Centre No.						Surname	Initial(s)
Candidate No.						Signature ANSWERS	

Paper Reference(s)

4400/4H

Examiner's use only

Team Leader's use only

London Examinations IGCSE

Mathematics

Paper 4H

Higher Tier

Wednesday 8 November 2006 – Morning

Time: 2 hours

Page Number	Leave Blank
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
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Total	

Materials required for examination

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Items included with question papers

Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
The paper reference is shown at the top of this page. Check that you have the correct question paper.
Answer **ALL** the questions in the spaces provided in this question paper.
Show all the steps in any calculations.

Information for Candidates

There are 20 pages in this question paper. All blank pages are indicated.
The total mark for this paper is 100. The marks for parts of questions are shown in round brackets: e.g. **(2)**.
You may use a calculator.

Advice to Candidates

Write your answers neatly and in good English.

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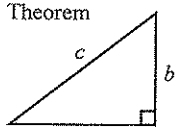
IGCSE MATHEMATICS 4400
FORMULA SHEET – HIGHER TIER

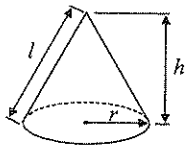
Pythagoras' Theorem



$a^2 + b^2 = c^2$

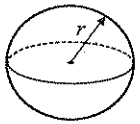
Volume of cone $= \frac{1}{3}\pi r^2 h$

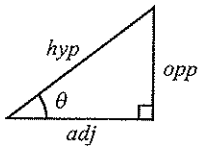
Curved surface area of cone $= \pi r l$



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

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





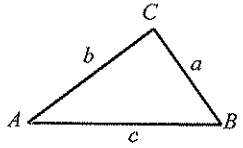
adj = hyp × cos θ
opp = hyp × sin θ
opp = adj × tan θ

or $\sin\theta = \frac{\text{opp}}{\text{hyp}}$

$\cos\theta = \frac{\text{adj}}{\text{hyp}}$

$\tan\theta = \frac{\text{opp}}{\text{adj}}$

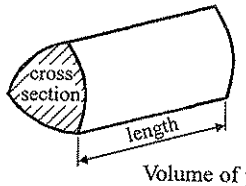
In any triangle ABC



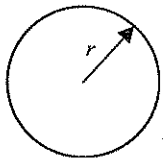
Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



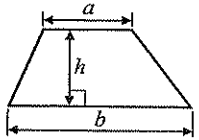
Volume of prism = area of cross section × length

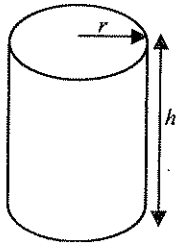


Circumference of circle $= 2\pi r$

Area of circle $= \pi r^2$

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





Volume of cylinder $= \pi r^2 h$

Curved surface area of cylinder $= 2\pi rh$

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 TWENTY-FIVE questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1. Work out the value of $\frac{6.46}{1.8+1.6}$

1.9

(Total 2 marks) Q1

2. (a) Expand $3(2t + 5)$

6t+15

(1)

(b) Expand $y(y^2 - 3y)$

$y^3 - 3y^2$

(2)

(c) Expand and simplify $(x + 3)(x + 7)$

$x^2 + 10x + 21$

(2)

(d) Simplify $p^4q^2 \times p^3q^6$

p^7q^8

(2)

(Total 7 marks) Q2

Leave blank

3. The total of Kim's age and Pablo's age is 45 years.
The ratio of Kim's age to Pablo's age is 1 : 4

Work out Kim's age.

add the ratio's 1+4=5
Divide the amount = 45/5
=9
∴ Kim is 9

9 ..... years

(Total 2 marks)

Q3

4. Here is a pattern of shapes made from centimetre squares.

Shape number 1 | Shape number 2 | Shape number 3

This rule can be used to find the perimeter of a shape in this pattern.

> Add 1 to the Shape number and then multiply your answer by 2

P cm is the perimeter of Shape number n.

(a) Write down a formula for P in terms of n.

$2(n+1)=P$ .....

(3)

(b) Make n the subject of the formula in part (a).

$\frac{P}{2}=n+1$

$\frac{P}{2}-1=n$

$n =$ $\frac{P}{2}-1$ .....

(3)

Q4

(Total 6 marks)

5. Bridget flew from the UK to Dubai.
Her flight from the UK to Dubai covered a distance of 5456 km.
The flight time was 7 hours 45 minutes.

Work out the average speed of the flight.

$S = d/t$
$= 5456/7.75$
$= 704$

704 ..... km/h

(Total 3 marks)

Q5

6. $\mathcal{E}$ = {**even** numbers less than 19}
M = {multiples of 3}
F = {factors of 12}

(a) (i) Explain why it is **not** true that $9 \in M$.

The universal set is just even numbers & 9 is odd .....

(ii) List the members of M.

{6, 12, 18} .....

(2)

(b) List the members of $M \cap F$.

{6, 12} .....

(2)

Q6

(Total 4 marks)

Leave blank

7.

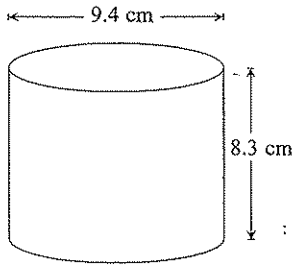


Diagram **NOT** accurately drawn

A solid cylinder has a diameter of 9.4 cm and a height of 8.3 cm.

Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

Volume $= \pi r^2 \times h$
$= \pi \times 6.7^2 \times 8.3$
$= 576 \text{ cm}^3$

576 ..... cm^3

(Total 3 marks)

Q7

8. $y = 4x - 1$

Work out the value of x when $y = -7$

$4x - 1 = -7$
$4x = -6$
$(\div 4) \quad x = -3/2$

$x =$ $-3/2$

(Total 2 marks)

Q8

9. There are 48 beads in a bag.
Some of the beads are red and the rest of the beads are blue.
Shan is going to take a bead at random from the bag.

The probability that she will take a red bead is $\frac{3}{8}$

(a) Work out the number of red beads in the bag.

$3/8 \times 48 = 18$

18 .....

(2)

Shan adds some **red** beads to the 48 beads in the bag.

The probability that she will take a red bead is now $\frac{1}{2}$

(b) Work out the number of red beads she adds.

18 red $\therefore$ 30 blue
so ready to add 12 red

12 .....

(2)

(Total 4 marks)

Q9

10. Express 225 as the product of powers of its prime factors.

$225 = 3 \times 3 \times 5 \times 5$

(Total 3 marks)

Q10

Turn over

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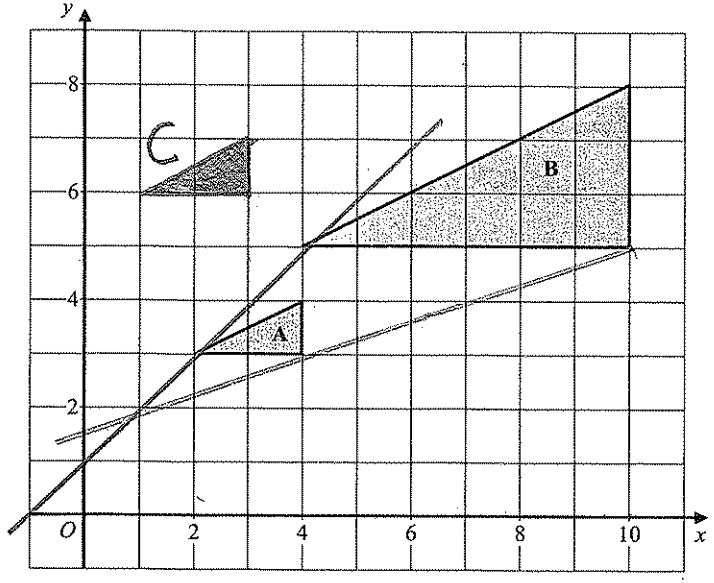
11.



(a) Describe fully the **single** transformation which maps triangle **A** onto triangle **B**.

Enlarge A, scale factor 3, centre of enlargement (1, 2)

(3)

(b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$

Label the new triangle **C**.

(2)

(Total 5 marks)

Q11

12. Solve the simultaneous equations

$6x + 5y = 5$ (1)

$3x - 10y = 15$ (2)

multiply (1) by 2

$12x + 10y = 10$

$+ \quad 3x - 10y = 15$

$15x = 25$

$x = 5/3$

when $x = 5/3$

$6 \times 5/3 + 5y = 5$

$y = -1$

$x = 5/3$

$y = -1$

(Total 3 marks)

Q12

13. (a) Write the number 78 000 000 in standard form.

7.8×10^{7}

(1)

(b) Write 4×10^{-3} as an ordinary number.

0.004

(1)

(c) Work out the value of $\frac{3 \times 10^{-2}}{8 \times 10^{9}}$

Give your answer in standard form.

3.75×10^{-12}

(1)

(Total 3 marks)

Q13

14.

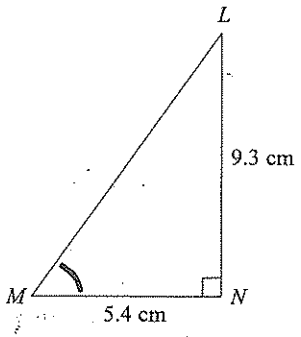


Diagram **NOT** accurately drawn

Leave blank

Triangle LMN is right-angled at N.
$MN = 5.4$ cm and $LN = 9.3$ cm.

(a) Work out the size of angle LMN.
Give your answer correct to 1 decimal place.

$\tan LMN = \frac{9.3}{5.4}$

$LMN = 59.9°$

59.9 °

(3)

The length of MN is 5.4 cm, correct to 2 significant figures.

(b) (i) Write down the upper bound of the length of MN.

5.45 cm

(ii) Write down the lower bound of the length of MN.

5.35 cm

(2)

The length, 5.4 cm, of MN and the length, 9.3 cm, of LN, are each correct to 2 signi... figures.
The line MN is horizontal and the line LN is vertical.

(c) Work out the upper bound for the gradient of the line LM.

$\text{gradient} = \frac{\text{rise}}{\text{run}} = \frac{9.35}{5.35} = 1.75$

1.746663551

(2)

Q14

(Total 7 marks)

15.

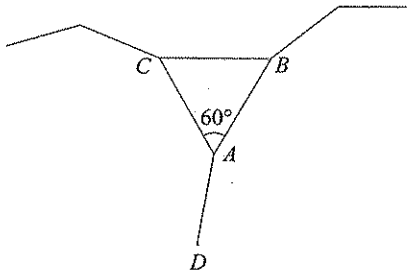


Diagram **NOT** accurately drawn

The sides of an equilateral triangle ABC and two **regular** polygons meet at the point A.
AB and AD are adjacent sides of a regular 10-sided polygon.
AC and AD are adjacent sides of a regular n-sided polygon.

Work out the value of n.

Angle $DAB = 180 - (\frac{360}{10})$
$= 144°$
$\therefore \hat{DAC} = 360 - 144 - 60$
$= 156$
$\therefore$ Exterior angle $= 180 - 156$
$= 24°$
$\frac{360}{n} = 24$ $n = 15$

$n =$ 15

Q15

(Total 5 marks)

Leave blank

16. The grouped frequency table gives information about the time spent on the Internet last week by each of 80 students.

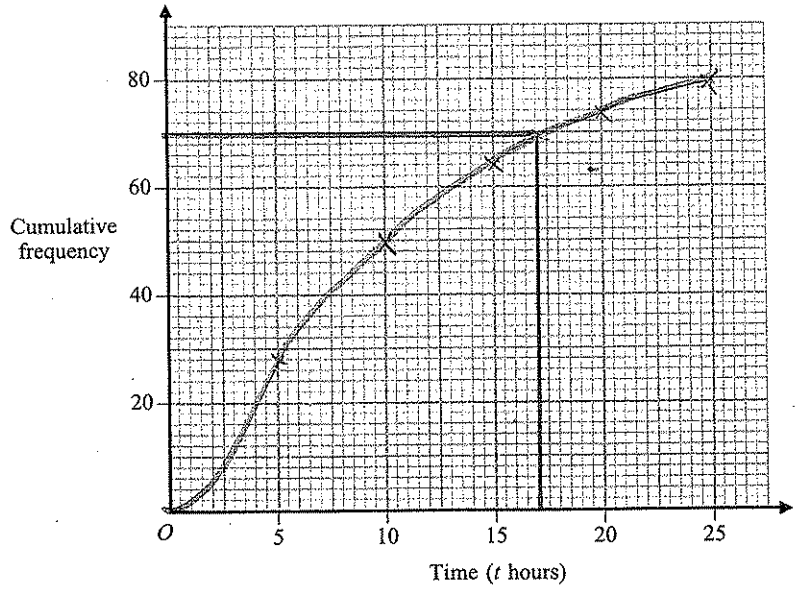
Time (t hours)	Frequency
$0 < t \leqslant 5$	28
$5 < t \leqslant 10$	22
$10 < t \leqslant 15$	14
$15 < t \leqslant 20$	10
$20 < t \leqslant 25$	6

(a) Complete the cumulative frequency table.

Time (t hours)	Cumulative frequency
$0 < t \leqslant 5$	28
$0 < t \leqslant 10$	50
$0 < t \leqslant 15$	64
$0 < t \leqslant 20$	74
$0 < t \leqslant 25$	80

(1)

(b) On the grid, draw the cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the number of students who spent more than 17 hours on the Internet last week.
Show your method clearly.

from graph 70 spent less than 17 hours
∴ 10

10

(2) Q16

(Total 5 marks)

17.

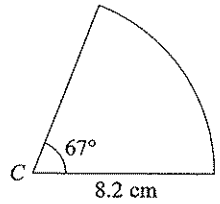


Diagram **NOT** accurately drawn

The diagram shows a sector of a circle, centre C.
The radius of the circle is 8.2 cm.
The angle at the centre of the circle is 67°.

Calculate the area of the sector.
Give your answer correct to 3 significant figures.

$\text{Area} = \frac{67}{360} \times \pi \times 8.2^2$

$= 39.3\text{cm}^2$

39.3 cm^2 Q17

(Total 3 marks)

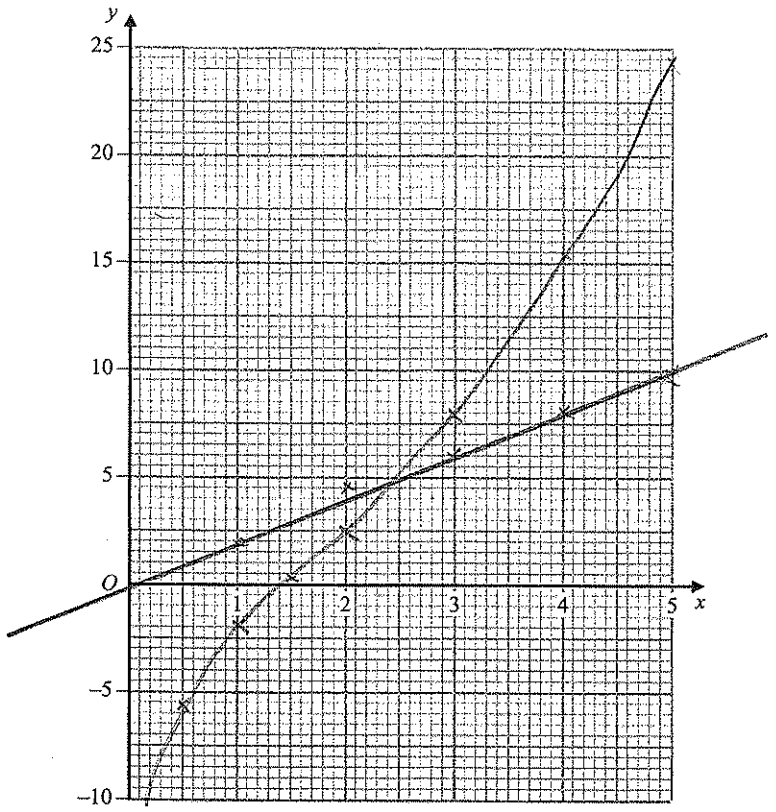
Leave blank

18. (a) Complete the table of values for $y = x^2 - \frac{3}{x}$

x	0.5	1	1.5	2	3	4	5
y	−5.75	−2	0·25	2·5	8	15·25	24.4

(2)

(b) On the grid, draw the graph of $y = x^2 - \frac{3}{x}$ for $0.5 \leqslant x \leqslant 5$



(2)

N 2 4 6 9 2 A 0 1 4 2 0

(c) Use your graph to find an estimate for a solution of the equation

$$x^2 - \frac{3}{x} = 0$$

$x =$ 1·4

(1)

(d) Draw a suitable straight line on your graph to find an estimate for a solution of the equation

$$x^2 - 2x - \frac{3}{x} = 0$$

$x^2 - \frac{3}{x} = 2x$ draw $y = 2x$

$x =$ 2·4

(2)

Q18

(Total 7 marks)

19. Convert the recurring decimal $0.\dot{2}\dot{3}$ to a fraction.

$x = 0.\dot{2}\dot{3}$

(×100) $100x = 23.\dot{2}\dot{3}$

subtract $99x = 23$

$x = \frac{23}{99}$

$\frac{23}{99}$

Q19

(Total 2 marks)

Leave blank

20.

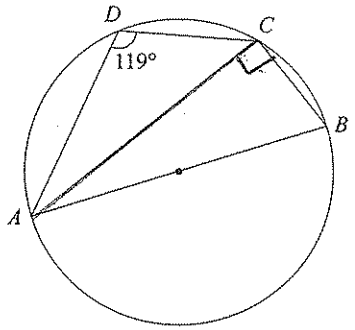


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on the circumference of a circle.
AB is a diameter of the circle.
Angle *ADC* = 119°.

(a) (i) Work out the size of angle *ABC*.

180-119 = 61°

61 °

(ii) Give a reason for your answer.

ABCD is a cyclic quadrilateral so opposite angles sum to 180°

(2)

(b) Work out the size of angle *BAC*.

180-90-61 = 29°

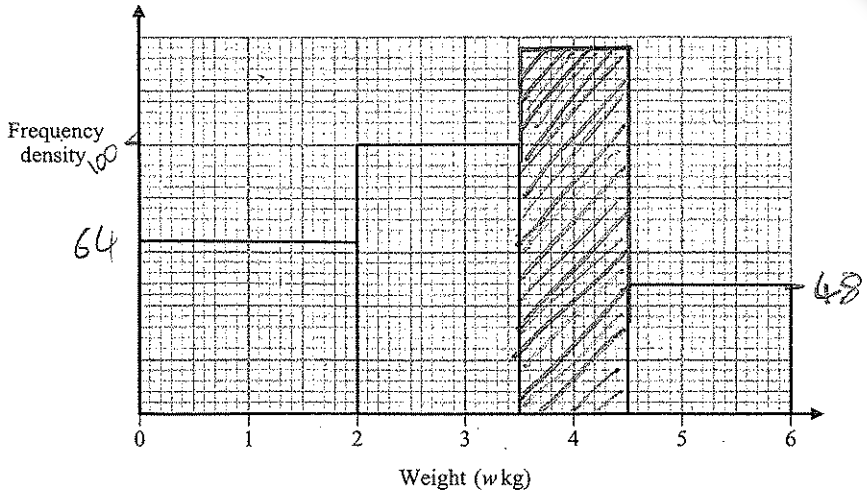
29 °

(2)

(Total 4 marks)

Q20

21. The unfinished table and histogram show information about the weights, in kg, of babies.



Weight (w kg)	Frequency
$0 < w \leqslant 2$	128
$2 < w \leqslant 3.5$	150
$3.5 < w \leqslant 4.5$	136
$4.5 < w \leqslant 6$	72

fd
64
100
136
48

(a) Use the histogram to complete the table.

(2)

(b) Use the table to complete the histogram.

(1)

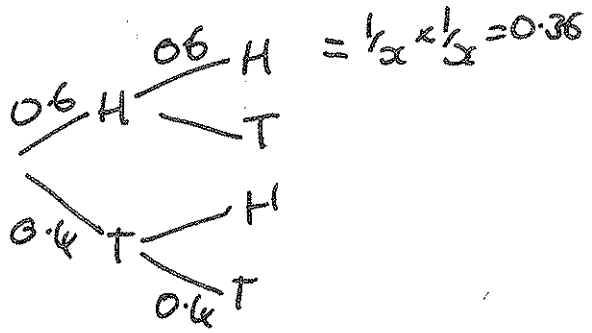
(Total 3 marks)

Q21

Leave blank

22. Younis spins a biased coin twice.
The probability that it will come down heads both times is 0.36

Calculate the probability that it will come down tails both times.



$0.6 \times 0.6 = 0.36$

$\therefore 0.4 \times 0.4 = 0.16$

0.16

(Total 3 marks)

Q22

23. Simplify fully $\frac{2x^2 - 5x - 12}{4x^2 - 9}$

$$\frac{(2x+3)(x-4)}{(2x+3)(2x-3)}$$

$$= \frac{x-4}{2x-3}$$

$\frac{x-4}{2x-3}$

(Total 3 marks)

Q23

24.

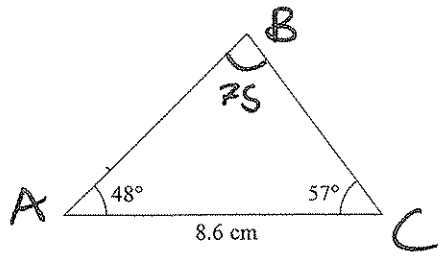


Diagram **NOT** accurately drawn

Calculate the area of the triangle.
Give your answer correct to 3 significant figures.

$$\frac{BC}{\sin 48} = \frac{8.6}{\sin 75}$$

$$BC = \frac{8.6 \times \sin 48}{\sin 75}$$

$$= 6.62\text{cm}$$

$$\therefore \text{Area} = \frac{1}{2} \times 6.62 \times 8.6 \times \sin 57$$

$$= 23.9\text{cm}^2$$

23.9 cm²

(Total 4 marks)

Q24

TURN OVER FOR QUESTION 25

25.

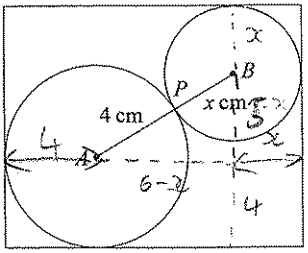


Diagram **NOT** accurately drawn

The diagram shows one disc with centre A and radius 4 cm and another disc with centre B and radius x cm.
The two discs fit exactly into a rectangular box 10 cm long and 9 cm wide.
The two discs touch at P.
APB is a straight line.

(a) Use Pythagoras' Theorem to show that $x^2 - 30x + 45 = 0$

$(6-x)^2 + (5-x)^2 = (4+x)^2$

$36 - 12x + x^2 + 25 - 10x + x^2 = 16 + 8x + x^2$

$2x^2 - 22x + 61 = 16 + 8x + x^2$

$x^2 - 30x + 45 = 0$

(4)

(b) Find the value of x.
Give your value correct to 3 significant figures.

$x = \dfrac{30 \pm \sqrt{30^2 - 4 \times 1 \times 45}}{2 \times 1}$

$= \dfrac{30 \pm \sqrt{720}}{2} = 28.4, 1.58$ ✗ ✓

$x =$ 1.58

(3)

Q25

(Total 7 marks)

TOTAL FOR PAPER: 100 MARKS

END