GRAPHICAL MATHEMATICS

FOR 121/2

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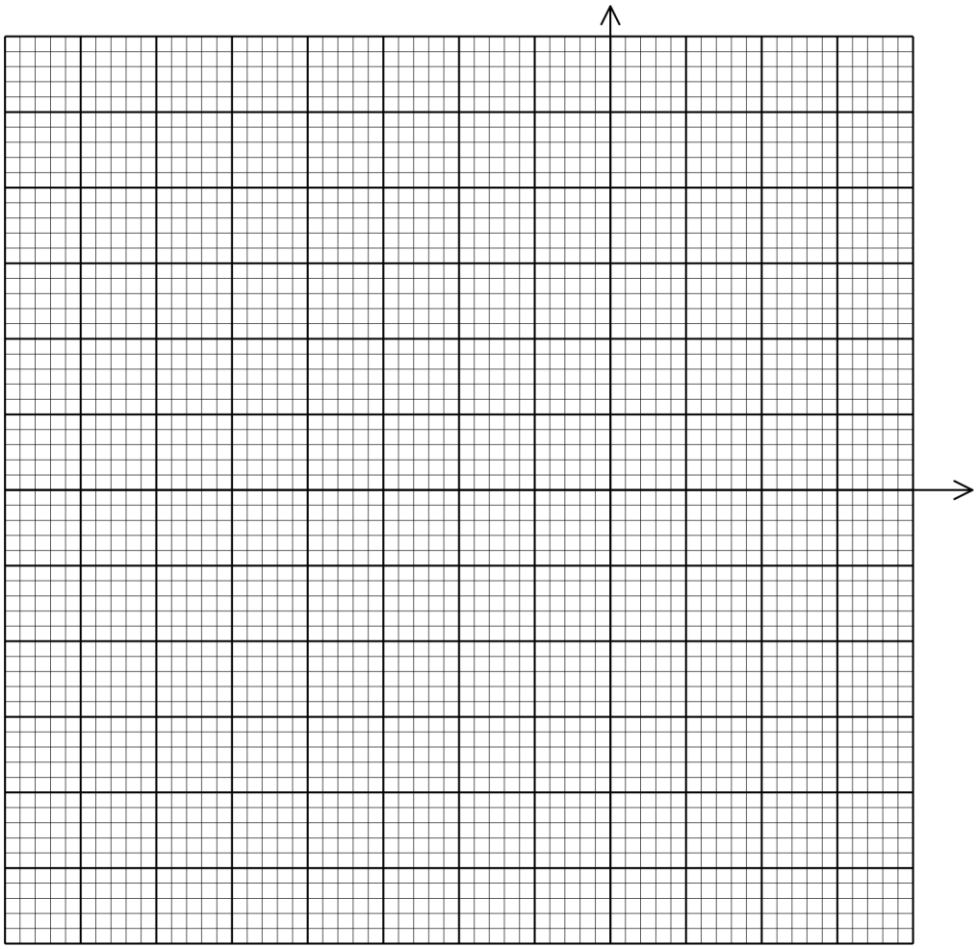
Contents

1. (a) Complete the table below for $y = 2x^2 + 5x - 7$ for the range $-4 \le x \le 2$. *(2 marks)*

x	–4	–3.5	–3	–2.5	–2	–1.5	–1	–0.5	0	0.5	1	1.5	2
y	5			–7		–10	–10		–7			5	11

(b) On the grid provided, draw the graph of $y = 2x^2 + 5x - 7$ for the range $-4 \le x \le 2$.

Use the scale: 1 cm represents 0.5 units on the x – axis.
1 cm represents 2 units on the y – axis. *(3 marks)*



(c) Using your graph, solve the equations:

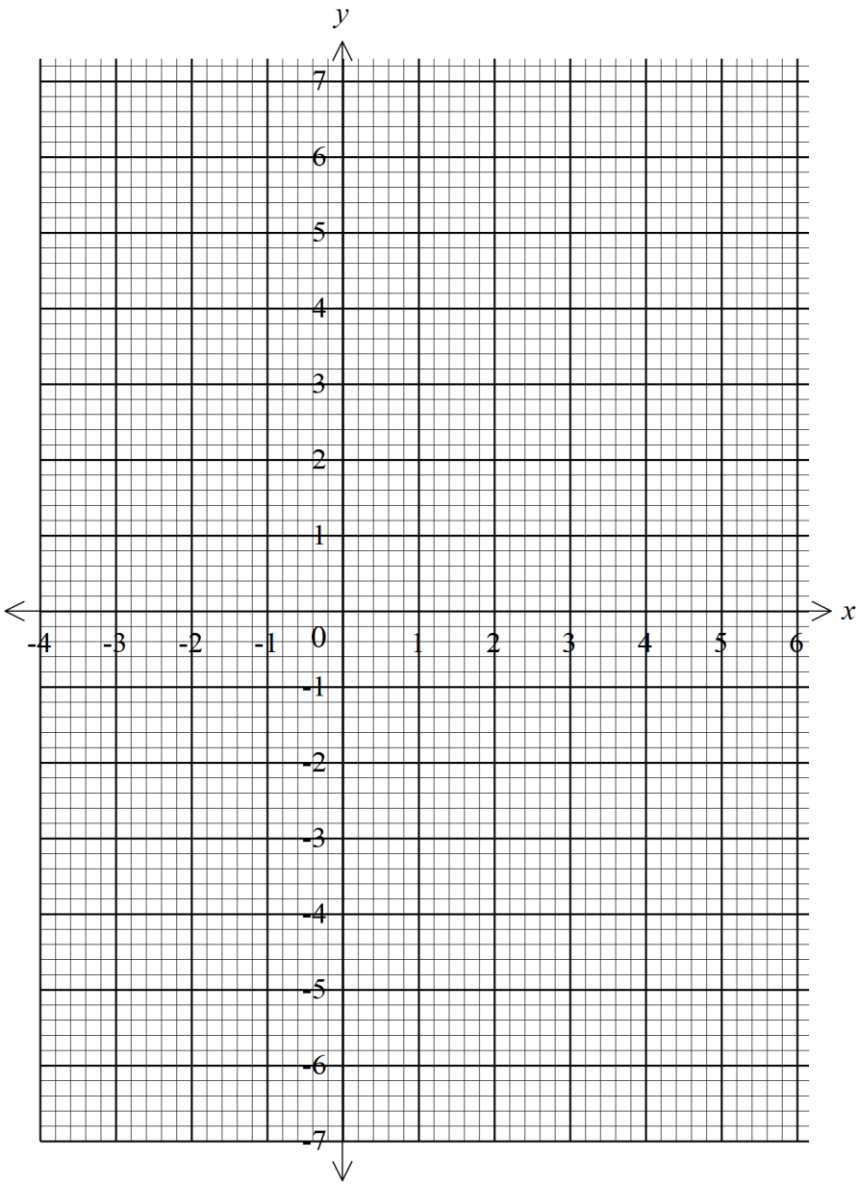
i) $2x^2 + 5x - 7 = 0$ *(2 marks)*

ii) $2x^2 + 5x - 7 = 4x + 3$ *(3 marks)*

2. (a) Complete the table below for the function $y = -x^2 + 3x + 4$ *(2 marks)*

x	–2	–1	0	1	2	3	4	5
y			4					

(b) On the grid provided below, draw the graph of $y = -x^2 + 3x + 4$ *(3 marks)*



(b) Use your graph (a) above to solve the quadratic equations below

(i) $-x^2 + 3x + 4 = 0$ *(2 marks)*

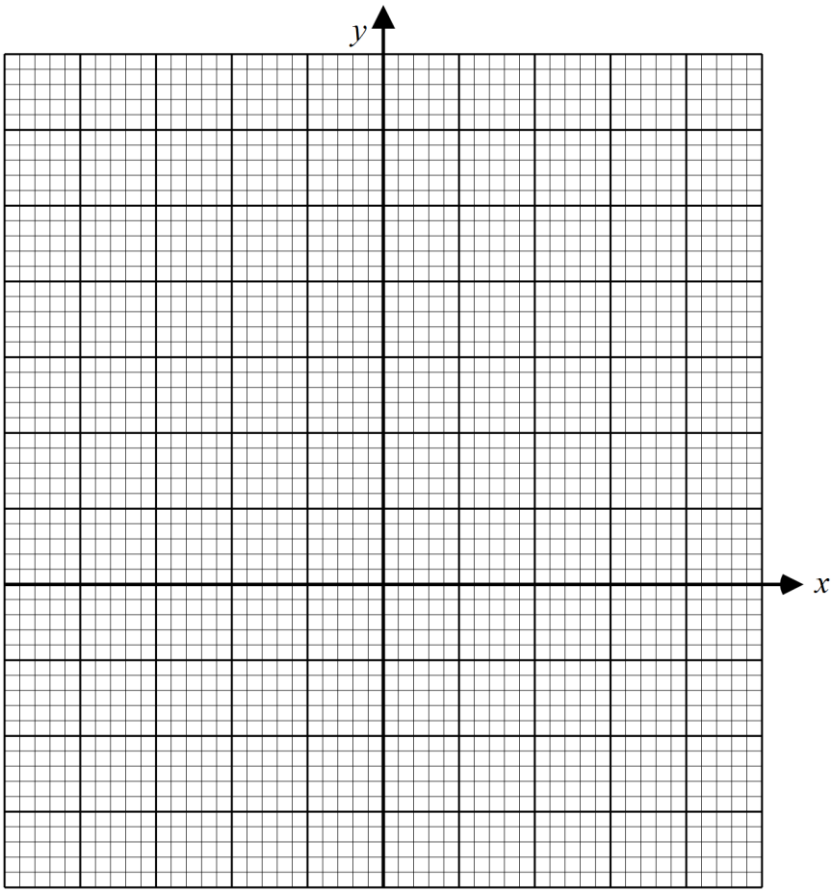
(ii) $-x^2 + 5x = 0$ *(3 marks)*

3. (a) Complete the table below given that $y = -x^2 + x + 12$ for $-4 \le x \le 5$. *(2 marks)*

x	–4	–3	–2	–1	0	1	2	3	4	5
y	–8				12	12				–8

(b) On the grid provided below, draw the graph of $y = -x^2 + x + 12$ for $-4 \le x \le 5$.

Scale: 1 cm represents 1 unit on the x – axis and 1 cm represents 2 units on the y – axis. *(3 marks)*



(c) Using your graph,

i) Solve the equation $x^2 - 3x - 10 = 0$. *(3 marks)*

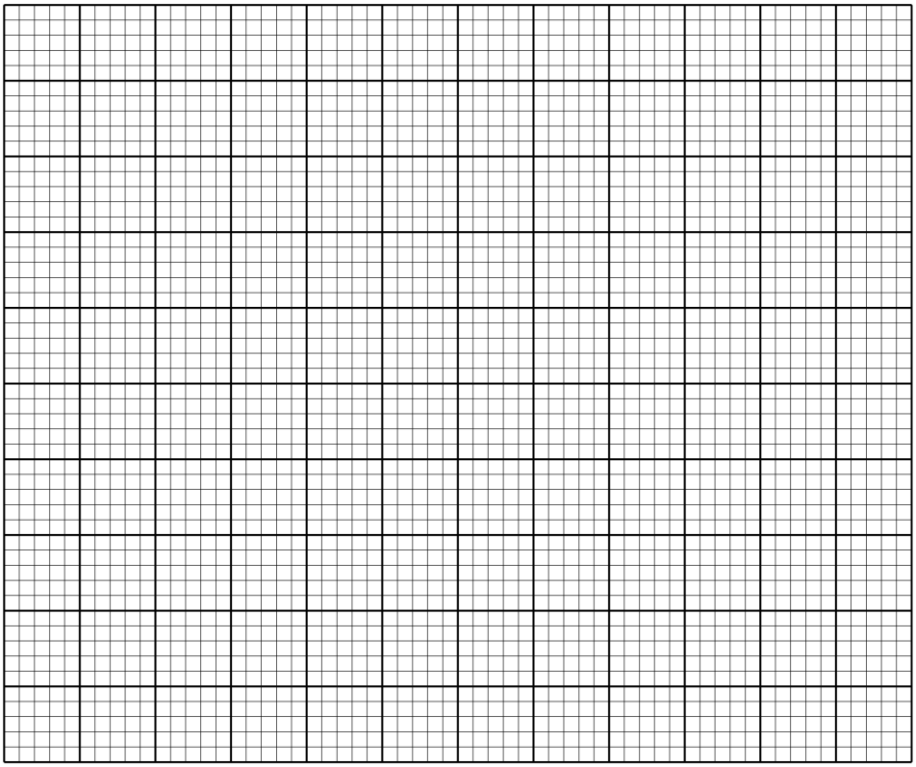
ii) State the range of values of x for which $-x^2 + x + 12 \ge 0$. *(1 mark)*

(d) Estimate the coordinates of the turning point of the curve $y = -x^2 + x + 12$. *(1 mark)*

4. (a) Complete the table for the function $y = 1 - 2x - 3x^2$ for $-3 \le x \le 3$. *(2 marks)*

x	–3	–2	–1	0	1	2	3
$1-2x$		5		1	–1		–5
$-3x^2$	–27		–3	0		–12	
y	–20			1		–15	

(b) Draw the graph of $y = 1 - 2x - 3x^2$ for $-3 \le x \le 3$. Use the scale of 2 cm to represent 1 unit on the x – axis and 1 cm to represent 5 units on the y – axis. *(3 marks)*



(c) Use the graph in (b) above to solve:

i) $1 - 2x - 3x^2 = 0$ *(2 marks)*

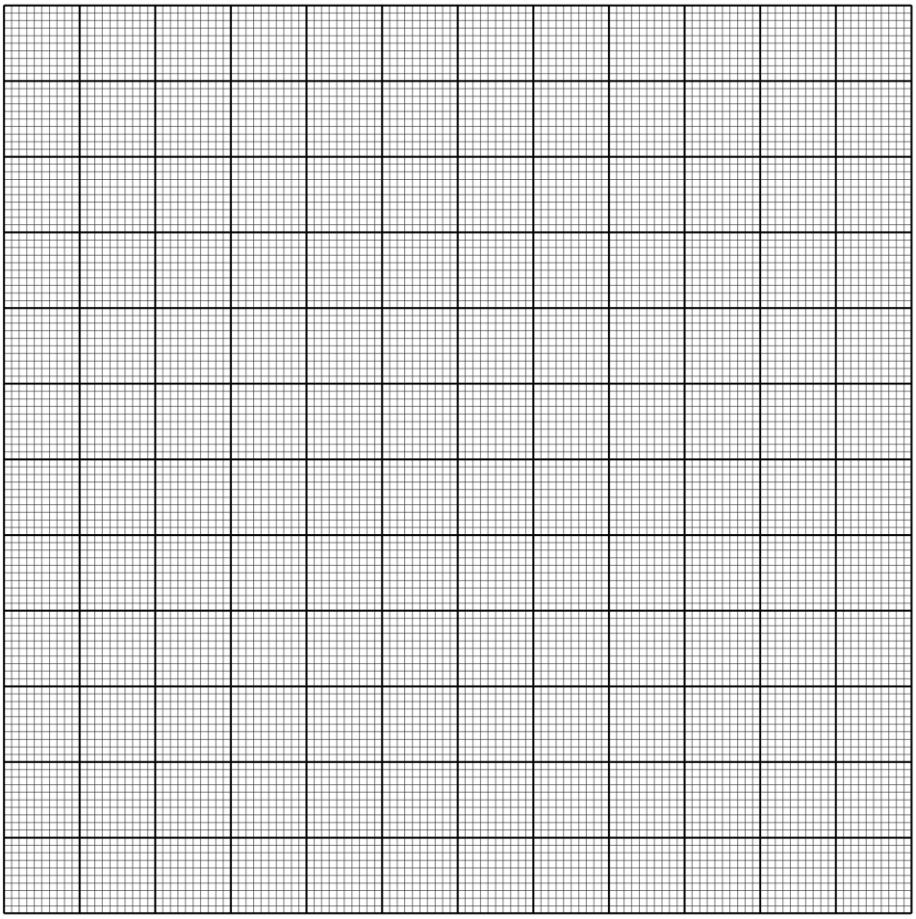
ii) $3x^2 + 2x - 5 = 0$ *(3 marks)*

5. The equation of a curve is given by $y = 2x^2 + x - 36$.

(a) Complete the table for the integral values of y in the domain $-5 \le x \le 5$. *(2 marks)*

x	–5	–4	–3	–2	–1	0	1	2	3	4	5
y	9		–21		–35			–26			19

(b) On the grid provided below, draw the graph of $y = 2x^2 + x - 36$ for $-5 \le x \le 5$. Use the scale of 1 cm to represent 1 unit on the horizontal axis and 1 cm to represent 5 units on the vertical axis. *(3 marks)*



(c) Using your graph:

(i) State the range of values of x that satisfy the inequality $2x^2 + x - 36 > 0$. *(2 marks)*

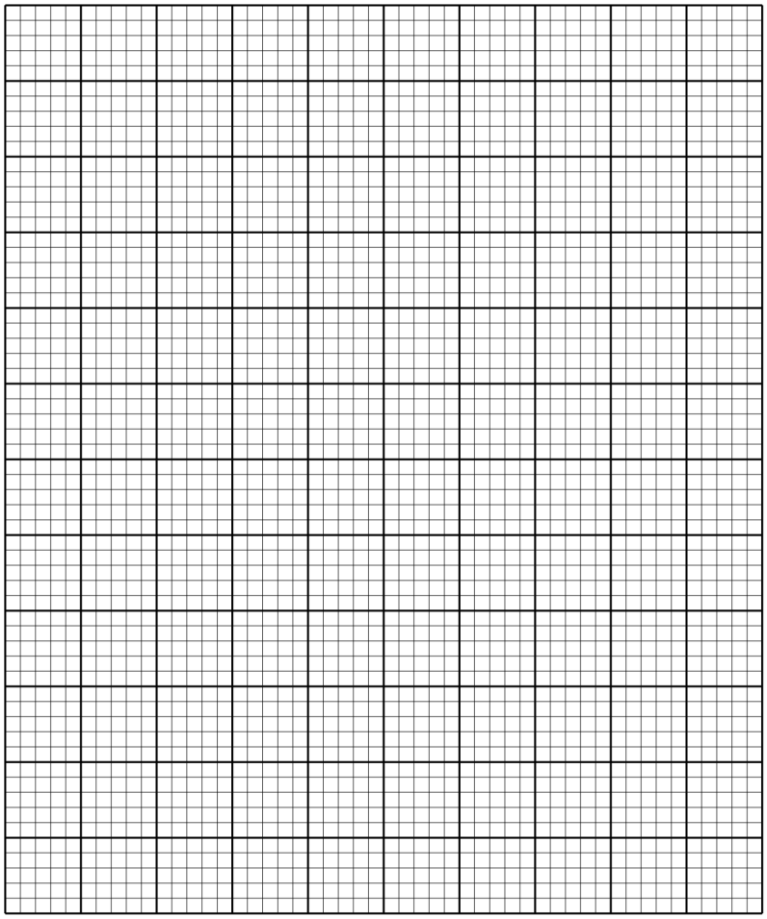
(ii) Solve the equation: $x^2 - x - 12 = 0$ *(3 marks)*

1. (a) Complete the table below for $y = x^3 + 3x^2 - 6x - 8$. *(2 marks)*

x	–5	–4	–3	–2	–1	0	1	2	3
y	–28			8			–10		

(b) On the grid provided, draw the graph of $y = x^3 + 3x^2 - 6x - 8$ for $-5 \le x \le 3$.

Use the scale: 1 cm represents 1 unit on the x – axis
1 cm represents 5 units on the y – axis *(3 marks)*



(b) (i) Use the graph to solve the equation $x^3 + 3x^2 - 6x - 8 = 0$. *(2 marks)*

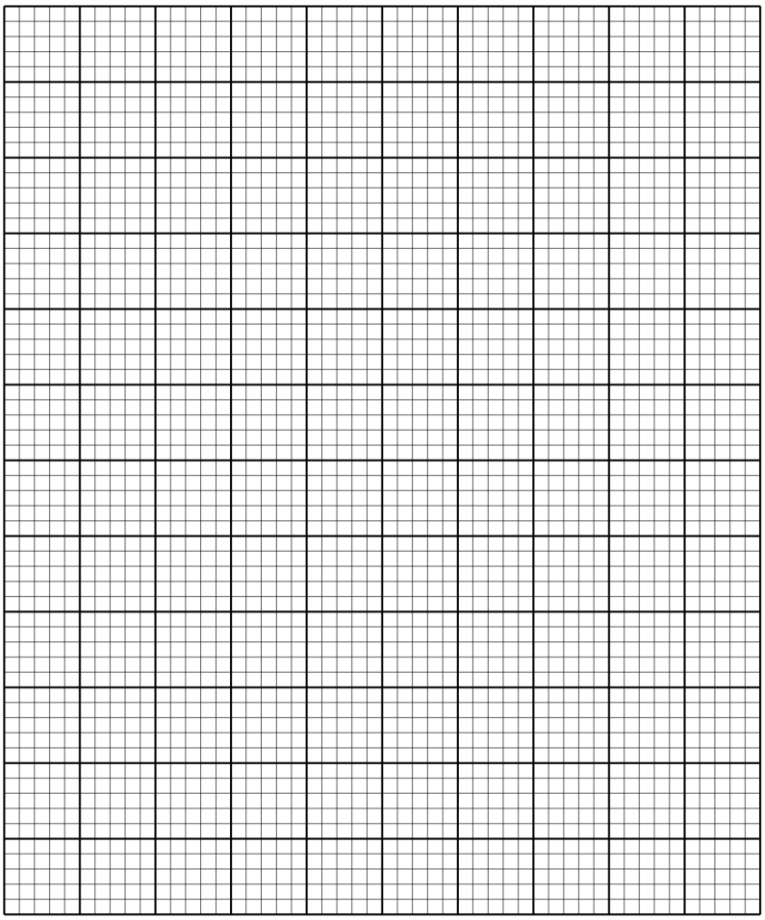
(ii) By drawing a suitable straight line on the graph, solve the equation $x^3 + 3x^2 - 6x - 8 = 5x + 5$. *(3 marks)*

2. (a) Complete the table below for $y = x^3 + 2x^2 - 5x - 6$. *(2 marks)*

x	–4	–3	–2	–1	0	1	2	3
y	–18				–6			24

(b) On the grid provided, draw the graph of $y = x^3 + 2x^2 - 5x - 6$ for $-4 \le x \le 3$.

Use the scale: 1 cm represents 1 unit on the x – axis
1 cm represents 5 units on the y – axis *(3 marks)*



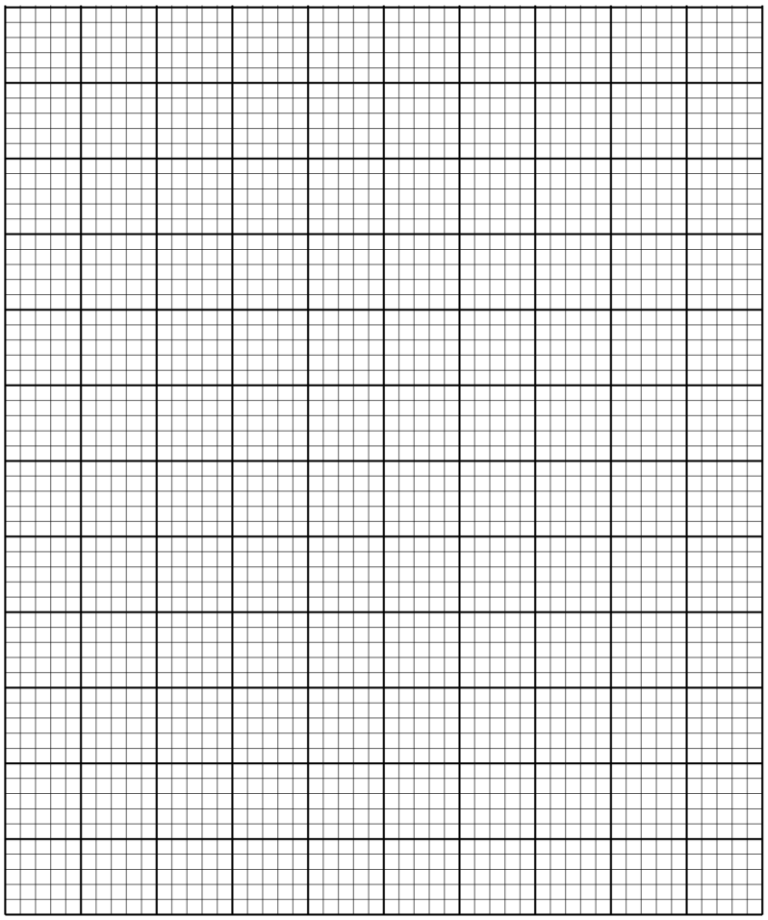
(c) (i) Use the graph to solve the equation $x^3 + 2x^2 - 5x - 6 = 0$. *(2 marks)*

(iii) By drawing a suitable straight line on the graph, solve the equation $x^3 + 2x^2 - 11x - 12 = 0$. *(3 marks)*

3. (a) Complete the table below for the equation $y = x^3 + 4x^2 - 5x - 5$ for $-5 \le x \le 2$ *(2 marks)*

x	–5	–4	–3	–2	–1	0	1	2
y			19			–5		

(b) On the grid provided draw the graph of $y = x^3 + 4x^2 - 5x - 5$ for $-5 \le x \le 2$. Use a scale of 1 cm to represent 1 unit on the x – axis and 2 cm to represent 5 units on the y – axis. *(3 marks)*



(c) Use your graph to solve the equations;

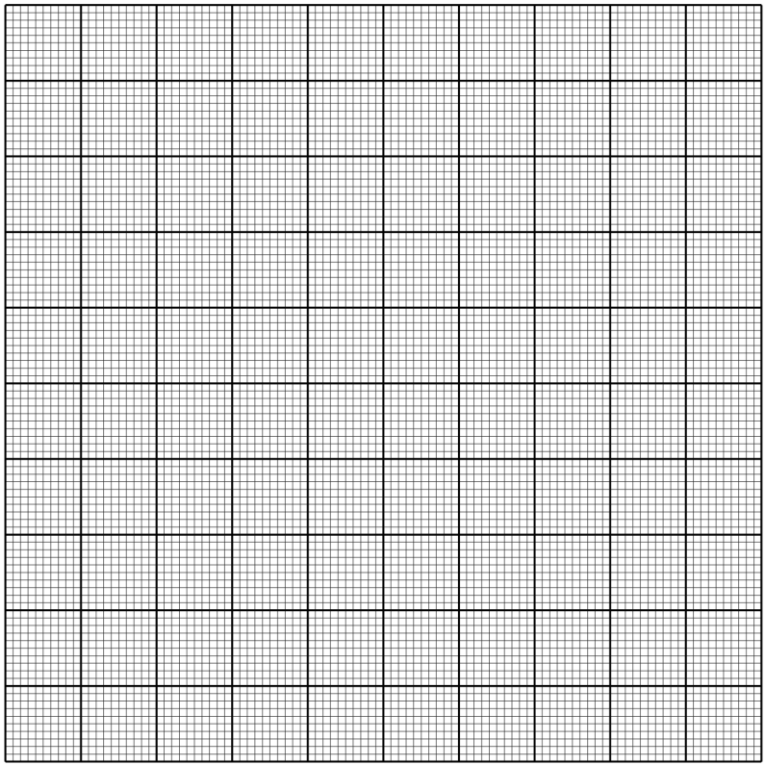
(i) $x^3 + 4x^2 - 5x - 5 = 0$ *(2 marks)*

(ii) $x^3 + 4x^2 - 5x - 5 = -4x - 1$ *(3 marks)*

4. (a) Complete the table below for $y = x^3 + x^2 - 12x$. *(2 marks)*

x	–5	–4	–3	–2	–1	0	1	2	3	4
y	–40				12			–12		32

(b) On the grid provided, draw the graph of $y = x^3 + x^2 - 12x$ for $-5 \le x \le 4$. Use the scale of 1 cm to represent 1 unit on the x – axis and 1 cm to represent 10 units on the y axis. *(3 marks)*



(c) Using your graph, solve the equations:

i) $x^3 + x^2 - 12x = 0$ *(1 mark)*

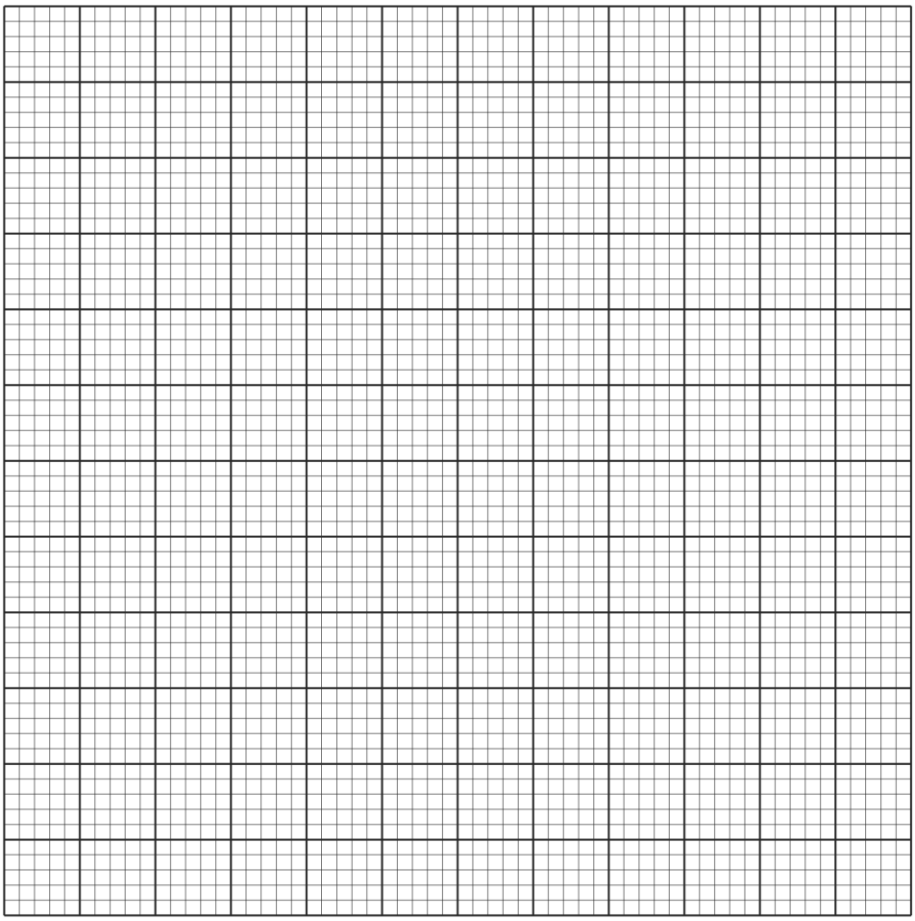
ii) $x^3 + x^2 - 20x = 0$ *(2 marks)*

(d) State the maximum and minimum values of $y = x^3 + x^2 - 12x$ *(2 marks)*

5. (a) Complete the table below for the function $y = 4x^3 - 8x^2 - 15x + 9$ for $-2 \le x \le 3$. *(2 marks)*

x	–2	–1.5	–1	–0.5	0	0.5	1	1.5	2	2.5	3
y	–25			14			–10	–18		–16	

(a) On the grid provided below, draw the graph of $y = 4x^3 - 8x^2 - 15x + 9$ for $-2 \le x \le 3$. Use the scale of 2 cm for 1 unit on the x – axis and 1 cm for 5 units on the y – axis. *(3 marks)*



(b) Using the graph drawn:

(i) Solve the equation $4x^3 - 8x^2 - 15x + 9 = 5x - 15$. *(3 marks)*

(ii) Find the range of values of x for which:

$4x^3 - 8x^2 - 15x + 9 \ge 0$ *(1 mark)*

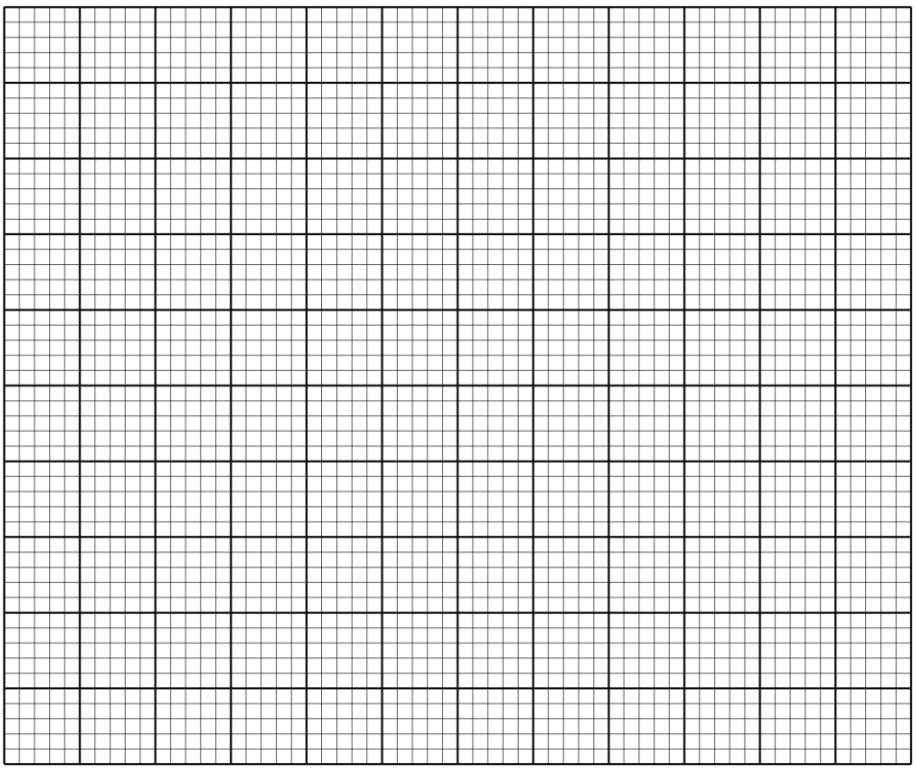
$4x^3 - 8x^2 - 15x + 9 < 0$ *(1 mark)*

CUMULATIVE FREQUENCY CURVES (OGIVES)

1. At an Agricultural Research Centre, the length of a sample of 40 maize cobs were measured and recorded as shown in the frequency distribution table below.

Length (*cm*)	8 – 10	11 – 13	14 – 16	17 – 19	20 – 22	23 – 25	26 – 28	29 – 31
Frequency	2	3	6	9	11	5	3	1

(a) On the grid provided below, draw an ogive for the data. Use a scale of 1 cm to represent 3 units on the x – axis and 2 cm to represent 10 units on the y – axis. *(4 marks)*



(b) Use the graph in (a) above to determine:

i) The median length. *(1 mark)*

ii) The quartile deviation. *(3 marks)*

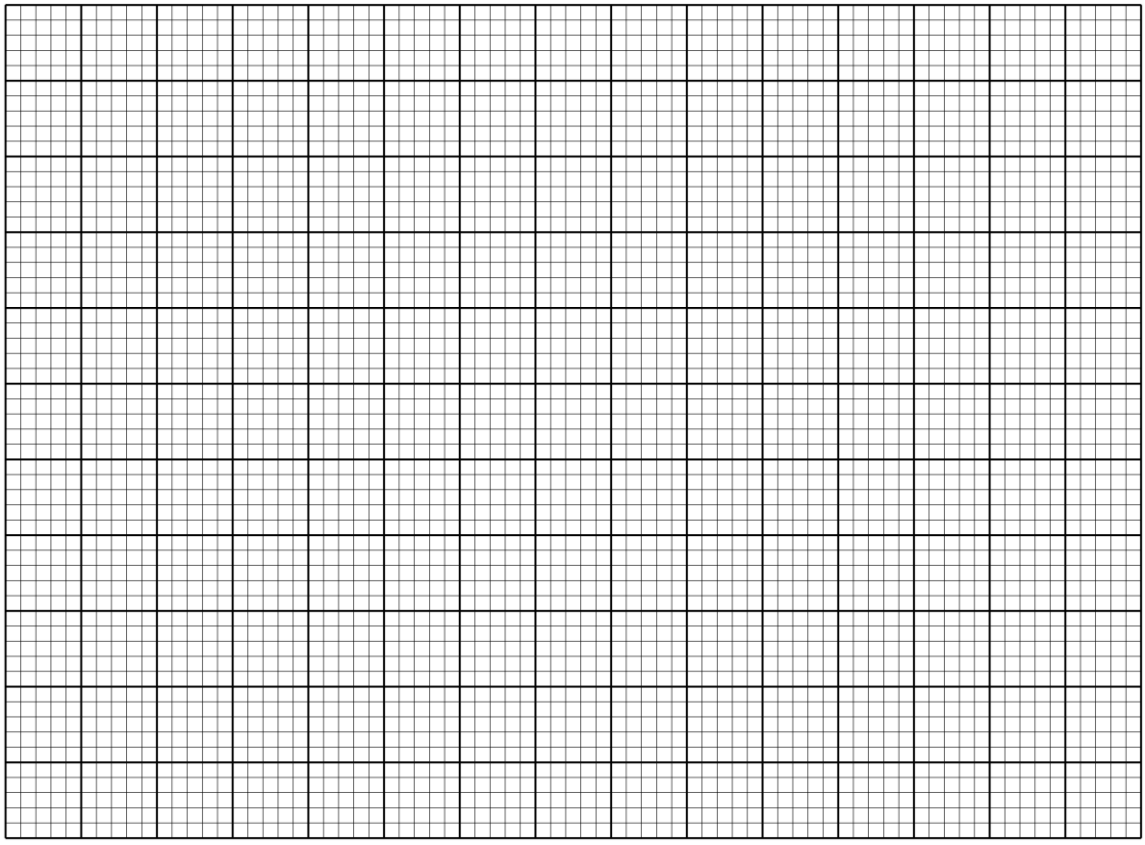
iii) The percentage of the maize cobs with length above 23.1 cm. *(2 marks)*

2. The data below shows the masses in kg of 50 calves in a dairy farm.

Mass (*kg*)	25 – 34	35 – 44	45 – 54	55 – 64	65 – 74	75 – 84	85 – 94
No. of calves	x	$2x$	16	$4x$	8	4	1

(a) Determine the value of x *(2 marks)*

(b) On the grid provided draw a cumulative frequency curve for the data *(4 marks)*



(c) Use the graph in (b) above to determine:

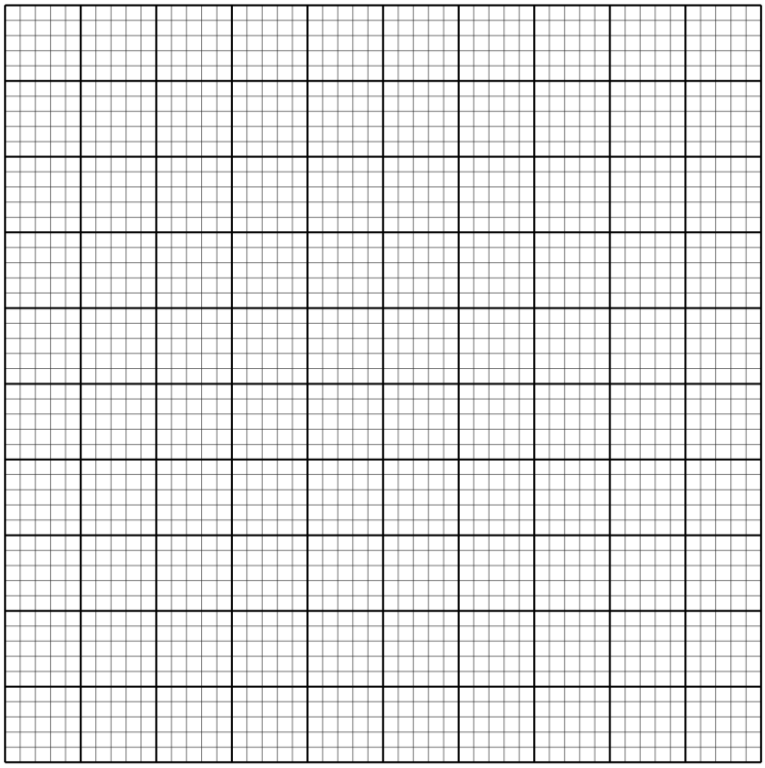
(i) The difference between the 3rd and 7th decile *(3 marks)*

(ii) The number of calves whose mass is greater than 70kg *(1 mark)*

3. The table below shows the heights of 40 trees measured to the nearest metre.

Height	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39
Frequency	3	8	15	8	4	2

a) Draw a cumulative frequency curve to represent the above information *(4 marks)*



b) Use your graph to determine

i) The median height *(1 mark)*

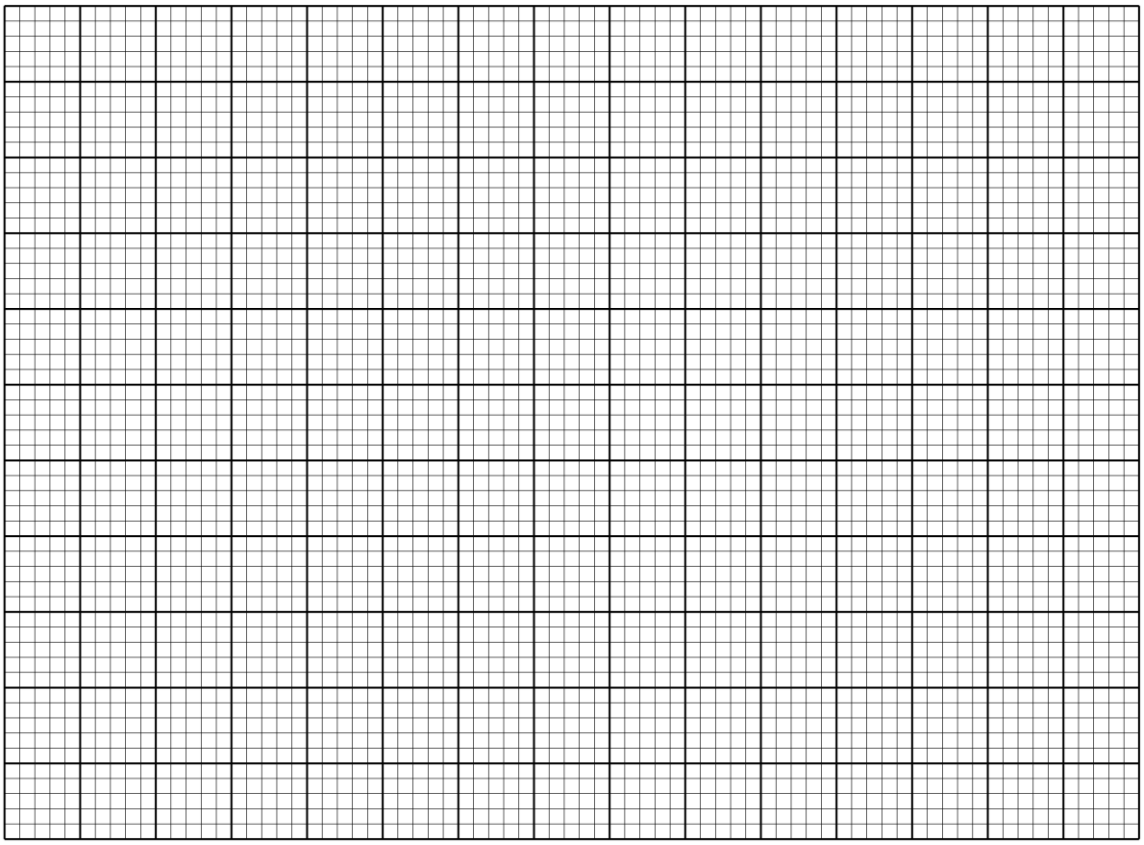
ii) The interquartile range *(3 marks)*

iii) The percentage of trees whose heights are less than 27 m *(2 marks)*

4. The table below shows the masses of 40 babies in a certain clinic.

Mass in kg	1.0 – 1.9	2.0 – 2.9	3.0 – 3.9	4.0 – 4.9	5.0 – 5.9	6.0 – 6.9
No. of babies	2	6	15	10	5	2

(a) On the grid provided, draw the cumulative frequency curve for the given information. *(4 marks)*



(b) Use the graph to estimate:

(i) The median mass. *(1 mark)*

(ii) Quartile deviation *(4 marks)*

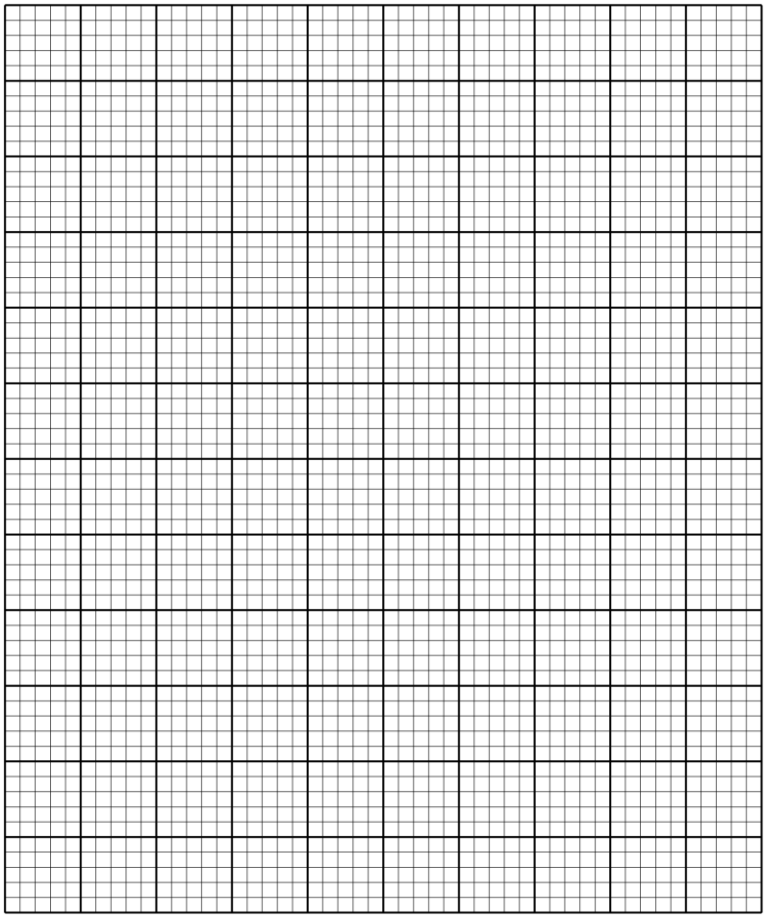
(iii) The number of babies that weigh 4.5 kg. *(1 mark)*

5. The table below shows marks scored by 40 students in a test.

24	30	44	27	40	30	35	37	29	36	32	30
33	42	30	43	35	34	26	32	34	38	29	40
35	35	27	33	25	39	36	31	37	31	33	32
39	35	27	41	33	34	40	28	33	29	34	38
36	37	35	34	37	46	28	31	38	32	41	30

(a) Starting with 24 and using a class size of 3, make a frequency distribution table. *(2 marks)*

(b) On the grid provided, draw the ogive for the data. *(4 marks)*



(c) Using the graph in (b) above, estimate:

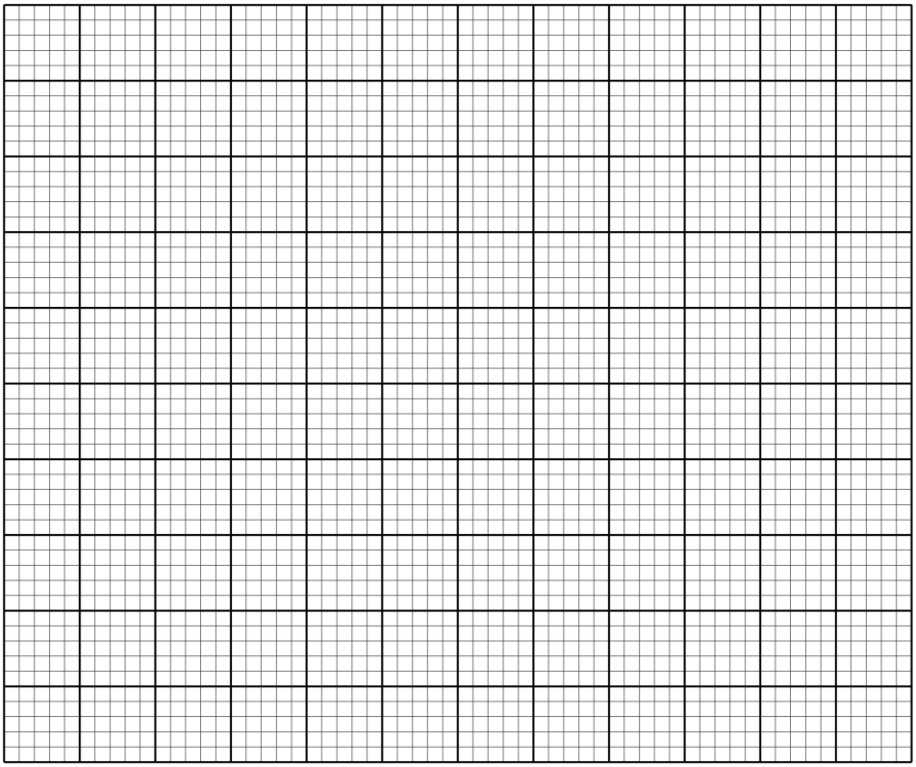
i) The median mark *(1 mark)*

ii) The quartile deviation *(3 marks)*

1. (a) Complete the table below giving the values correct to 2 decimal places. *(2 marks)*

x^o	0	20	40	60	80	100	120	140	160	180
$\cos x$	1	0.94	0.77	0.5		–0.17		–0.77		–1
$\sin x - \cos x$	–1	–0.60		0.37	0.81		1.37		1.28	1

(b) Draw the graph of $y = \cos x^o$ and $y = \sin x^o - \cos x^o$ for $0^o \le x \le 180^o$. Use the scale; 1 cm for 20^o on the x – axis and 4 cm for 1 unit on the y – axis. *(5 marks)*



(c) Using the graph drawn;

(i) solve the equation $\sin x^o - \cos x^o = 1.2$ *(1 mark)*

(ii) solve the equation $\cos x^o = \frac{1}{2}\sin x^o$ *(1 mark)*

(iii) determine the value of $\cos x^o$ in (c) (ii) above. *(1 mark)*

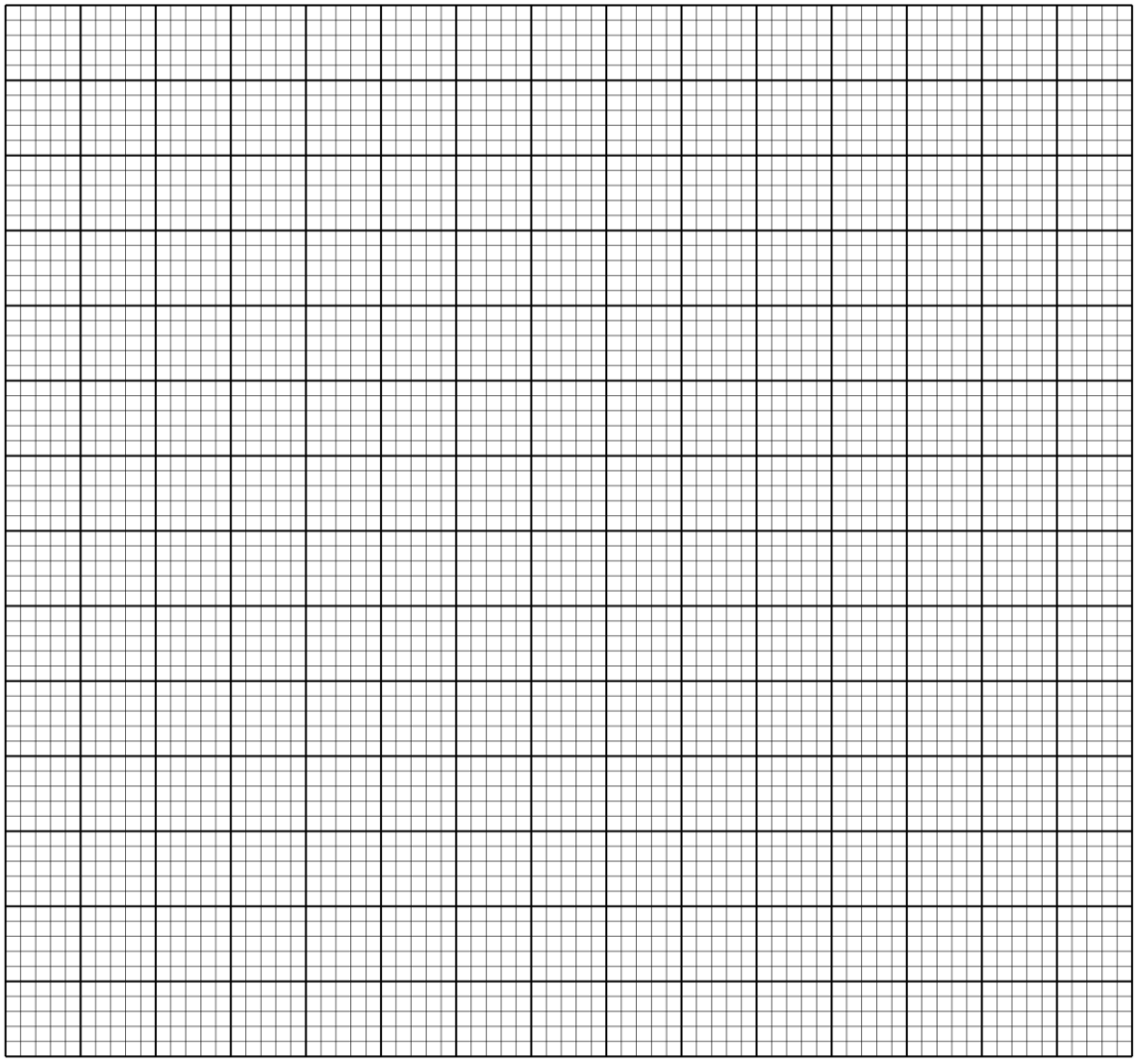
2. (a) Fill the table below giving your values correct to 2 decimal places *(2 marks)*

x^0	-180^0	-150^0	-120^0	-90^0	-60^0	-30^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0
$y = 3\cos x^0$	-3			0			3			0			-3
$y = \sin 2x^0$	0			0			0			0			0

(b) On the same axes, draw the graphs of $y = 3\cos x^0$ and $y = \sin 2x^0$ for $-180^0 \le x \le 180^0$

Scale: 1 cm rep 0.5 units on the vertical axis

1 cm rep 30^0 on the horizontal axis *(4 marks)*



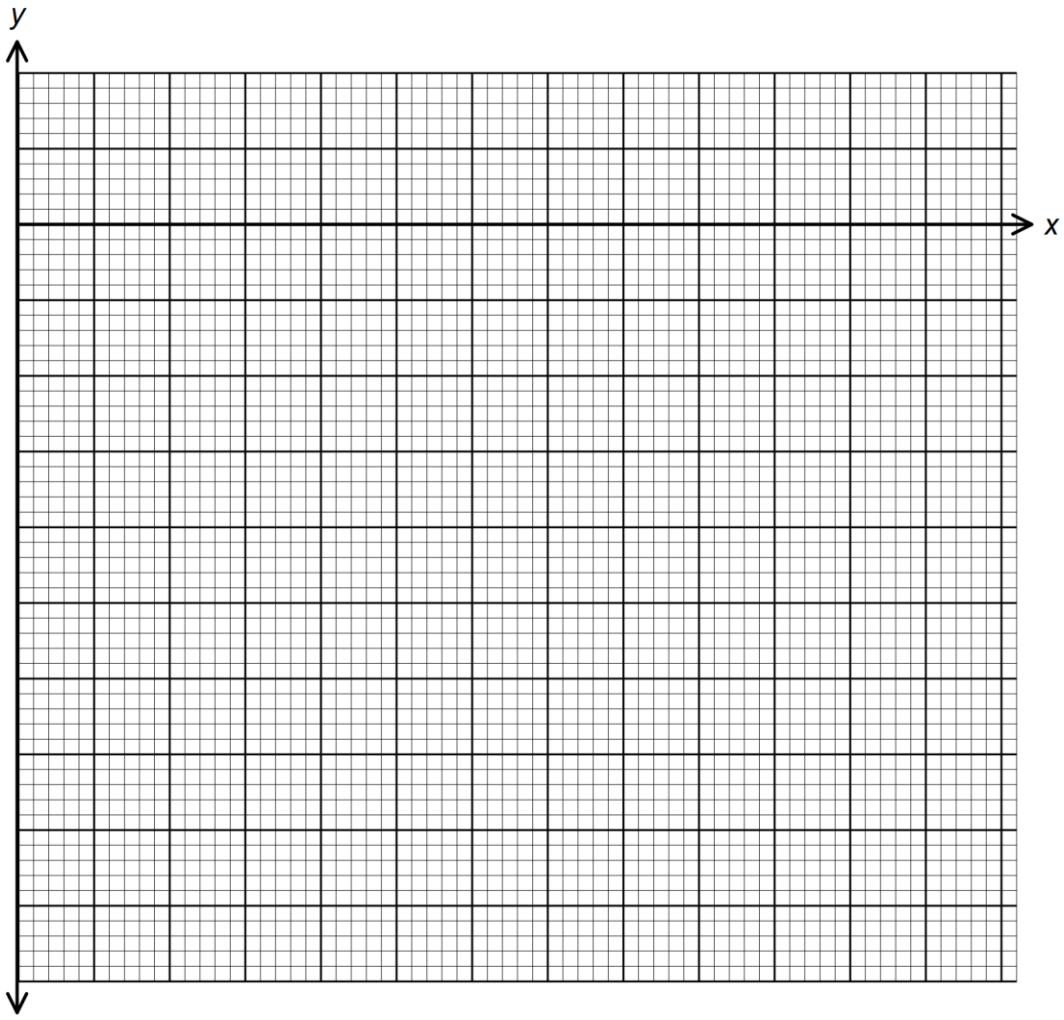
(c) Use the graph in (b) above to solve the equation $3\cos x^0 - \sin 2x^0 = 0$ *(2 marks)*

(d) Using the graphs, determine the range of values of x such that $3\cos x^0 \ge 1.5$ *(2 marks)*

3. (a) Complete the table below, giving the values correct to 2 decimal places. *(2 marks)*

x^0	0	30	60	90	120	150	180	210	240	270	300	330	360
$y = -\sin 2x$	0.00				0.87		0.00						0.00
$y = -3\cos x - 2$	–5.00			–2.00						–2.00			–5.00

(b) On the grid provided draw the graph of $y = -\sin 2x$ and $y = -3\cos x - 2$ for $0^o \le x \le 360^o$ on the same axes. **Use the scale 1cm represents 30^o on the x – axis and 2 cm to represent 1 unit on the y – axis.** *(4 marks)*



(c) Use the graph in (b) above to solve the equation $\sin 2x - 3\cos x = 2$ *(2 marks)*

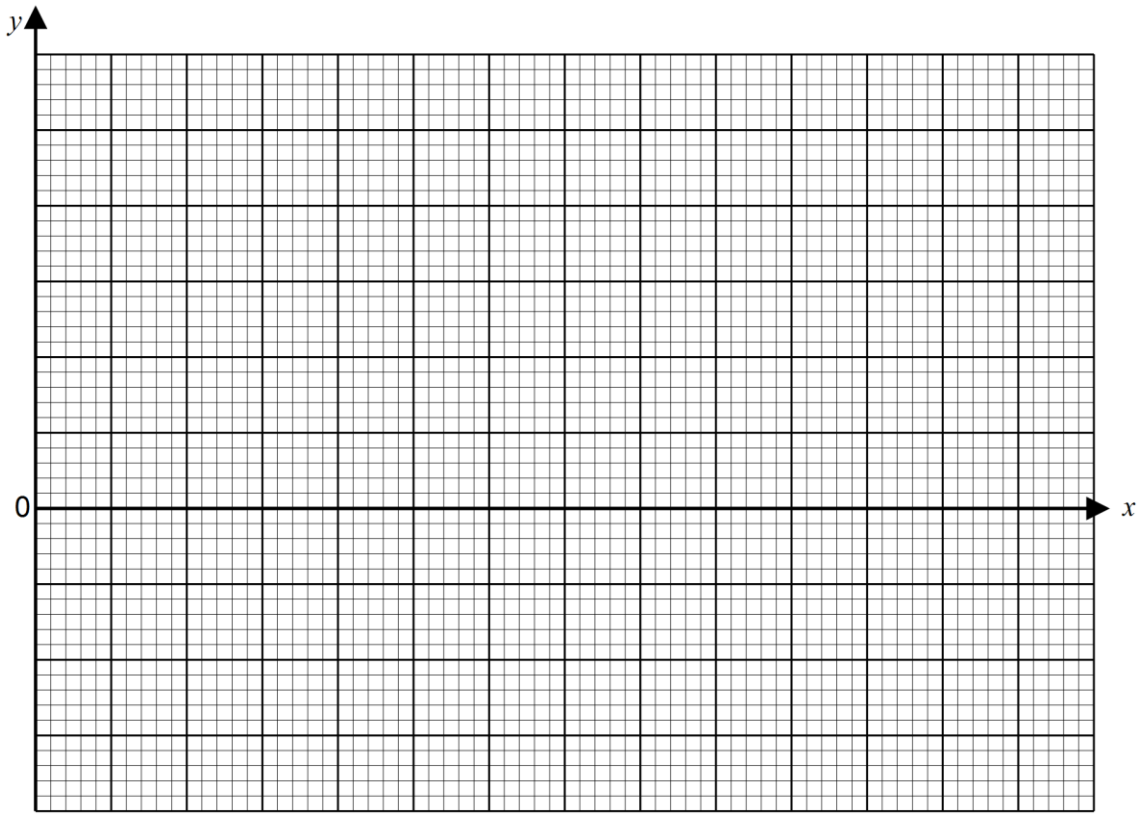
(d) State the range of x for which $-3\cos x - 2 \ge -2$ *(1 mark)*

(e) State the period of the curve $y = -\sin 2x$ *(1 mark)*

4. (a) Complete the table below by filling in the blank spaces. *(2 marks)*

x^o	0	30	60	90	120	150	180	210	240	270	300	330	360
$2\cos x$	2.00	1.73		0		–1.73	–2.00	–1.73		0		1.73	2.00
$1+2\sin x$	1.00	2.00		3.00		2.00	1.00	0		–1.00		0	1.00

(b) On the grid provided, draw the graph of $y = 2\cos x^o$ and $y = 1+2\sin x^o$ for $0^o \le x \le 360^o$, use the scale of 1 cm to represent 30^o on the x – axis and 2 cm to represent 1 unit on the y – axis. *(5 marks)*



(c) Using the graph above;

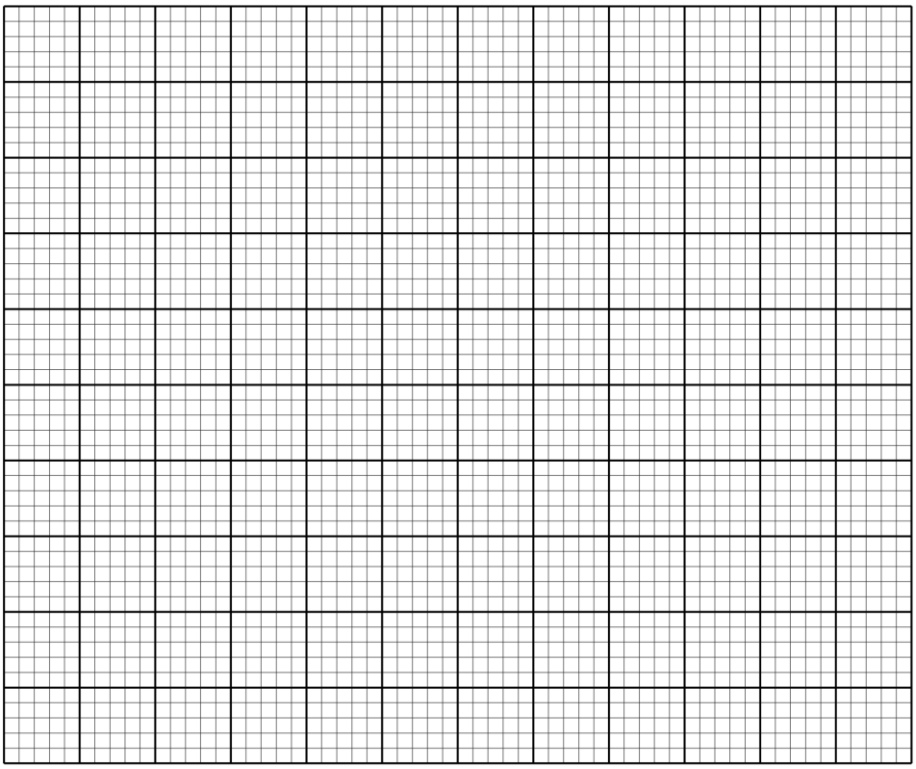
i) Solve the equation $2\cos x^o = 1+2\sin x^o$ *(2 marks)*

ii) State the amplitude of the curve $y = 1+2\sin x^o$ *(1 mark)*

5. (a) Complete the table below, giving the values correct to 2 decimal places. *(2 marks)*

x^o	0	10	20	30	40	50	60	70	80	90
$2\sin 4x+1$	1.00			2.73			-0.73			1.00

(b) On the grid provided, draw the graph of $y=2\sin 4x+1$ for $0^o \le x \le 90^o$. Use the scale of 1 cm to represent 10^o on the x – axis and 2 cm to represent 1 unit on the y – axis. *(3 marks)*

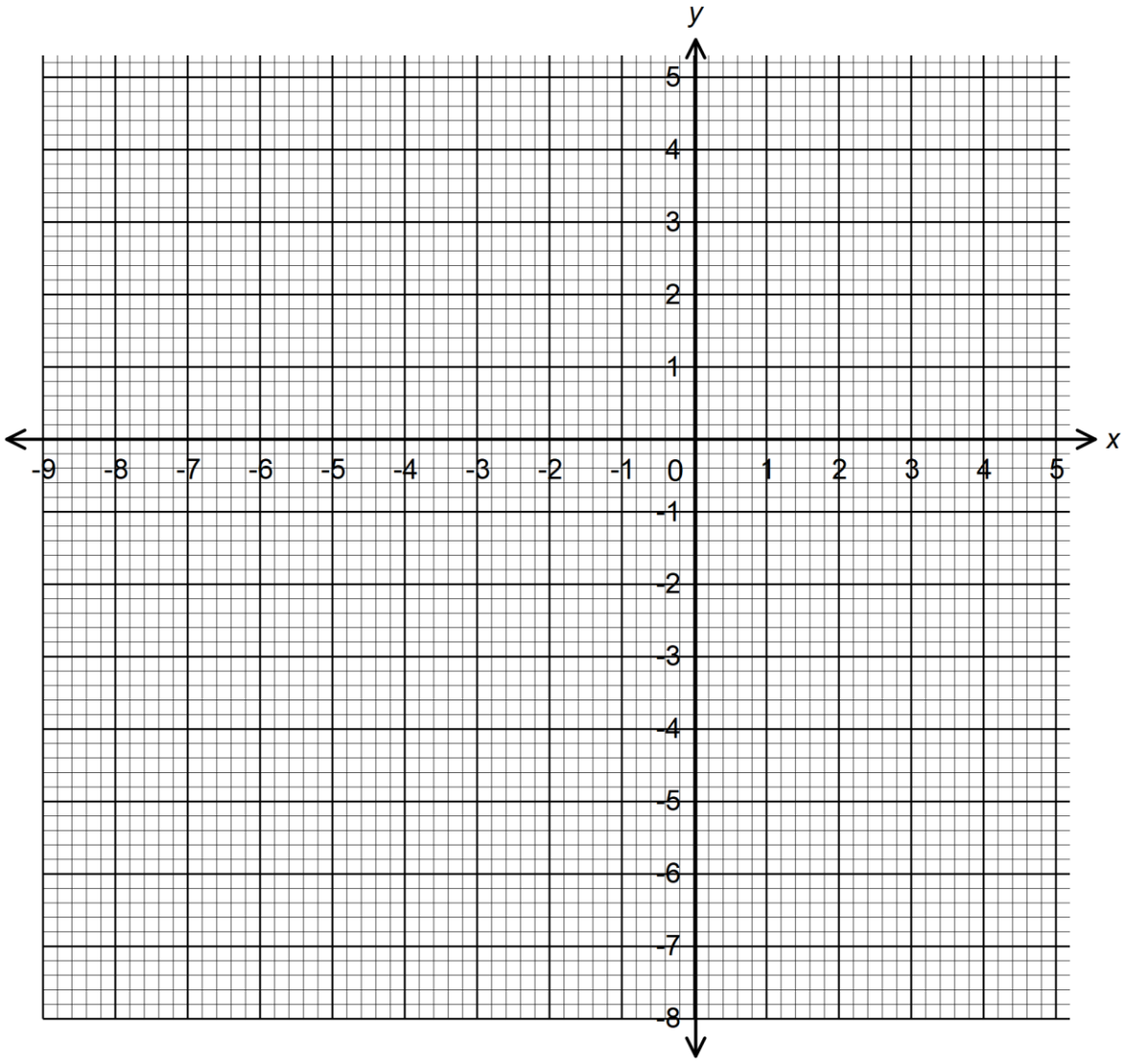


(c) From the graph drawn in (b) above, or otherwise, find the amplitude and the period of $y=2\sin 4x+1$. *(2 marks)*

(d) Use your graph to solve the equation $\sin 4x=-\frac{1}{2}$ for $0^o \le x \le 90^o$ *(3 marks)*

1. The vertices of a square $PQRS$ are $P(1,1)$, $Q(1,3)$, $R(3,3)$ and $S(3,1)$. The vertices of its image under a transformation $\mathbf{T}$ are $P'(1,-2)$, $Q'(1,-6)$, $R'(3,-6)$ and $S'(3,-2)$.

(a) (i) On the grid provided draw $PQRS$ and its image $P'Q'R'S'$ under $\mathbf{T}$. *(2 marks)*



(ii) Describe fully the transformation $\mathbf{T}$. *(3 marks)*

(iii) Determine the matrix of transformation. *(2 marks)*

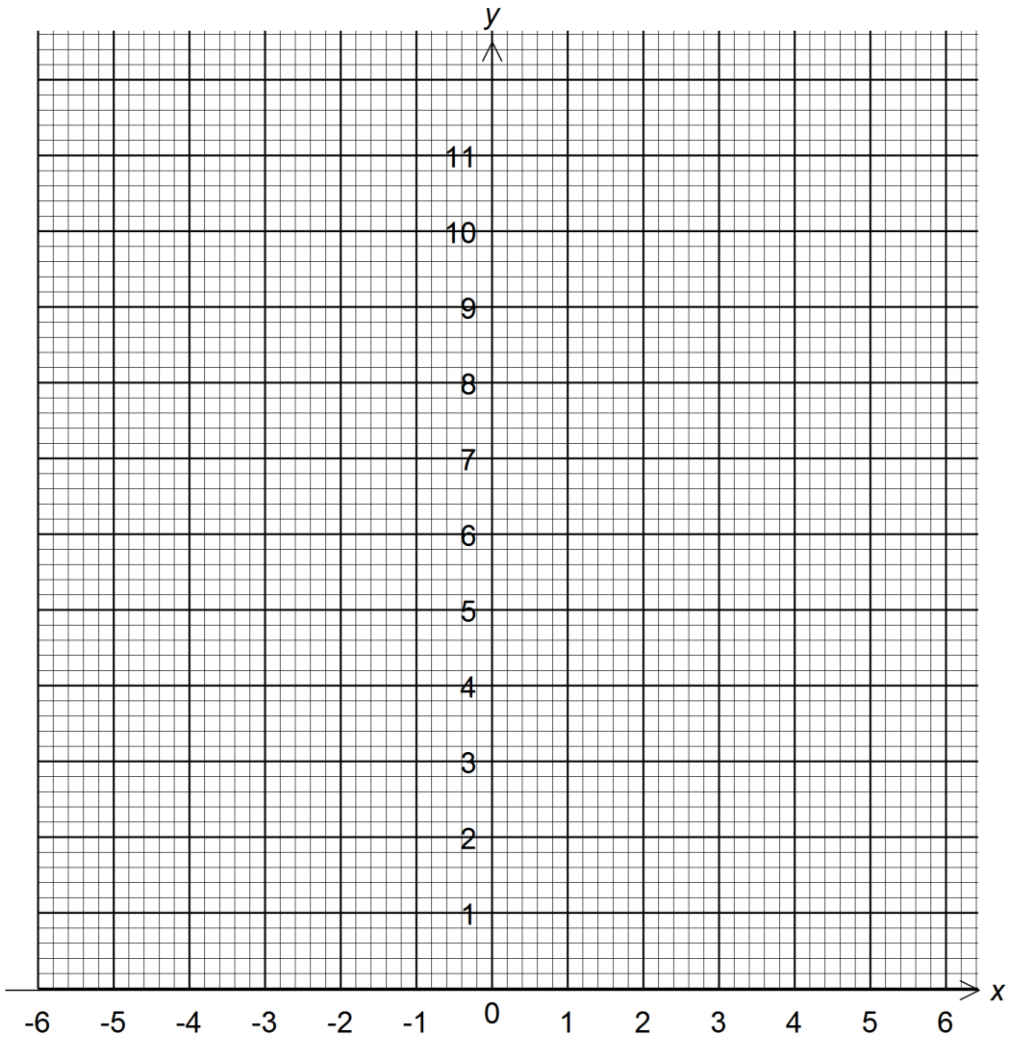
(b) On the same grid as in (a) above, draw the image of the square $PQRS$ under a shear with line $y=-1$ invariant and $R(3,3)$ is mapped onto $R''(-5,3)$. *(3 marks)*

2. The vertices of a rhombus OABC are O(0,0), A(1,3), B(4,4) and C(3,1). $OA'B'C'$ is the image of OABC under a transformation represented by the matrix $\mathbf{M} = \begin{pmatrix} 0 & 1 \\ 2 & 0 \end{pmatrix}$.

(a) On the grid provided below;

i) Draw the rhombus OABC and its image $OA'B'C'$. *(3 marks)*

ii) State the coordinates of the image $OA'B'C'$. *(1 mark)*



(b) A second transformation **N** described as reflection in the line $x = 0$ maps $OA'B'C'$ onto $OA''B''C''$.

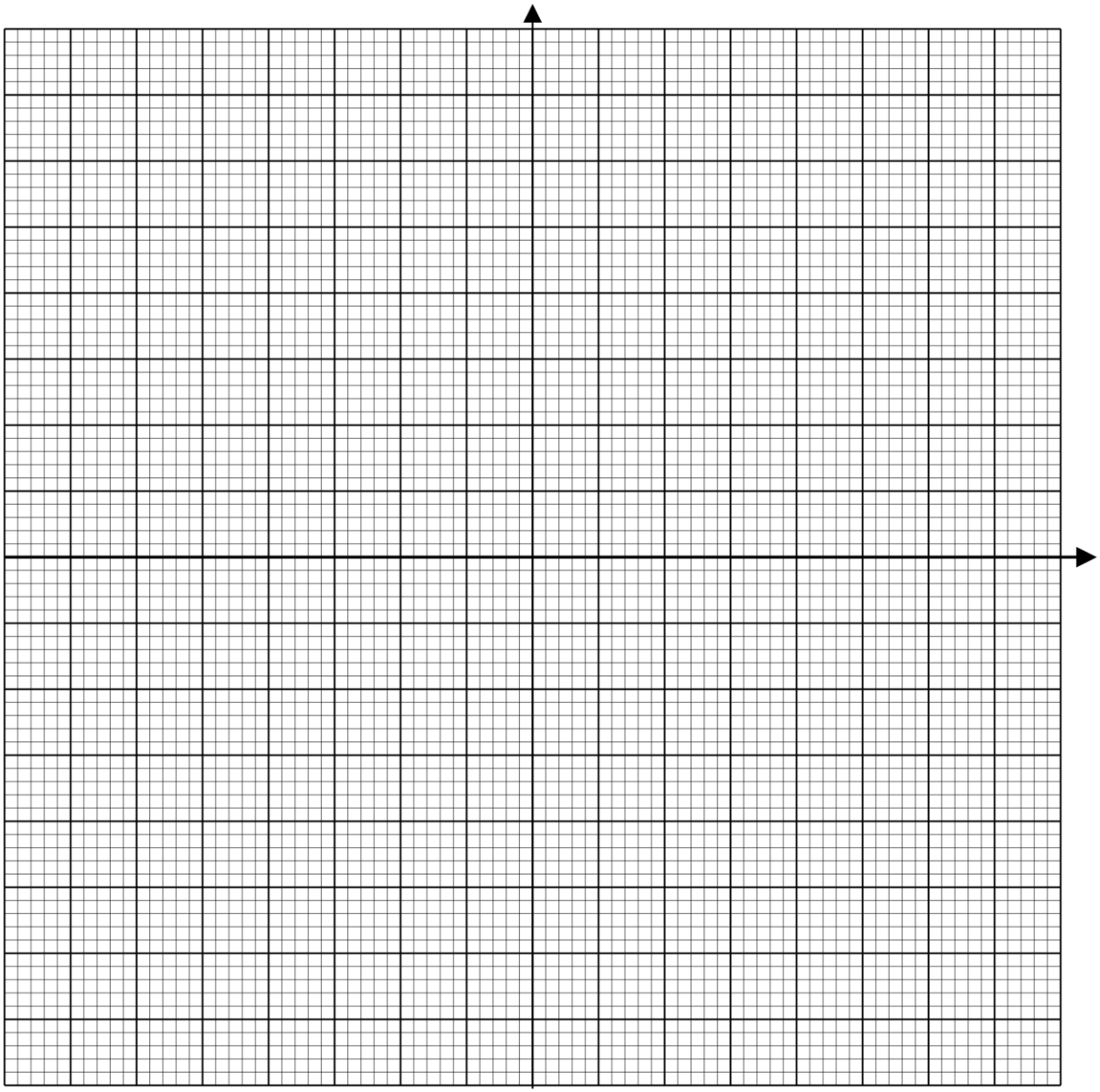
i) Find a 2×2 matrix that represents **N**. *(1 mark)*

ii) Draw $OA''B''C''$ on the same axes. *(2 marks)*

(c) Determine a single matrix that maps $OA''B''C''$ onto OABC. *(3 marks)*

3. A transformation represented by the matrix $\begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$ maps the points $O(0,0)$, $A(2,0)$, $B(2,3)$ and $C(0,3)$ of the quadrilateral OABC onto $OA'B'C'$.

(a) Draw the quadrilateral OABC and its image $OA'B'C'$ on the grid provided below. *(4 marks)*



(b) Determine the area of $OA'B'C'$. *(2 marks)*

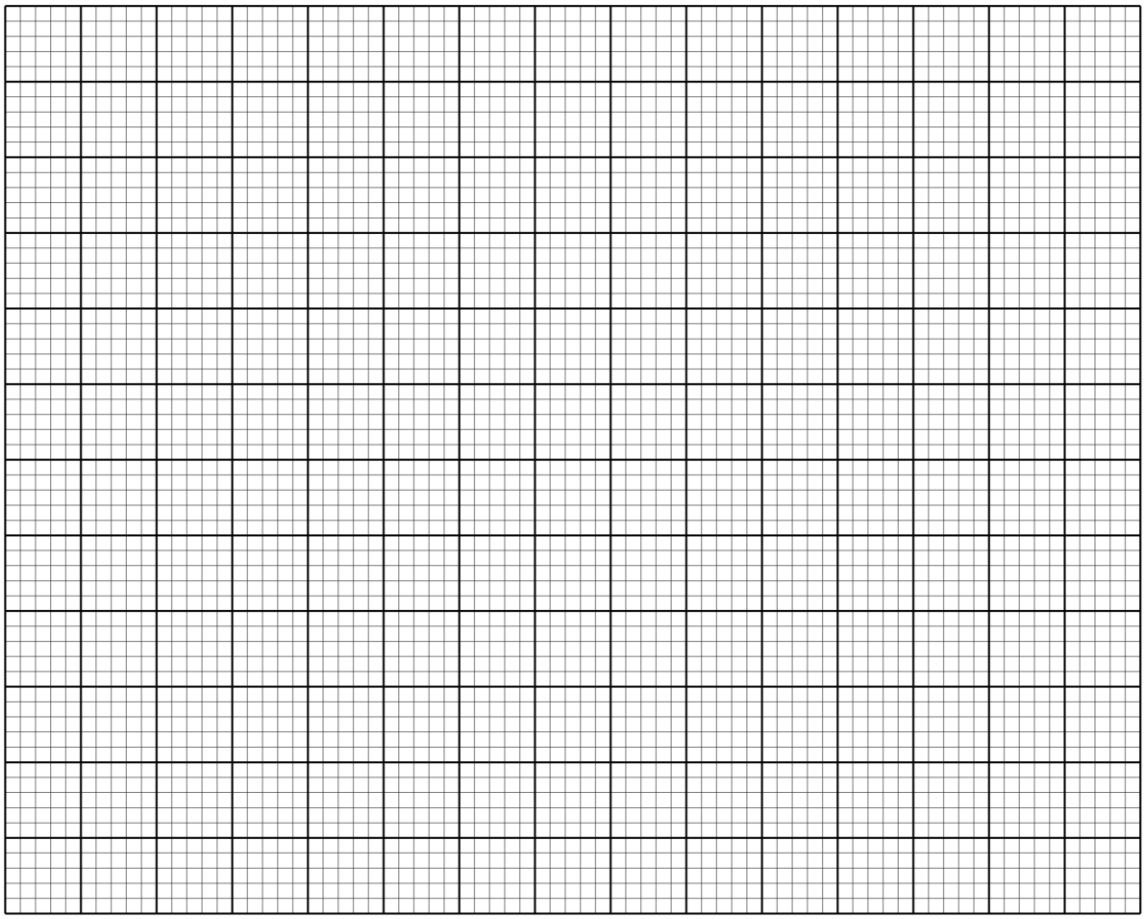
(c) Another transformation $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ maps $OA'B'C'$ onto $OA''B''C''$. Draw the image $OA''B''C''$ *(2 marks)*

(d) Determine the single matrix which maps $OA''B''C''$ onto OABC. *(2 marks)*

4. A rhombus OABC with vertices at $O(0,0)$, $A(3,1)$, $B(4,4)$ and $C(1,3)$ is mapped onto $OA'B'C'$ by a transformation described as **reflection in the line y = 0**.

(a) (i) Find a matrix **P** that represents the transformation which maps OABC onto $OA'B'C'$. *(1 mark)*

(ii) On the grid provided below, draw OABC and its image $OA'B'C'$. *(2 marks)*



(b) $OA''B''C''$ is the image of $OA'B'C'$ under a transformation represented by the matrix

$\mathbf{Q} = \begin{pmatrix} -2 & 0 \\ 0 & -1 \end{pmatrix}$.

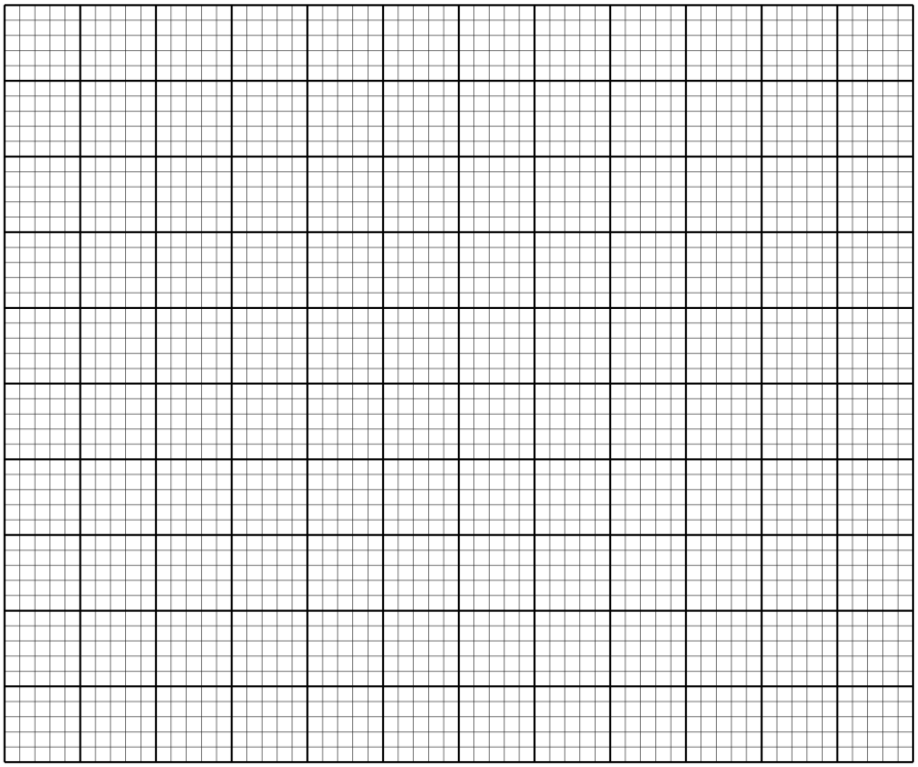
(i) Find the vertices of $OA''B''C''$. *(3 marks)*

(ii) On the same axes, draw $OA''B''C''$. *(1 mark)*

(c) Find a single matrix that maps $OA''B''C''$ onto OABC. *(3 marks)*

5. The square $OP'Q'R'$ with vertices at $O(0,0)$, $P'(-6,8)$, $Q'(2,14)$ and $R'(8,6)$ is the image of $OPQR$ with vertices at $O(0,0)$, $P(10,0)$, $Q(10,10)$ and $R(0,10)$ under a transformation $\mathbf{T}$.

(a) On the grid provided, draw the square $OPQR$ and its image $OP'Q'R'$ hence describe the transformation $\mathbf{T}$. *(4 marks)*



(b) Determine a 2×2 matrix that represents $\mathbf{T}$. *(2 marks)*

(c) A quadrilateral $OP''Q''R''$ is the image of $OP'Q'R'$ under a transformation $\mathbf{U}=\begin{pmatrix} 0 & 2 \\ -1 & -1 \end{pmatrix}$. On the same axes, draw $OP''Q''R''$. *(2 marks)*

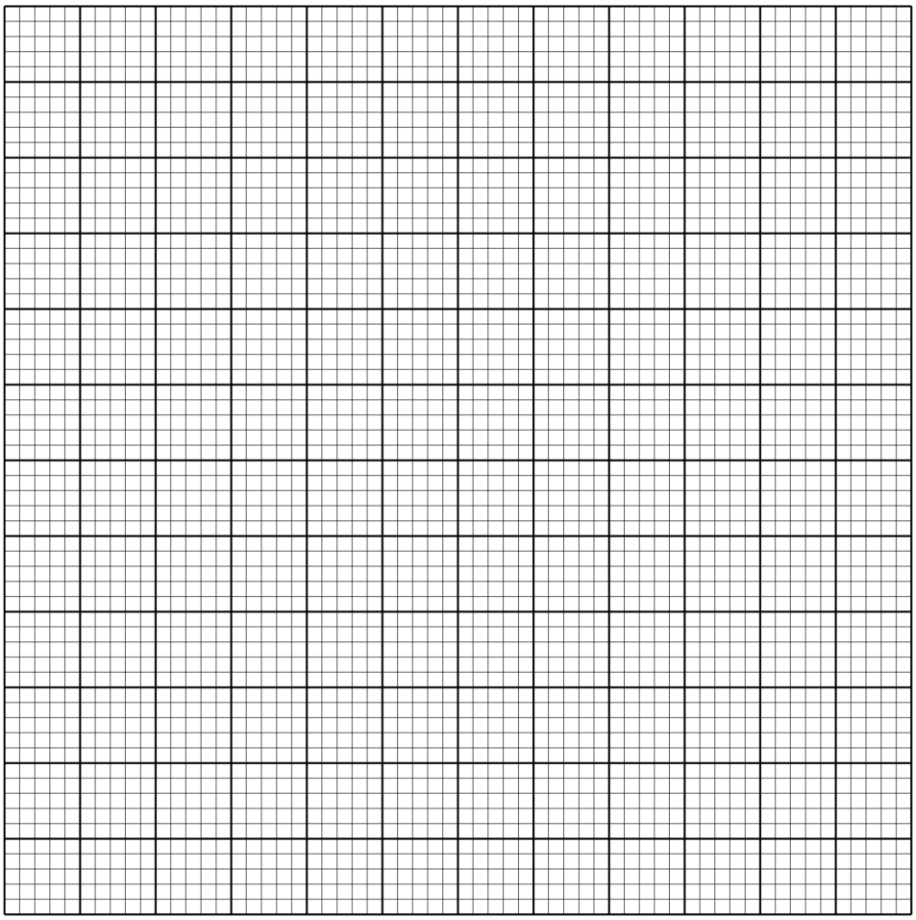
(d) Determine the matrix that would map $OPQR$ onto $OP''Q''R''$. *(2 marks)*

1. In an experiment involving two variables P and T, the following results were obtained

P	–0.8	–0.2	0.5	1	1.8	2	3	4	4.4
T	1	1.5	2	2.5	3	3.5	4	4.5	5

The relationship between P and T is said to be of the form $P = rT - x$, where r is a constant.

(a) Plot the graph of P against T *(4 marks)*



(b) Using the graph above find;

(i) The value of r *(3 marks)*

(ii) The vertical axis intercept. *(1 mark)*

(c) (i) Write the equation connecting P and T. *(1 mark)*

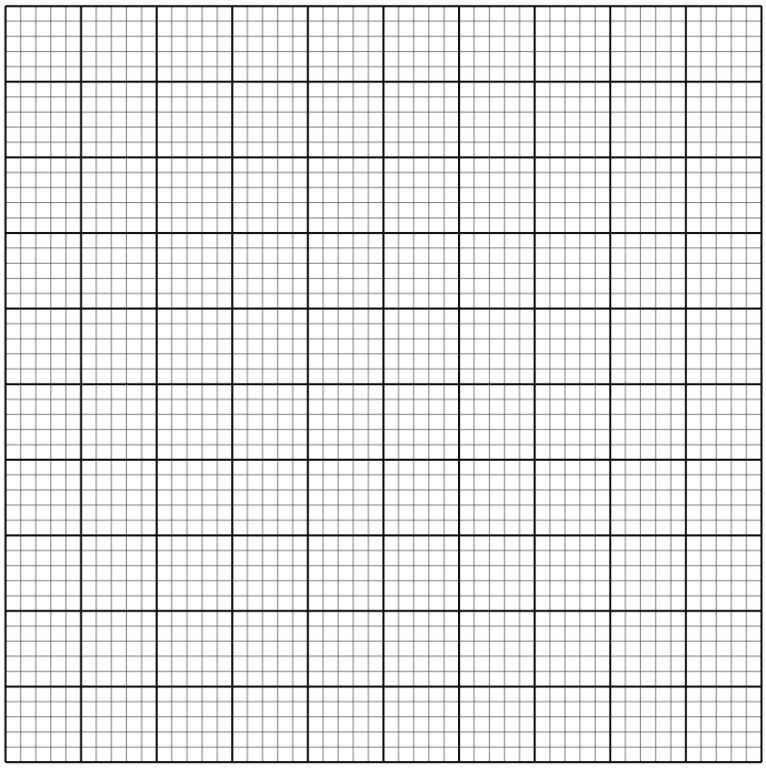
(ii) Hence, find the value of P when T is 0.3 *(1 mark)*

2. Two variables x and y are believed to obey the law $y = mx + nx^2$. The following table gives their corresponding values in an experiment.

x	1	2	3	4	5	6	7	8
y	6	8	6	0	–10	–24	–42	–64
$\frac{y}{x}$								

(a) Complete the table above for the values of $\frac{y}{x}$. *(2 marks)*

(b) Draw the graph of $\frac{y}{x}$ (y – axis) against x (x – axis) on the grid provided below. Use a scale of 1 cm to represent 1 unit on the x – axis and 1 cm to represent 2 units on the y – axis. *(3 marks)*



(c) Determine the values of the constants m and n. *(3 marks)*

(d) Use the law connecting x and y to determine the value of y when x is 20. *(2 marks)*

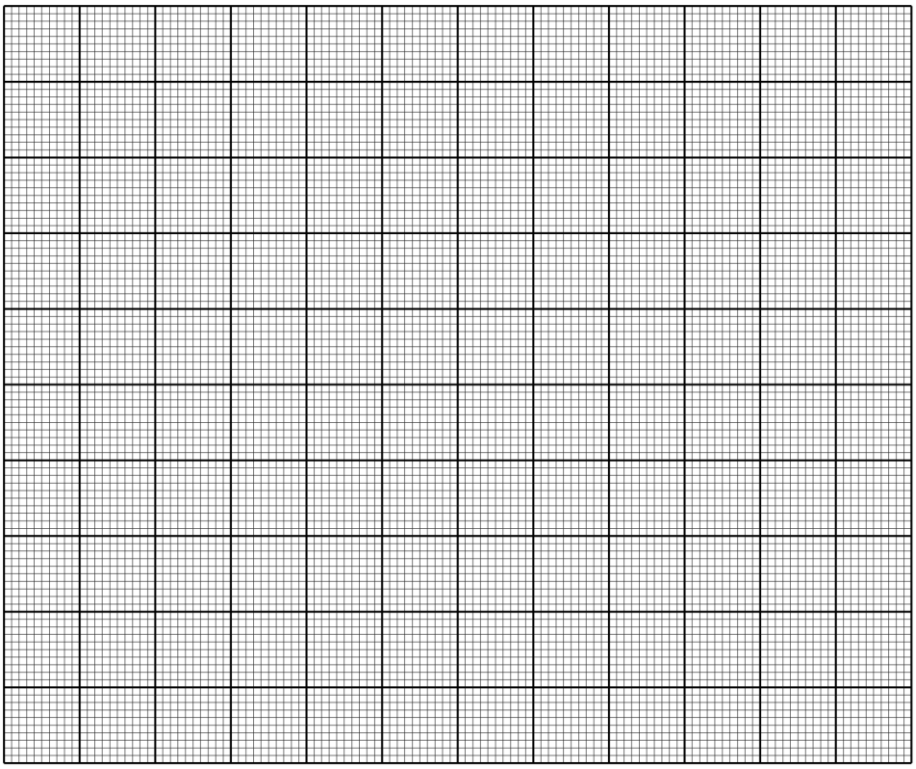
3. Two variables R and P are connected by a function $R = kP^n$ where k and n are constants. The table below shows the data involving the two variables.

P	3	3.5	4	4.5	5
R	36	49	64	81	100
$\log P$					
$\log R$					

(a) Complete the table above for $\log P$ and $\log R$ correct to 2 decimal places. *(2 marks)*

(b) Express $R = kP^n$ in a linear form. *(2 marks)*

(c) Using a scale of 1 cm for 0.1 on the x – axis and 1 cm for 0.2 on the y – axis, draw a line of best fit to represent the information. *(3 marks)*



(d) Using your graph, determine the law connecting R and P. *(3 marks)*

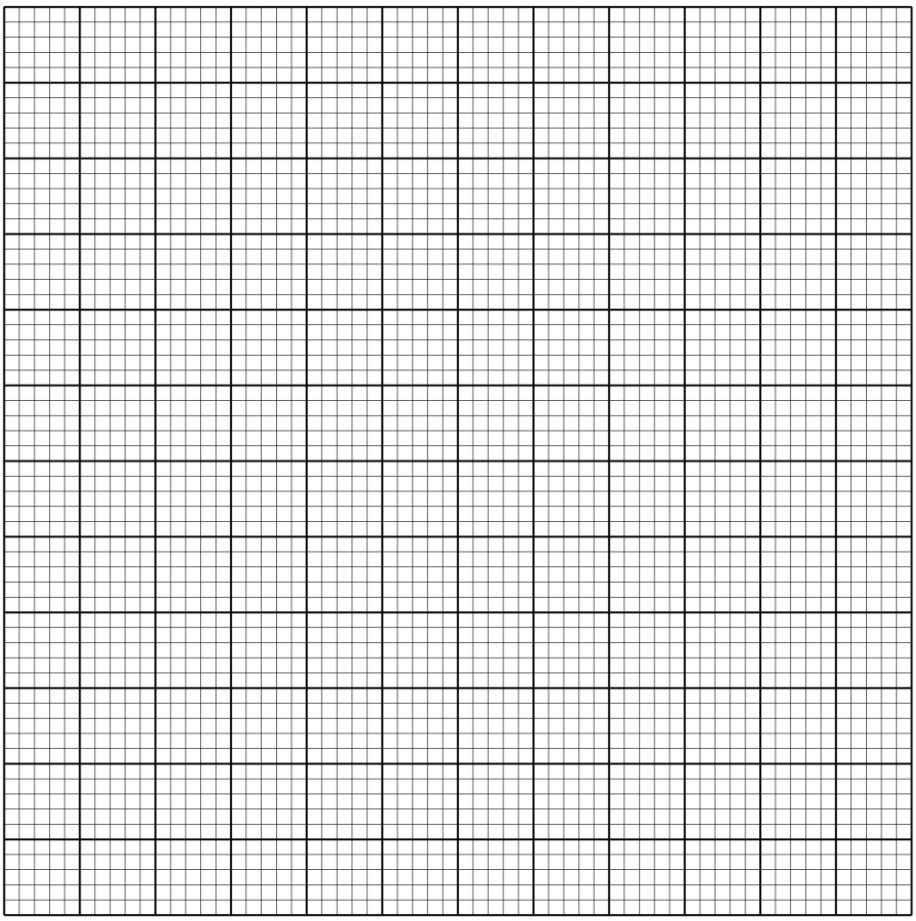
4. Two quantities P and r are connected by the equation $P = ar^n$ where a and n are constants. The table below gives the values of P and r.

P	1.2	1.5	2.0	2.5	3.5	4.5
r	1.58	2.25	3.39	4.74	7.86	11.50
$\log P$						
$\log r$						

(a) Express the equation $P = ar^n$ in the form $y = mx + c$ where m and c are constants. *(2 marks)*

(b) Complete the table above for $\log P$ and $\log r$ correct to 2 decimal places. *(2 marks)*

(c) On the grid below, draw the linear graph to represent the information above. *(3 marks)*



(d) From your graph, determine the values of the constants a and n hence find P when $r = 8$. *(3 marks)*

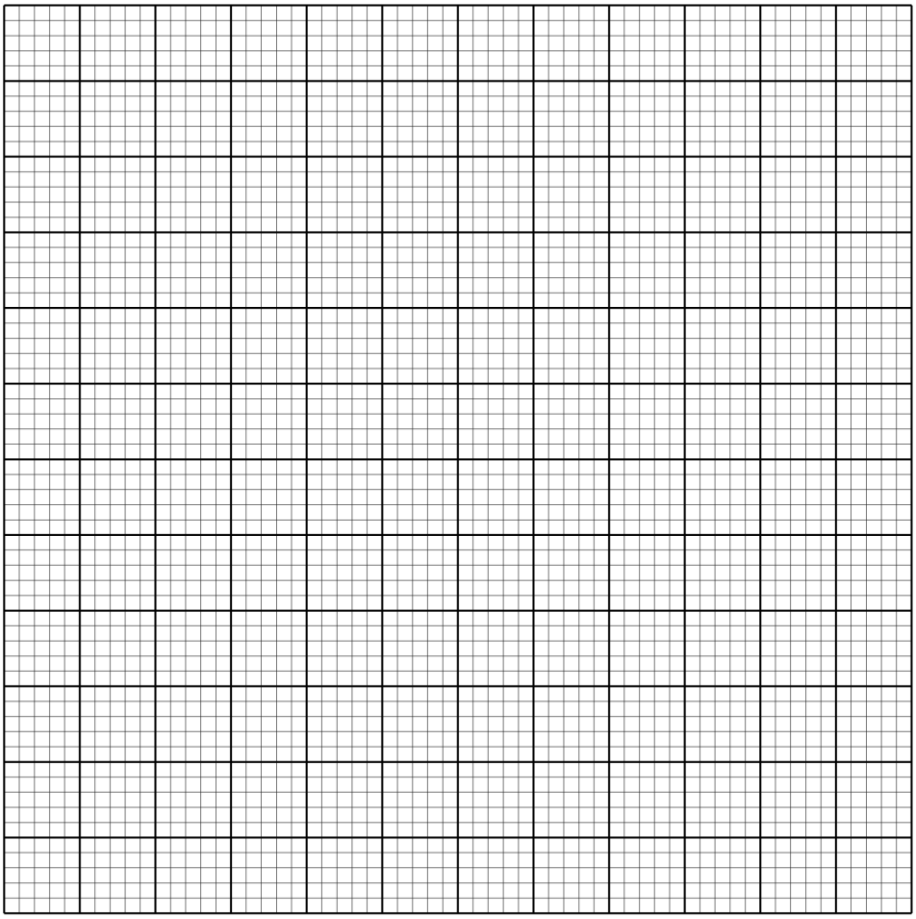
5. The variables P and Q are connected by the equation $P = ab^Q$ where a and b are constants. The values of P and Q are given below.

P	6.56	17.7	47.8	129	349	941	2540	6860
Q	0	1	2	3	4	5	6	7
$\log P$								

(a) Complete the table for $\log P$ correct to 2 decimal places. *(1 mark)*

(b) State the equation that would give a straight line. *(1 mark)*

(c) On the grid provided below, draw a suitable straight line graph to represent this information. Use the scale of 1 cm for 1 unit on the horizontal axis and 1 cm for 0.5 units on the vertical axis. *(3 marks)*



(d) From your graph, determine the law connecting P and Q. *(3 marks)*

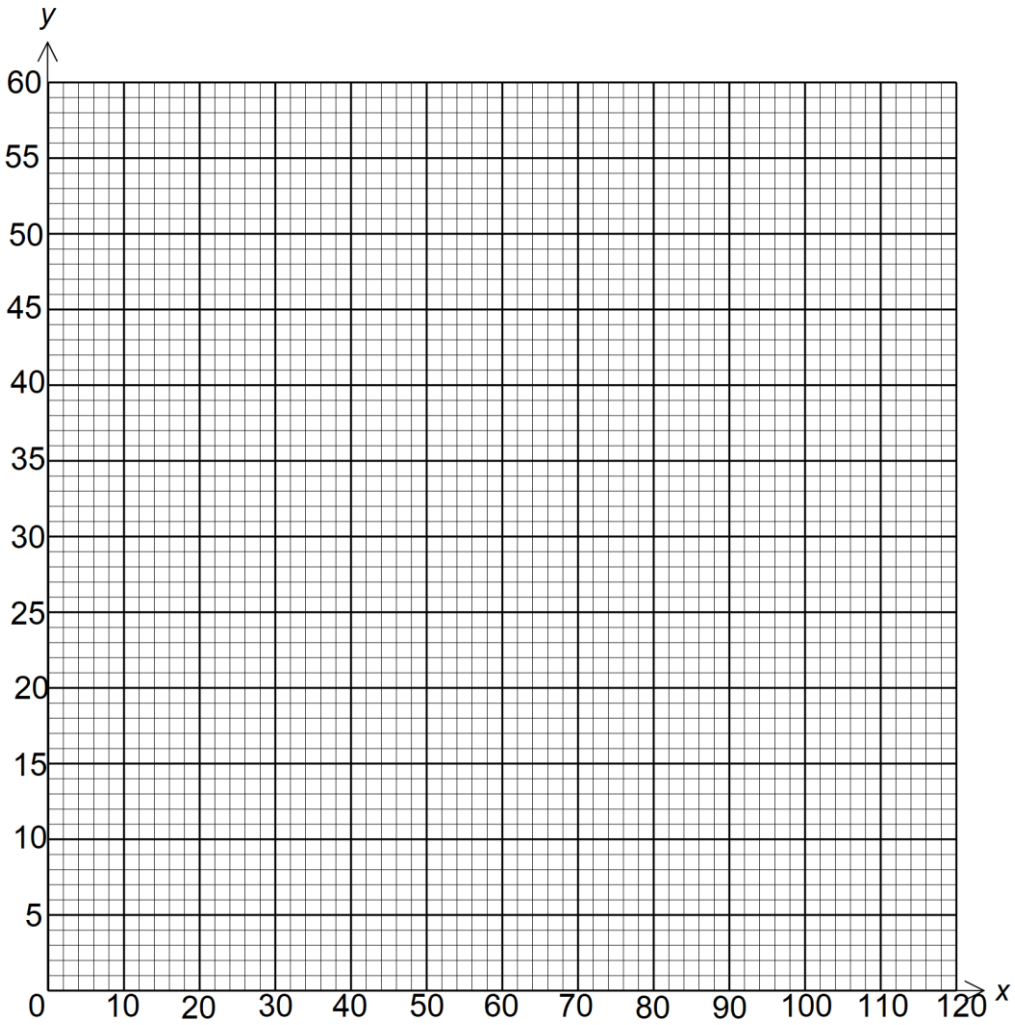
(e) Find P when $Q = 4.6$. *(2 marks)*

1. A farmer intends to use at least 30 hectares to plant wheat and barley. The number of hectares of wheat should be less than 6 times the number of hectares of barley. The cost of planting per hectare is sh. 4000 for wheat and sh. 10,000 for barley. The farmer has a maximum of sh.400,000 to spend on planting. He wishes to plant wheat on at least 20 hectares. By letting the number of hectares on which he plants wheat be x and on which he plants barley be y.

(a) Write down four inequalities that represent the above information other than $x \geq 0$ and $y \geq 0$.

(4 marks)

(b) Represent the inequalities in (a) above on the grid provided. *(4 marks)*

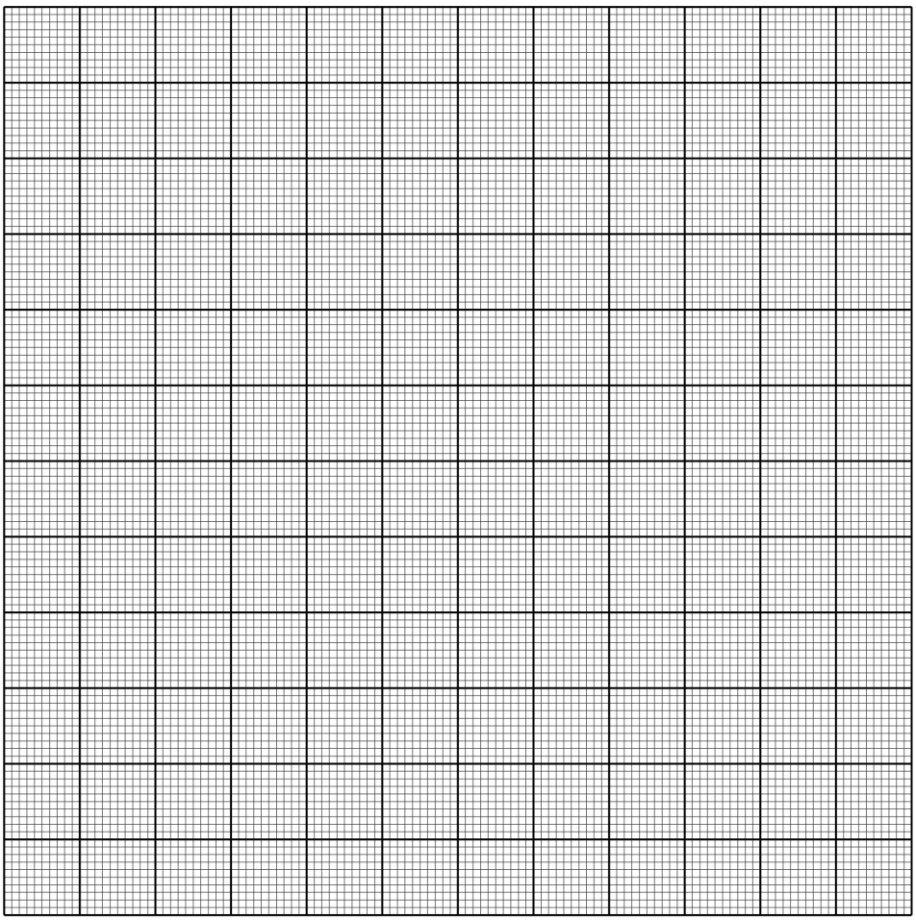


(c) If the farmer makes a profit of sh.10,000 for each hectare of wheat and sh.20,000 for each hectare of barley, use a search or otherwise to determine the land in multiples of 5 hectares the farmer should use for maximum profit. *(2 marks)*

2. Mary owns a restaurant where she stocks two types of soft drinks; Apple and Orange. The two drinks are produced in cans of the same size. She needs to order fresh supplies and has room for up to 1000 cans. Orange is more popular and she decides to order at least twice as many cans of Orange as Apple. She wishes however, to have at least 100 cans of Apple and not more than 800 cans of Orange. Taking x and y to be the number of cans of Apple and Orange respectively;

(a) Write down four inequalities involving x and y which satisfy these conditions. *(4 marks)*

(b) On the grid provided draw all the inequalities in (a) above by shading the unwanted region. Use a scale of 1 cm 100 cans on each axis. *(4 marks)*

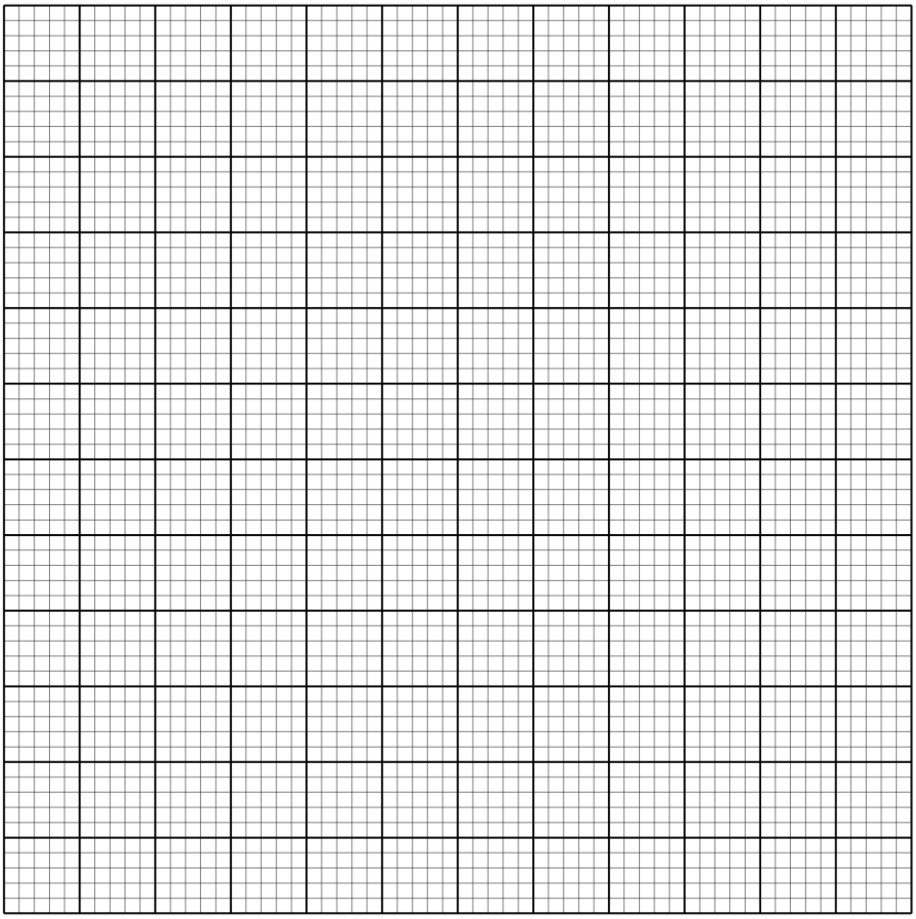


(c) The profit of a can of Apple is sh. 20 while that of Orange is sh. 25. Use the graph to determine the number of cans of each drink that Mary's restaurant should order to give maximum profit.
(2 marks)

3. An NGO has to transport at least 900 people and at least 25 tonnes of supplies to a refugee camp. There are two types of vehicles available; type A and type B. Type A can carry 30 people and 500 kg of supplies while type B can carry 20 people and 1000 kg of supplies. The NGO requires to use at least 10 vehicles of each type. Taking the number of type A and type B vehicles as x and y respectively:

(a) Form four linear inequalities to represent this information. *(4 marks)*

(b) On the grid provided below, and using a scale of 1 cm to represent 5 units on both axes, draw all the inequalities and shade the unwanted regions. *(4 marks)*

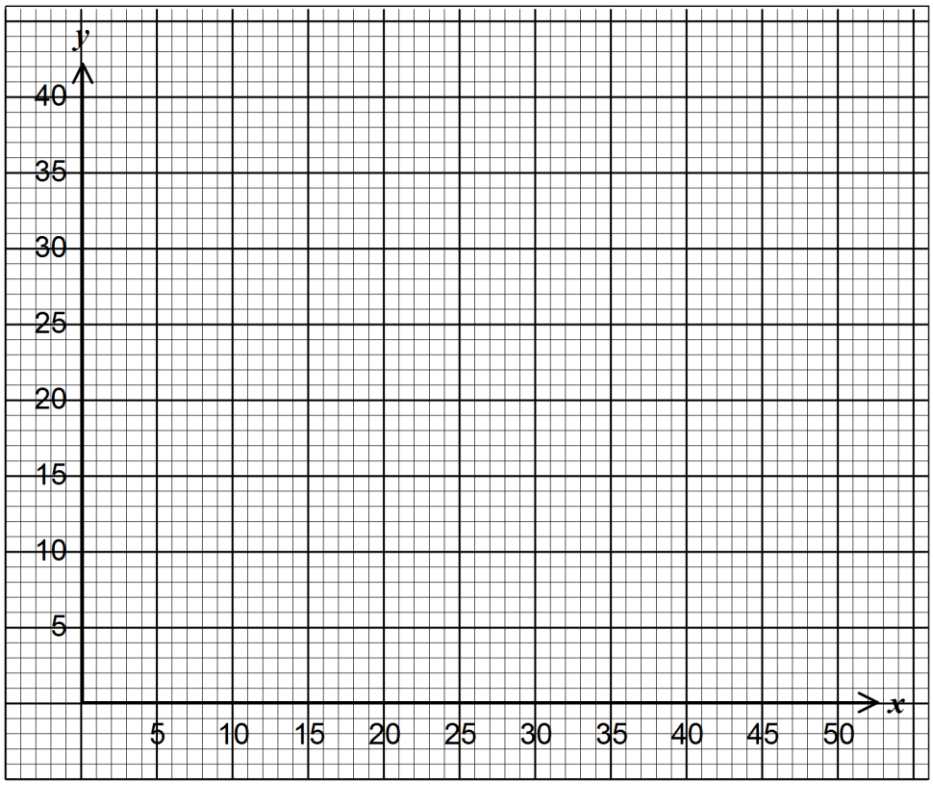


(c) From your graph, determine the number of vehicles required at the site for optimal operation. *(2 marks)*

4. A welder requires 6 hours to make a bed and 9 hours to make a door. It takes the welder at least 216 hours to make x beds and y doors. The labour cost of making a bed is Ksh 500 and that of a door is Ksh 1000. The total labour cost should not exceed Ksh 24 000. The welder must make at least 16 beds and more than 10 doors in order to make a profit.

(a) Form all the linear inequalities which will represent the above information. *(3 marks)*

(b) On the grid provided, draw the inequalities and shade the unwanted region. *(4 marks)*



(c) The welder makes a profit of Ksh 400 on a bed and Ksh 1000 on a door. Use the graph and a search line to determine the maximum profit the welder can make. *(3 marks)*

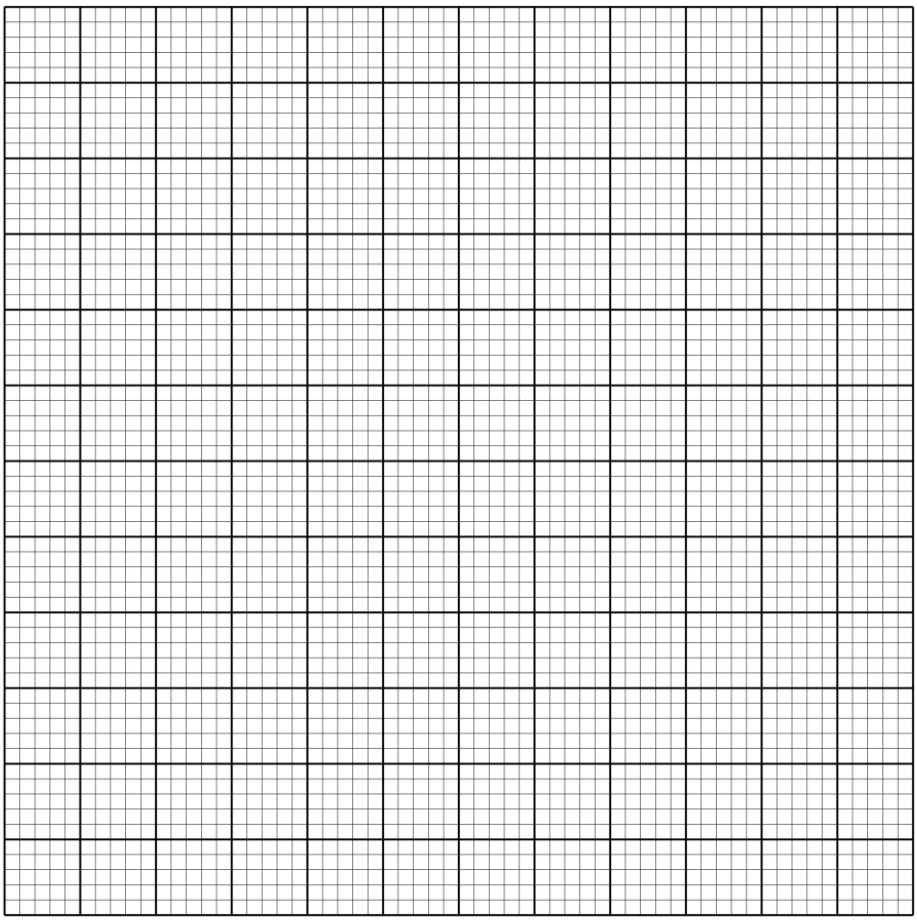
5. The dimensions of a rectangular floor of a proposed room are such that:

- The length is greater than the width but at most twice the width;
- The sum of the width and length is more than 4 metres but less than 10 metres.

If x represents the width and y the length;

(a) Write inequalities to represent the above information. *(4 marks)*

(b) Represent the inequalities in (a) above on a linear programming diagram. *(4 marks)*



(c) Using the integral values of x and y, list all the possible dimensions of the floor hence find the maximum possible area of the floor. *(2 marks)*