Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	4	0	0	/	3	H	Signature	

Examiner's use only

Team Leader's use only

Paper Reference(s)

4400/3H

London Examinations IGCSE

Mathematics

Paper 3H

Higher Tier

Monday 10 May 2004 – Morning

Time: 2 hours

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

Page Numbers	Leave Blank
3	
4	
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15	
16	
17	
Total	

Instructions to Candidates

In the boxes above, write your centre number and 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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London Examinations
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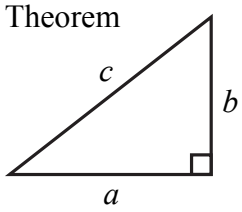
IGCSE MATHEMATICS 4400
FORMULA SHEET – HIGHER TIER

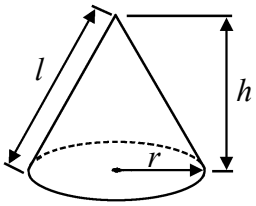
Pythagoras' Theorem



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

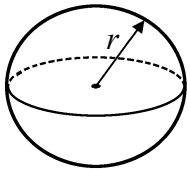
Volume of cone = $\frac{1}{3}\pi r^2 h$

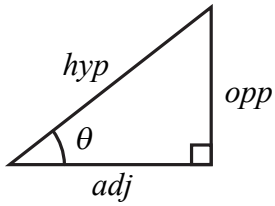
Curved surface area of cone = $\pi r l$



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

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





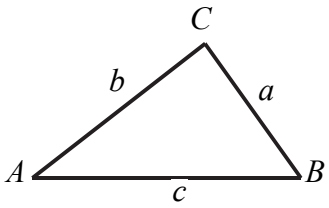
adj = hyp × cos θ
opp = hyp × sin θ
opp = adj × tan θ

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

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

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

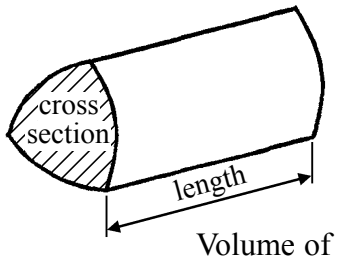
In any triangle ABC



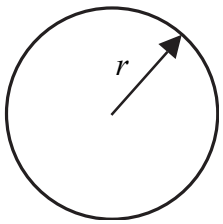
Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



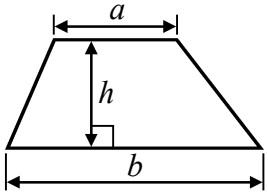
Volume of prism = area of cross section × length

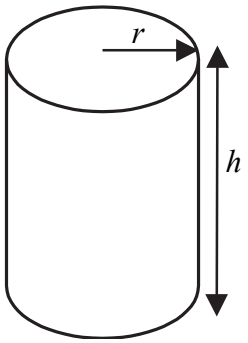


Circumference of circle = $2\pi r$

Area of circle = πr^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 questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

Leave blank

1. In July 2002, the population of Egypt was 69 million.
By July 2003, the population of Egypt had increased by 2%.

Work out the population of Egypt in July 2003.

..... million

(Total 3 marks)

Q1

2. (a) Expand $3(2t + 1)$

.....

(1)

(b) Expand and simplify $(x + 5)(x - 3)$

.....

(2)

(c) Factorise $10p - 15q$

.....

(1)

(d) Factorise $n^2 + 4n$

.....

(1)

(Total 5 marks)

Q2

3.

Leave blank

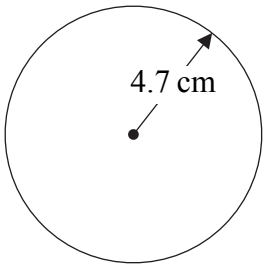


Diagram **NOT** accurately drawn

A circle has a radius of 4.7 cm.

(a) Work out the area of the circle.
Give your answer correct to 3 significant figures.

..... cm^2
(2)

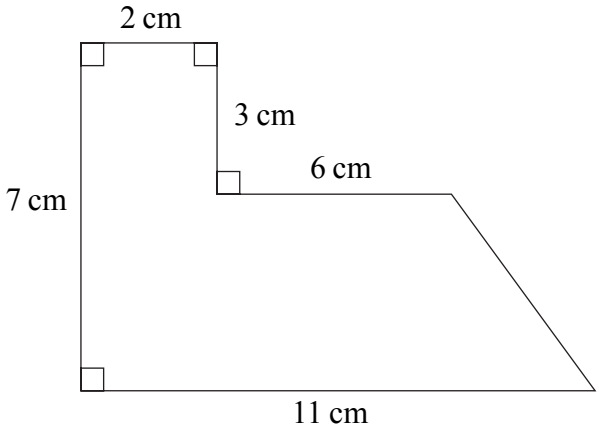


Diagram **NOT** accurately drawn

The diagram shows a shape.

(b) Work out the area of the shape.

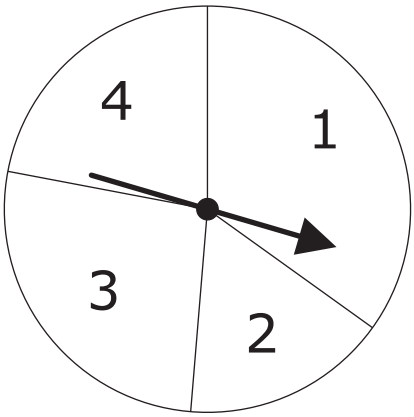
..... cm^2
(4)

Q3

(Total 6 marks)

4. The diagram shows a pointer which spins about the centre of a fixed disc.

Leave blank



When the pointer is spun, it stops on one of the numbers 1, 2, 3 or 4.
The probability that it will stop on one of the numbers 1 to 3 is given in the table.

Number	1	2	3	4
Probability	0.35	0.16	0.27	

Magda is going to spin the pointer once.

(a) Work out the probability that the pointer will stop on 4.

.....

(2)

(b) Work out the probability that the pointer will stop on 1 or 3.

.....

(2)

Omar is going to spin the pointer 75 times.

(c) Work out an estimate for the number of times the pointer will stop on 2.

.....

(2)

Q4

(Total 6 marks)

5. (a) Express 200 as the product of its prime factors.

Leave blank

.....

(2)

(b) Work out the Lowest Common Multiple of 75 and 200.

.....

(2)

Q5

(Total 4 marks)

6. Two points, *A* and *B*, are plotted on a centimetre grid.
A has coordinates (2, 1) and *B* has coordinates (8, 5).

(a) Work out the coordinates of the midpoint of the line joining *A* and *B*.

(..... , ...)

(2)

(b) Use Pythagoras' Theorem to work out the length of *AB*.
Give your answer correct to 3 significant figures.

..... cm

(4)

Q6

(Total 6 marks)

7. $A = \{1, 2, 3, 4\}$
$B = \{1, 3, 5\}$

Leave blank

(a) List the members of the set

(i) $A \cap B$,

.....

(ii) $A \cup B$.

.....

(2)

(b) Explain clearly the meaning of $3 \in A$.

.....

(1)

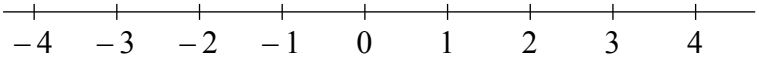
Q7

(Total 3 marks)

8. (i) Solve the inequality $3x + 7 > 1$

.....

(ii) On the number line, represent the solution to part (i).



Q8

(Total 4 marks)

9. The grouped frequency table gives information about the distance each of 150 people travel to work.

Leave blank

Distance travelled (d km)	Frequency
$0 < d \leq 5$	34
$5 < d \leq 10$	48
$10 < d \leq 15$	26
$15 < d \leq 20$	18
$20 < d \leq 25$	16
$25 < d \leq 30$	8

(a) Work out what percentage of the 150 people travel more than 20 km to work.

..... %

(2)

(b) Work out an estimate for the mean distance travelled to work by the people.

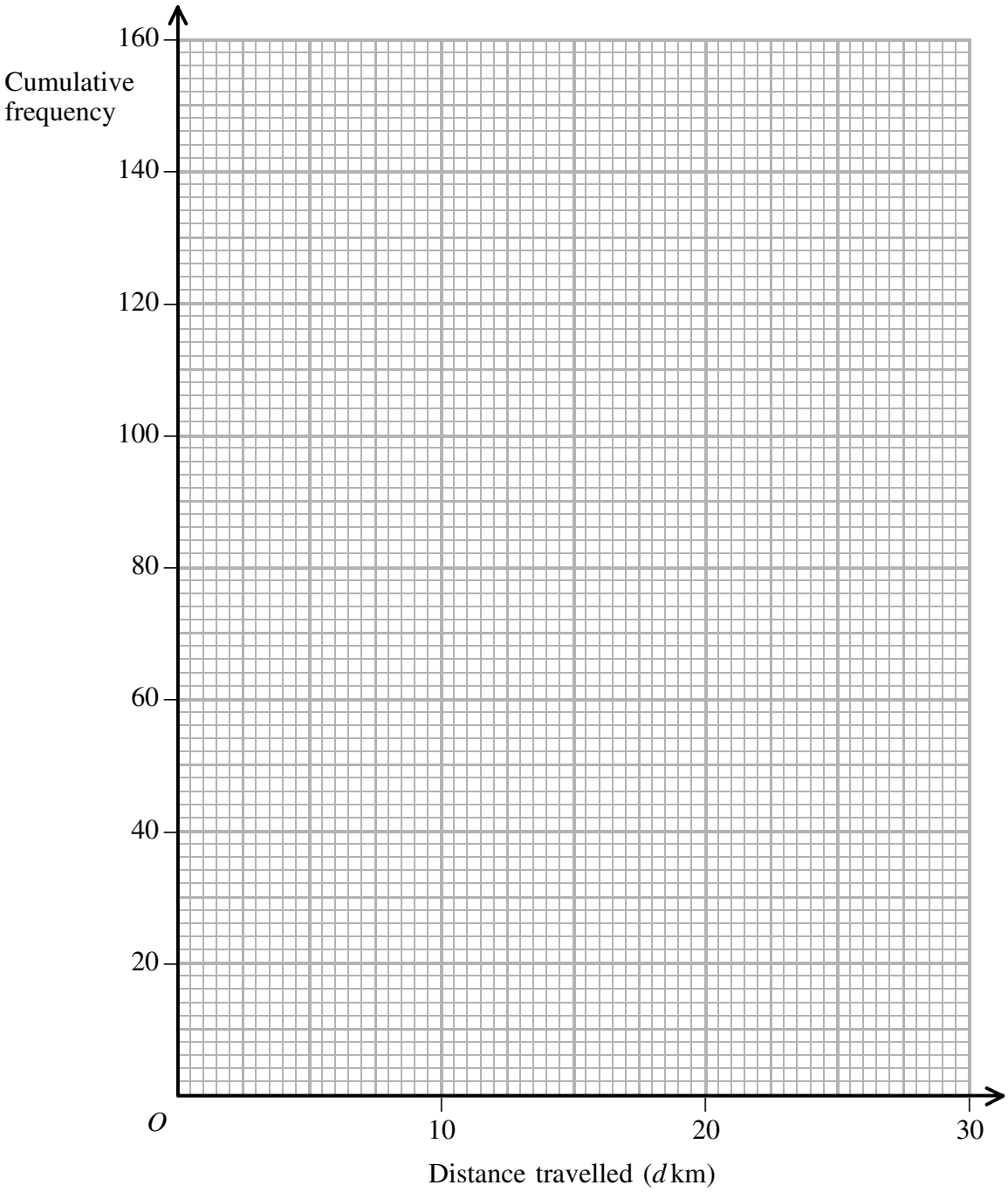
..... km

(4)

(c) Complete the cumulative frequency table.

Distance travelled (d km)	Cumulative frequency
$0 < d \leq 5$	
$0 < d \leq 10$	
$0 < d \leq 15$	
$0 < d \leq 20$	
$0 < d \leq 25$	
$0 < d \leq 30$	

(1)



Leave blank

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

(2)

(e) Use your graph to find an estimate for the median of the distance travelled to work by the people.
Show your method clearly.

..... km

(2)

Q9

(Total 11 marks)

10.

Leave blank

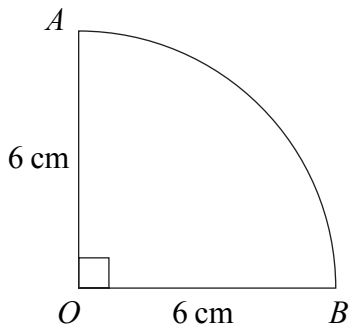


Diagram **NOT** accurately drawn

The diagram shows a shape.
AB is an arc of a circle, centre O.
Angle $AOB = 90°$.
$OA = OB = 6$ cm.

Calculate the perimeter of the shape.
Give your answer correct to 3 significant figures.

..... cm

(Total 4 marks)

Q10

11. The distance between the Earth and the Sun is 150 000 000 km.

(a) Write the number 150 000 000 in standard form.

.....

(1)

The distance between Neptune and the Sun is 30 times greater than the distance between the Earth and the Sun.

(b) Calculate the distance between Neptune and the Sun.
Give your answer in standard form.

..... km

(2)

(Total 3 marks)

Q11

12. (a) Find the gradient of the line with equation $3x - 4y = 15$

Leave blank

.....

(3)

(b) Work out the coordinates of the point of intersection of the line with equation $3x - 4y = 15$ and the line with equation $5x + 6y = 6$

(……. , ……..)

(4)

Q12

(Total 7 marks)

13. A body is moving in a straight line which passes through a fixed point O.
The displacement, s metres, of the body from O at time t seconds is given by

$$s = t^3 + 4t^2 - 5t$$

(a) Find an expression for the velocity, v m/s, at time t seconds.

$v =$ .....

(2)

(b) Find the acceleration after 2 seconds.

..... m/s^2

(2)

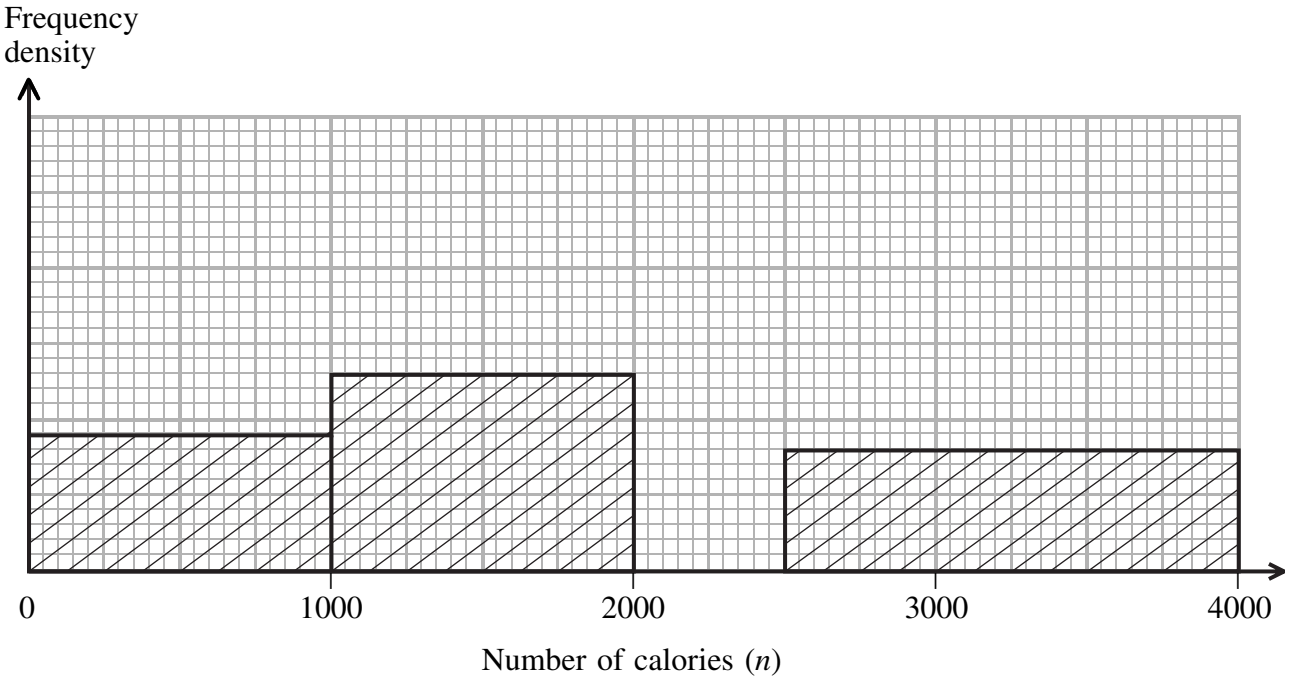
Q13

(Total 4 marks)

14. The unfinished table and histogram show information from a survey of women about the number of calories in the food they eat in one day.

Leave blank

Number of calories (n)	Frequency
$0 < n \leq 1000$	90
$1000 < n \leq 2000$	
$2000 < n \leq 2500$	140
$2500 < n \leq 4000$	



(a) (i) Use the information in the table to complete the histogram.

(ii) Use the information in the histogram to complete the table.

(3)

(b) Find an estimate for the upper quartile of the number of calories.
You must make your method clear.

.....

(2)

Q14

(Total 5 marks)

15. The length of a side of a square is 6.81 cm, correct to 3 significant figures.

Leave blank

(a) Work out the lower bound for the perimeter of the square.

..... cm
(2)

(b) Give the perimeter of the square to an appropriate degree of accuracy.
You must show working to explain how you obtained your answer.

..... cm
(2)

Q15

(Total 4 marks)

16. Express the algebraic fraction $\frac{2x^2 - 3x - 20}{x^2 - 16}$ as simply as possible.

Q16

.....

(Total 3 marks)

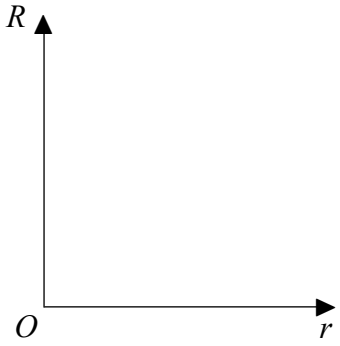
Leave blank

17. An electrician has wires of the same length made from the same material.
The electrical resistance, R ohms, of a wire is inversely proportional to the square of its radius, r mm.
When $r = 2$, $R = 0.9$

(a) (i) Express R in terms of r.

$R =$ .....

(ii) On the axes, sketch the graph of R against r.



(4)

One of the electrician's wires has a radius of 3 mm.

(b) Calculate the electrical resistance of this wire.

..... ohms

(1)

Q17

(Total 5 marks)

18.

Leave blank

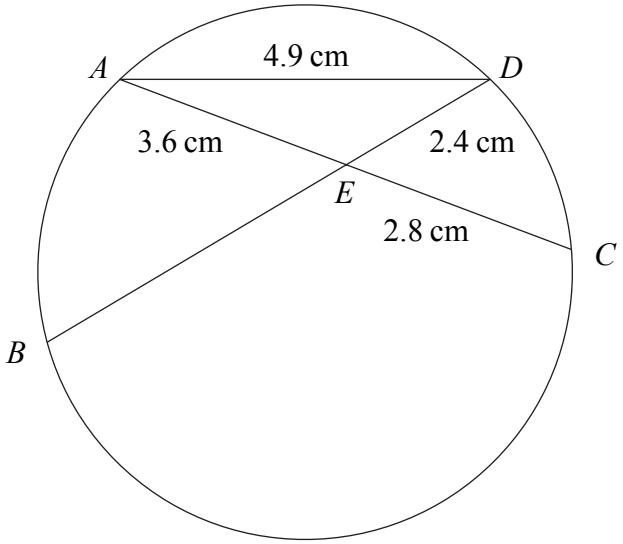


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are four points on the circumference of a circle.
The chords *AC* and *BD* intersect at *E*.
AE = 3.6 cm, *CE* = 2.8 cm, *DE* = 2.4 cm and *AD* = 4.9 cm.

(a) Calculate the length of *BE*.

..... cm
(3)

(b) Calculate the size of angle *AED*.
Give your answer correct to 3 significant figures.

°
.....
(3)

Q18

(Total 6 marks)

19. $f : x \mapsto 2x - 1$

$$g : x \mapsto \frac{3}{x}, \quad x \neq 0$$

Leave blank

(a) Find the value of

(i) f(3),

.....

(ii) fg(6).

.....

(2)

(b) Express the inverse function f^{-1} in the form $f^{-1} : x \mapsto ...$

.....

(2)

(c) (i) Express the composite function gf in the form $gf : x \mapsto ...$

.....

(ii) Which value of x must be excluded from the domain of gf?

$x =$ .....

(2)

Q19

(Total 6 marks)

20.

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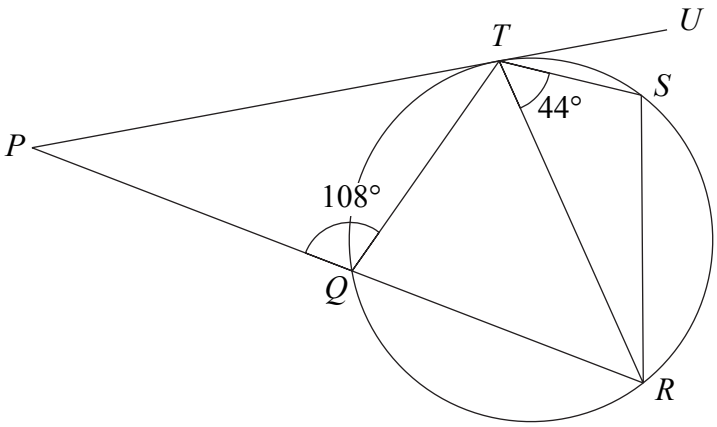

Diagram **NOT** accurately drawn

Q, *R*, *S* and *T* are points on the circumference of a circle.
PU is a tangent to the circle at *T*.
PQR is a straight line.
Angle *PQT* = 108°.
Angle *STR* = 44°.

Work out the size of angle *STU*.
You must give a reason for each step in your working.

° **Q20**

.....

(Total 5 marks)

TOTAL FOR PAPER: 100 MARKS

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London Examinations

IGCSE

IGCSE Mathematics (4400)

Mark Schemes for May 2004 examination session

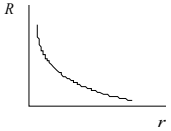
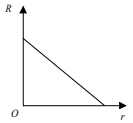
Paper 3H (Higher Tier)

No		Working	Answer	Mark	Notes	
1		$\frac{2}{100}\times 69$ or 1.38 69 + "1.38"	 70.38	3	M1 M1 A1	or M2 for 69×1.02 dep on 1st M1 Accept 70.4 Condone 70 380 000, 70 400 000
2	a		$6t + 3$	1	B1	cao
	b	$x^2 - 3x + 5x - 15$		2	M1	for 4 terms ignoring signs or 3 terms with correct signs
	c		$x^2 + 2x - 15$		A1	
			$5(2p - 3q)$	1	B1	
	d		$n(n + 4)$	1	B1	
3	a	$\pi \times 4.7^2$	 69.4	2	M1 A1	 for 69.4 or better (69.39778…)
	b	Splits shape appropriately eg triangle & 2 rectangles, rectangle & trapezium eg $7\times 2 + 6\times 4$ or 14 + 24 $\frac{1}{2}\times 3\times 4$ or 6	 44	4	M1 M1 M1 A1	 for area of at least one rectangle for area of triangle or trapezium cao
4	ai	$1 - (0.35 + 0.16 + 0.27)$	 0.22	4	M1 A1	 oe
	ii	0.35 + 0.27	 0.62		M1 A1	 oe
	b	0.16×75	 12	2	M1 A1	 cao

No		Working	Answer	Mark	Notes	
5	a	prime factors 2 & 5 seen		2	M1	
			$2\times2\times2\times5\times5$ or $2^3\times5^2$		A1	
	b	$2\times2\times2\times3\times5\times5$		2	M1	for $2\times2\times2\times3\times5\times5$ or for lists of multiples with at least 3 correct in each list
			600		A1	cao
6	a		(5, 3)	2	B2	B1 for each coordinate
	b	$8-2=6$ & $5-1=4$		4	B1	
		6^2+4^2 or 36 + 16 or 52			M1	for squaring & adding
		$\sqrt{6^2+4^2}$ or $\sqrt{52}$ (7.2110…)			M1	(dep on 1st M1) for square root
			7.21		A1	for 7.21 or better
						Either 6 or 4 must be correct for award of M marks
7	i		1, 3	3	B1	Condone repetition
	ii		1, 2, 3, 4, 5		B1	Condone repetition
	iii		"is a member of" oe		B1	
8	i	$3x>-6$		4	M1	SC if M0, award B1 for −2
			$x>-2$		A1	
	ii		line to right of -2 indicated		B1	ft from (i) line must either have arrow or reach 4
			open circle at -2		B1	ft from (i)

No		Working	Answer	Mark	Notes	
9	a	$\frac{16+8}{150}$ or $\frac{24}{150}$ or 0.16		2	M1	
			16		A1	cao
	b	$34\times2.5+48\times7.5+26\times12.5$ $+18\times17.5+16\times22.5+8\times27.5$ or 85+360+325+315+360+220 or1665		4	M1	finds products $f\times x$ consistently within intervals (inc end points) and sums them
					M1	use of midpoints
		$\frac{"1665"}{150}$			M1	(dep on 1st M1) for division by 150
			11.1		A1	Accept 11 if $\frac{1665}{150}$ seen
	c		34, 82, 108, 126, 142, 150	1	B1	cao
	d		Points	2	B1	$\pm$ ½ square ft from sensible table
			Curve		B1	or line segments (dep on 5 pts correct or ft correctly or 5 ordinates from (c) plotted correctly and consistently within intervals but not above end points)
	e	cf of 75 (or 75½) used		2	M1	
			~ 9		A1	ft from sensible graph
10		$\pi\times12$ or 37.6991…		4	M1	
		$\div4$			M1	(dep)
						SC B2 for 3π or 9.4247… seen
		$+2\times6$ or +12			B1	(indep)
			21.4		A1	for 21.4 or better (21.4247…)

No	Working	Answer	Mark	Notes
11 a		1.5×10^8	1	B1 cao
b		4.5×10^9	2	M1 4.5×10^n for integer $n > 0$ A1 for $n = 9$ SC B1 for 4.5^{09}
12 a	$4y = 3x - 15$ $y = \frac{3}{4}x - \frac{15}{4}$	 $\frac{3}{4}$	3	M1 M1 for $\frac{"3x-15"}{4}$ A1 ft from $\frac{"3x-15"}{4}$
b	eg Eqn (A)$\times3$ or Eqn(B)$\times2$ or Eqn(A)$\times5$ or Eqn(B)$\times3$ eg Eqn (A)$\times3$ + Eqn(B)$\times2$ or Eqn(A)$\times5$ - Eqn(B)$\times3$ eg $x = 3$	 $(3,-1\frac{1}{2})$	4	M1 for clear attempt at first step in correct process to eliminate either or y M1 Completes correct process to eliminate either x or y (Condone one error) A1 cao for non-eliminated one A1 cao
13 a		$3t^2 + 8t - 5$	2	B2 (B1 for 2 terms correct)
b	$6t + 8$	 20	2	M1 for $6t + 8$ or d(a)/dt if at least B1 scored A1 ft
14 ai		bar correct	3	B1 $28 \pm ½$ sq
ii		130, 120		B2 B1 cao for each value
b	$\Sigma f = 480, \quad \frac{3}{4}\times480 = 360$	 2500	2	M1 A1 ft from "480" ie Σf

No		Working	Answer	Mark	Notes	
15	a	6.805×4		2	M1	
			27.22		A1	cao
	b	$6.815 \times 4 = 27.26$		2	M1	
			27		A1	cao
16		$(2x+5)(x-4)$		3	M1	
		$(x+4)(x-4)$			M1	
			$\frac{2x+5}{x+4}$		A1	cao
17	ai	$R = \frac{k}{r^2}$		4	M1	
			$R = \frac{3.6}{r^2}$		A1	
	ii				B2	B1 for graph with negative gradient (increasing or constant) even if it touches of crosses one or both axes eg 
	b		0.4	1	B1	ft from k

No		Working	Answer	Mark	Notes	
18	a	$3.6 \times 2.8 = 2.4 \times BE$		3	M1	Accept $AE \times CE = BE \times ED$
		$\frac{3.6 \times 2.8}{2.4}$			M1	
			4.2		A1	cao
	b	$\frac{3.6^2 + 2.4^2 - 4.9^2}{2 \times 3.6 \times 2.4}$		3	M1	
		-0.3061			A1	at least 3 sf
			108		A1	for 108 or better (107.826…)
19	ai		5	2	B1	cao
	ii		0		B1	cao
	b	eg $\begin{matrix} \times 2 \rightarrow -1 \\ \div 3 \leftarrow +1 \end{matrix}$ or attempt to make x the subject of $y = 2x - 1$		2	M1	
			$\frac{x+1}{2}$ oe		A1	
	ci		$\frac{3}{2x-1}$	2	B1	
	ii		$\frac{1}{2}$		B1	

No	Working	Answer	Mark	Notes	
20	$\angle RST = 108°$		5	B1	
	opposite angles of a cyclic quadrilateral			B1	or exterior angle = opposite interior angle Accept *cyclic quadrilateral*
	$\angle SRT = 28°$			B1	
	angle between chord & tangent = angle in alternate segment			B1	Accept *alternate segment* or *chord & tangent*
		28		B1	
	or				
	$\angle RST = 108°$		5	B1	
	opposite angles of a cyclic quadrilateral			B1	or exterior angle = opposite interior angle Accept *cyclic quadrilateral*
	$\angle PTR = 108°$			B1	
	angle between chord & tangent = angle in alternate segment			B1	Accept *alternate segment* or *chord & tangent*
		28		B1	
	or				
	$\angle UTR = 72°$		5	B2	
	angle between chord & tangent = angle in alternate segment			B1	Accept *alternate segment* or *chord & tangent*
		28		B2	B1 for 72 − 44