Surname

Other Names

Candidate Signature

AQA

General Certificate of Secondary Education
Higher Tier
November 2010

Mathematics (Specification A)

4306/2H

H

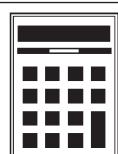## Paper 2 Calculator

Friday 12 November 2010   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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- If your calculator does not have a π button, take the value of π to be 3.14 unless otherwise instructed in the question.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.
- You are expected to use a calculator where appropriate.

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

4306/2H

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$
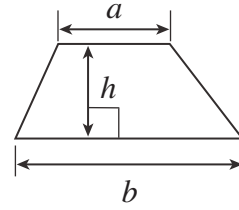
Volume of prism = area of cross-section × length
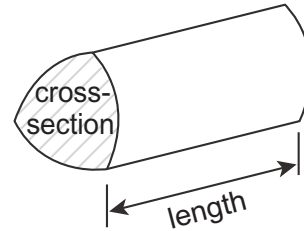
Volume of sphere = $\frac{4}{3}\pi r^3$

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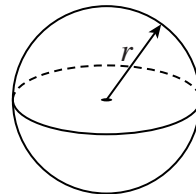
Volume of cone = $\frac{1}{3}\pi r^2 h$

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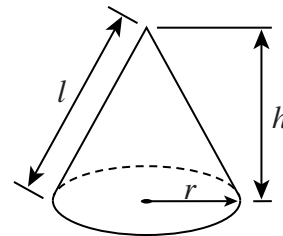
In any triangle ABC

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

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

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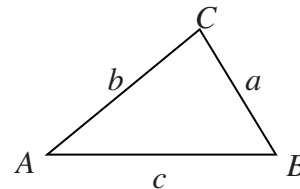
The Quadratic Equation

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 Increase £145 by 18%.

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Answer £ .... *(3 marks)*

2 The table shows the marks scored on a mental arithmetic test by 30 students.

Mark	Frequency
4	3
5	1
6	2
7	8
8	6
9	5
10	5

Calculate the mean mark.

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Answer .... *(3 marks)*

6

Turn over ▶

3 (a) p is a prime number and r is an odd number.

Is the expression pr^2 always odd, always even or could it be either odd or even?
Tick the correct box.

☐ Always odd   ☐ Always even   ☐ Could be either odd or even

Give examples to justify your answer.

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(1 mark)

3 (b) x, y and z are all odd numbers.

Write an expression in terms of x, y and z so that the value of the expression is always even.

....

Answer ....   *(1 mark)*

4 *ABC* is an isosceles triangle.

A

x

Not drawn accurately

104°

B   C
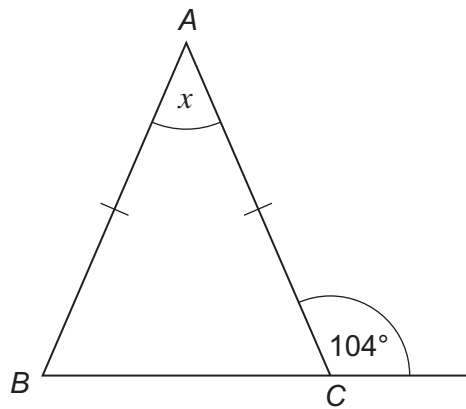
Calculate the value of the angle x.

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

5 (a) Factorise $\qquad$ $x^2 + 7x$

....

Answer .... *(1 mark)*

5 (b) Expand $\qquad$ $5(3x + 8)$

....

Answer .... *(1 mark)*

5 (c) Expand and simplify $\qquad$ $3(2x + 1) - 2(x - 3)$

....

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Answer .... *(2 marks)*

6 Here are some values used to convert between metric units and imperial units.

1.6   1.75   2.2   4.5   30

Fill in the appropriate value to make these sentences true.

One kilogram is approximately ………… pounds.

One foot is approximately ………… centimetres.

One litre is approximately ………… pints.

(2 marks)

Turn over ▶

7 The bar chart shows a breakdown of the population of Hayville.
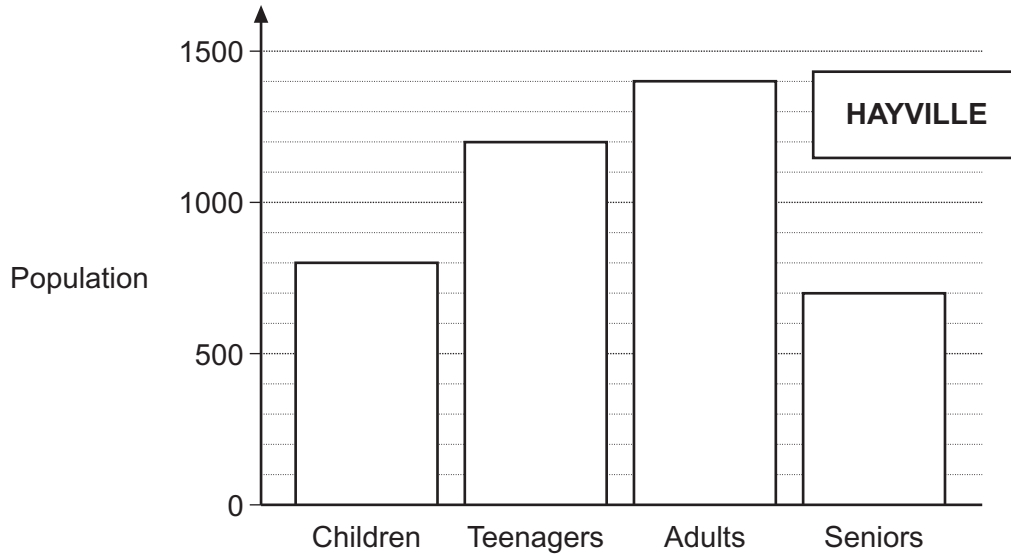
The pie chart shows the proportions of the same groups in Deetown.
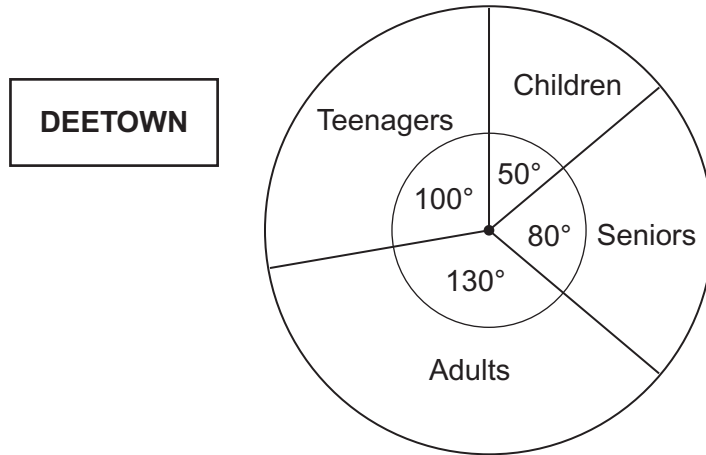
There are twice as many people in Deetown as Hayville.

Work out the number of people in Deetown who are Adults.

Give your answer to an appropriate degree of accuracy.

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Answer .... *(5 marks)*

8 (a) Solve the equation $\dfrac{6}{x} = 12$

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

8 (b) Solve the equation $3y + 8 = 3 - 2y$

....

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

9 (a) The nth term of a sequence is $n^2 + 1$

Write down the first three terms.

....

....

Answer 1st term ....

2nd term...

3rd term .... *(2 marks)*

9 (b) Write down the nth term of the sequence

5   11   17   23   29   35   ….…..

....

....

Answer .... *(2 marks)*

13

Turn over ▶

10   Work out the area enclosed by the lines

$y = 3$ $x = -2$ $y = x$

Use the grid to help you.

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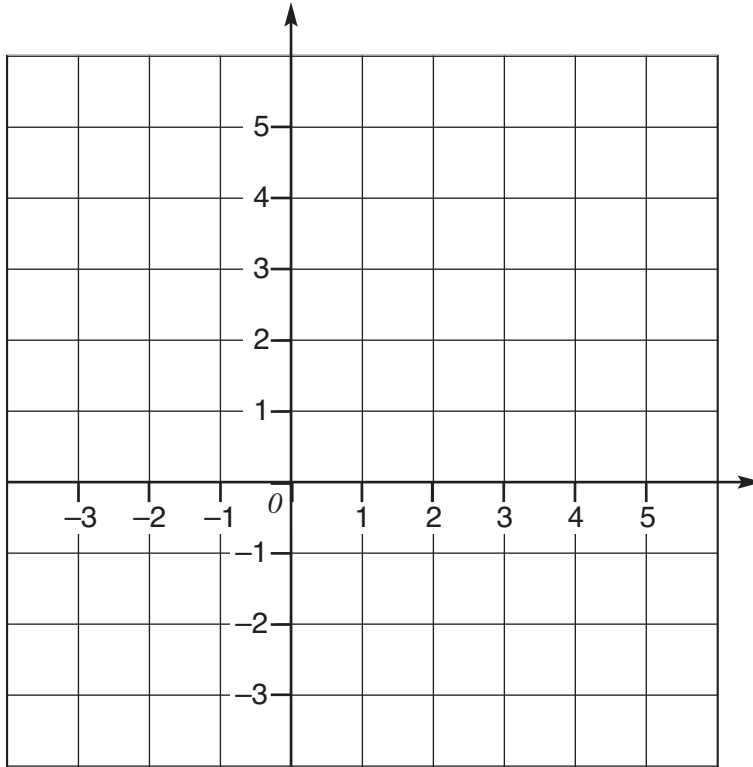
Answer ....square units   *(4 marks)*

11 This shape is made from a rectangle and a semicircle.

Not drawn accurately

12 cm

16 cm
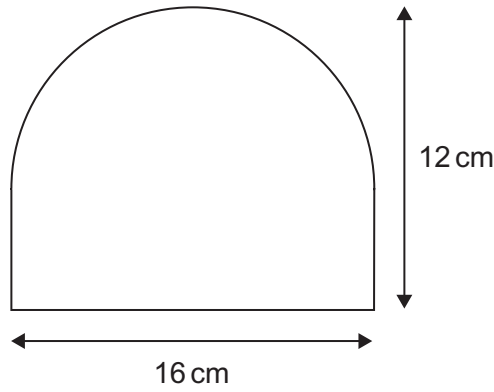
Calculate the area of the shape.

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Answer ....cm^2 *(4 marks)*

12 (a) Show clearly that $(x - 2)(x - 3) \equiv x^2 - 5x + 6$

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(1 mark)

12 (b) Show that when $x = 2$ the value of $x^2 - 5x + 6$ is zero.

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(1 mark)

12 (c) Write down another value of x for which $x^2 - 5x + 6$ is zero.

Answer ....   *(1 mark)*

11

Turn over ▶

13 The waist-to-hip ratio has been found to be an important predictor of health problems.

The ratio is expressed as 1 : n

where $n = \dfrac{\text{waist circumference}}{\text{hip circumference}}$

The table shows the health risk associated with different ratios.

Risk	Men	Women
High Risk	$n > 1.2$	$n > 1$
Moderate Risk	$1 \leqslant n \leqslant 1.2$	$0.8 \leqslant n \leqslant 1$
Low Risk	$n < 1$	$n < 0.8$

This graph shows the health risk for **men** for various waist and hip circumferences.

Hip circumference (inches)

Waist circumference (inches)

Men
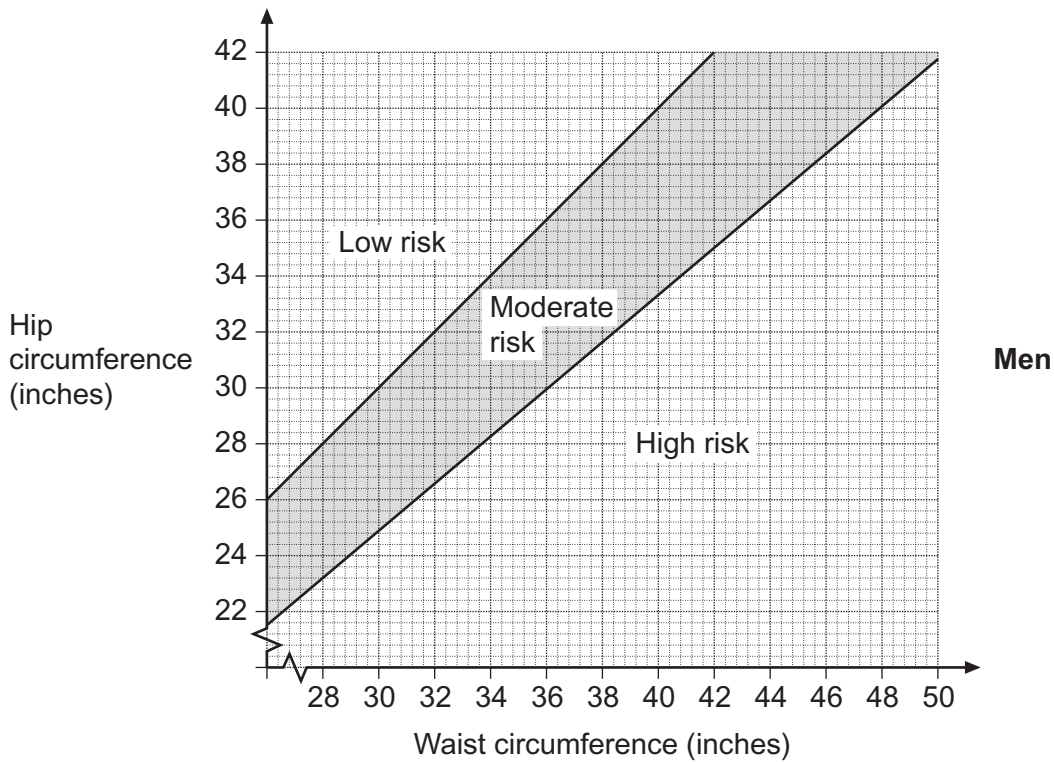
13 (a) Alf has a waist circumference of 38 inches and a hip circumference of 30 inches.

Is Alf at high, moderate or low health risk?

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Answer .... *(1 mark)*

13 (b)   Marlene has a 24 inch waist circumference.
What would her hip circumference be if $n = 0.8$?

....

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

13 (c)   On the graph below the boundary line between low and moderate health risk is shown for women.
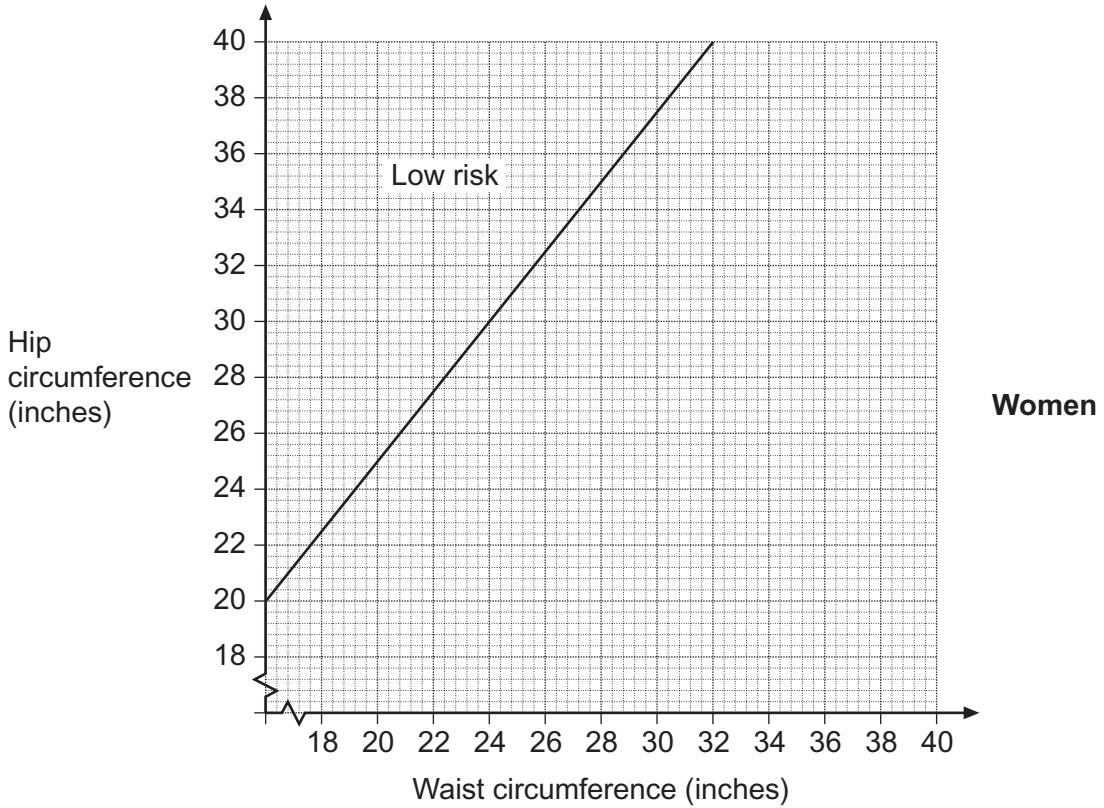
Complete the graph to show the health risk factors for **women**.

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(2 marks)

4

Turn over ▶

14
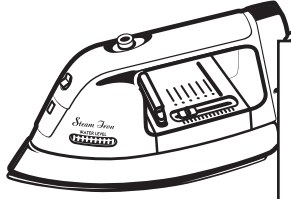
Sale
15% off all
household goods
This iron now only £30.60

The price of an iron is reduced by 15% in a sale.
The sale price is £30.60

What is the reduction from the normal price?

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Answer   £.. *(3 marks)*

15 (a)   Solve the inequality $2x - 1 < 7$

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Answer   .... *(2 marks)*

15 (b)   Write down the inequality shown on the number line below
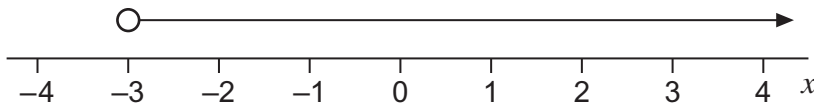
Answer   .... *(1 mark)*

15 (c)   Write down **all** the integers that satisfy both the inequality in part (a) and the inequality in part (b).

....

Answer   .... *(1 mark)*

16   Describe how you would investigate the hypothesis

'More goals are scored in the second half of
football matches than in the first half'

Your answer should read logically and make reference to a plan covering:

- how you collect the data
- how much data to collect
- how you process the data
- your interpretation and conclusion.

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(5 marks)

12

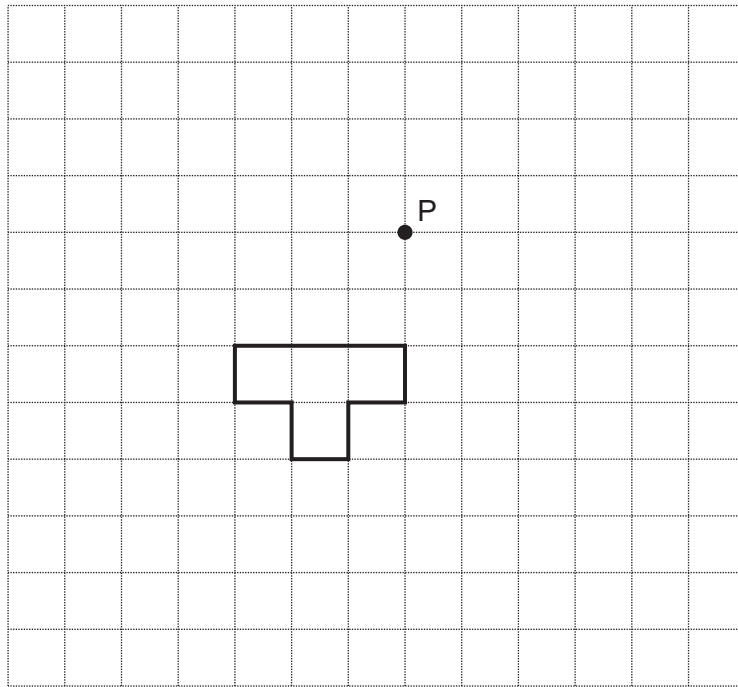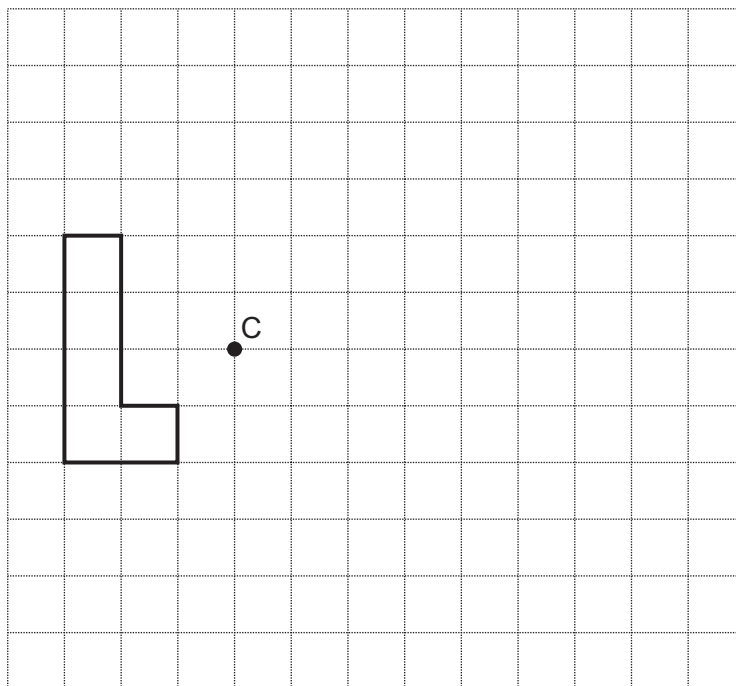**Turn over ▶**

17 (a)   Rotate the T-shape by a quarter turn anti-clockwise about P.

(2 marks)

17 (b)   Enlarge the L-shape by a scale factor of –2, using C as the centre of enlargement.

(2 marks)

Do not write outside the box

18 In January 2008 the following statistics were released by the United States government.

- There are 2.5×10^8 passenger vehicles in the United States.
- On average 2×10^7 barrels of fuel are used by these vehicles each day.
- One barrel contains 42 gallons.
- On average each passenger vehicle travels 18 miles on one gallon of fuel.

18 (a) On average, how many gallons of fuel are used each day?

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

18 (b) Calculate the average distance each passenger vehicle travels each day.

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

Turn over for the next question

8

Turn over ▶

19   These ten letters are placed in a hat.

| S | T | A | T | I | S | T | I | C | S |

A letter is drawn from the hat at random, noted, and replaced.
Another letter is drawn from the hat at random and noted.

19 (a)   Complete the tree diagram to show whether or not the letters drawn are
vowels (A or I) or consonants (C, S or T).

First Letter   **Second Letter**

……… ⟋ vowel

vowel

0.3

……… ⟍ consonant

……… ⟋ vowel

………

consonant

……… ⟍ consonant

………
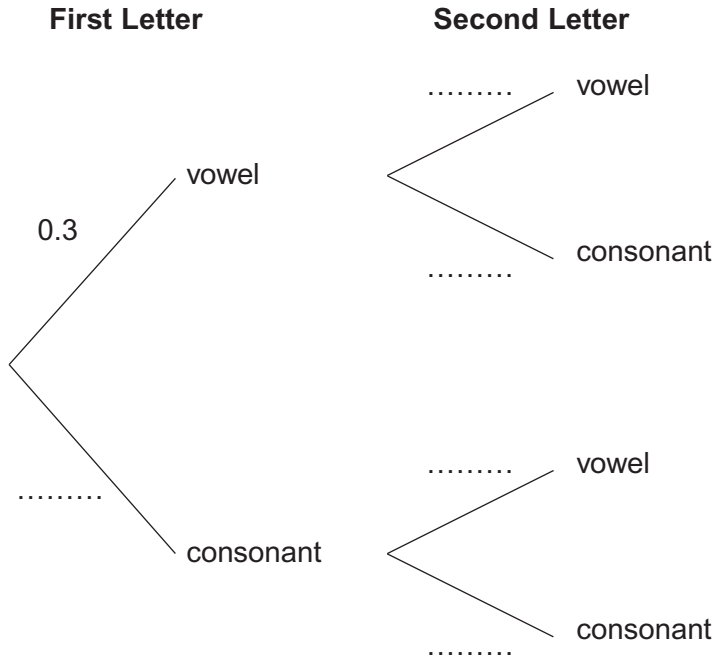
(1 mark)

19 (b)   Work out the probability that at least one of the two letters drawn is a vowel.

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Answer ....   *(3 marks)*

20 (a)   *A*, *B*, *C* and *D* are four points on the circumference of a circle, centre *O*.

Not drawn
accurately

20 (a) (i)   Give a reason why angle x is 140º.

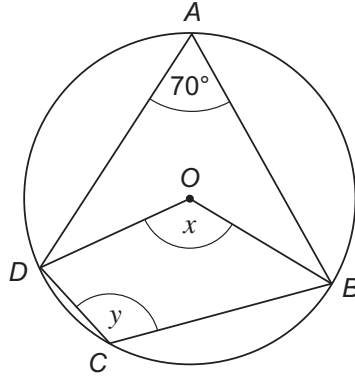...

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(1 mark)

20 (a) (ii)   Give a reason why angle y is 110º.

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(1 mark)

20 (b)   *P*, *Q*, *R* and *S* are four points on the circumference of a circle, centre *O*.
Angle *SPQ* = 50º
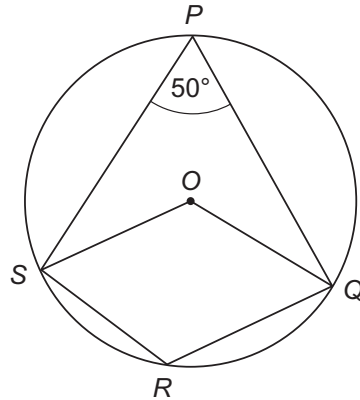
Not drawn
accurately

Show that *OQRS* is **not** a rhombus.

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(2 marks)

8

Turn over ▶

21   The table shows the ten-pin bowling scores for a league night at the local bowling alley.

Score, s	Frequency
$75 < s \leqslant 125$	40
$125 < s \leqslant 150$	55
$150 < s \leqslant 175$	65
$175 < s \leqslant 225$	95
$225 < s \leqslant 300$	45
Total	300

Draw a fully labelled histogram to illustrate the data.

Score, *s*
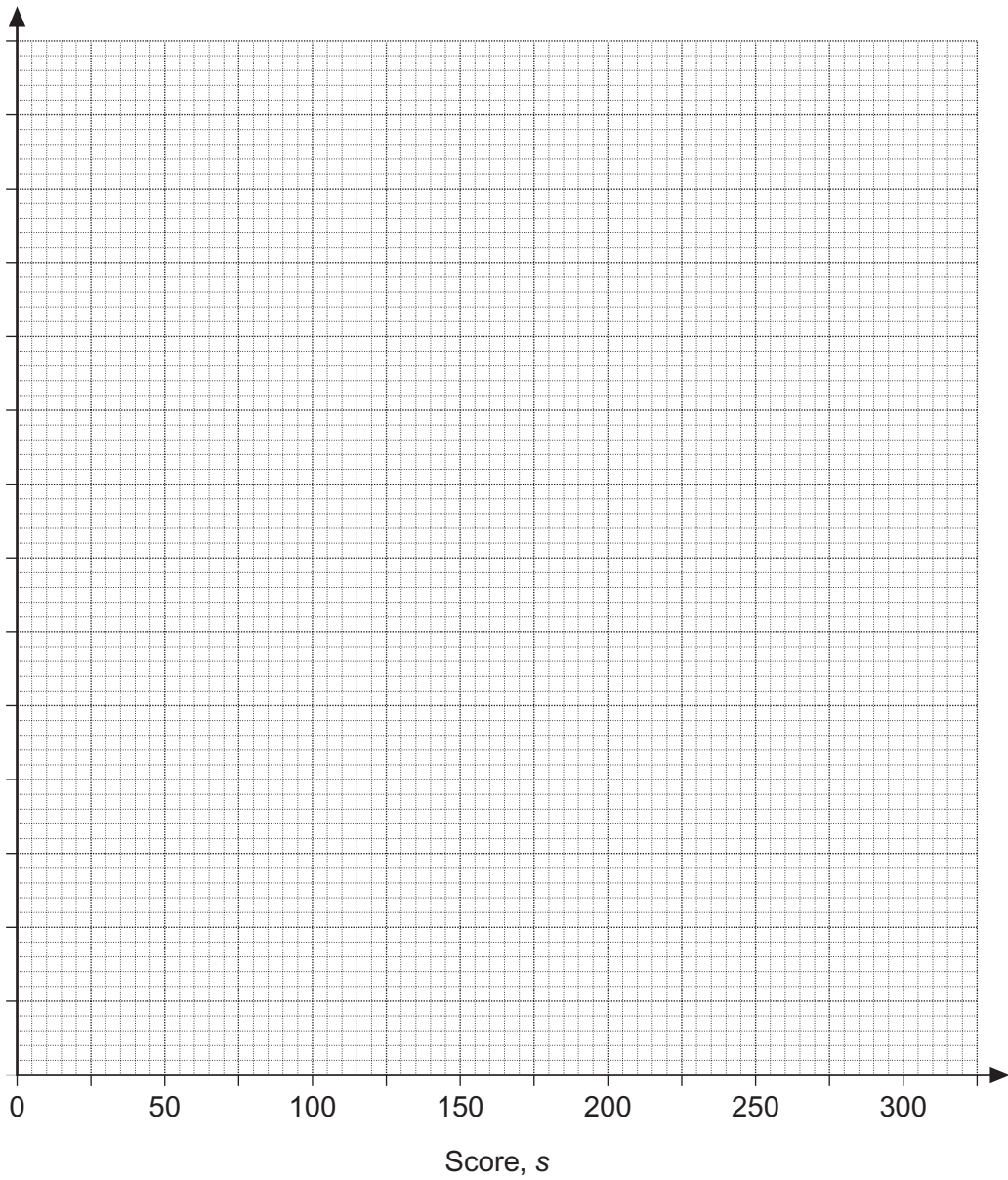
(3 marks)

22 Rearrange the formula $\quad y = \dfrac{3x - 1}{2x + 5} \quad$ to make x the subject.

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Answer   ....   *(4 marks)*

Turn over for the next question

7

Turn over ▶

23   *ABC* is a triangle.
AB = 14 cm, *AC* = 15 cm
Angle ABC = 52º

A

15 cm   14 cm   Not drawn
                                        accurately

52°   B

C
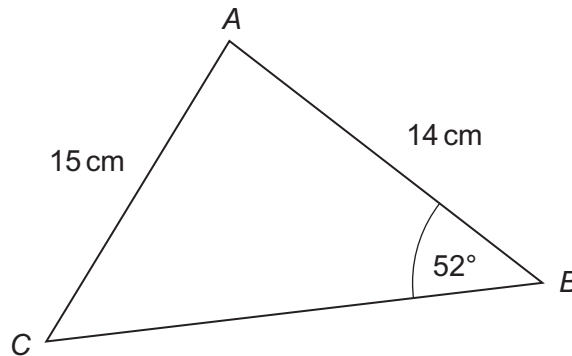
Calculate the area of triangle *ABC*.

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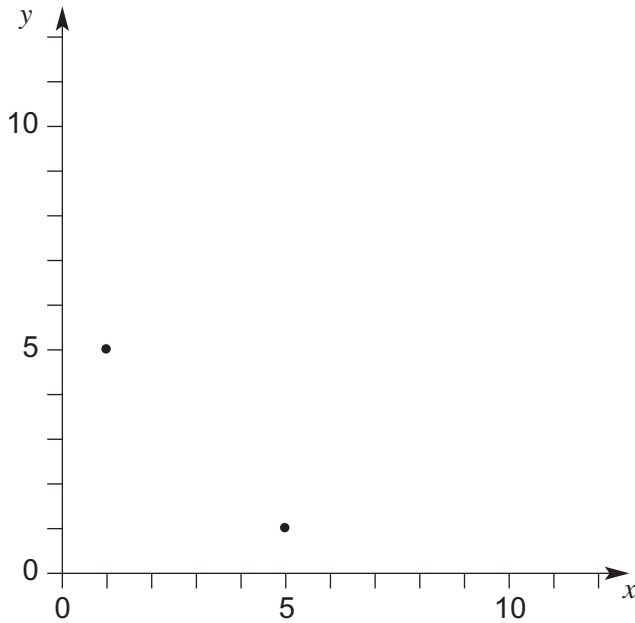Answer ....cm^2 *(5 marks)*

24   Two points (5, 1) and (1, 5) on the graph of $y = \dfrac{5}{x}$ for $x > 0$ are plotted.

24 (a)   Complete a sketch of the graph of $y = \dfrac{5}{x}$ for $x > 0$

(2 marks)

24 (b)   Calculate the coordinates of the point where this curve intersects with the line $y = x$

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

Turn over for the next question

Turn over ▶

25 Solve the equation $\dfrac{2}{3x-1} - \dfrac{3}{2x+1} = \dfrac{2}{5}$

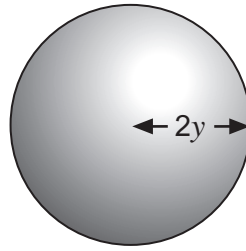...

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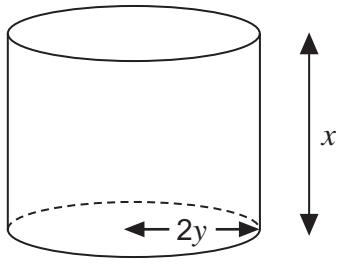Answer   ....   *(6 marks)*
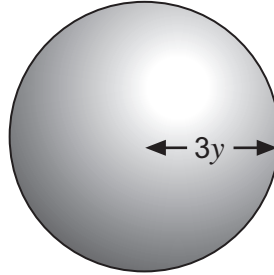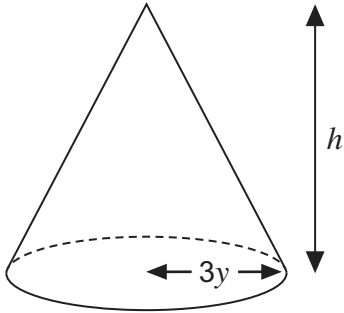
26 This cylinder and sphere have the same volume.

Not drawn accurately

This cone and sphere also have the same volume

Not drawn accurately

Find h in terms of x

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Answer .... *(5 marks)*

END OF QUESTIONS

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**