

Monday 16 January 2012 – Morning

GCSE MATHEMATICS SYLLABUS A

J512/04 Paper 4 (Higher Tier)

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:

- Electronic calculator
- Geometrical instruments
- Tracing paper (optional)

Duration: 2 hours



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.
- Show your 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.

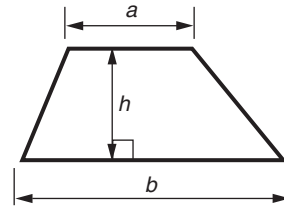
INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- You are expected to use an electronic calculator for this paper.
- Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
- The total number of marks for this paper is **100**.
- This document consists of **24** pages. Any blank pages are indicated.

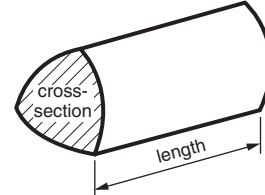
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Formulae Sheet: Higher Tier

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



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

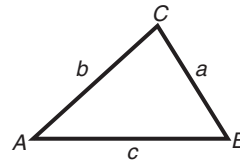


In any triangle ABC

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

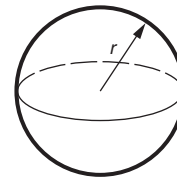
Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

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



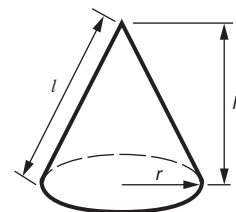
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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



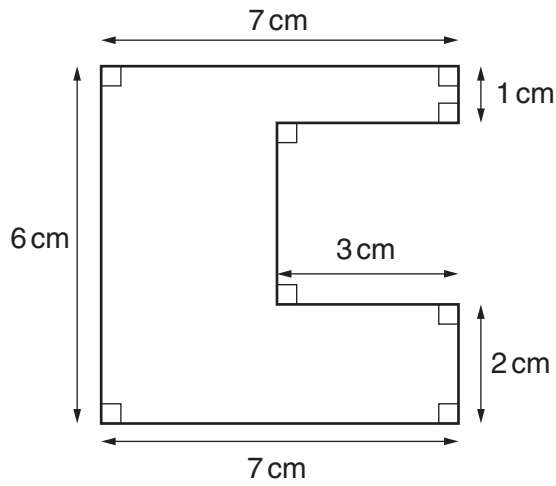
The Quadratic Equation

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

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

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1 Find the perimeter and area of this shape.



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Perimeter _____ cm

Area _____ cm² [4]

2 Calculate.

(a) $\frac{19.7 - 3.64}{5.2 + 3.85}$

Give your answer correct to one decimal place.

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(a) _____ [2]

(b) $\sqrt{5.92 + 7.2^2}$

.....
.....

(b) _____ [2]

- 3 A lifeboat, B, is 9 km from a lighthouse, L, on a bearing of 320° .
A dinghy, D, is 5 km from the lighthouse, L, on a bearing of 075° .

- (a) Make a scale drawing to show the positions of the lifeboat and the dinghy.
Use a scale of 1 cm represents 1 km.



[4]

- (b) How far, and on what bearing, is the dinghy from the lifeboat?

.....
.....

(b) _____ km and _____ $^\circ$ [2]

- 4 Hank, an American shopping in London, wishes to buy a T-shirt. The price of the T-shirt is either £28 or €32.

The exchange rates for American dollars are:

$$\$1 = \pounds 0.606$$

$$\$1 = \text{€}0.697$$

Which currency represents the lower price for the T-shirt?
Show your calculations.

[5]

- 5 Mr Patel walked for 3 hours.
During that time he took 7800 steps.
The length of each step was 90 cm.

Work out Mr Patel's average speed.
Give your answer in kilometres per hour.

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_____ km/h [4]

6 Here is a sequence of diagrams.

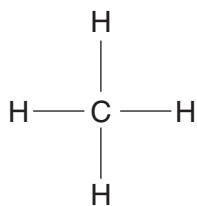


Diagram 1

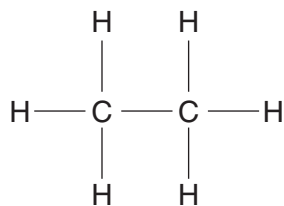


Diagram 2

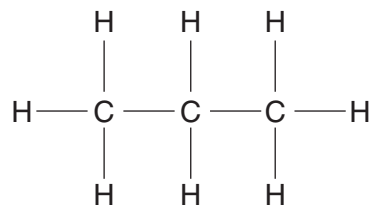


Diagram 3

(a) Draw Diagram 4.

[1]

(b) How many Cs and how many Hs will be in Diagram 7?

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(b) C _____

H _____ [2]

(c) Write down expressions in terms of n for the number of Cs and Hs in Diagram n .

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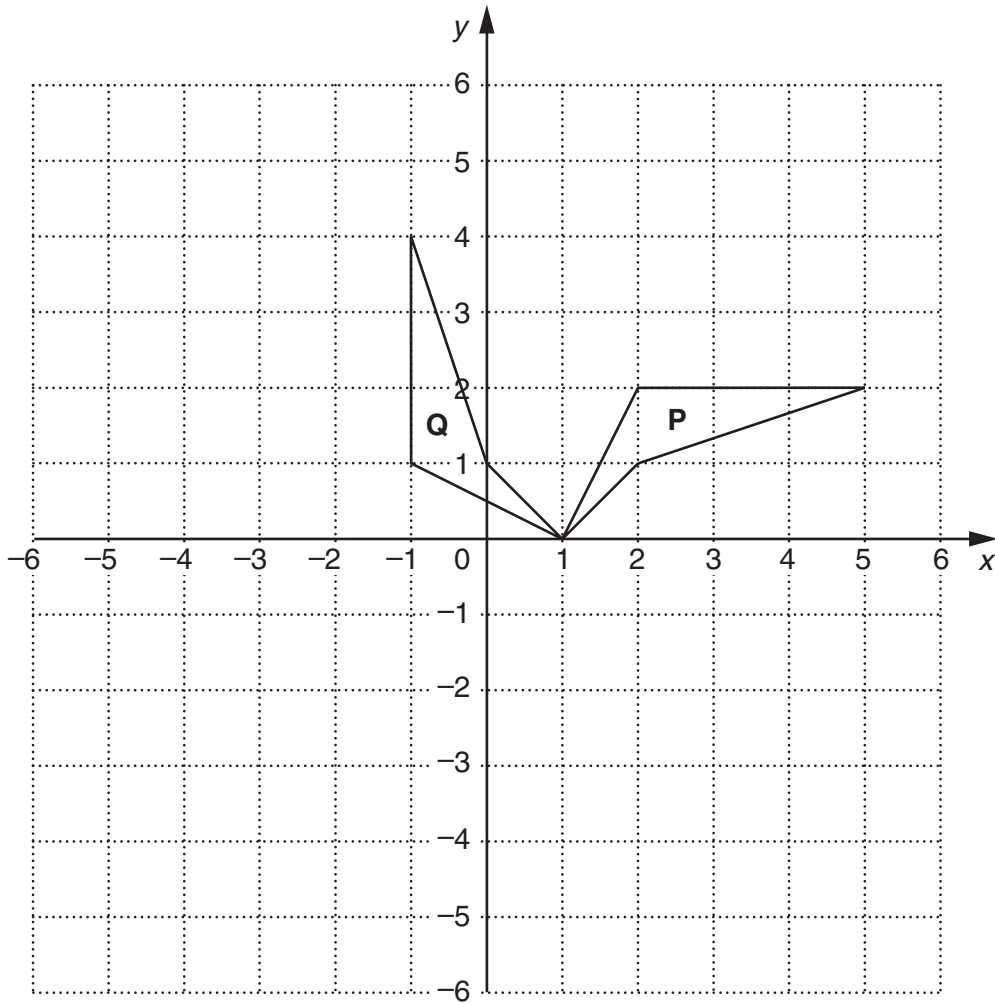
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(c) C _____

H _____ [3]

- 7 Jonah drew shape **P** on a square grid. He then transformed shape **P** to shape **Q**.



- (a) Describe fully the **single** transformation that maps shape **P** onto shape **Q**.

[3]

- (b) Draw the reflection of shape **P** in the line $y = -1$. Label the image **R**.

[2]

- 8 This is a formula for changing temperatures in degrees Celsius, C , into degrees Fahrenheit, F .

$$F = \frac{9}{5} \times C + 32$$

There is a temperature when the numerical value of F is equal to the numerical value of C .

Find the temperature when $F = C$.

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_____ degrees [3]

- 9 Items are advertised for sale on an internet site.
The cost of the advert for each item is a percentage of the selling price.

2% on each item sold for £50 or less
7% on each item sold for over £50

Carrie uses the site to sell a pair of shoes for £52 and a dress for £49.50.

After paying for the adverts, for which item did Carrie receive more?
How much more did she receive?

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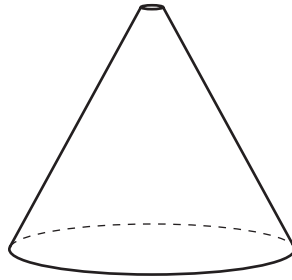
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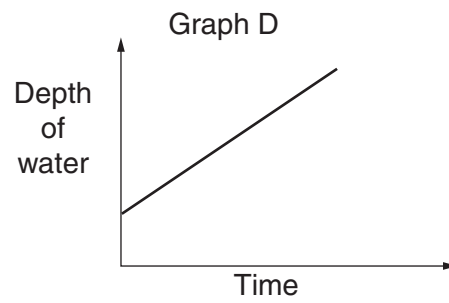
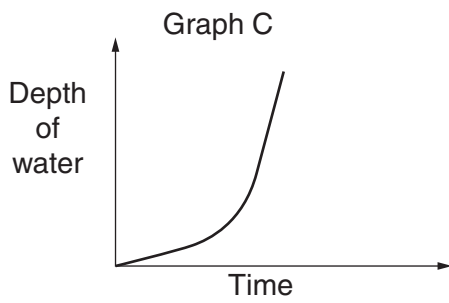
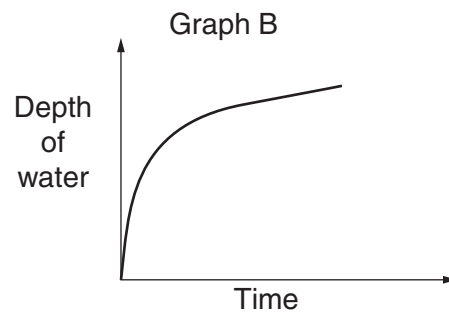
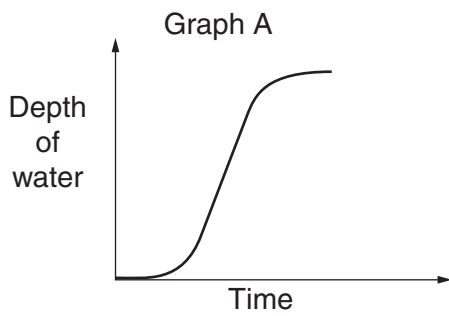
Carrie received _____ pence more for selling _____ [4]

10 (a) Here is an empty container.



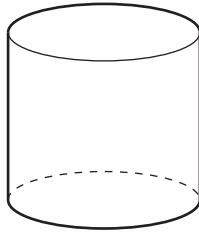
Water is poured into the container at a constant rate.

Which of these graphs represents the depth of water in the container as water is poured in?

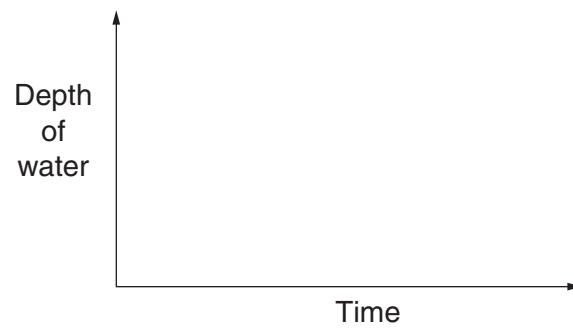


(a) Graph _____ [1]

- (b) Here is an empty cylinder.
Water is poured into the cylinder at a constant rate.



Sketch a graph to represent the depth of water in the cylinder as water is poured in.



[1]

- 11 90 people each exercised for 30 minutes. Each person's recovery time was measured. The results are summarised in this table.

Recovery time (m minutes)	Number of people
$0 < m \leq 4$	2
$4 < m \leq 8$	7
$8 < m \leq 12$	29
$12 < m \leq 16$	26
$16 < m \leq 20$	16
$20 < m \leq 24$	10

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

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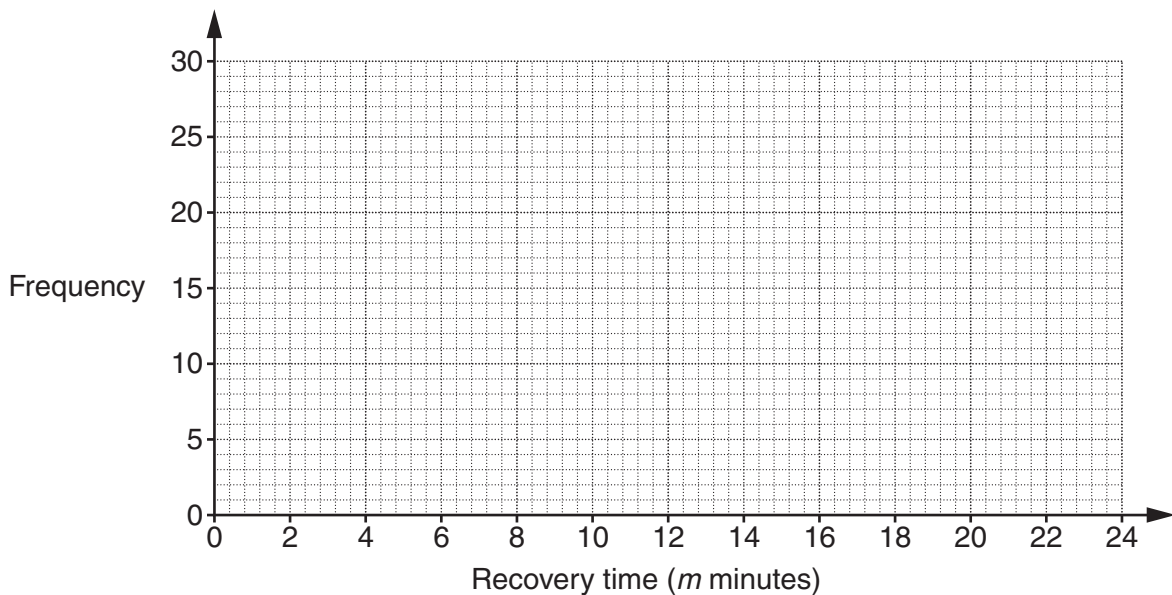
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(a) _____ minutes [4]

- (b) Write down the modal class.

(b) _____ [1]

- (c) Draw a frequency polygon for the data in the table.



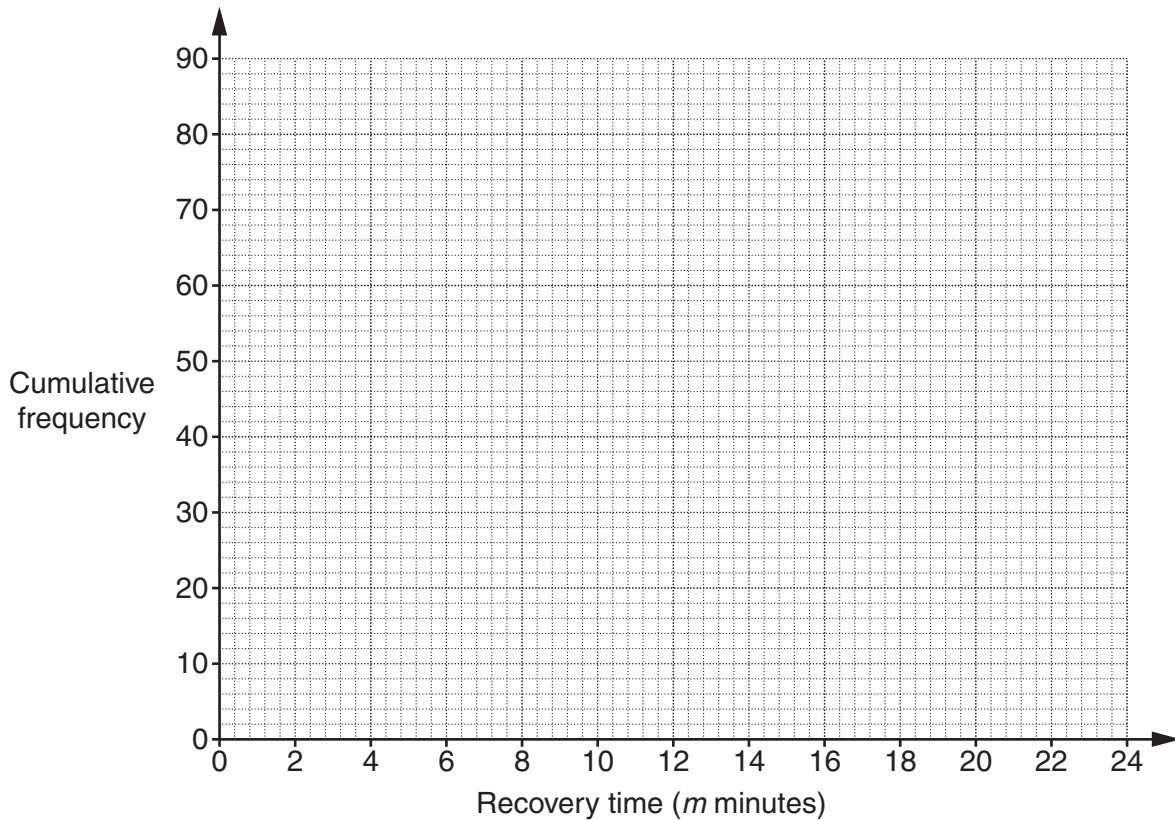
[2]

(d) Complete this cumulative frequency table for the recovery times.

Recovery time (m minutes)	Number of people
$0 < m \leq 4$	2
$0 < m \leq 8$	
$0 < m \leq 12$	
$0 < m \leq 16$	
$0 < m \leq 20$	
$0 < m \leq 24$	

[1]

(e) Draw a cumulative frequency graph for the recovery times.



[3]

(f) Use your graph to estimate

(i) the median recovery time,

.....
 (f)(i) _____ minutes [1]

(ii) the number of people who took **longer than** 15 minutes to recover.

.....
 (ii) _____ [2]

- (g) Which of mean, median or modal class is the most appropriate to use as the average recovery time?
Give a reason for your choice.

_____ because _____
_____ [2]

- (h) One week later these people were asked to see how an energy drink affected their recovery time.

Write a question, with a response section, that they could be asked.

_____ [2]

12 (a) Factorise.

$$x^2 - 16$$

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(a) _____ [1]

(b) Rearrange this formula to make u the subject.

$$v^2 = u^2 + 2as$$

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(b) _____ [2]

(c) Simplify.

(i) $s^2t^8 \times s^3t^2$

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(c)(i) _____ [2]

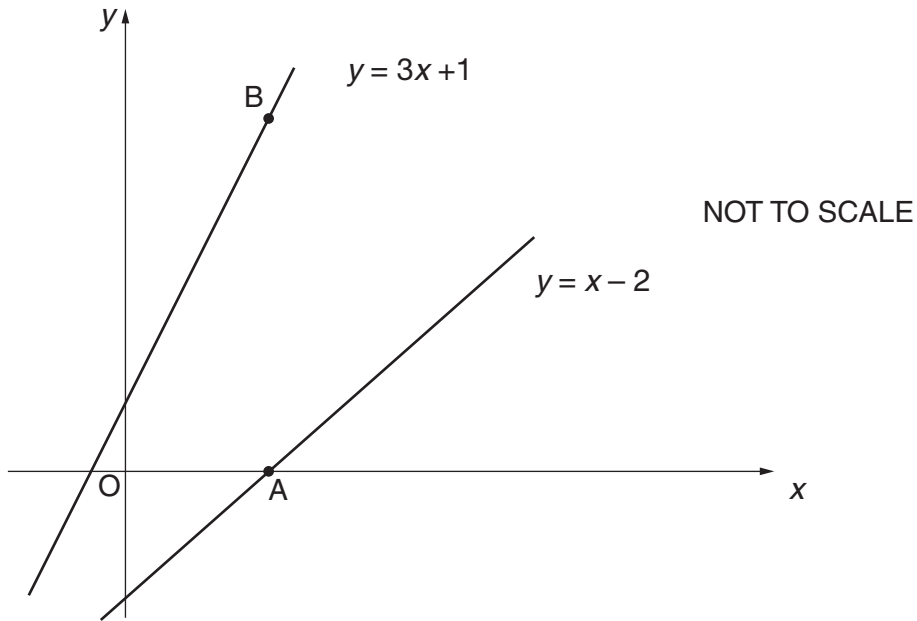
(ii) $(x^3y)^4$

.....

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(ii) _____ [2]

13 The diagram shows the graphs of $y = x - 2$ and $y = 3x + 1$.



- (a) The line $y = x - 2$ cuts the x -axis at A.
 B is on the line $y = 3x + 1$ such that the line AB is parallel to the y -axis.

Work out the coordinates of B.

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(a) (_____ , _____) [3]

- (b) Work out the coordinates of the point where the lines $y = x - 2$ and $y = 3x + 1$ cross.

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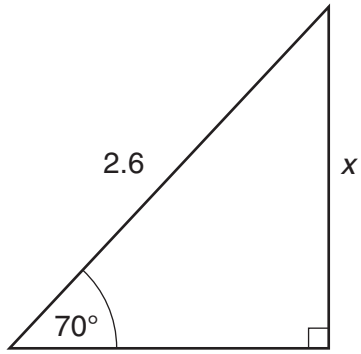
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(b) (_____ , _____) [3]

14 (a)



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Calculate x .

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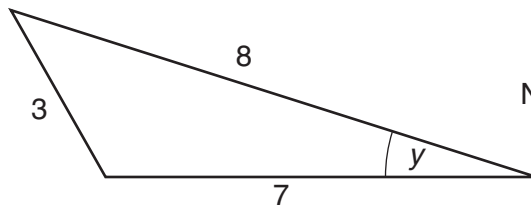
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(a) _____ [3]

(b)



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Calculate angle y .

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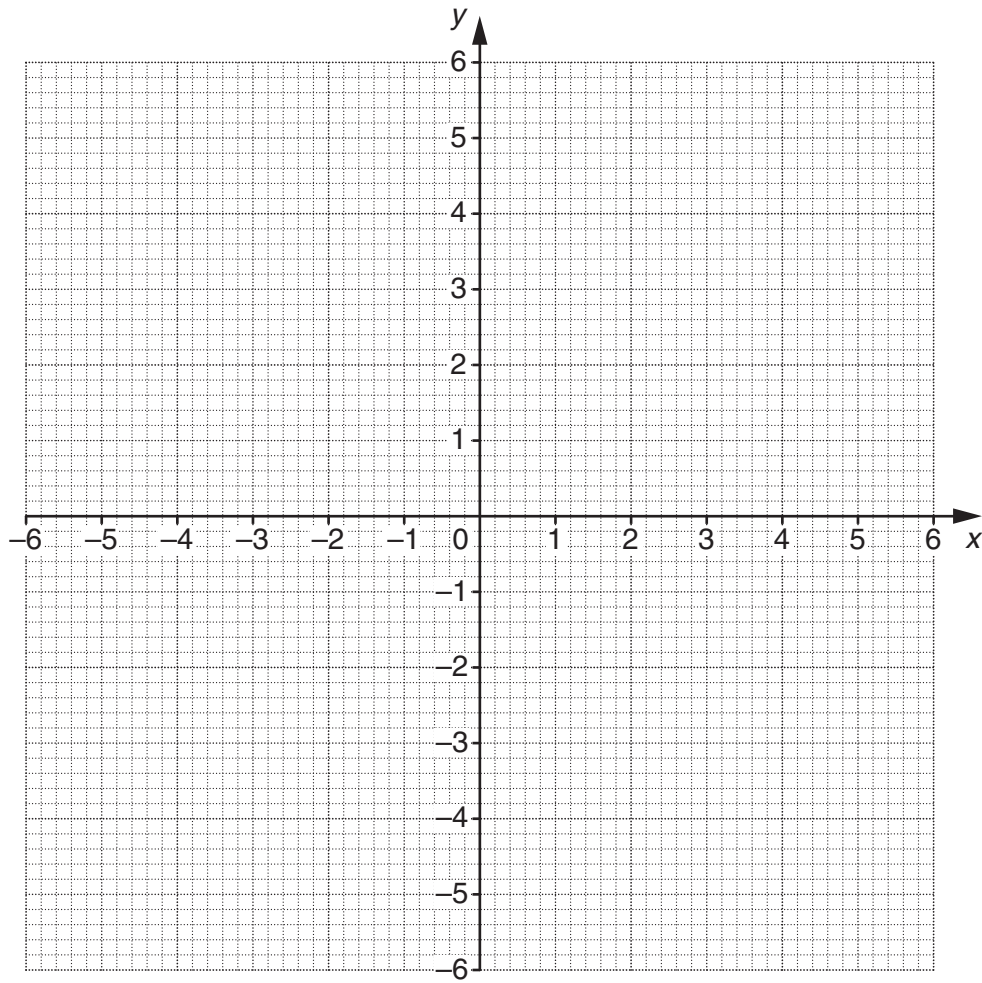
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(b) _____ ° [4]

- 15 (a) Draw accurately the graph of $x^2 + y^2 = 25$.



[2]

- (b) (i) Show that the curve $x^2 + y^2 = 25$ and the line $y = 3x - 1$ intersect when $5x^2 - 3x - 12 = 0$.

[3]

- (ii) Solve algebraically $5x^2 - 3x - 12 = 0$.
Give your answers correct to 2 decimal places.

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(b)(ii) _____ [3]

- (iii) Hence find the coordinates of the points where the curve and the line intersect.

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(iii) _____ [2]

- 16** Ian has 160 metal cylinders each of length 36 cm and radius r cm.
The 160 cylinders are melted down and made into a sphere of radius 30 cm.

Calculate r .

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_____ [5]

17 The total resistance, T , of an electrical circuit is given by this formula.

$$\frac{1}{T} = \frac{1}{A} + \frac{1}{B}$$

$A = 1.5$ and $B = 5.6$, each correct to the nearest 0.1.

Work out the maximum possible value of T .
Show clearly the values you use.

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_____ [4]

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