ANSWERS

Centre No.					
Candidate No.					

Surname	Initial(s)
Signature	

Paper Reference(s)

4400/3H

Examiner's use only

Team Leader's use only

London Examinations IGCSE

Mathematics

Paper 3H

Higher Tier

Friday 5 May 2006 – Morning

Time: 2 hours

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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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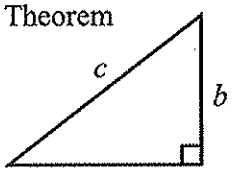
IGCSE MATHEMATICS 4400
FORMULA SHEET – HIGHER TIER

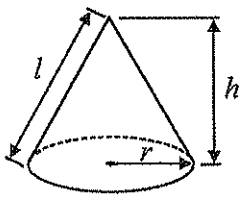
Pythagoras' Theorem



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

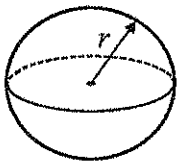
Volume of cone = $\frac{1}{3}\pi r^2 h$

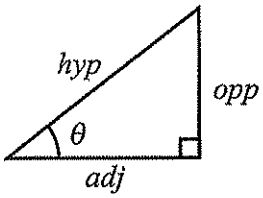
Curved surface area of cone = $\pi r l$



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

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





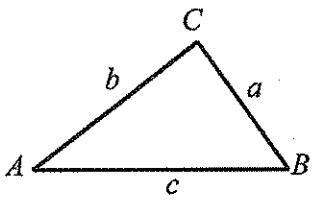
adj = hyp × cos θ
opp = hyp × sin θ
opp = adj × tan θ

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

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

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

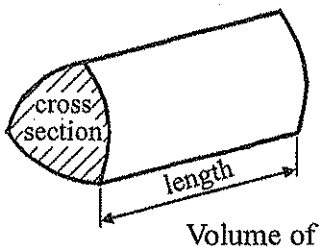
In any triangle ABC



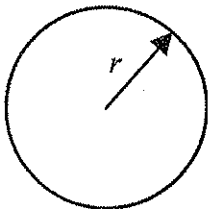
Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



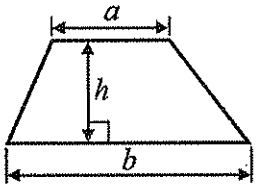
Volume of prism = area of cross section × length

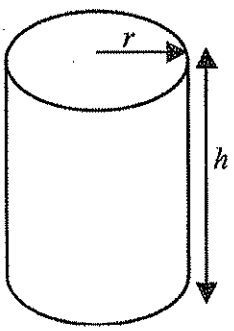


Circumference of circle = $2\pi r$

Area of circle = 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

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

Leave blank

Answer ALL TWENTY-THREE questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1. The surface area of the Earth is 510 million km^2.
The surface area of the Pacific Ocean is 180 million km^2.

(a) Express 180 million as a percentage of 510 million.
Give your answer correct to 2 significant figures.

$\frac{180}{510} \times 100$

35 ..... %

(2)

The surface area of the Arctic Ocean is 14 million km^2.
The surface area of the Southern Ocean is 35 million km^2.

(b) Find the ratio of the surface area of the Arctic Ocean to the surface area of the Southern Ocean.
Give your ratio in the form 1 : n.

14 : 35

$(\div 14)$ 1 : 2.5

1 : 2.5 .....

(2)

(Total 4 marks)

Q1

2. Solve $7 - 4x = 10$

$(+4x)$ $7 = 10 + 4x$

(-10) $-3 = 4x$

$(\div 4)$ $-3/4 = x$

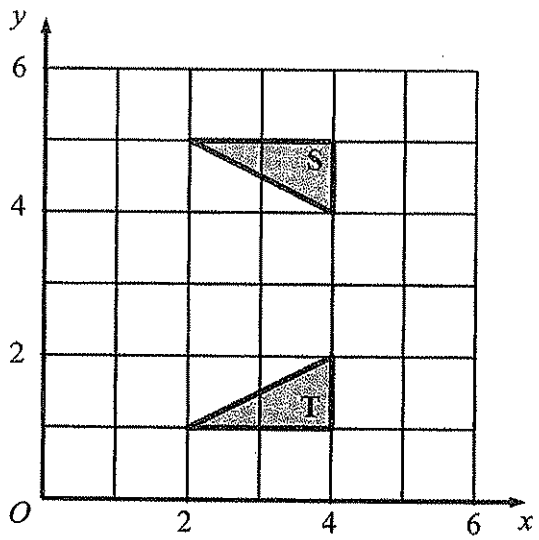
$x =$ $\frac{-3}{4}$ .....

(Total 3 marks)

Q2

Leave blank

3.



Describe fully the single transformation that maps triangle **S** onto triangle **T**.

Reflection in the line $y=3$

Q3

(Total 2 marks)

4. (a) Work out the value of $y^2 - 4y$ when $y = -3$

$(-3)^2 - 4(-3)$

$= 9 + 12$

$= 21$

21

(2)

(b) Simplify

(i) $p^3 \times p^5$

p^8

(ii) $q^7 \div q$

q^6

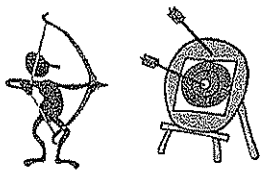
(2)

Q4

(Total 4 marks)

Leave blank

5. Robin fired 15 arrows at a target.
The table shows information about his scores.



Score	Frequency
1	6
2	3
3	1
4	1
5	4

(a) Find his median score.

middle no = 8ths

2

(2)

(b) Work out his mean score.

$$\frac{1\times6+2\times3+3\times1+4\times1+5\times4}{15}$$

$$=\frac{39}{15}$$

2.6

(3)

(Total 5 marks)

Q5

Leave blank

6. (a) Work out $\frac{2}{15} \times 6$

Give your answer as a fraction in its simplest form.

$\frac{2}{15} \times 6 = \frac{12}{15} = \frac{4}{5}$

$\frac{4}{5}$

(2)

(b) Work out $2\frac{2}{3} \div \frac{5}{6}$

Give your answer as a mixed number in its simplest form.

$2\frac{2}{3} \div \frac{5}{6}$

$\frac{8}{\cancel{2}_1} \times \frac{\cancel{6}^2}{5} = \frac{16}{5} = 3\frac{1}{5}$

$3\frac{1}{5}$

(2)

(Total 4 marks)

Q6

7.

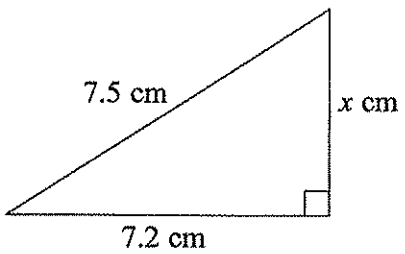


Diagram **NOT** accurately drawn

Work out the value of x.

$7.5^2 - 7.2^2 = x^2$

$4.41 = x^2$

$2.1 = x$ (✓)

$x =$ 2.1

(Total 3 marks)

Q7

Leave blank

8. The perimeter of a triangle is 54 cm.
The lengths of its sides are in the ratios 2 : 3 : 4

Work out the length of the longest side of the triangle.

add ratio's 2+3+4 = 9
divide the amount = 54/9
= 6

longest side
= 4×6
= 24

..... 24 ..... cm

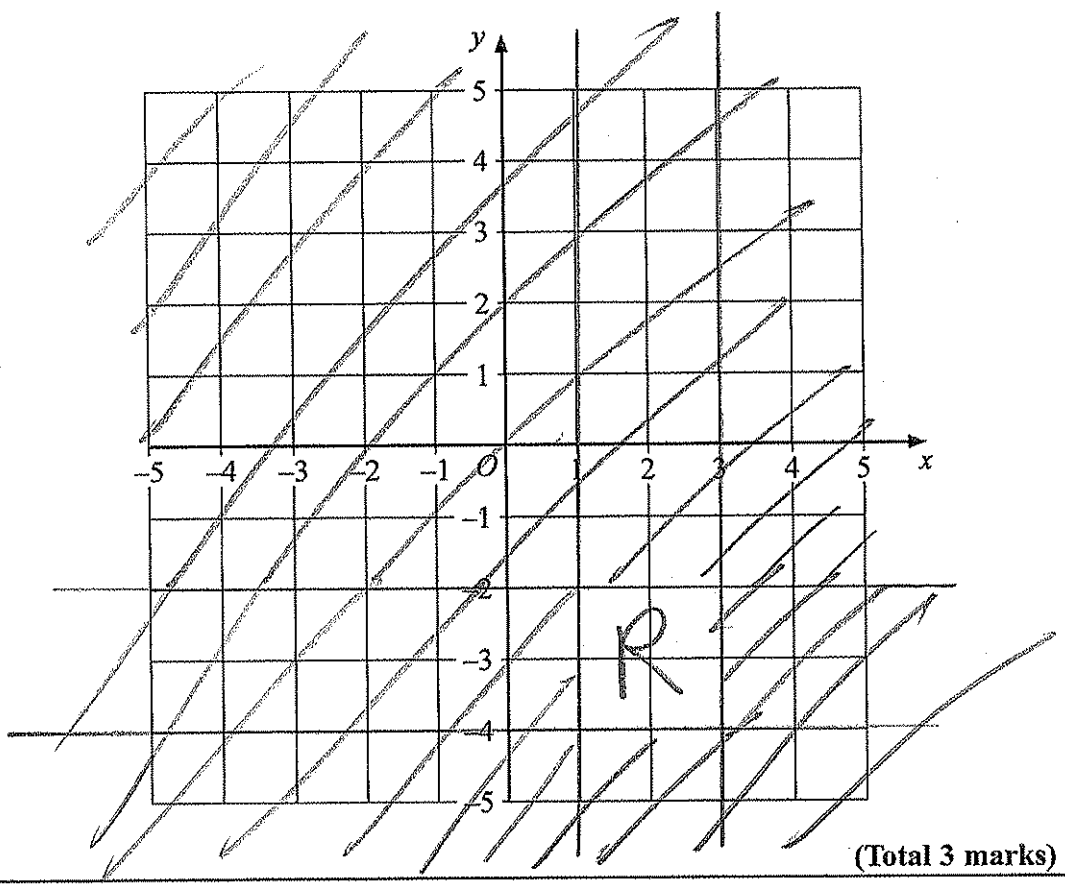
(Total 2 marks)

Q8

9. Show, by shading on the grid, the region which satisfies these inequalities

$1 \leqslant x \leqslant 3$ **and** $-4 \leqslant y \leqslant -2$

Label your region **R**.



(Total 3 marks)

Q9

Leave blank

10.

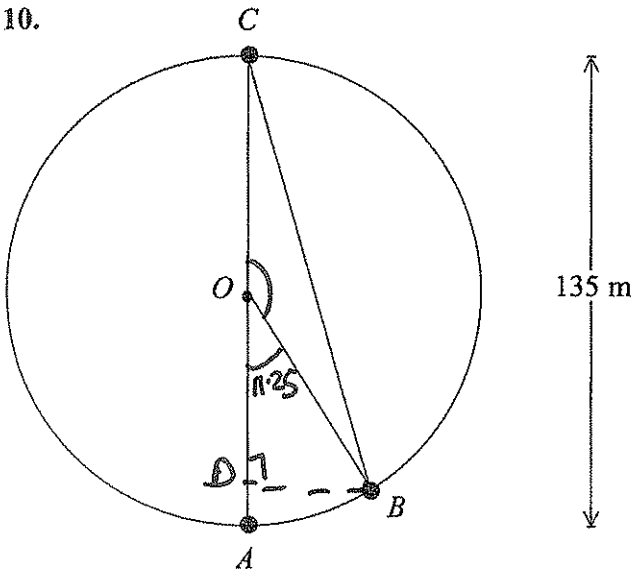
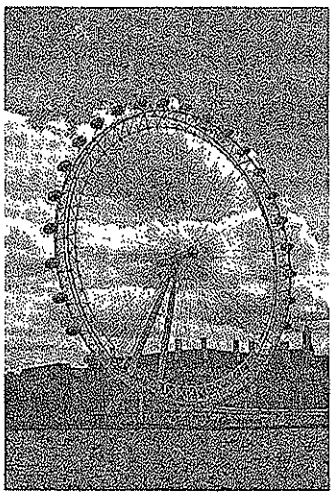


Diagram **NOT** accurately drawn



The diagram represents part of the London Eye.
A, *B* and *C* are points on a circle, centre *O*.
A, *B* and *C* represent three capsules.
The capsules at *A* and *B* are next to each other.
A is at the bottom of the circle and *C* is at the top.

The London Eye has 32 equally spaced capsules on the circle.

(a) Show that angle $AOB = 11.25°$.

32 capsules so 360÷32 gives angle between.
= 11·25°

(1)

(b) Find the size of the angle between *BC* and the horizontal.

angle $\hat{COB}$ = 180 − 11·25
= 168·75°

$\hat{CBO} = \frac{180 - 168 \cdot 75}{2}$

= 5·625°

84·375°

(3)

$\hat{OBA}$ = 90 − 11·25
= 78·75

∴ CBD = 78·75 + 5·625

Leave blank

The capsules move in a circle of diameter 135 m.

(c) Calculate the distance moved by a capsule in making a complete revolution.
Give your answer correct to 3 significant figures.

$\pi \times d = \pi \times 135$
$= 424$

424 ..... m
(2)

The capsules move at an average speed of 0.26 m/s.

(d) Calculate the time taken for a capsule to make a complete revolution.
Give your answer in minutes, correct to the nearest minute.

$s = d/t$ so $t = d/s$
$= 424/0.26$
$= 1631.2s$
$(\div 60) =$ 27 ..... min
(3)

Q10

(Total 9 marks)

11. Write as ordinary numbers

(i) 3.6×10^5

360000

(ii) 2.9×10^{-3}

0.0029

Q11

(Total 2 marks)

Leave blank

12.

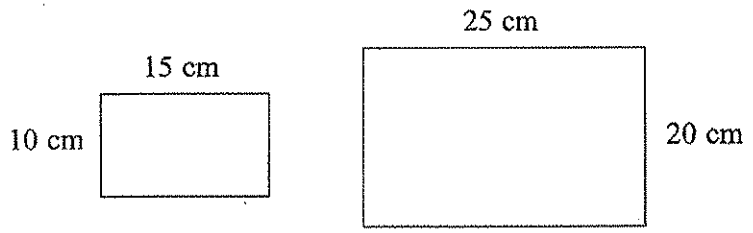


Diagram **NOT** accurately drawn

Are the two rectangles mathematically similar?
Tick (✓) the appropriate box.
You must show working to justify your answer.

Yes	No
☐	☑

The sides aren't in the same ratio. I.e. $\frac{25}{15} \neq \frac{20}{10}$

Q12

(Total 3 marks)

13. (a) Expand and simplify $(3x - 5)(4x + 7)$

$12x^2 + 21x - 20 - 35$

$= 12x^2 + x - 35$

$12x^2 + x - 35$

(2)

(b) Simplify $(2p^4)^3$

$8p^{12}$

(2)

(c) Simplify $(64y^6)^{\frac{2}{3}}$

$= ((64y^6)^{1/3})^2$

$= (4y^2)^2 = 16y^4$

$16y^4$

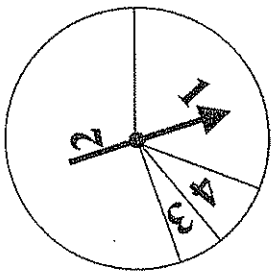
(2)

Q13

(Total 6 marks)

Leave blank

14. Here is a biased spinner.



When the pointer is spun, the score is 1 or 2 or 3 or 4
The probability that the score is 1 is 0.3
The probability that the score is 2 is 0.6

Hajra spins the pointer once.

(a) Work out the probability that

(i) the score is 1 or 2

$0.3+0.6 = 0.9$ ..... 0.9 .....

(ii) the score is 3 or 4

$1-0.9$ ..... 0.1 .....

(3)

Nassim spins the pointer twice.

(b) Work out the probability that

(i) the score is 1 both times,

0.3×0.3

$= 0.09$

..... 0.09 .....

(ii) the score is 2 exactly once.

0.6×0.4

$+ 0.4 \times 0.6$

$= 0.24 + 0.24$

$= 0.48$

..... 0.48 .....

(5)

(Total 8 marks)

Q14

Lea blank

15. $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8\}$
$P = \{2, 3, 5, 7\}$

(a) List the members of P'

$P' = \{1, 4, 6, 8\}$ **(1)**

The set Q satisfies both the conditions $Q \subset P$ **and** $n(Q) = 3$

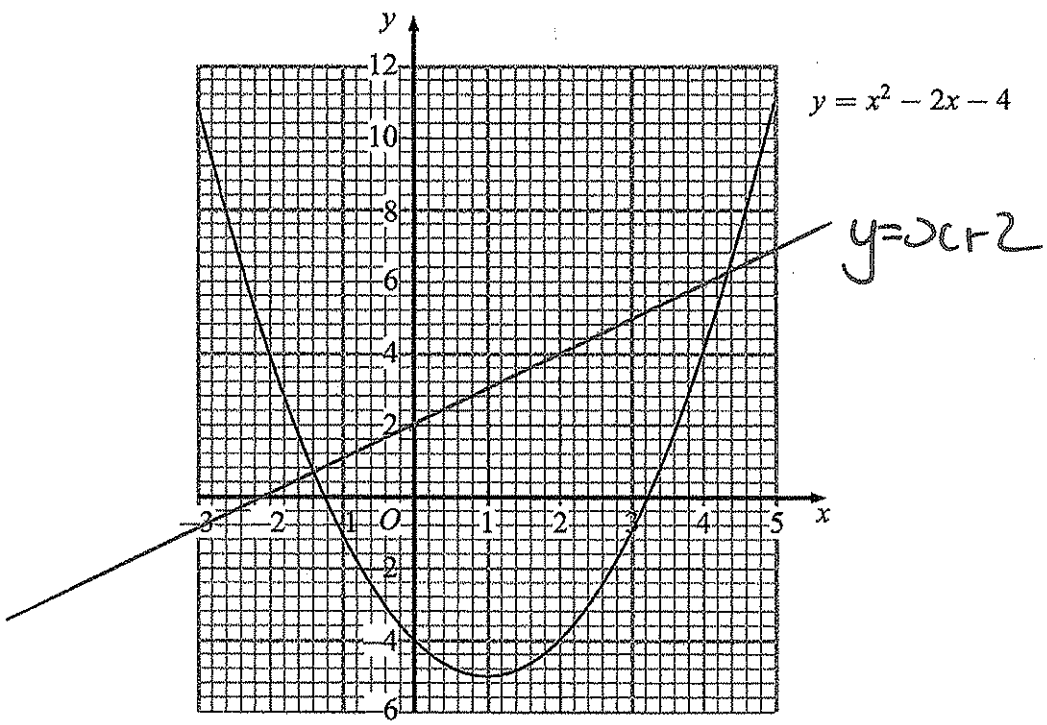
(b) List the members of **one** set Q which satisfies both these conditions.

$Q = \{2, 3, 5\}$ **(2)**

Q15

(Total 3 marks)

16. Part of the graph of $y = x^2 - 2x - 4$ is shown on the grid.



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(a) Write down the coordinates of the minimum point of the curve.

(1 , -5)

(1)

(b) Use the graph to find estimates of the solutions to the equation $x^2 - 2x - 4 = 0$
Give your answers correct to 1 decimal place.

3.2, -1.2

(2)

(c) Draw a suitable straight line on the grid to find estimates of the solutions of the equation $x^2 - 3x - 6 = 0$

$x^2 - 3x - 6 = 0$

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

4.4, -1.2

(3)

(d) For $y = x^2 - 2x - 4$

(i) find $\frac{dy}{dx}$, $= 2x - 2$

$2x - 2$

(ii) find the gradient of the curve at the point where $x = 6$

when $x = 6$

$\frac{dy}{dx} = 2(6) - 2$

$= 12 - 2$

$= 10$

10

(4)

Q16

(Total 10 marks)

Leave blank

17. Michael says *"When the fraction $\frac{n}{45}$ is converted to a decimal, it never gives a terminating decimal."*

(a) (i) Find a value of n which shows that Michael is wrong.

$n =$ 9

(ii) Write down the name of the type of number n must be, when $\frac{n}{45}$ gives a terminating decimal.

A multiple of 9

(2)

(b) $\frac{62}{45} < \sqrt{2} < \frac{64}{45}$

Use these bounds to write the value of $\sqrt{2}$ to an appropriate degree of accuracy.
You must show your working and explain your answer.

$\frac{62}{45} + \frac{64}{45} = \frac{126}{45}$

$(\div 2)$

$\frac{126}{45} \times \frac{1}{2} = \frac{126}{90}$

$= 1\frac{3}{5} = 1.4$

1.4

(2)

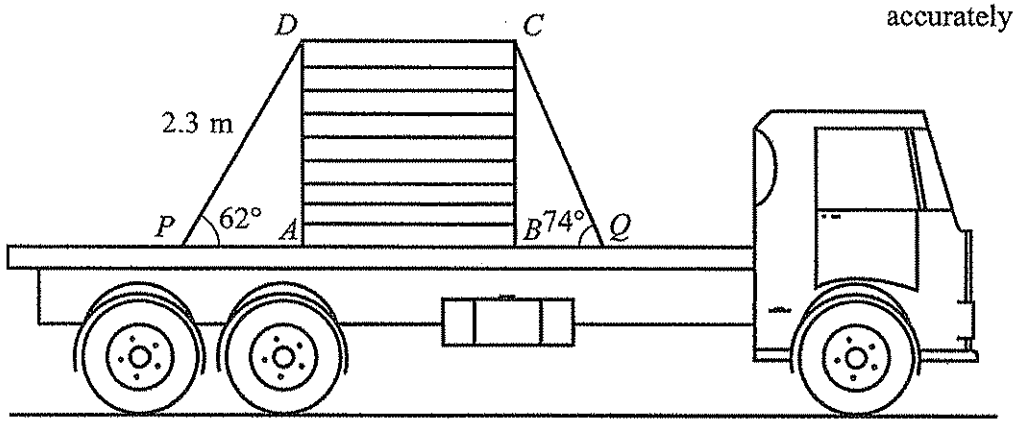
(Total 4 marks)

Q17

Leave blank

18.

Diagram **NOT** accurately drawn



The diagram shows a side view of a rectangular box *ABCD* on a lorry.
The box is held down on the horizontal flat surface of the lorry by a rope.
The rope passes over the box and is tied at two points, *P* and *Q*, on the flat surface.

DP = 2.3 m.
Angle *APD* = 62°.
Angle *BQC* = 74°.

Calculate the length of *BQ*.
Give your answer correct to 3 significant figures.

$\sin 62 = \frac{AD}{2.3}$

$AD = 2.03\text{m} = CB$

so $\tan 74 = \frac{2.03}{BQ}$

$BQ = 0.58\text{ m}$

0.58 ..... m

Q18

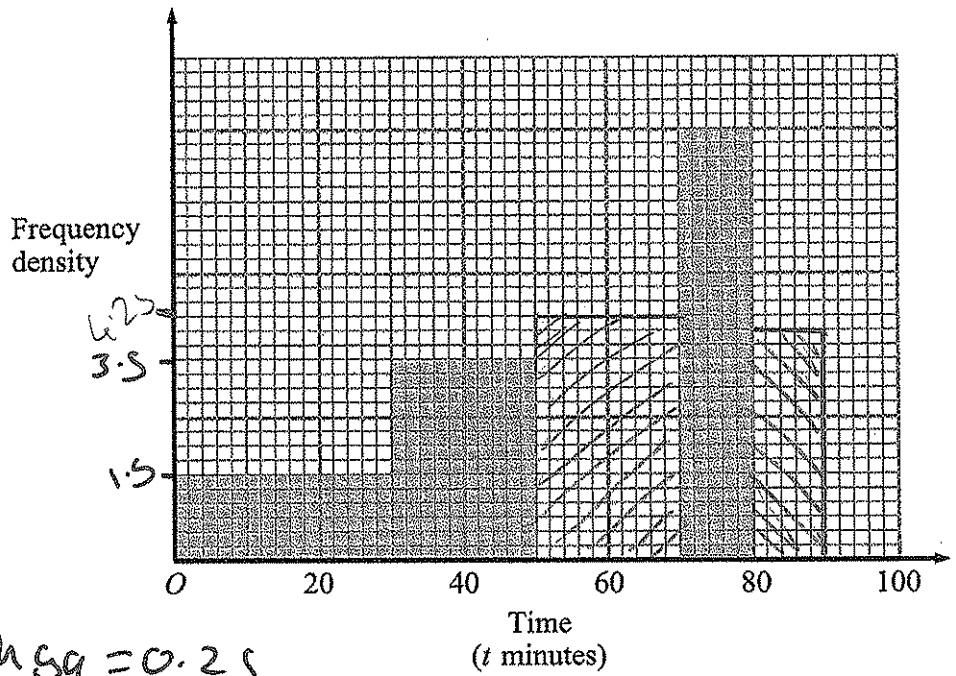
(Total 5 marks)

Leave blank

19. The unfinished table and histogram give information about the times taken by some students to complete a science test.

Time (t minutes)	Frequency
$0 < t \leqslant 30$	45
$30 < t \leqslant 50$	70
$50 < t \leqslant 70$	85
$70 < t \leqslant 80$	75
$80 < t \leqslant 90$	40

4d
1·5
3·5
4·25
7·5
4



each sq = 0·25

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

(2)

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

(2)

(Total 4 marks)

Q19

Leave blank

20. Make R the subject of the formula $A = \pi(R + r)(R - r)$

$$\frac{A}{\pi} = R^2 - r^2$$

$$R^2 = \frac{A}{\pi} + r^2$$

$$R = \sqrt{\frac{A}{\pi} + r^2}$$

$R =$ $\sqrt{\frac{A}{\pi} + r^2}$ **Q20**

(Total 4 marks)

21. $(1+3\sqrt{5})^2 = p + q\sqrt{5}$ where p and q are integers.
Find the value of p and the value of q.

$$(1+3\sqrt{5})(1+3\sqrt{5})$$

$$= 1 + 6\sqrt{5} + 45$$

$$= 46 + 6\sqrt{5}$$

$p =$ 46

$q =$ 6 **Q21**

(Total 2 marks)

Lea blank

22.

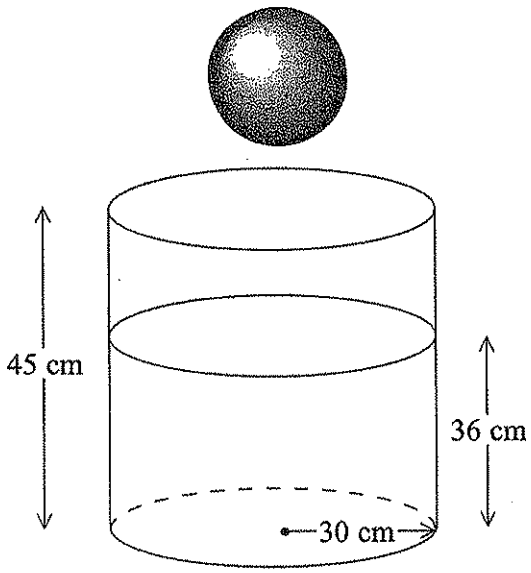


Diagram **NOT** accurately drawn

A cylindrical tank has a radius of 30 cm and a height of 45 cm.
The tank contains water to a depth of 36 cm.

A metal sphere is dropped into the water and is completely covered.
The water level rises by 5 cm.

Calculate the radius of the sphere.

volume of sphere = $\pi \times 30^2 \times 5$
$= 14137.17 cm^3$

sphere volume = $4/3 \pi r^3$

$14137.17 = 4/3 \pi r^3$

$r^3 = 3375$

$r = 15$

15 cm

Q22

(Total 5 marks)

Leave blank

23. $f(x) = x^2$

$g(x) = 2x + 3$

Solve $fg(x) = f(x)$.

$fg(x)$

$= (2x+3)^2 = x^2$

$4x^2 + 12x + 9 = x^2$

$3x^2 + 12x + 9 = 0$

$(\div 3)\ x^2 + 4x + 3 = 0$

$(x+3)(x+1)$

$x = -1, -3$

Q23

(Total 5 marks)

TOTAL FOR PAPER: 100 MARKS

END

Edexcel gratefully acknowledges the following source used in the preparation of this paper.

- Photograph of London Eye: www.freefoto.com