cone = $\pi r l$



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

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

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

1 The n^{th} term of a sequence is given by the expression

$$n^2 + 5$$

Write down the first **three** terms of the sequence.

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

2 A household has one pint of milk delivered each day from Monday to Friday.
On Saturday they have three pints of milk and one carton of cream delivered.
There is no delivery on a Sunday.
A carton of cream costs £1.20
The weekly bill is £4.80

How much does a pint of milk cost?

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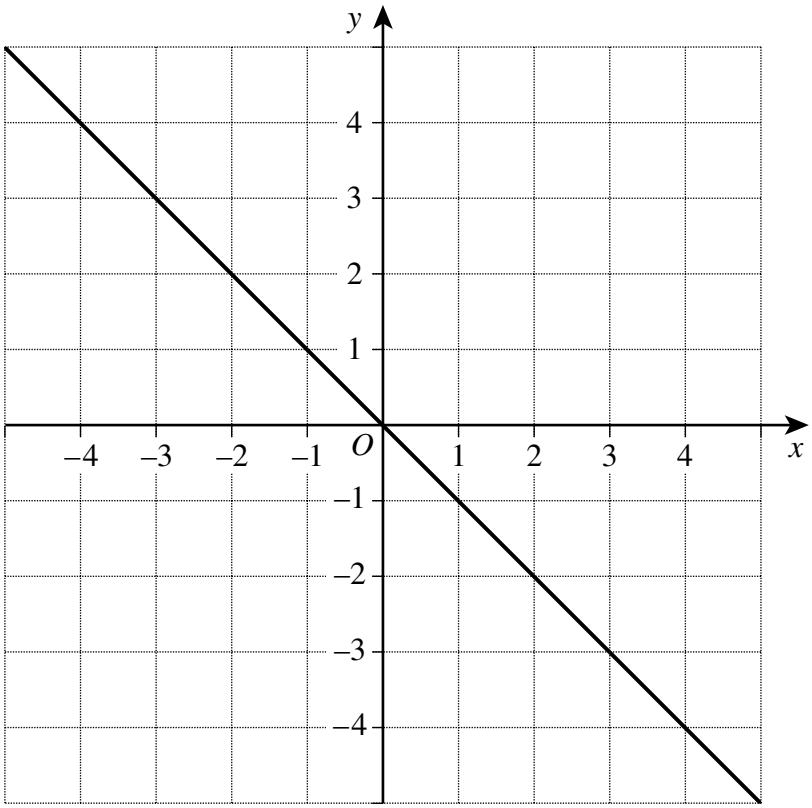
Answer ..... pence *(3 marks)*

5

3



3 (a) Pat says the graph shows the line $y = x$

Explain why Pat is wrong.

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(1 mark)

3 (b) Find the equation of the line that passes through the points (–4, –3), (0, 1) and (3, 4)

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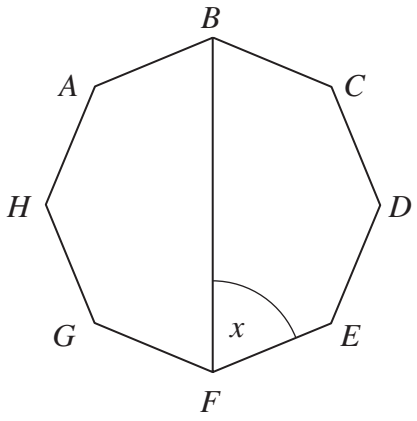
Answer ..... *(2 marks)*

4 *ABCDEFGH* is a regular octagon.



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Work out the value of x.

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

5 (a) Expand $6(x - 7)$

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

5 (b) Factorise $x^2 + 6x$

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

5 (c) Expand and simplify $x(2x + 3) - 4(x^2 - 1)$

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

10

6 The standard quadrilaterals are

Square	**Rectangle**	**Parallelogram**
Kite	**Rhombus**	**Trapezium**

6 (a) Three different quadrilaterals have these two properties.

Both pairs of opposite sides are equal.
Rotational symmetry order 2

Name the **three** quadrilaterals.

Answer .....

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..... *(2 marks)*

6 (b) Two of the quadrilaterals in part (a) also have this property

Diagonals do not cross at right angles.

Name the **two** quadrilaterals.

Answer .....

..... *(1 mark)*

6 (c) For one of the quadrilaterals in part (b), write down an extra property that will distinguish it from the other.

Quadrilateral chosen .....

Property .....

.....

(1 mark)

7 Adila wants to buy three cosmetic items.

Lipstick
£5.50

Nail polish
£3.99

Perfume
£9.99

She sees two adverts in the paper.

Bates the Chemists
Buy 3 items pay for 2 !
Cheapest item in any 3 is free.

Doyll's Pharmacy
20% off everything.

In which shop will she pay less for the three items?
You **must** show your working.

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

8

8 The costs per mile, in pence, and the flight distance, in thousands of miles, are shown for 10 flights on Flyaway airlines.

Flight	A	B	C	D	E	F	G	H	I	J
Distance (Thousands of miles)	0.3	0.5	0.8	1.0	1.2	1.4	1.7	2.6	3.3	3.9
Cost per mile (pence)	6.4	5.8	6.2	5.7	5.0	4.6	4.4	3.4	2.4	1.8

8 (a) Calculate the cost of the ticket for flight A.

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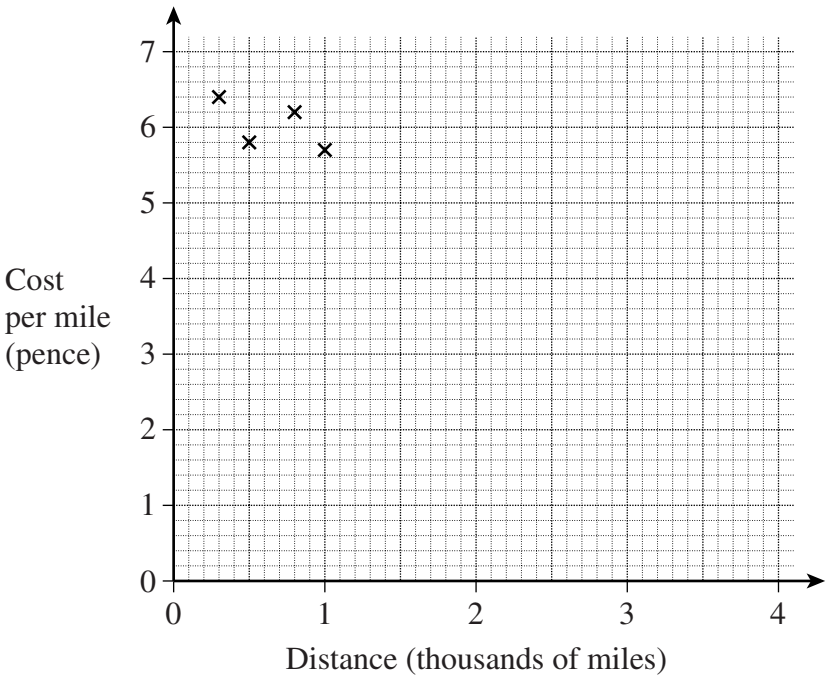
Answer £ ..... *(2 marks)*

8 (b) The data for the first four flights has been plotted on the scatter diagram.

Plot the data for the remaining flights.



(2 marks)

8 (c) Draw a line of best fit on the diagram.

(1 mark)

8 (d) Estimate the cost per mile, in pence, of a flight of 2000 miles.

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

8 (e) The scatter diagram shows negative correlation.

Explain what this means for the relationship between the cost per mile and the distance of the flight.

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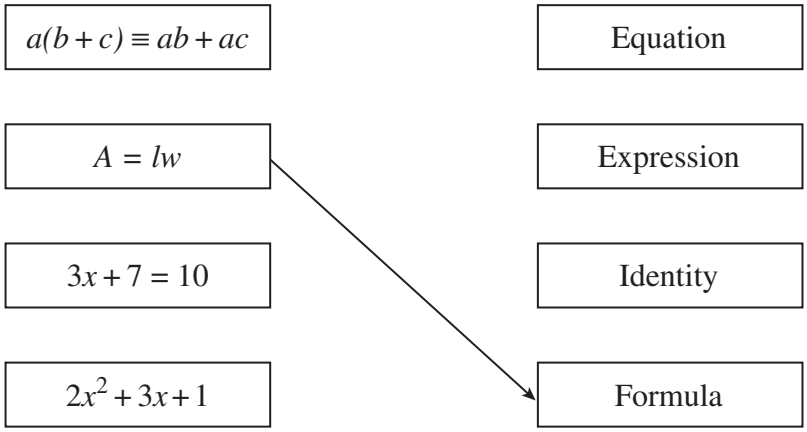
(1 mark)

Turn over for the next question

7

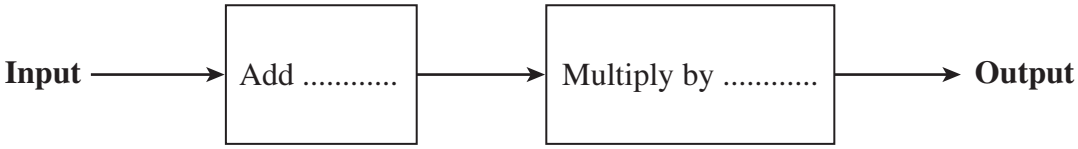
9 (a) Draw arrows to join each item on the left with its correct description on the right.

One of them has been done for you.



(2 marks)

9 (b) A two-stage operation is shown.



Fill values in the boxes so that when the input is an odd number the output is also an odd number.

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(2 marks)

10 Solve the equations

10 (a) $3x - 8 = 7 - x$

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

10 (b) $\frac{x + 4}{5} + \frac{x - 2}{3} = 4$

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

Turn over for the next question

10

11 Money is invested in a bank which pays compound interest.
A rule to find the approximate number of years it takes to double the investment is

Number of years = 72 ÷ the annual rate of interest

For example:
Annual rate = 5%
Approximate number of years to double investment is 72 ÷ 5 = 14.4

Show that this rule works when the annual rate of interest is 6%.

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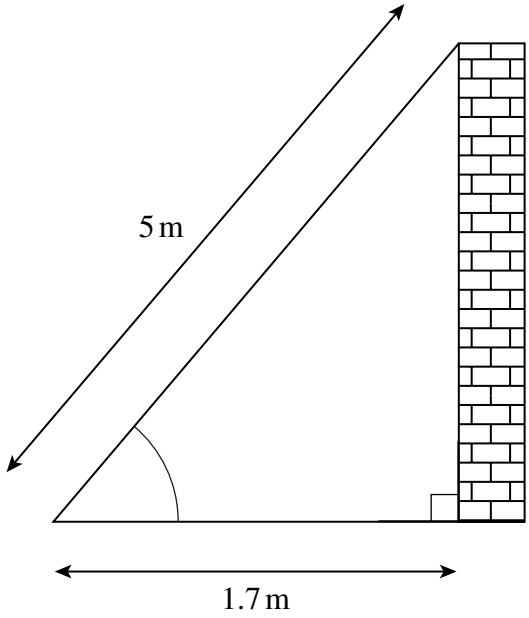
(4 marks)

12 A ladder of length 5 m rests against a wall.
The foot of the ladder is 1.7 m from the base of the wall.



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12 (a) How far up the wall does the ladder reach?

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

12 (b) Calculate the angle the ladder makes with the ground.

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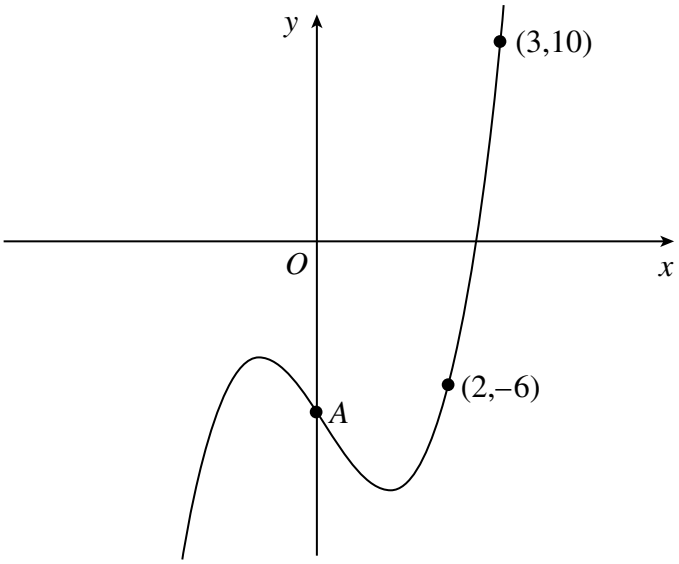
Answer ..... degrees *(3 marks)*

10

13 The sketch shows the graph of $y = x^3 - 3x - 8$
The graph passes through the points (2, –6) and (3, 10)



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13 (a) The graph crosses the *y*-axis at the point *A*.
Write down the coordinates of the point *A*.

Answer (0, ...) *(1 mark)*

13 (b) Use trial and improvement to find the solution of

$$x^3 - 3x - 8 = 0$$

Give your answer to 1 decimal place.

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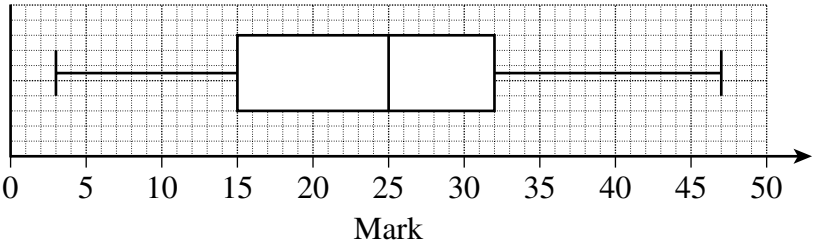
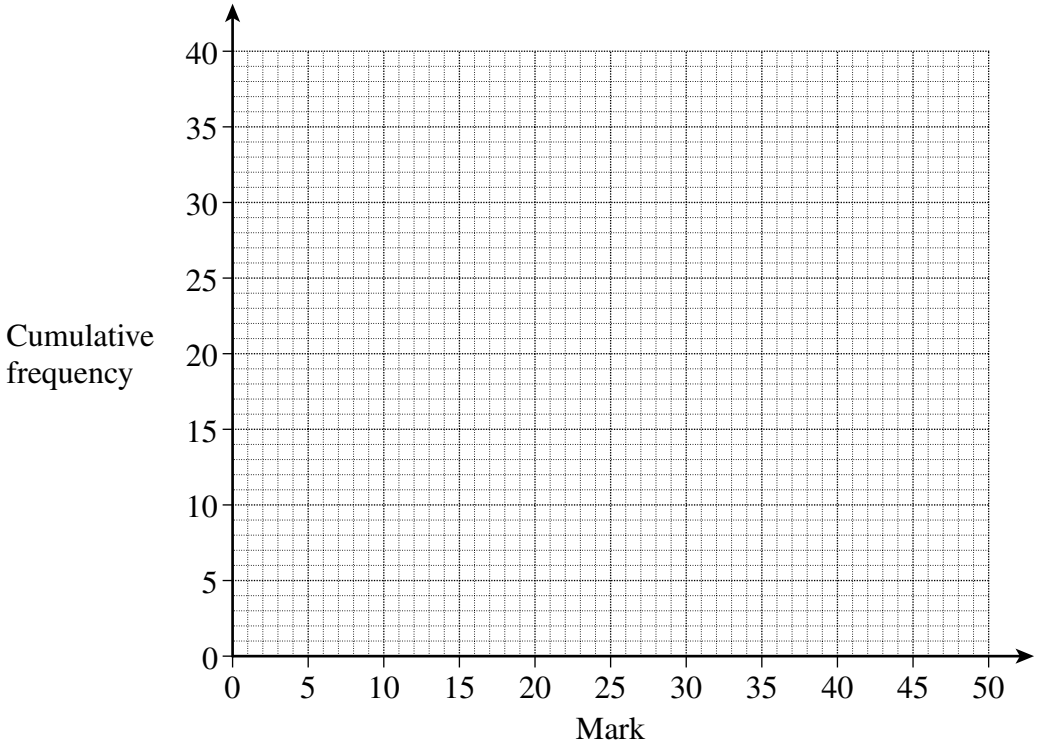
Answer x = ... *(4 marks)*

14 The box plot shows the marks of forty students in a mathematics test.
Two students scored the lowest mark of 3





14 (a) Use the box plot to draw a cumulative frequency diagram for the marks of the forty students.

(3 marks)

14 (b) What is the probability that a student picked at random from the group scored more than 32 marks?

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

9

Turn over ▶

15 The length of a plank of wood is given as 2.40 m to the nearest 10 cm.

15 (a) What is the least possible length of one of these planks?

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

15 (b) Martin has 60 of these planks.
He needs 140 metres of wood.

Can he be sure that he will have enough wood?
Show your working.

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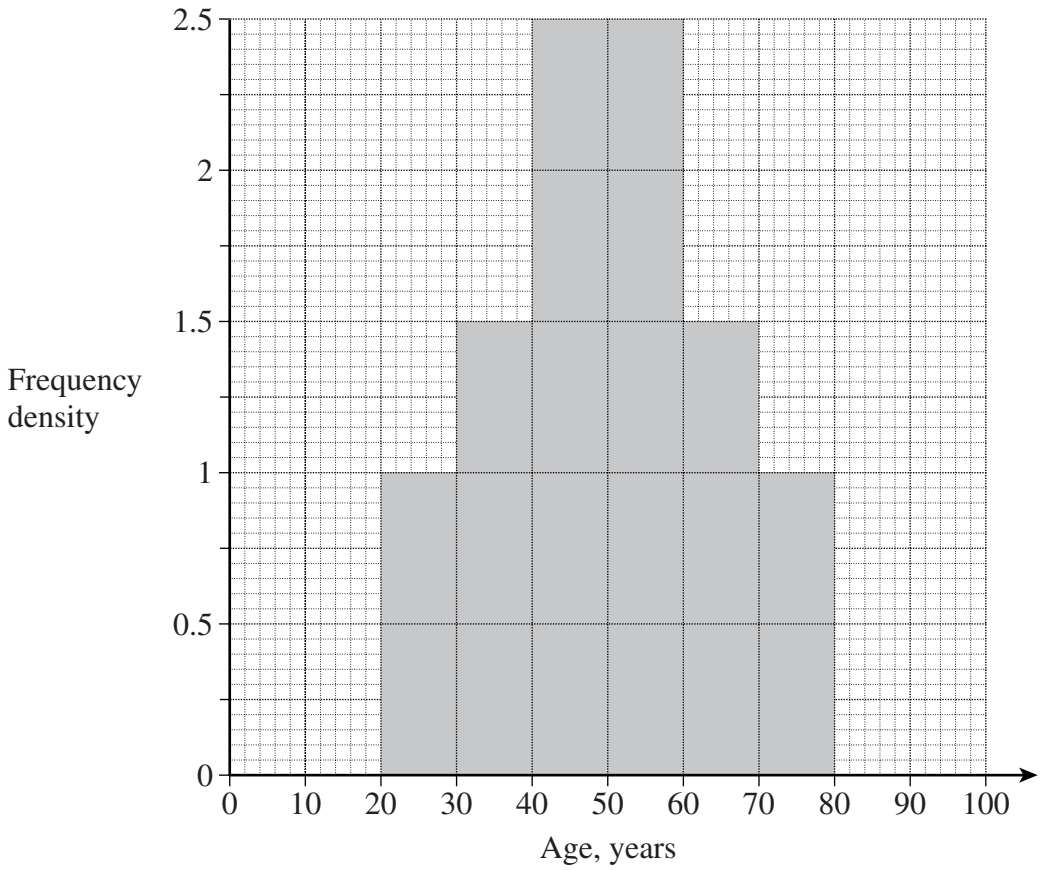
(2 marks)

16 The histogram shows the distribution of ages of 100 members of a chess club.



16 (a) How many members of the club were less than 40 years old?

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

16 (b) How many members of the club are between 40 and 60 years old?

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

16 (c) Work out the inter-quartile range of the ages.

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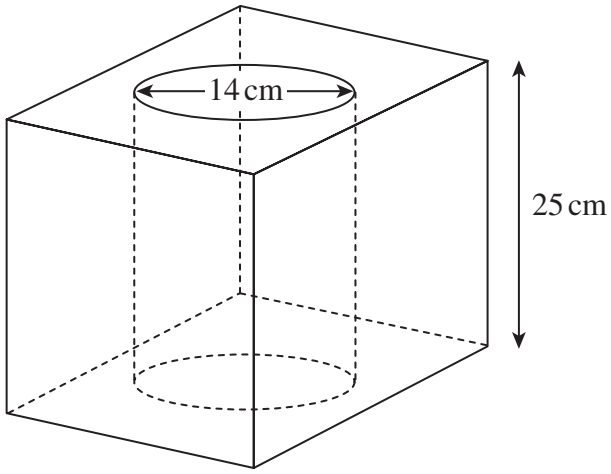
Answer ..... years *(2 marks)*

7

17 A solid cube of side 25 cm has a circular hole cut through vertically.
The circle has a diameter of 14 cm.



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Calculate the volume remaining.

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

18 The time, T, in seconds, that a pendulum takes to do a complete oscillation is given by the formula

$$T = 2\pi\sqrt{\frac{l}{g}}$$

where l is the length of the pendulum, in metres, and g is the acceleration due to gravity. Take the value of g to be 9.807 m/s^2.

In St. Isaac's cathedral in St. Petersburg there is a pendulum of length 94 m.

18 (a) (i) Calculate the value of T for this pendulum.
Give all the figures in your calculator display.
Give your answer as a decimal.

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

18 (a) (ii) Give your answer to a suitable degree of accuracy.

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

18 (b) Calculate the length of a pendulum that will give a value of $T = 1$

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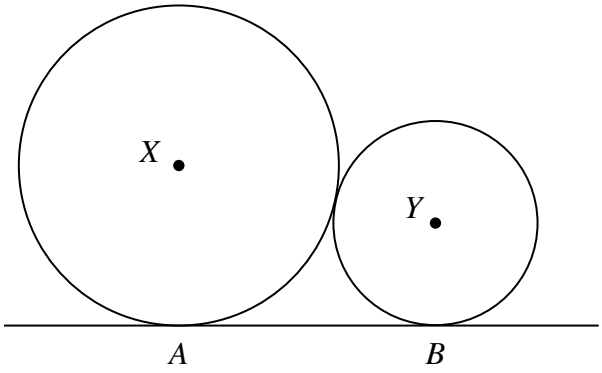
Answer ..... m *(4 marks)*

10

19 The circle, with centre X, has a radius of 5 cm.
The circle, with centre Y, has a radius of 3 cm.
The circles touch externally.
The circles have a common tangent AB.



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19 (a) Explain why $ABYX$ is a trapezium.

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(2 marks)

19 (b) Show that $AB = 7.75$ cm to 3 significant figures.

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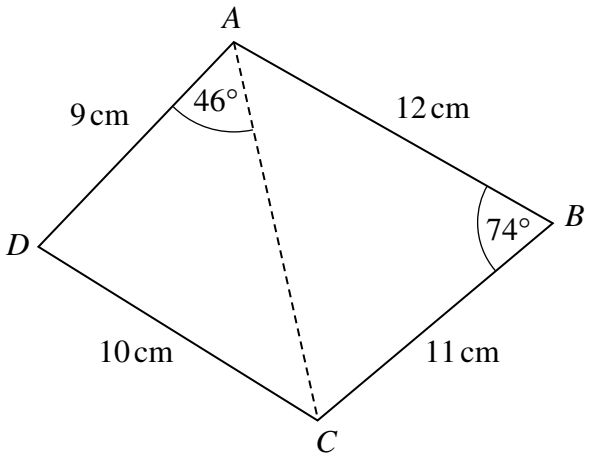
(3 marks)

20 *ABCD* is a quadrilateral.
$AB = 12\,\text{cm}$, $BC = 11\,\text{cm}$, $CD = 10\,\text{cm}$ and $DA = 9\,\text{cm}$
$\angle ABC = 74°$ and $\angle DAC = 46°$



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20 (a) Use the cosine rule to find *AC*.

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

20 (b) Use the sine rule to find the size of angle *ACD*.

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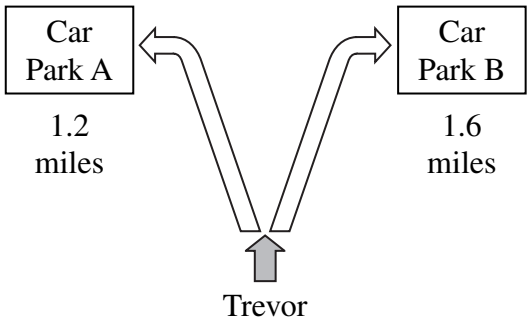
Answer ..... degrees *(3 marks)*

11

Turn over ▶

21 Trevor is sitting in his car at some traffic lights.
He knows that he is 1.2 miles from Car Park A and 1.6 miles from Car Park B.
He knows his average speed is 10 miles per hour in city traffic.



A sign on the traffic lights shows the number of spaces currently available in each car park.

Trevor is sitting at the lights for one minute.

In that time the sign changes as shown below.

START

	SPACES
Car Park A	510
Car Park B	700

1 MINUTE LATER

	SPACES
Car Park A	450
Car Park B	630

21 (a) It will take Trevor 7.2 minutes to drive to car park A at 10 mph.

How long will it take Trevor to drive to car park B at 10 mph?

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

21 (b) Which car park will give Trevor the better chance of finding a space?
You **must** show your working.

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(4 marks)

Turn over for the next question

6

22 (a) Show that the algebraic expression

$$\frac{2x-3}{x-3} - \frac{2x-1}{2x+1}$$

can be written as $\dfrac{2x^2+3x-6}{(x-3)(2x+1)}$

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(4 marks)

22 (b) Hence, or otherwise, solve the equation

$$\frac{2x-3}{x-3} - \frac{2x-1}{2x+1} = 1$$

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

END OF QUESTIONS

7