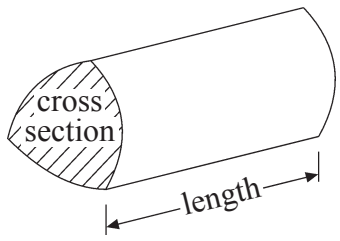
GCSE Mathematics 1387/8

Formulae: Higher Tier

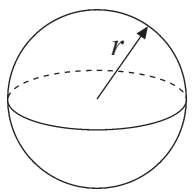
You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

Volume of a prism = area of cross section × length



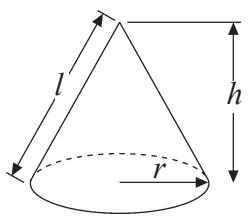
Volume of sphere $= \frac{4}{3}\pi r^3$

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

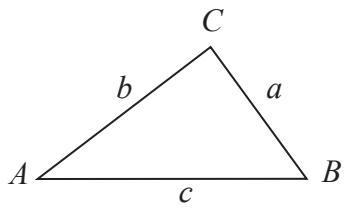


Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle ABC



The Quadratic Equation

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

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

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 $= \frac{1}{2}ab \sin C$

Leave blank

Answer ALL TWENTY SEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

You must NOT use a calculator.

1. A bag contains counters which are red or green or yellow or blue.

The table shows each of the probabilities that a counter taken at random from the bag will be red or green or blue.

Colour	**Red**	**Green**	**Yellow**	**Blue**
Probability	0.2	0.3		0.1

A counter is to be taken at random from the bag.

(a) Work out the probability that the counter will be yellow.

.....

(2)

The bag contains 200 counters.

(b) Work out the number of red counters in the bag.

.....

(2) **Q1**

(Total 4 marks)

Leave blank

2. Kate buys 2 lollies and 5 choc ices for £6.50
Pete buys 2 lollies and 3 choc ices for £4.30

Work out the cost of one lolly.
Give your answer in pence.

..... pence
(Total 3 marks)

Q2

3. Matthew wants to collect information about the time students take to travel to school.

Design a suitable question he could use on a questionnaire.

Q3

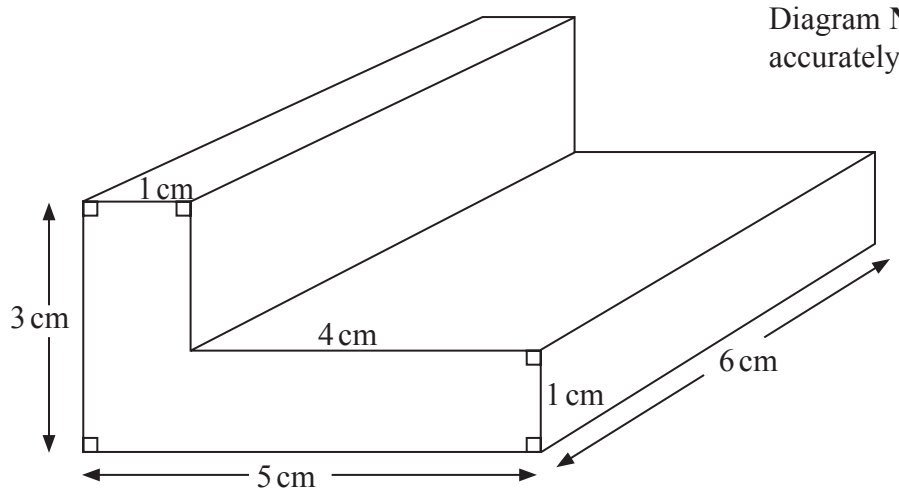
(Total 2 marks)

N 2 5 7 6 6 A 0 4 2 4

Leave blank

4.

Diagram **NOT** accurately drawn



Work out the total surface area of the L-shaped prism.
State the units with your answer.

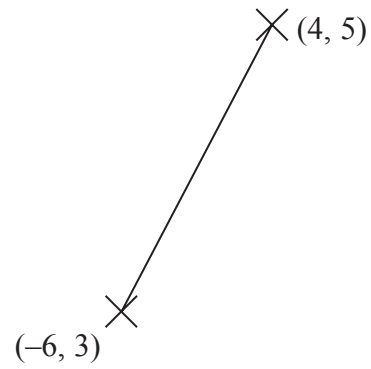
.....

(Total 4 marks)

Q4

Leave blank

5. Work out the coordinates of the midpoint of the line joining the points (4, 5) and (–6, 3).



(–6, 3)

(..... , ...)

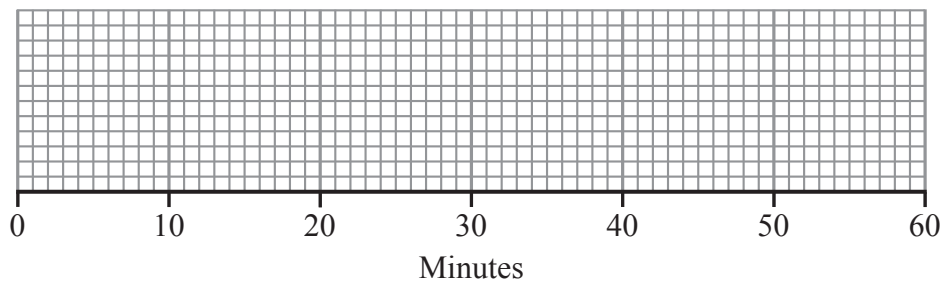
(Total 2 marks)

Q5

6. Mrs Raja set work for the students in her class.
She recorded the time taken, in minutes, for each student to do the work.
She used her results to work out the information in the table.

	Minutes
Shortest time	4
Lower quartile	14
Median	26
Upper quartile	30
Longest time	57

On the grid, draw a box plot to show the information in the table.



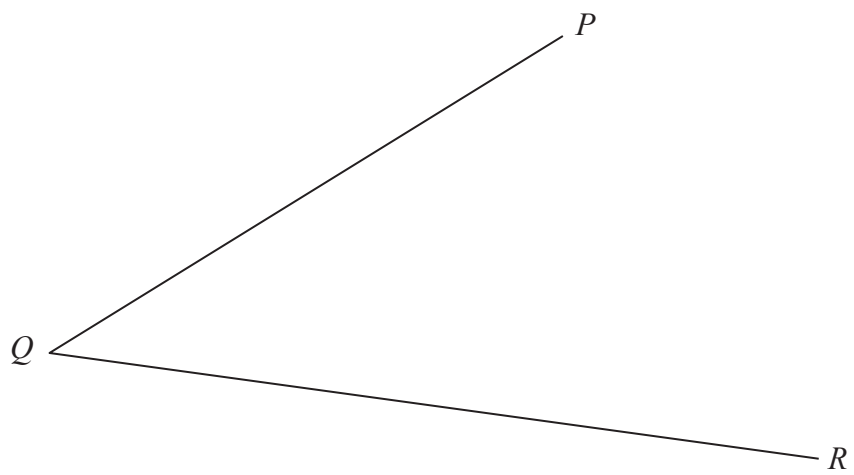
(Total 2 marks)

Q6

N 2 5 7 6 6 A 0 6 2 4

Leave blank

7.



Use ruler and compasses to **construct** the bisector of angle *PQR*.
You must show all your construction lines.

Q7

(Total 2 marks)

N 2 5 7 6 6 A 0 7 2 4

Turn over

Leave blank

8. (a) Write 126 as a product of its prime factors.

.....

(2)

(b) Find the Highest Common Factor (HCF) of 84 and 126

.....

(2)

Q8

(Total 4 marks)

N 2 5 7 6 6 A 0 8 2 4

Leave blank

9. (a) m is an integer such that $-1 \leqslant m < 4$
List all the possible values of m.

.....

(2)

(b) (i) Solve the inequality $3x \geqslant x + 7$

.....

(ii) x is a whole number.
Write down the smallest value of x that satisfies $3x \geqslant x + 7$

.....

(3)

Q9

(Total 5 marks)

N 2 5 7 6 6 A 0 9 2 4

Leave blank

10. (a) Write as a power of 7

(i) $7^8 \div 7^3$

.....

(ii) $\dfrac{7^2 \times 7^3}{7}$

.....

(3)

(b) Write down the reciprocal of 2

.....

(1) **Q10**

(Total 4 marks)

11. (a) Make n the subject of the formula $m = 5n - 21$

$n =$ .....

(2)

(b) Make p the subject of the formula $4(p - 2q) = 3p + 2$

$p =$ .....

(3) **Q11**

(Total 5 marks)

Leave blank

12.

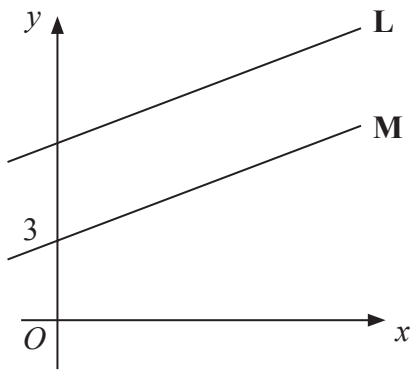


Diagram **NOT** accurately drawn

The straight line **L** has equation $y = \frac{1}{2}x + 7$

The straight line **M** is parallel to **L** and passes through the point (0, 3).

Write down an equation for the line **M**.

.....

(Total 2 marks)

Q12

13. Work out $2\frac{2}{3} \times 1\frac{1}{4}$

Give your answer in its simplest form.

.....

(Total 3 marks)

Q13

Turn over

Leave blank

14. Solve the simultaneous equations

$$4x + 2y = 8$$
$$2x - 5y = 10$$

$x =$ ..... , $y =$ .....

(Total 3 marks)

Q14

Leave blank

15.

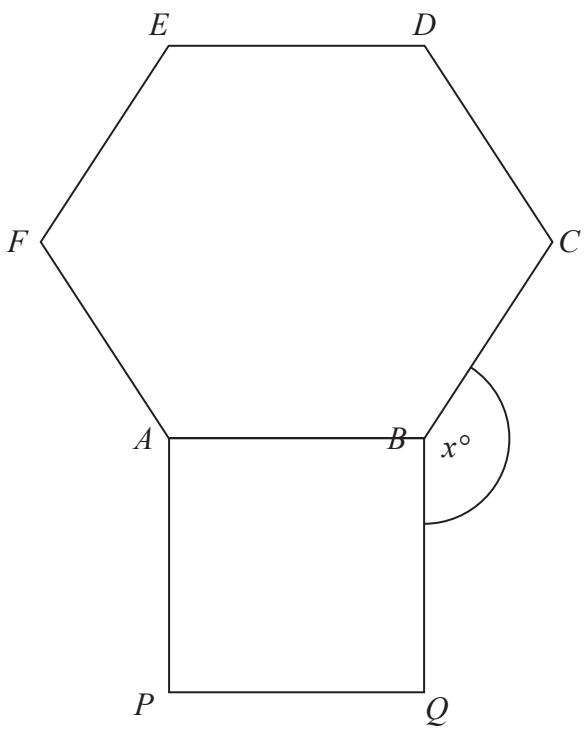


Diagram **NOT** accurately drawn

ABCDEF is a regular hexagon and *ABQP* is a square.
Angle *CBQ* = *x*°.

Work out the value of *x*.

x = ...

Q15

(Total 4 marks)

N 2 5 7 6 6 A 0 1 3 2 4

Turn over

Leave blank

16. An operator took 100 calls at a call centre.
The table gives information about the time (t seconds) it took the operator to answer each call.

Time (t seconds)	Frequency
$0 < t \leqslant 10$	16
$10 < t \leqslant 20$	34
$20 < t \leqslant 30$	32
$30 < t \leqslant 40$	14
$40 < t \leqslant 50$	4

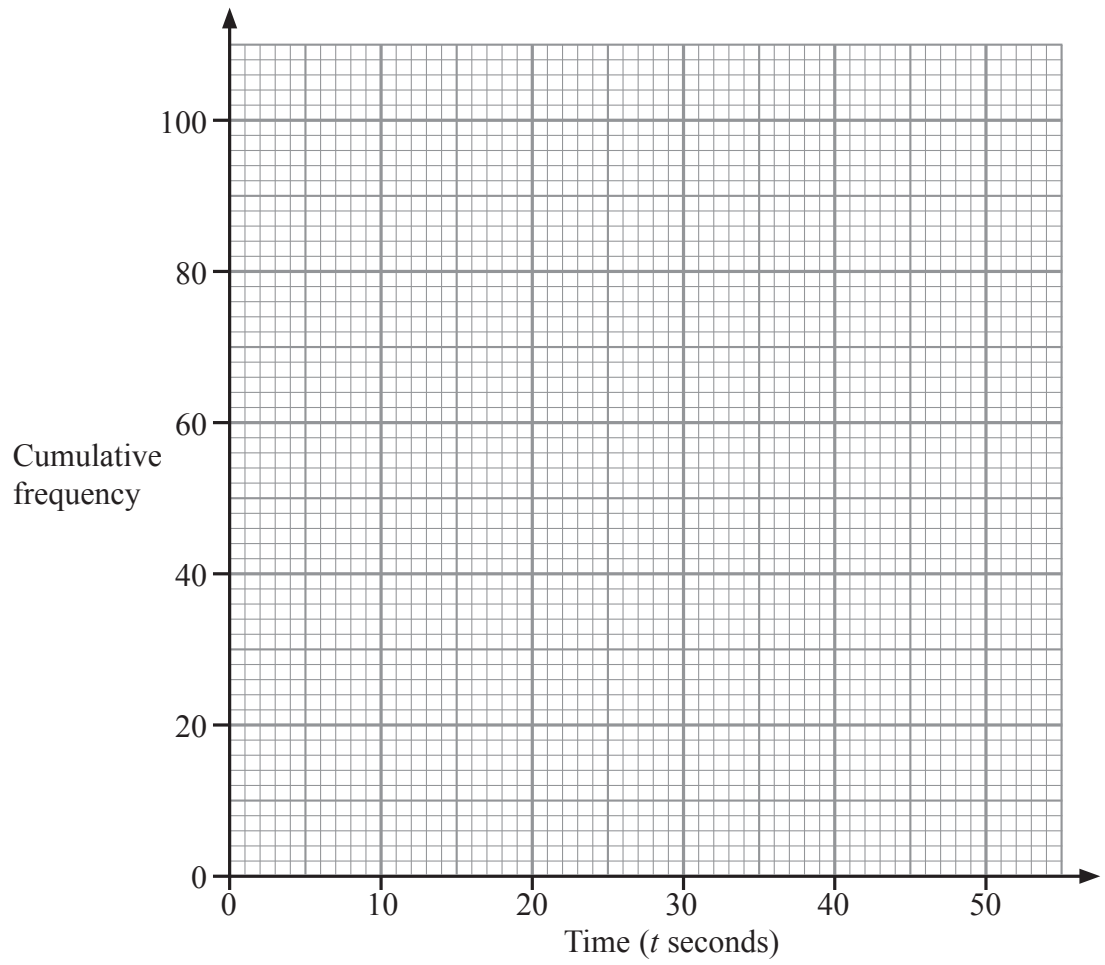
(a) Complete the cumulative frequency table.

Time (t seconds)	Cumulative frequency
$0 < t \leqslant 10$	16
$0 < t \leqslant 20$	
$0 < t \leqslant 30$	
$0 < t \leqslant 40$	
$0 < t \leqslant 50$	

(1)

N 2 5 7 6 6 A 0 1 4 2 4

Leave blank



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

(2)

(c) Use your graph to find an estimate for the number of calls the operator took **more** than 18 seconds to answer.

.....

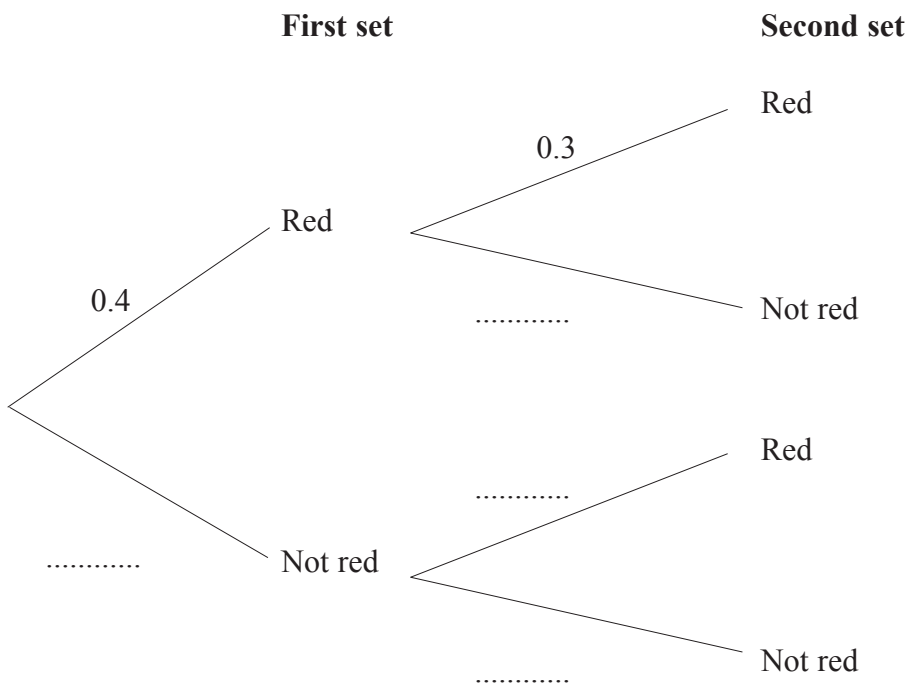
(2) **Q16**

(Total 5 marks)

Leave blank

17. There are two sets of traffic lights on Georgina's route to school.
The probability that the first set of traffic lights will be red is 0.4
The probability that the second set of traffic lights will be red is 0.3

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that both sets of traffic lights will be red.

.....

(2)

(c) Work out the probability that exactly one set of traffic lights will be red.

.....

(3)

(Total 7 marks)

Q17

N 2 5 7 6 6 A 0 1 6 2 4

Leave blank

18. Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$

Q18

(Total 3 marks)

19. Expand and simplify $(\sqrt{3} - \sqrt{2})(\sqrt{3} + \sqrt{2})$

Q19

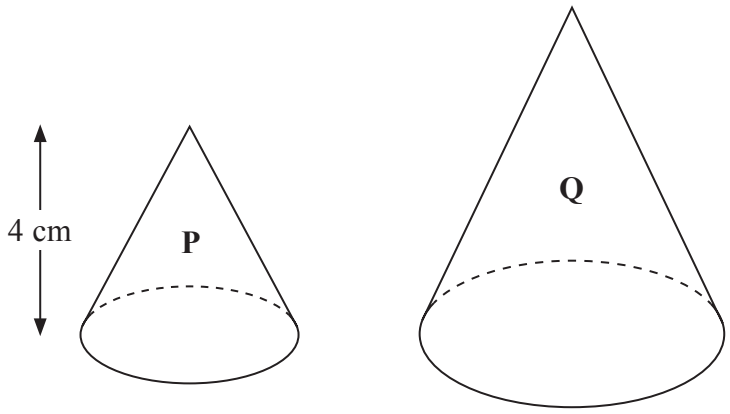
.....

(Total 2 marks)

Leave blank

20.

Diagrams **NOT** accurately drawn



Two cones, **P** and **Q**, are mathematically similar.
The total surface area of cone **P** is 24 cm^2.
The total surface area of cone **Q** is 96 cm^2.
The height of cone **P** is 4 cm.

(a) Work out the height of cone **Q**.

..... cm
(3)

The volume of cone **P** is 12 cm^3.

(b) Work out the volume of cone **Q**.

..... cm^3
(2)

(Total 5 marks)

Q20

N 2 5 7 6 6 A 0 1 8 2 4

Leave blank

21. (a) Expand $x(3 - 2x^2)$

.....

(2)

(b) Factorise completely $12xy + 4x^2$

.....

(2)

(c) Simplify $\dfrac{20a^2}{4ab^2}$

.....

(2)

(d) Simplify $\dfrac{x-3}{x^2-9}$

.....

(2)

Q21

(Total 8 marks)

Leave blank

22.

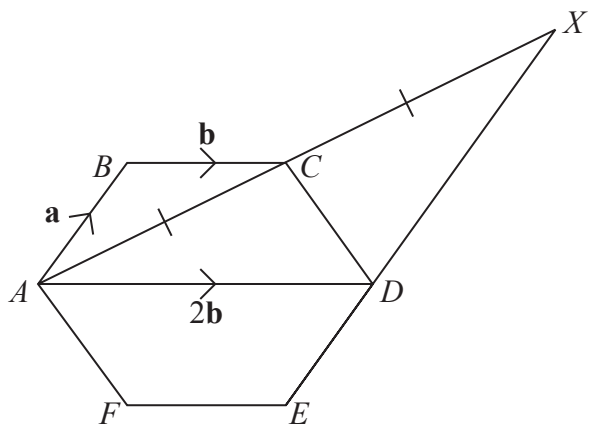


Diagram **NOT** accurately drawn

ABCDEF is a regular hexagon.

$\overrightarrow{AB} = \mathbf{a}$ $\overrightarrow{BC} = \mathbf{b}$ $\overrightarrow{AD} = 2\mathbf{b}$

(a) Find the vector $\overrightarrow{AC}$ in terms of **a** and **b**.

$\overrightarrow{AC}$ = ...

(1)

$\overrightarrow{AC} = \overrightarrow{CX}$

(b) Prove that *AB* is parallel to *DX*.

(3)

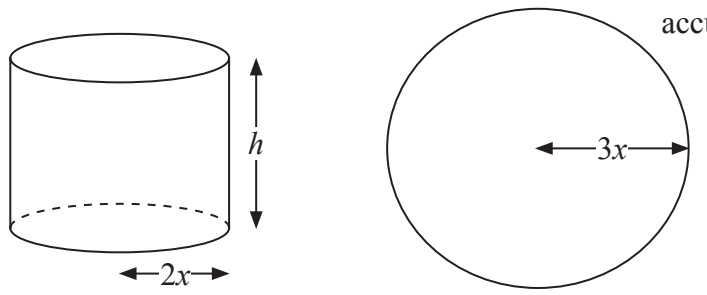
(Total 4 marks)

Q22

Leave blank

23. The diagram shows a cylinder and a sphere.

Diagram **NOT** accurately drawn



The radius of the base of the cylinder is $2x$ cm and the height of the cylinder is h cm.
The radius of the sphere is $3x$ cm.
The volume of the cylinder is equal to the volume of the sphere.

Express h in terms of x.
Give your answer in its simplest form.

$h =$ .....

(Total 3 marks)

Q23

Leave blank

24. (i) Expand and simplify

$$n^2 + (n + 1)^2$$

.....

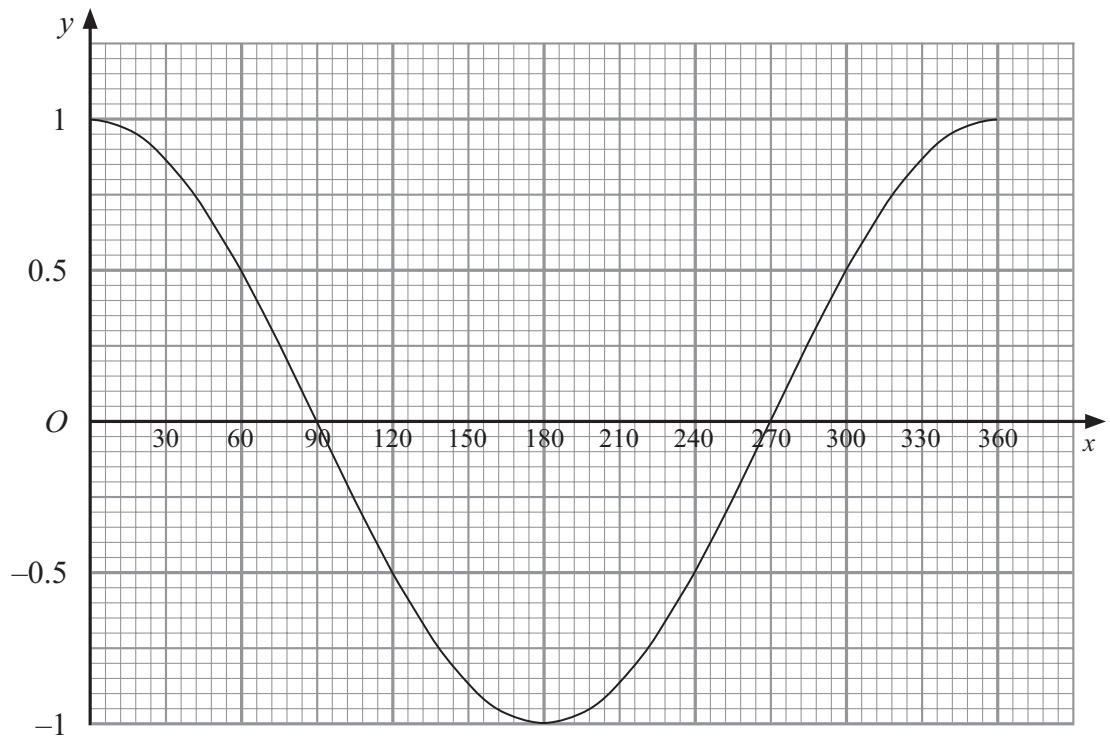
n is a whole number.

(ii) Prove that $n^2 + (n + 1)^2$ is always an odd number.

Q24

(Total 4 marks)

25. Here is a graph of the curve $y = \cos x°$ for $0 \leqslant x \leqslant 360$



Use the graph to solve $\cos x° = 0.75$ for $0 \leqslant x \leqslant 360$

Q25

.....

(Total 2 marks)

Leave blank

26. For all values of x,

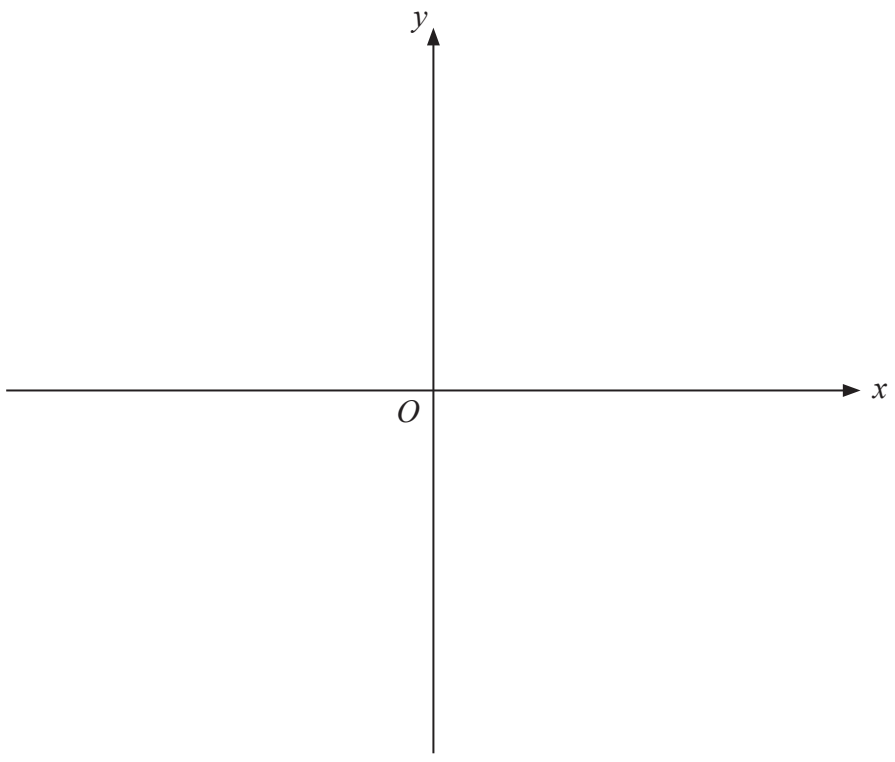
$$x^2 - 6x + 15 = (x - p)^2 + q$$

(a) Find the value of p and the value of q.

$p =$ ..... , $q =$ .....

(2)

(b) On the axes, draw a sketch of the graph $y = x^2 - 6x + 15$



(2) **Q26**

(Total 4 marks)

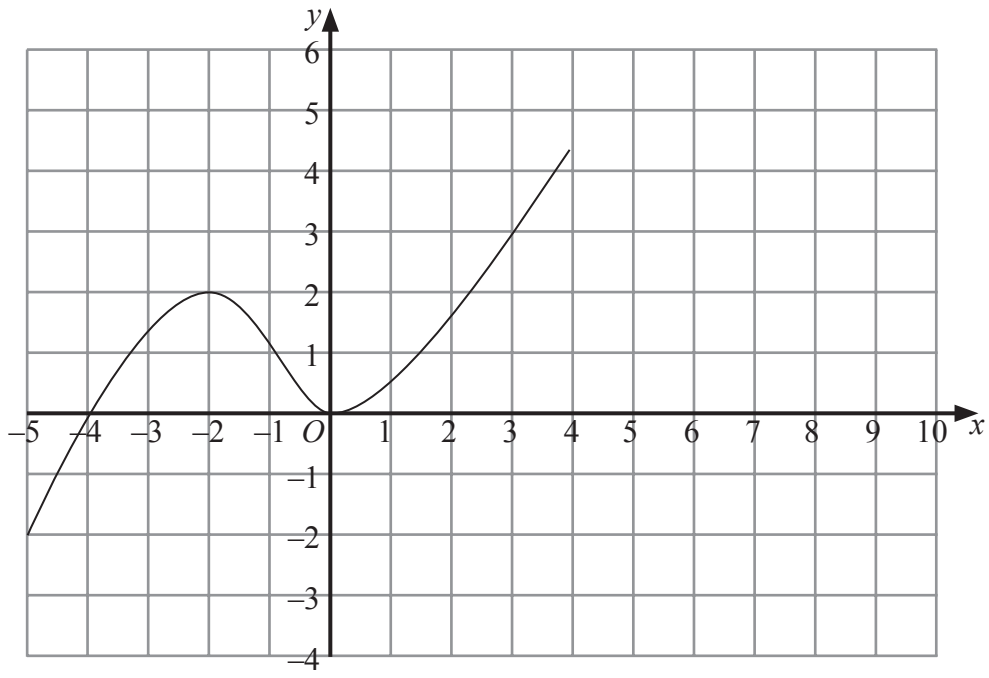
N 2 5 7 6 6 A 0 2 3 2 4

Turn over

Leave blank

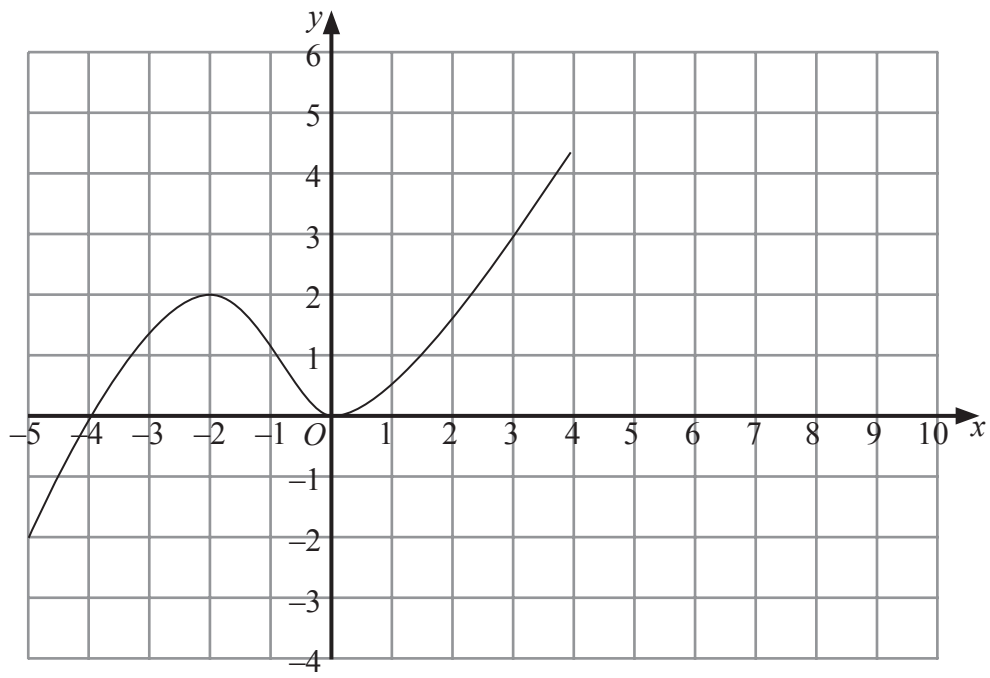
27. The graph of $y = f(x)$ is shown on the grids.

(a) On this grid, sketch the graph of $y = f(x) + 2$



(2)

(b) On this grid, sketch the graph of $y = - f(x)$



(2) **Q27**

(Total 4 marks)

TOTAL FOR PAPER: 100 MARKS

END

N 2 5 7 6 6 A 0 2 4 2 4