

**Friday 6 November 2015 – Morning**

**GCSE MATHEMATICS B**

**J567/04** Paper 4 (Higher Tier)

Candidates answer on the Question Paper.

**OCR supplied materials:**  
None

- Other materials required:**
- Geometrical instruments
  - Tracing paper (optional)
  - Scientific or graphical calculator

**Duration:** 1 hour 45 minutes



Candidate forename		Candidate surname	
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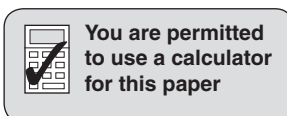
Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

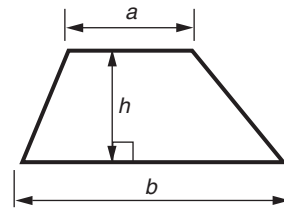
**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- Use the  $\pi$  button on your calculator or take  $\pi$  to be 3.142 unless the question says otherwise.
- The quality of written communication is assessed in questions marked with an asterisk (\*).
- The total number of marks for this paper is **100**.
- This document consists of **20** pages. Any blank pages are indicated.

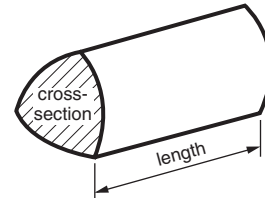


## Formulae Sheet: Higher Tier

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



**Volume of prism** = (area of cross-section)  $\times$  length

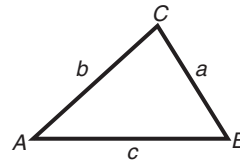


**In any triangle ABC**

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

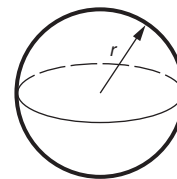
**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

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



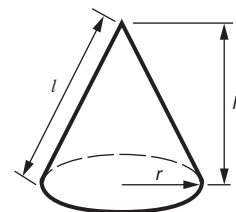
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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



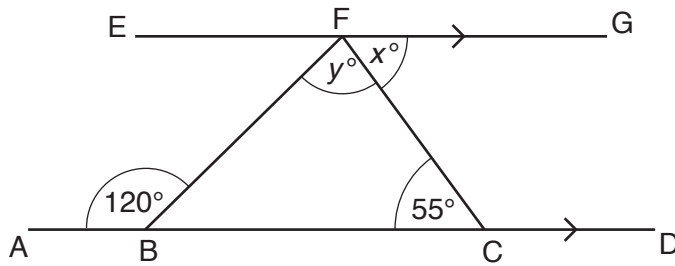
**The Quadratic Equation**

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

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

**PLEASE DO NOT WRITE ON THIS PAGE**

- 1 (a) In the diagram, ABCD is parallel to EFG.  
 Angle BCF = 55° and angle ABF = 120°.



Not to scale

- (i) Complete the sentence with a reason.

$x = 55^\circ$  because ..... [1]

- (ii) Work out  $y$ .

(a)(ii) .....° [2]

- (b) Work out the exterior angle of a regular 18-sided polygon.

(b) .....° [2]

- (c) An angle is measured as 27° correct to the nearest degree.

Write down the smallest possible size of the angle.

(c) .....° [1]

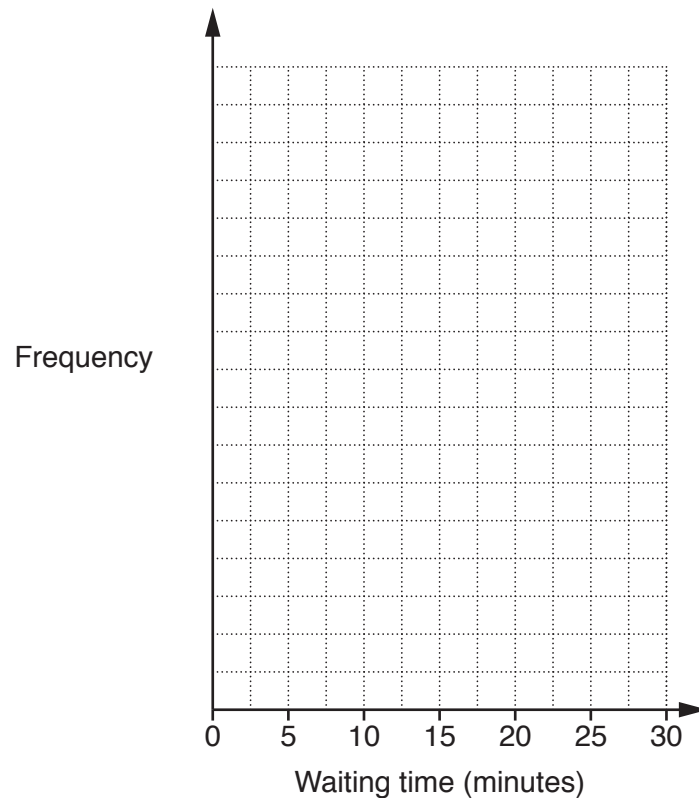
- 2 The dentists in a surgery keep a record of the waiting time for each patient. The waiting times for one Monday are summarised in the table.

Waiting time ( $t$ minutes)	Frequency		
$0 < t \leq 5$	12		
$5 < t \leq 10$	15		
$10 < t \leq 15$	16		
$15 < t \leq 20$	9		
$20 < t \leq 25$	5		
$25 < t \leq 30$	3		

- (a) Calculate an estimate of the mean waiting time.

(a) ..... minutes [4]

- (b) Draw a frequency polygon to display the waiting times data.



(c) Write down the modal class of the waiting times.

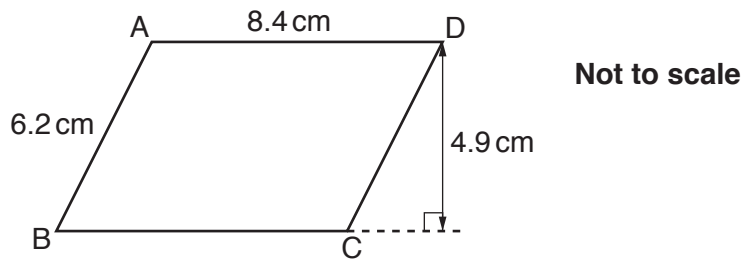
(c) ..... minutes [1]

(d) The dentists have a target of fewer than 25% of patients waiting more than 15 minutes.

Did they meet their target on Monday? Show how you decide.

..... because .....  
 ..... [2]

3 The diagram shows a parallelogram ABCD.



Work out the area of the parallelogram.

..... cm<sup>2</sup> [2]

4 (a) Work out.

$$\sqrt{\frac{2.52 + 4.78}{1.29}}$$

Give your answer correct to three significant figures.

(a) ..... [2]

(b) (i) Find the value of  $m$ .

$$2^m \times 2^3 = 4^4$$

(b)(i) ..... [2]

(ii) In the calculation below  $p$  and  $q$  are integers and  $p > q$ .  
One pair of values that make this calculation correct is  $p = 3$  and  $q = 2$ .

Find another pair of values that make the calculation correct.

$$\frac{3}{5} \times \frac{5}{p} = \frac{q}{2}$$

(ii)  $p =$  .....  $q =$  ..... [2]

- 5 (a) Pavel has a pack of cards.  
 Each card has a picture of either a square, a circle or a triangle.  
 Each picture is either black or white.  
 Pavel takes one of the cards from the pack at random.  
 Some probabilities for this are shown in the table.

	Square	Circle	Triangle
Black	0.24		0.04
White	0.12	0.20	0.08

- (i) Complete the table. [2]
- (ii) Find the probability that Pavel's card has a picture of a square.

(a)(ii) ..... [1]

- (b) A bag contains red balls, blue balls, yellow balls and green balls.

The probability that a ball taken at random from the bag is red is  $\frac{2}{5}$ .

The probability that a ball taken at random from the bag is blue is  $\frac{1}{10}$ .

The probability that a ball taken at random from the bag is yellow is  $\frac{3}{8}$ .

Find the **minimum** possible number of balls in the bag.

(b) ..... [2]

Turn over

6 (a) Factorise fully.

$$6xy - 9x^2$$

(a) ..... [2]

(b) Solve.

$$8x = 3(x + 7)$$

(b)  $x =$  ..... [3]

(c) Solve this inequality.

$$2x - 7 > 5$$

(c) ..... [2]



- 7\* A water tank is in the shape of a cylinder.  
It has diameter 0.44 m and height 1.2 m.  
Water flows into the tank at a rate of 20 litres per minute.  
1 litre = 1000 cm<sup>3</sup>.

John says that it will take about 10 minutes to completely fill the empty tank.  
Is he correct? Show calculations to justify your answer.

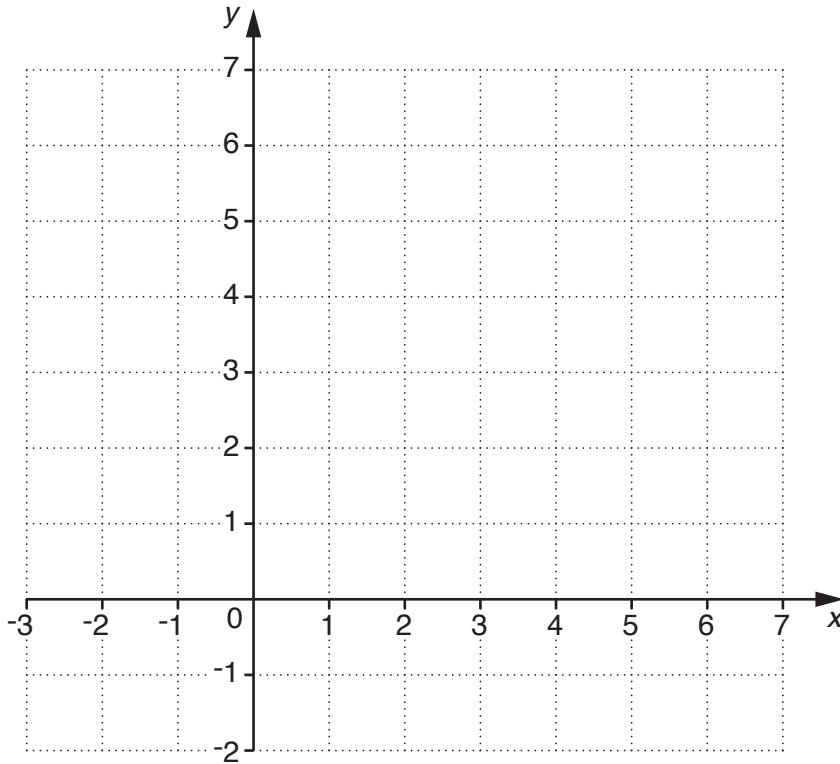
[5]

8 (a) Complete the table for  $y = 3 - \frac{1}{3}x$ .

$x$	-3	0	6
$y$		3	

[1]

(b) Draw the graph of  $y = 3 - \frac{1}{3}x$  on the grid below.



[2]

(c) On the same grid, draw the graph of  $x + y = 5$ .

[2]

(d) Use your graphs to solve the simultaneous equations  $y = 3 - \frac{1}{3}x$  and  $x + y = 5$ .

(d)  $x = \dots\dots\dots y = \dots\dots\dots$  [2]

9 (a) A website has a 24-hour sale offering 12% off all purchases.

- (i) Dina buys a skirt in the sale.  
The original price of the skirt was £36.

Calculate the price of the skirt in the sale.

(a)(i) £ ..... [2]

- (ii) Dina also buys a sweatshirt in the sale.  
She pays £24.20 for the sweatshirt.

Calculate the original price of the sweatshirt.

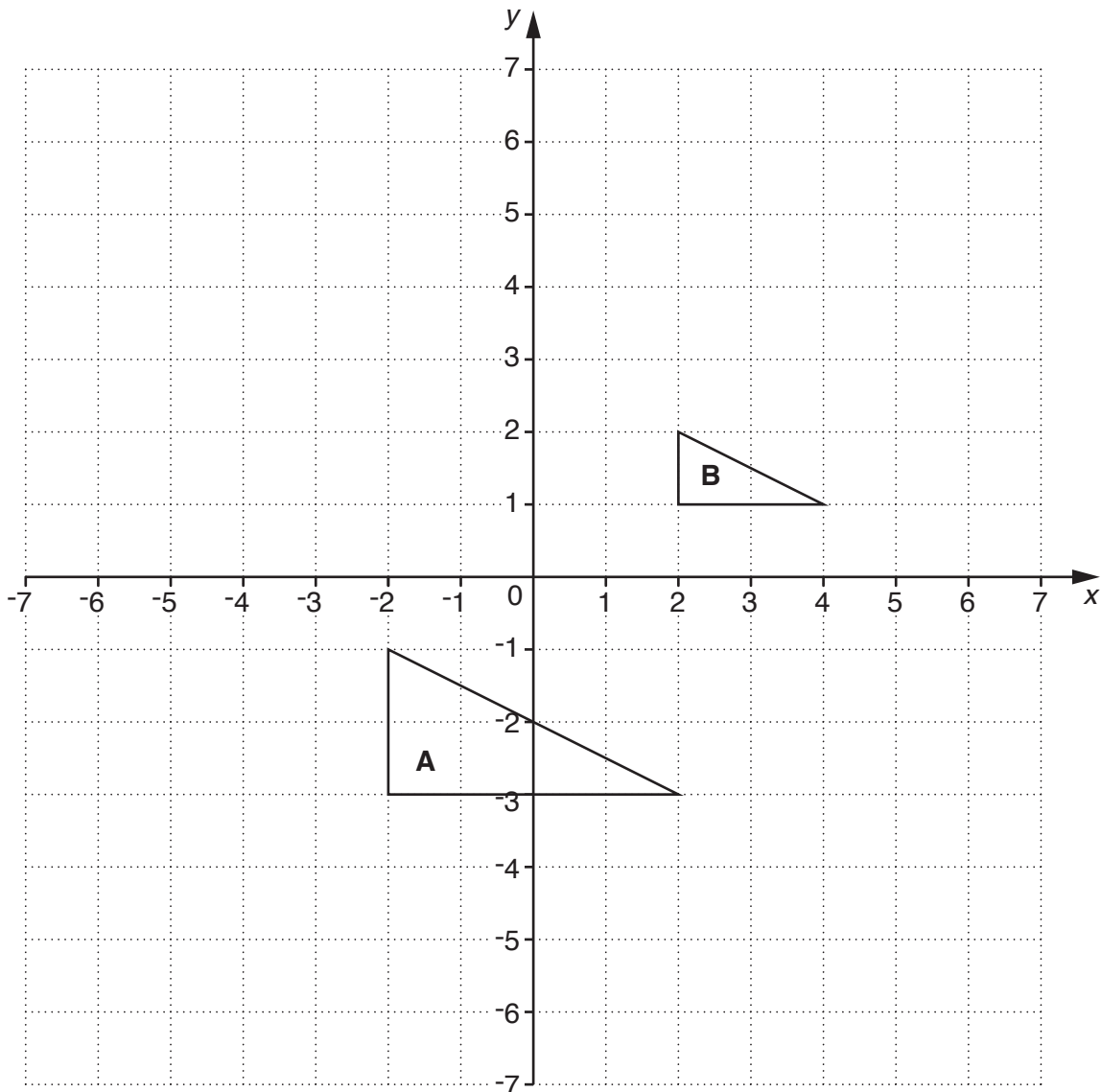
(ii) £ ..... [3]

- (b) Ross has a season ticket.  
In 2013 the season ticket cost £65.  
In 2014 the cost of the ticket was increased by 8%.  
In 2015 the cost of the ticket was increased by a further 5%.

Calculate the cost of the season ticket after the two price increases.

(b) £ ..... [3]

10 Triangles **A** and **B** are drawn on the grid below.



Triangle **B** is an enlargement of triangle **A**.

(a) Write down the coordinates of the centre of the enlargement.

(a) ( ..... , ..... ) [1]

(b) Write down the scale factor of the enlargement.

(b) ..... [1]

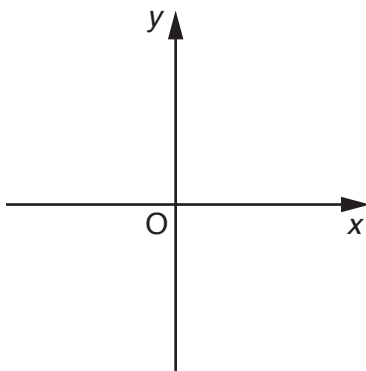
(c) Write down the ratio of the area of triangle **A** to the area of triangle **B**.  
Give your answer in its simplest form.

(c) ..... : ..... [2]

11 (a) Liam describes a graph.

It is a linear graph.  
It has a negative gradient.  
It passes through the origin.

On the axes below, sketch this graph.

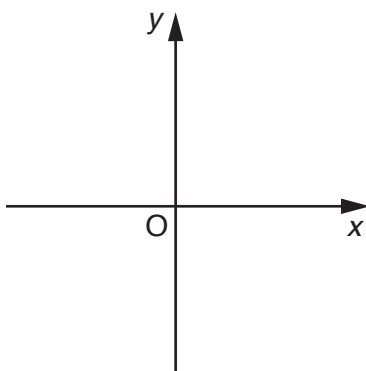


[1]

(b) Katy describes a graph.

It is a cubic graph.  
When  $x$  is positive,  $y$  is positive.  
The graph only crosses the  $x$ -axis once.

On the axes below, sketch this graph.



[2]

12 (a) Nathan keeps a record of the amount of money that he spends in the supermarket each week.

The table shows this information for an 8-week period and some 4-weekly moving averages.

Week	Amount spent	Moving average
1	£32.80	
2	£23.20	
3	£29.50	£27.40
4	£24.10	£26.50
5	£29.20	
6	£21.60	
7	£30.50	
8	£22.70	

(i) Complete the table to show the next three moving averages. [3]

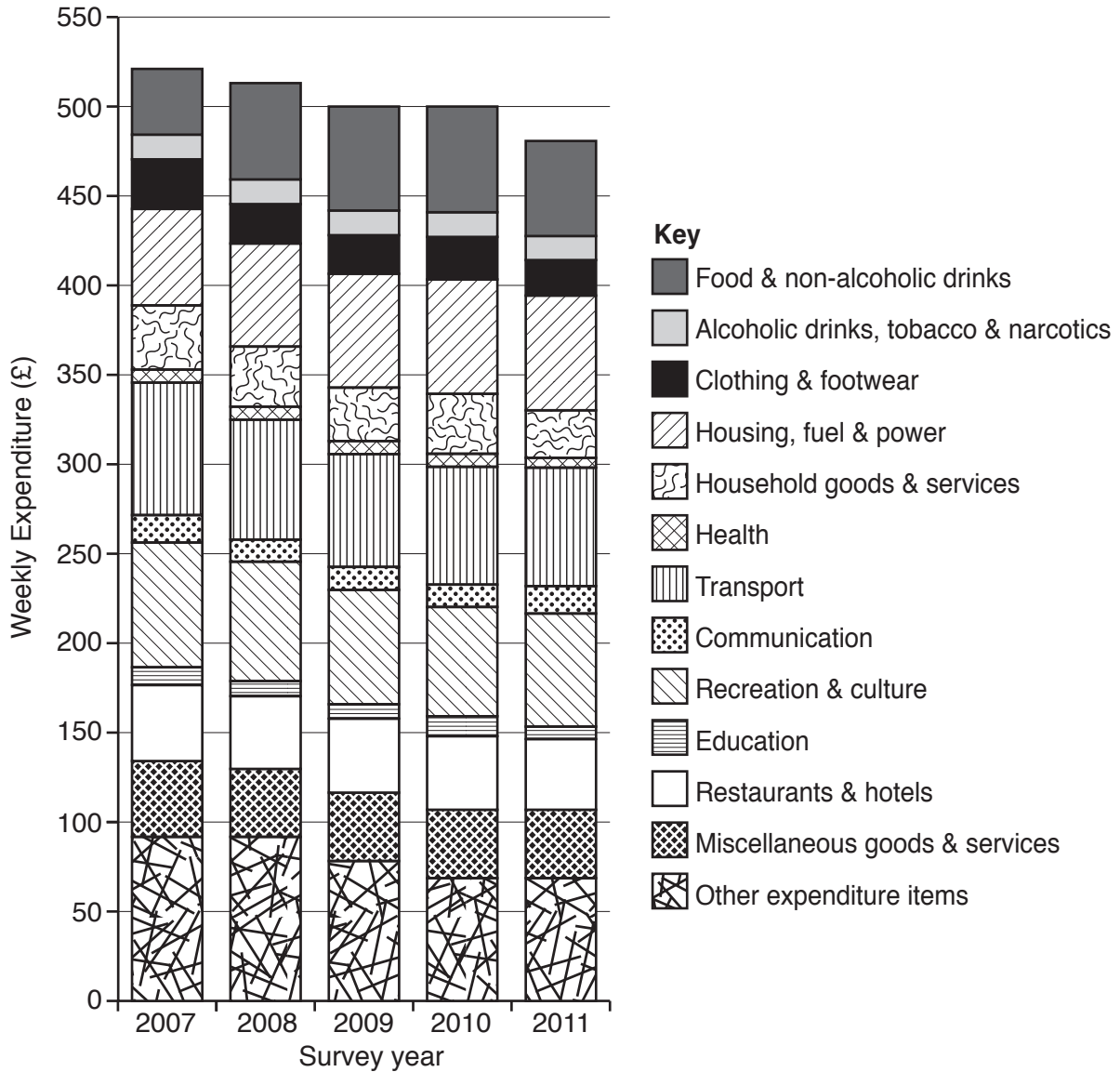
(ii) Describe how the amount Nathan spends on food changes from week to week.

.....  
 ..... [1]

(iii) Describe the **trend** in the amount Nathan spends on food.

.....  
 ..... [1]

(b) The chart below shows the average amount of money spent per week by households in the UK on different items over a number of years.



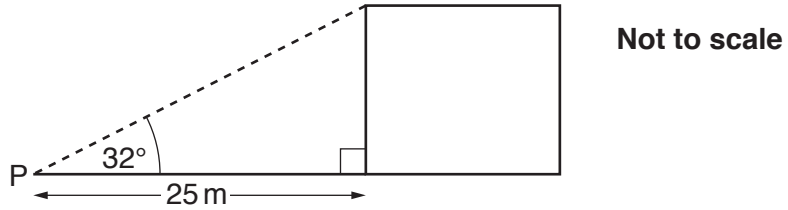
(i) Estimate the average amount of money spent per week by households in the UK in 2007 on housing, fuel and power.

(b)(i) £ ..... [1]

(ii) Comment on how the total amount of money spent has changed over time.

..... [1]

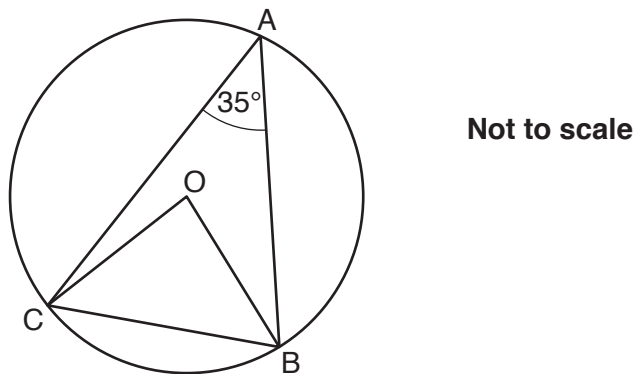
- 13 The angle of elevation of the top of a building from a point P is  $32^\circ$ .  
Point P is 25 m horizontally from the base of the building.



Calculate the height of the building.

..... m [3]

- 14 A, B and C are points on the circle, centre O.  
Angle BAC =  $35^\circ$ .



Find angle OBC.  
Give a reason for each step of your working.

.....

.....

.....

.....

..... [4]



- 15 (a)** A candle is in the shape of a cone.  
The radius of the base of the cone is 3.5 cm and its height is 10 cm.

Calculate the volume of the candle.

**(a)** ..... cm<sup>3</sup> [2]

- (b)** The mass of a candle is 180 g, correct to the nearest 10 g.  
Four of these candles are packed in a box.  
The mass of the box is 50 g, correct to the nearest 5 g.

Calculate the upper bound of the total mass of the box of candles.

**(b)** ..... g [3]

- 16** The population of a town is now 84 100.  
The population of the town is predicted to rise by 2% each year.

**(a)** Write down an expression for the population of the town after  $t$  years.

**(a)** ..... [2]

**(b)** Find the predicted population of the town after 6 years.

**(b)** ..... [1]

17 (a) Simplify fully.

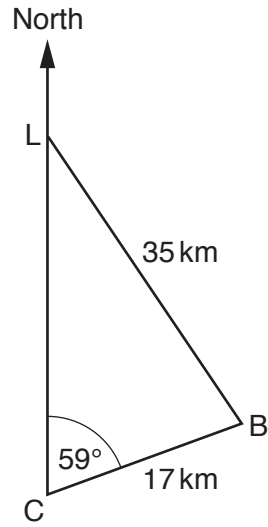
$$\frac{x+4}{x^2+2x-8}$$

(a) ..... [3]

(b) Complete the missing numbers in this identity.

$$x^2 + \dots x + 14 = (x + 3)^2 + \dots \quad [3]$$

- 18 A lighthouse, L, is due north of a coastguard station, C.  
A boat, B, is 17 km from the coastguard station on a bearing of  $059^\circ$ .  
The boat is 35 km from the lighthouse.



Not to scale

Calculate the bearing of the boat from the lighthouse.

..... $^\circ$  [4]

19 Solve algebraically these simultaneous equations.

$$y = x^2 + 5x - 4$$

$$y = 8 - 3x$$

Give your answers correct to 2 decimal places.

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots \quad [5]$$

**END OF QUESTION PAPER**



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