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Centre Number						Candidate Number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

J512/04

MATHEMATICS SYLLABUS A

Paper 4 (Higher Tier)

FRIDAY 15 JANUARY 2010: Morning

DURATION: 2 hours

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Electronic calculator

Geometrical instruments

Tracing paper (optional)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

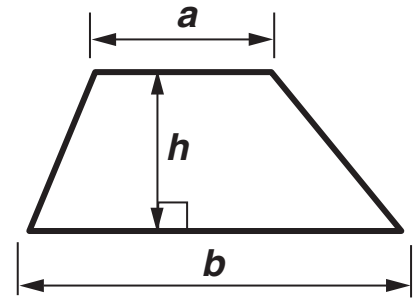
- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Show your working. Marks may be given for a correct method even if the answer is incorrect.
- Answer ALL the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

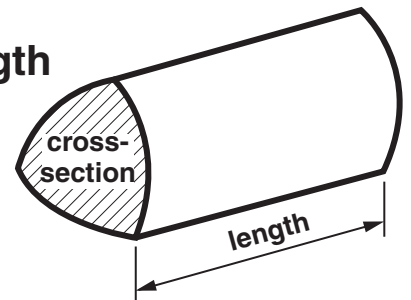
- The number of marks is given in brackets [] at the end of each question or part question.
- You are expected to use an electronic calculator for this paper.
- Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
- The total number of marks for this paper is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

Formulae Sheet: Higher Tier

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



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

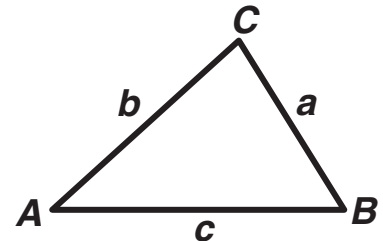


In any triangle *ABC*

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

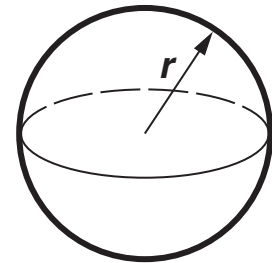
Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

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



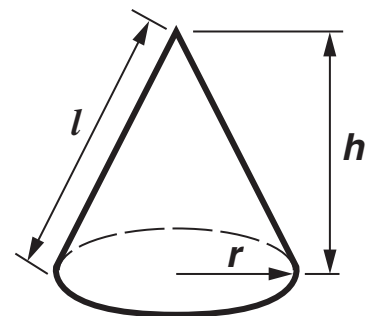
Volume of sphere = $\frac{4}{3} \pi r^3$

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

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

1 Calculate.

(a) $\frac{7.8 - 3.1}{1.2 + 6.9}$

(a) _____ [2]

(b) $\sqrt{2.56^2 - 1.4^2}$

(b) _____ [2]

2 Jayne uses these ingredients to make play dough.

Play dough for 2 children	
Plain flour	225 g
Oil	2 tablespoons
Water	$\frac{3}{4}$ pint
Salt	140 g

(a) Jayne wants to make enough play dough for 10 children.

Work out the amount of water Jayne will need.

(a) _____ pints [2]

(b) Jayne has lots of oil and water, but only a 1.5 kg bag of plain flour and a 1 kg bag of salt.

**What is the maximum number of children Jayne can make play dough for?
You must show your working.**

(b) _____ [3]

3 (a) One question on the 2001 Census form was:

‘How many cars are available for use by one or more members of your household?’

There was space on the form to write down who lived at that household.

Jenna collects information about the number of people and the number of cars at each household from a sample of 100 Census forms.

In this sample there were no households where more than 5 people lived and none had more than 3 cars.

(i) Design a two-way table for Jenna to use. [3]

- (ii) In Jenna's sample there are 14 households with 3 people and 2 cars.

Show this data in your table in part (a)(i). [1]

- (b) Jenna uses this question in a survey.

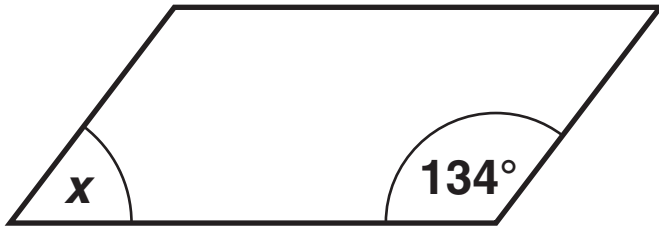
'How many bicycles are there in your household?'

None 1 – 2 More than 3

What mistake has Jenna made?

_____ [1]

4 (a) A parallelogram has angles as shown.



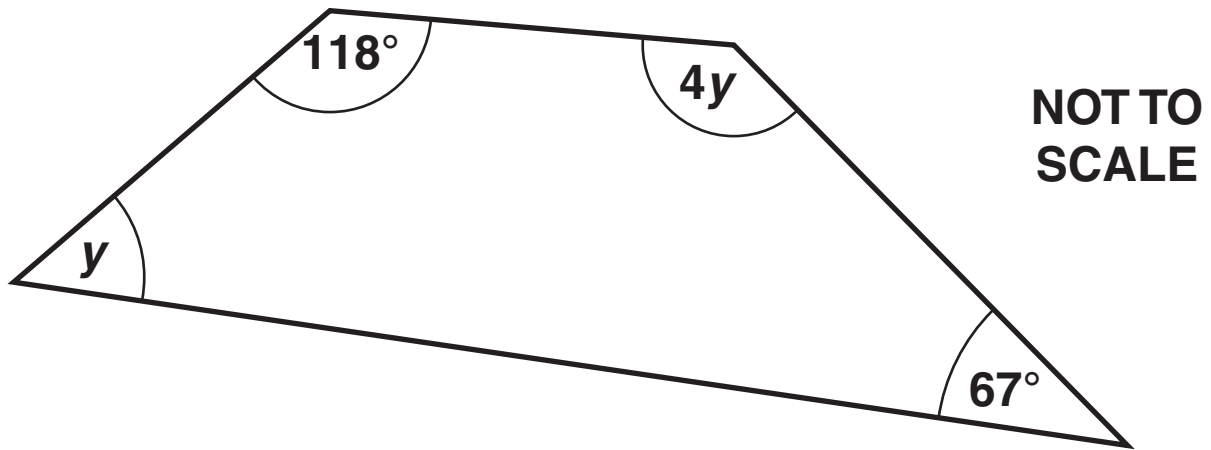
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Work out angle x .
Give a reason for your answer.

$x =$ _____ $^\circ$ because _____

_____ [2]

(b) A quadrilateral has angles as shown.



Work out angle y .

(b) _____ ° [4]

- 5 Gary's dogs eat 6 tins of dog food between them each day.
The tins are sold in boxes of 44.
Gary normally buys one box of 44 tins for each week.**

Explain, showing your calculations, why Gary does not have to buy a box for the 22nd week.

[3]

6 (a) The n th term of a sequence is given by $n^2 - 2$.

Work out the first three terms of this sequence.

(a) _____ [2]

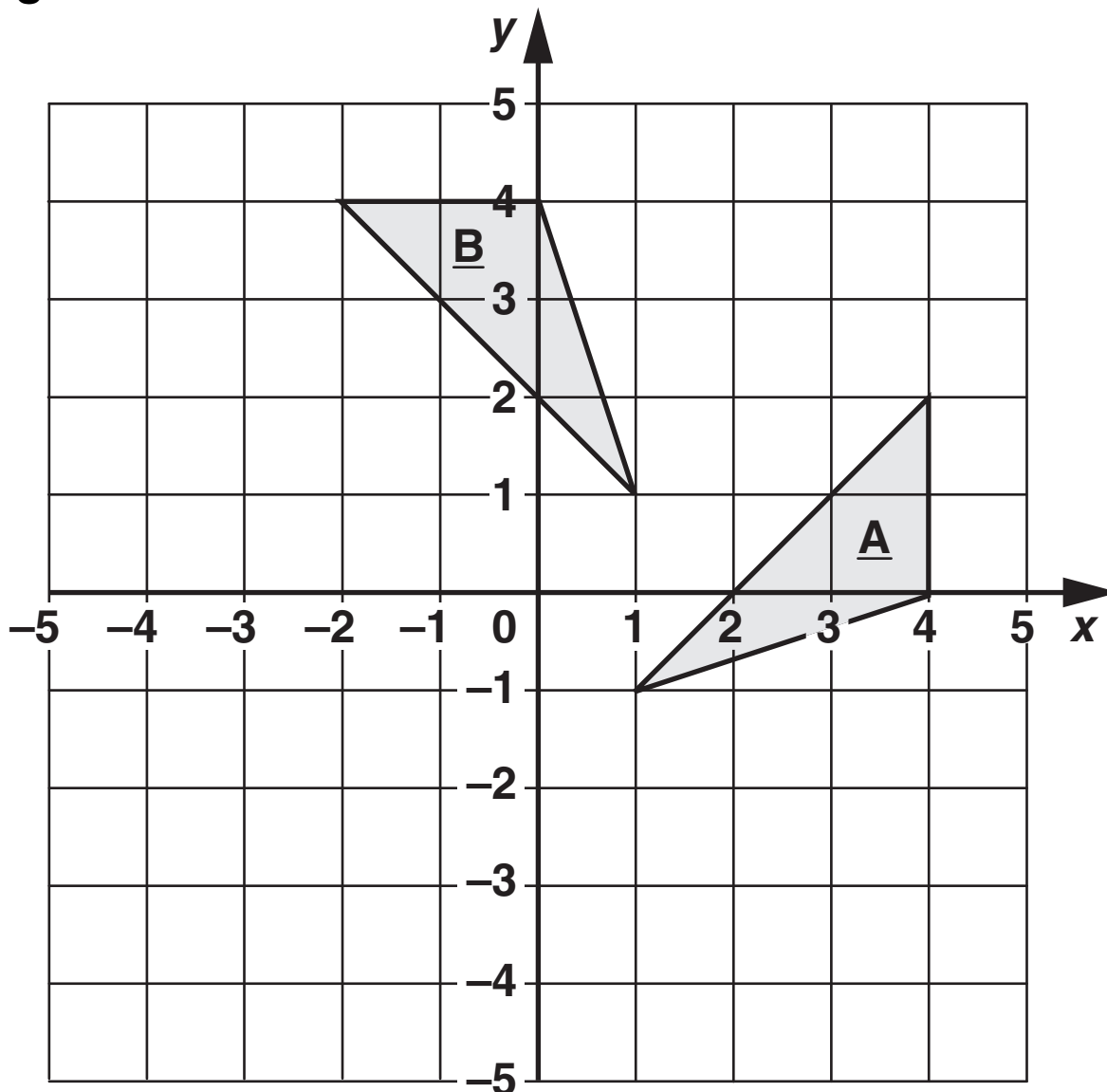
(b) In another sequence of three numbers, the difference between each number and the next is 4.

The total of the three numbers is 6.

What are the three numbers?

(b) _____ [2]

- 7 The diagram below shows two triangles A and B on a grid.



- (a) Describe fully the SINGLE transformation that maps triangle A onto triangle B.

[3]

- (b) Draw the reflection of triangle A in the x-axis. [2]

- 8 Tom made an electronic dice which gave scores of 1, 2, 3, 4, 5 or 6.
This table summarises 100 scores.

SCORE	FREQUENCY
1	17
2	19
3	15
4	17
5	18
6	14

- (a) Work out the mean score.

(a) _____ [3]

- (b) Is the dice biased?
Give a reason for your answer.

_____ [1]

9 Simplify.

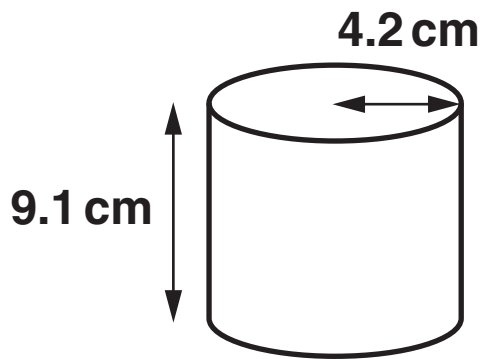
(a) $d^7 \times d^4$

(a) _____ [1]

(b) $\frac{d^9}{d^3}$

(b) _____ [1]

10 A cylindrical tin has radius 4.2 cm and height 9.1 cm.



Work out the curved surface area of the tin.
Give your answer to an appropriate degree of accuracy.

_____ cm² [4]

11 (a) Work out the integer values of n that satisfy this inequality.

$$7 < 4n \leq 20$$

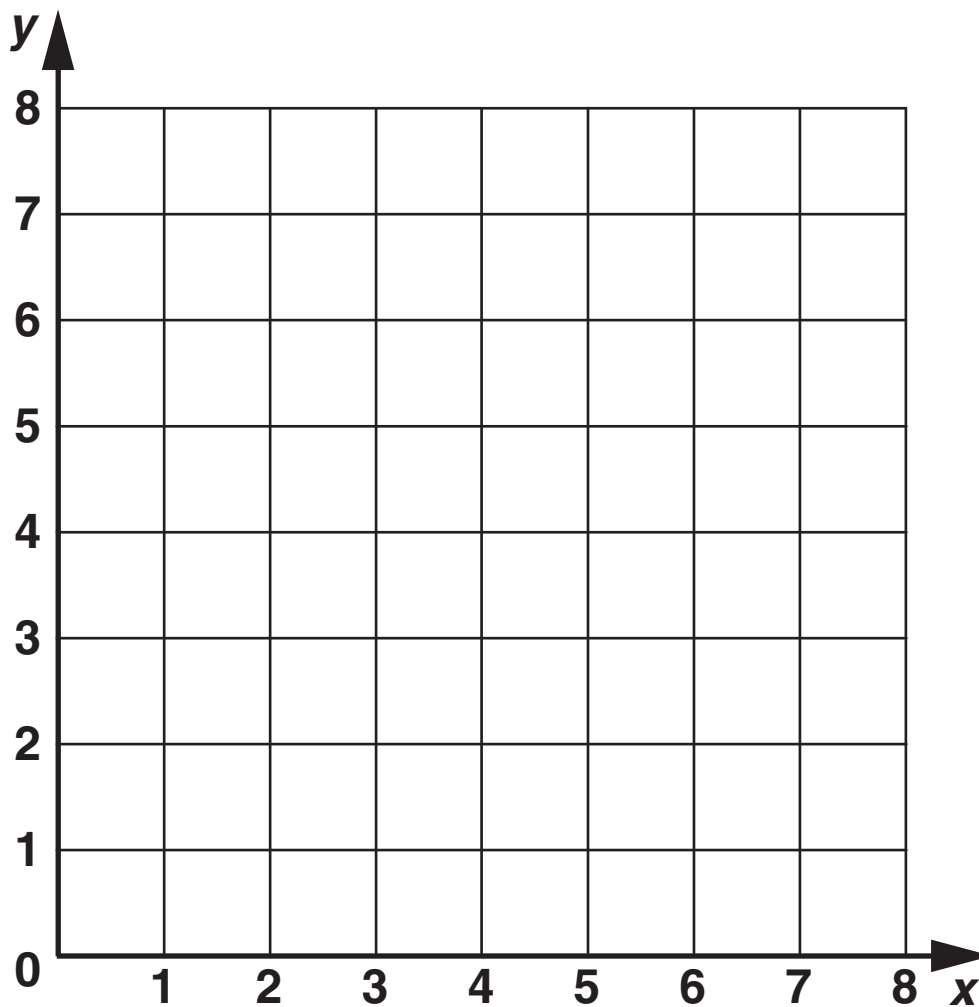
(a) _____ [3]

(b) On the grid, indicate clearly the region that satisfies all these inequalities.

$$x \geq 2$$

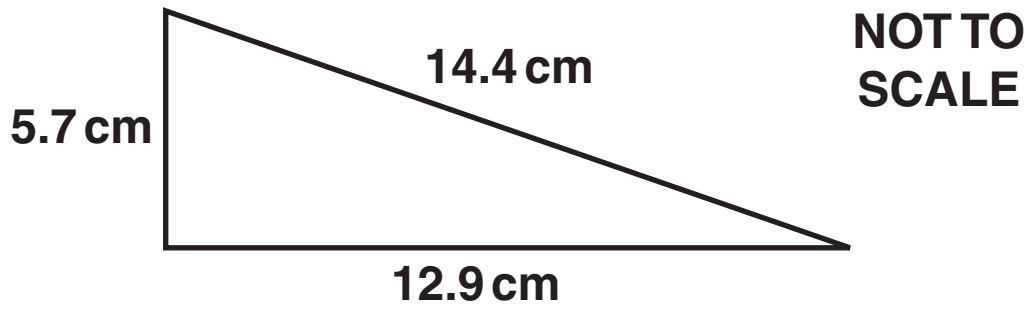
$$y \geq 3$$

$$x + y \leq 7$$



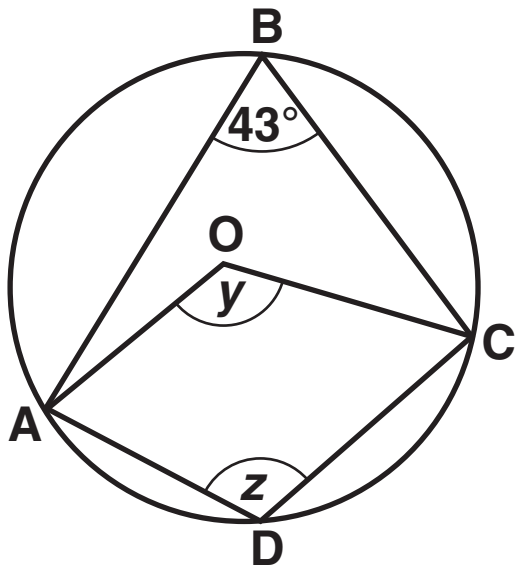
[3]

**12 Is a triangle with these lengths right-angled?
Explain your answer using calculations.**



[3]

- 13 The points A, B, C and D lie on the circumference of a circle, centre O.



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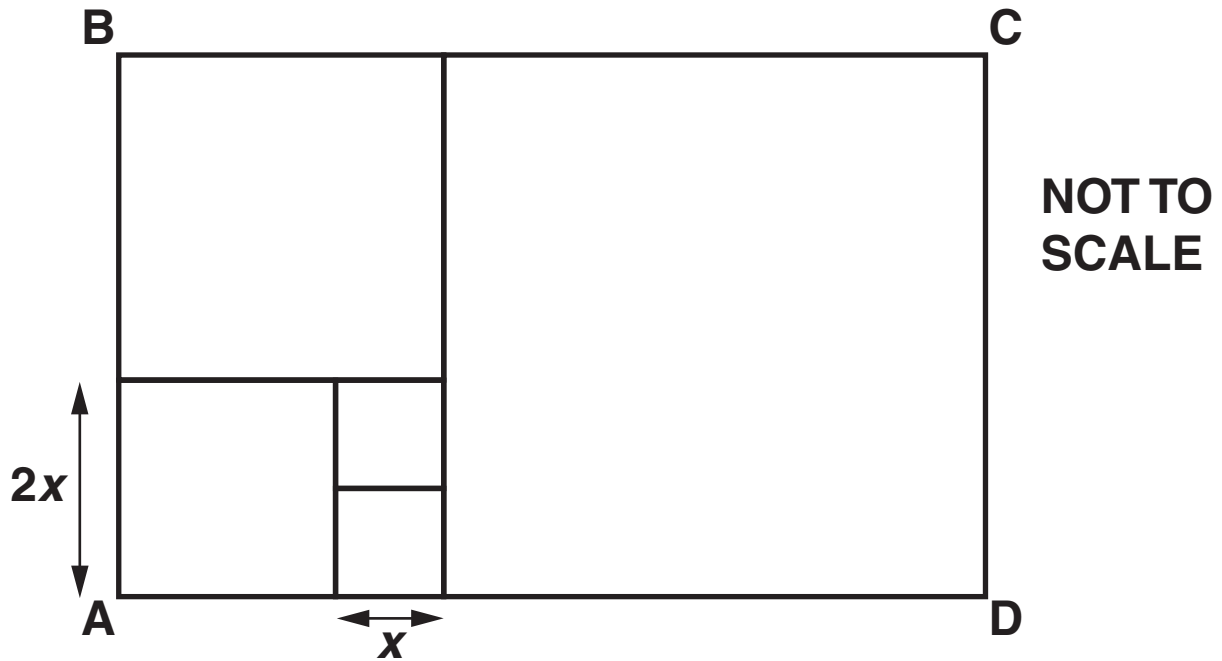
Find the size of angle y and angle z .
Give a reason for each answer.

$y =$ _____ $^{\circ}$ because _____

$z =$ _____ $^{\circ}$ because _____

[4]

14 Rectangle ABCD is made from five SQUARES.

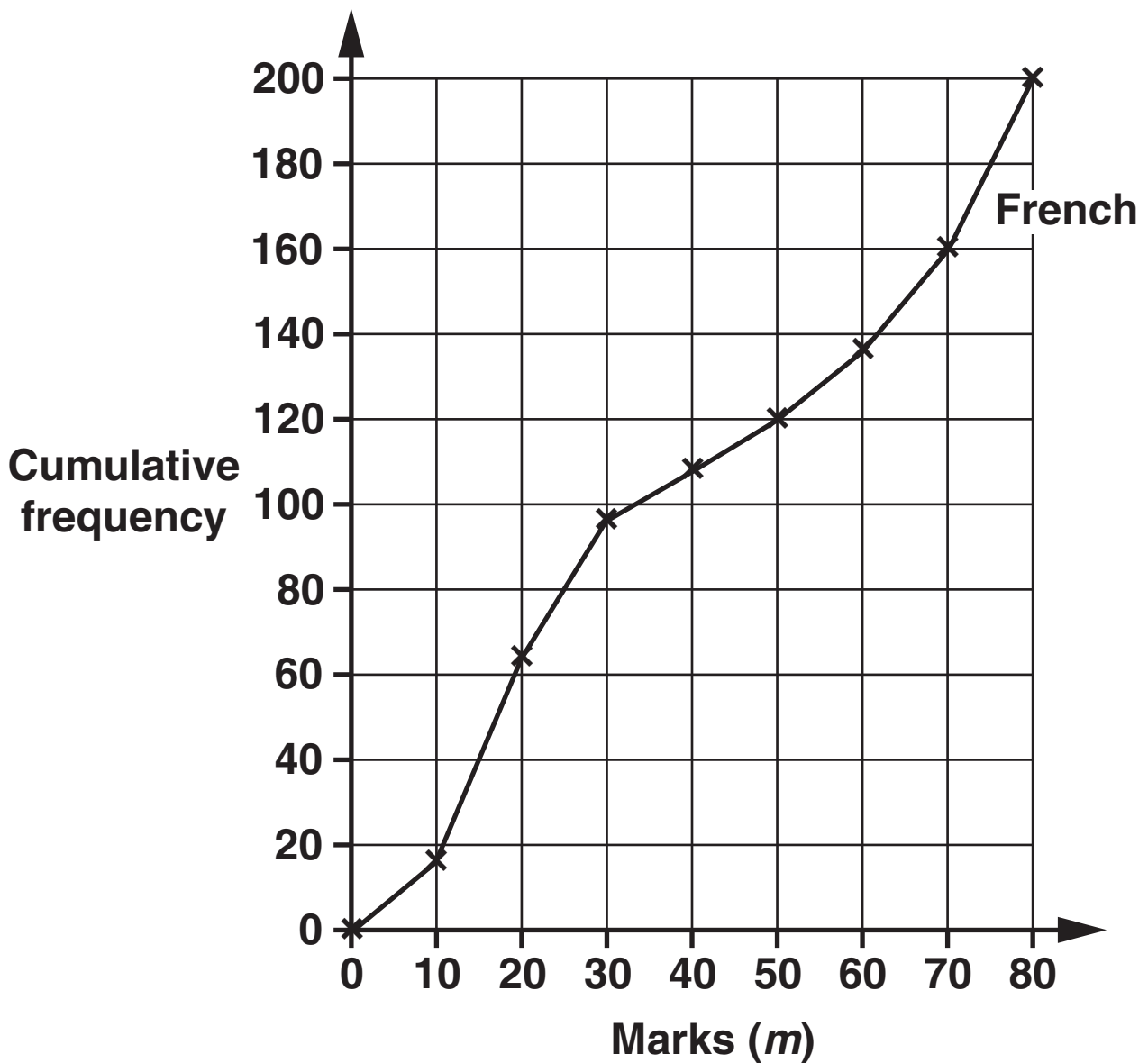


The area of rectangle ABCD is 810 cm^2 .

Work out the value of x .
Show all your working.

_____ cm [5]

15 The cumulative frequency graph summarises the marks obtained in a French exam by 200 students.



The table gives the cumulative frequencies of marks obtained in a German exam by 120 students.

Marks (m)	$m \leq 10$	$m \leq 20$	$m \leq 30$	$m \leq 40$	$m \leq 50$	$m \leq 60$	$m \leq 70$	$m \leq 80$
Cumulative frequency	4	20	36	60	84	104	112	120

(a) On the grid on the opposite page, draw a cumulative frequency graph to summarise the marks obtained by the students in the German exam. [3]

(b) In which exam, French or German, was the median mark higher, and by how much?

(b) _____ by _____ marks [2]

16 (a) Factorise.

(i) $x^2 - 8x$

(a)(i) _____ [1]

(ii) $6x^3 + 10xy^3$

(ii) _____ [2]

(iii) $4x^2 - y^2$

(iii) _____ [2]

(b) Simplify.

$$\frac{x^2 + 3x}{3x^2}$$

(b) _____ [2]

17 (a) Write 91 000 000 in standard form.

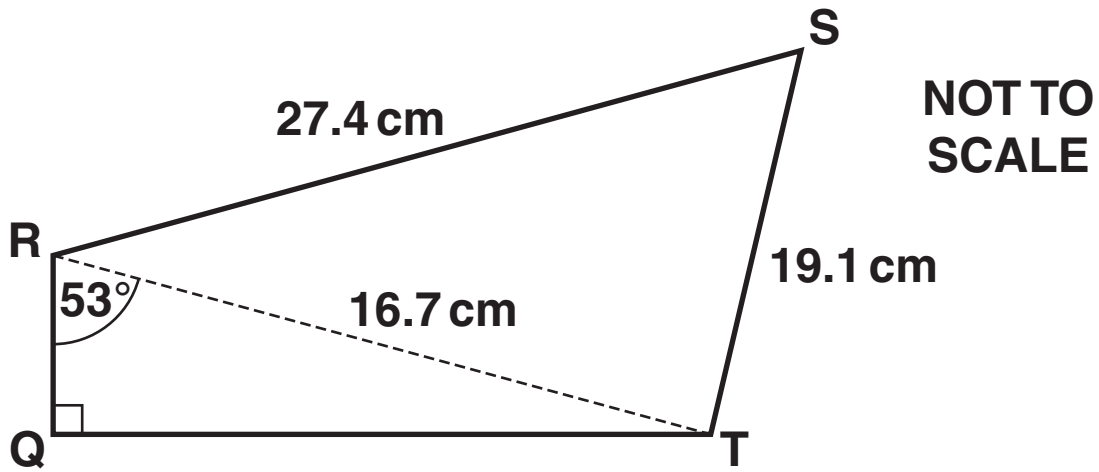
(a) _____ **[1]**

**(b) A picometre is 10^{-12} m.
A nanometre is 10^{-9} m.**

How many picometres are there in a nanometre?

(b) _____ **[2]**

18 This diagram shows a quadrilateral.



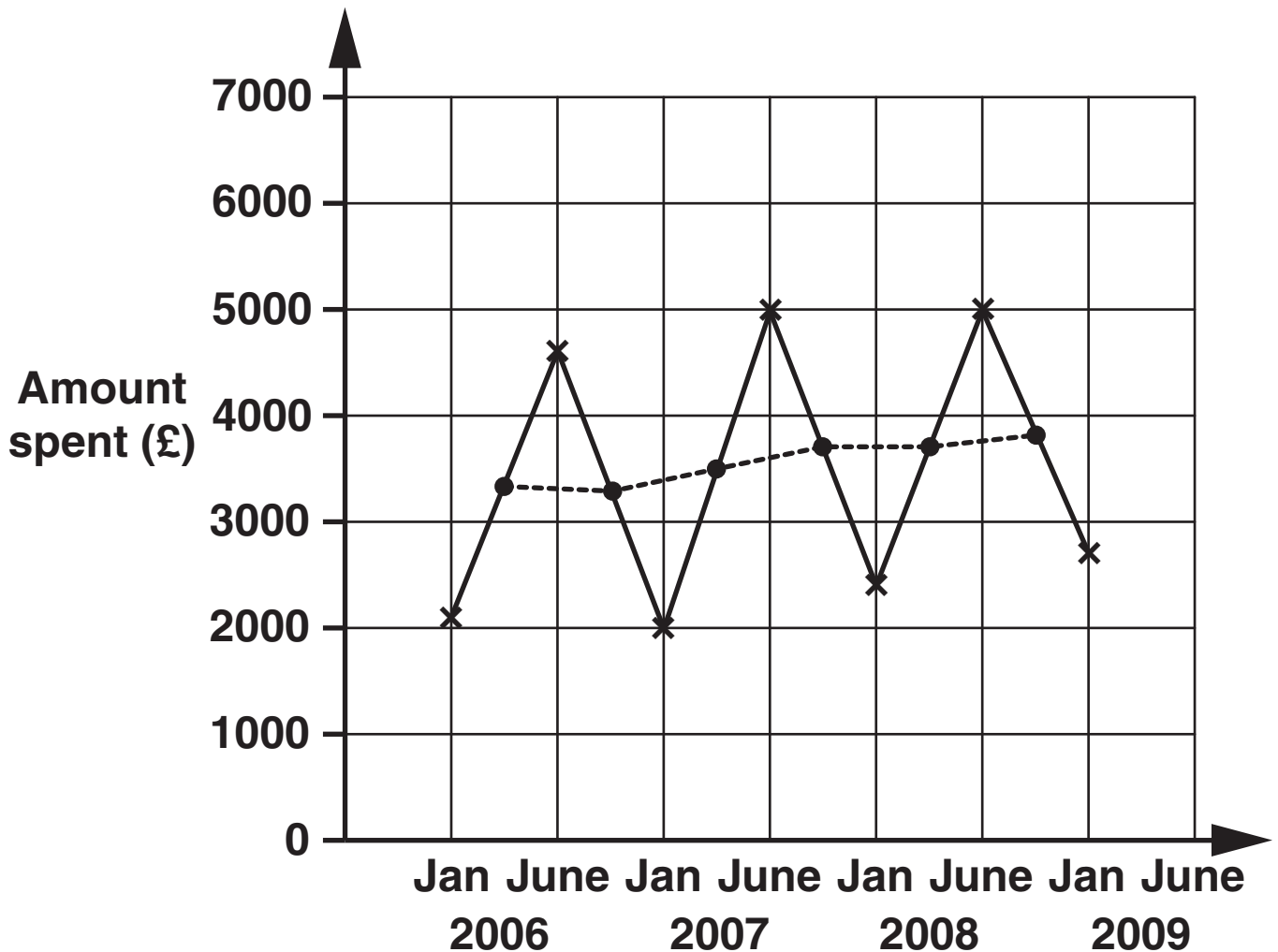
(a) Calculate length QT .

(a) _____ cm [3]

(b) Calculate angle RST.

(b) _____ ° **[3]**

19 The time series graph shows the amounts spent by a school on exams in January and in June each year. The two-point moving averages (•) are also shown.



(a) Give a reason why it is appropriate to use a two-point moving average.

[1]

(b) Predict the next moving average and use this to work out an estimate of the amount spent on exams by the school in June 2009.

(b) £ _____ [3]

**20 Use trial and improvement to solve $7^x = 27$.
Give your answer correct to 2 decimal places.
Show all your trials and their outcomes.**

_____ [4]

21 (a) Express $\sqrt{45}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible.

(a) _____ [1]

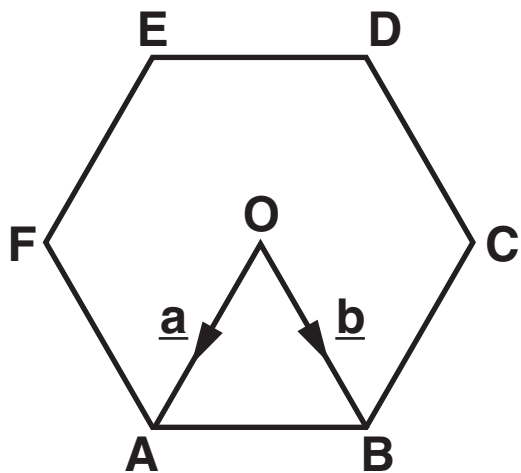
(b) Rationalise the denominator of $\frac{9}{\sqrt{6}}$.

Give your answer in its simplest form.

(b) _____ [2]

22 ABCDEF is a regular hexagon, centre O.

$$\vec{OA} = \underline{a}, \quad \vec{OB} = \underline{b}.$$



(a) Find in terms of \underline{a} and \underline{b} the vectors

(i) \vec{CB} ,

(a)(i) _____ [1]

(ii) \vec{DB} .

(ii) _____ [1]

(b) X lies on DB such that $DX : XB = 1 : 2$.

Find \overrightarrow{OX} , in terms of a and b.
Give your answer in a simplified form.

(b) _____ [3]

23 (a) Explain why $(x - y)^2 \geq 0$.

(b) Hence, show that $x^2 + y^2 \geq 2xy$.



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