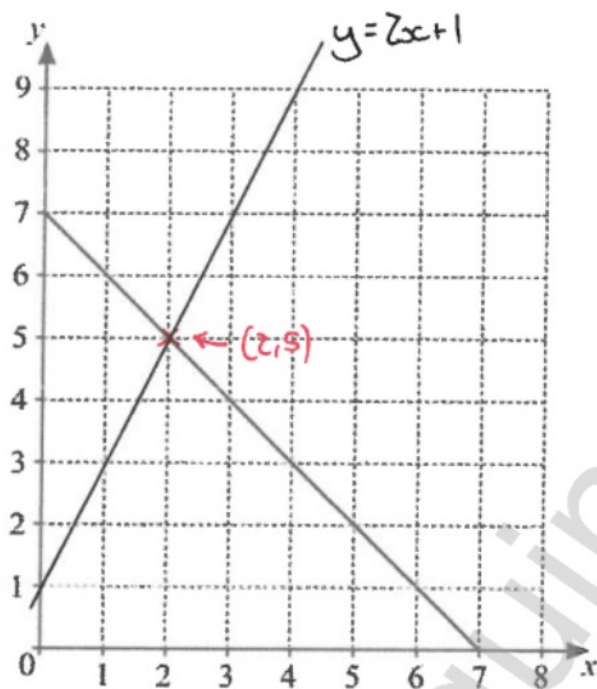




The line $x + y = 7$ is drawn on the grid.

(a) On the grid, draw the line $y = 2x + 1$.

[2]

(b) Use your graph to solve these simultaneous equations.

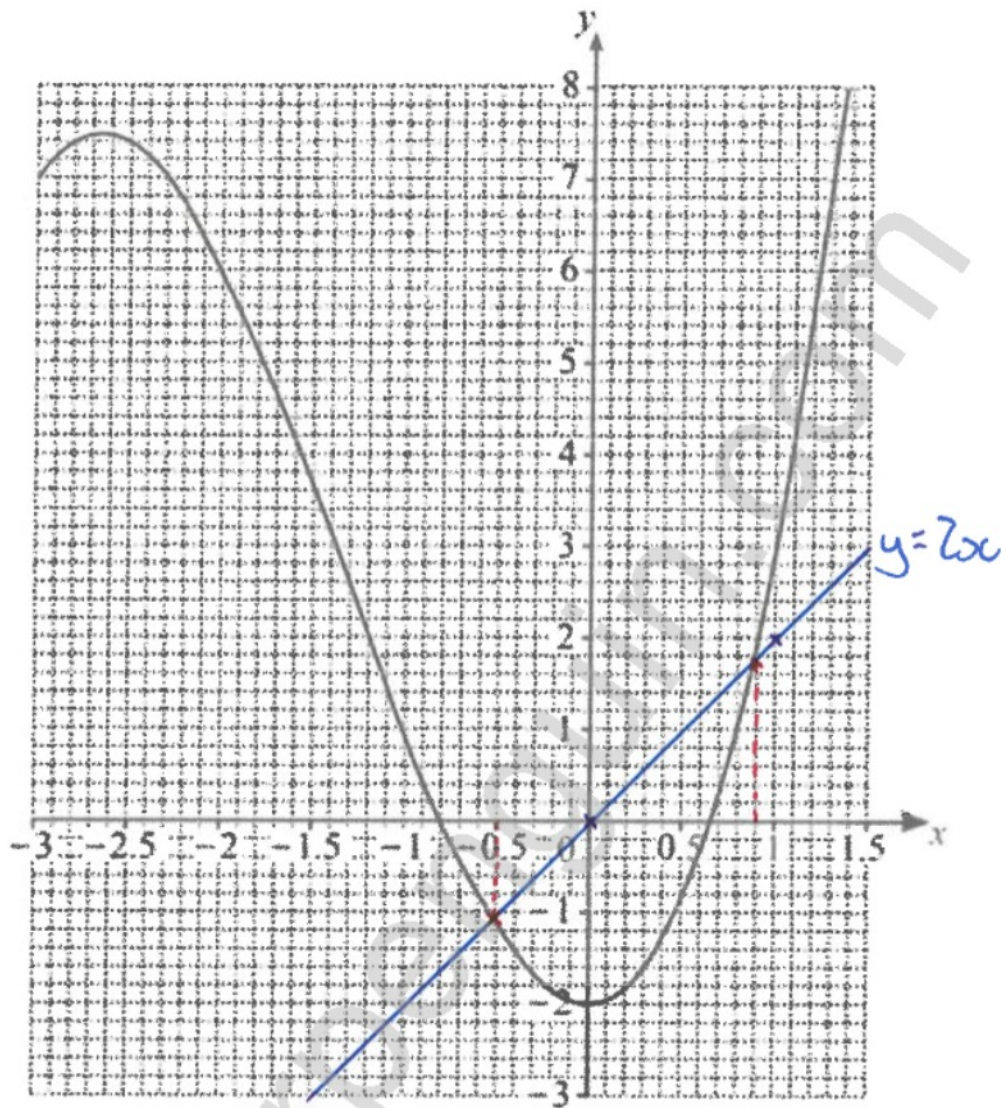
$$x + y = 7$$

$$y = 2x + 1$$

$$x = \frac{2}{5}$$

$$y = \frac{5}{5}$$

[1]



The diagram shows the graph of $y = x^3 + 4x^2 - 2$ for $-3 \leq x \leq 1.5$.

By drawing a suitable straight line, solve the equation $x^3 + 4x^2 - 2 = 2x$ for $-3 \leq x \leq 1.5$.

$$x^3 + 4x^2 - 2 = 2x$$

↑
plot $y = 2x$

$$x = -0.5 \text{ or } x = 0.9 \quad [3]$$

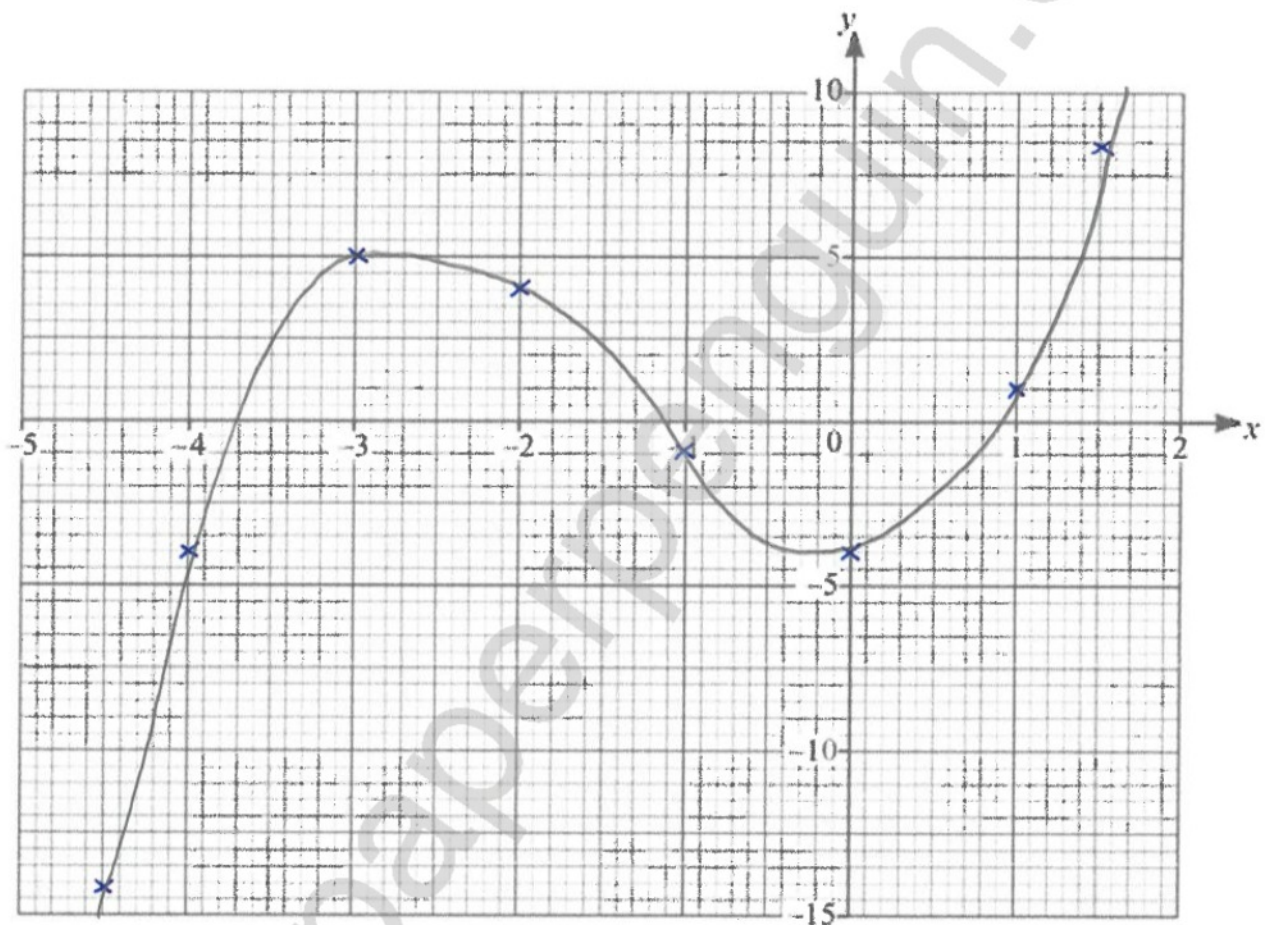
- 2 The table shows some values for $y = x^3 + 4x^2 - 4$.

x	-4.5	-4	-3	-2	-1	0	1	1.5
y	-14.1	-4	5	4	-1	-4	1	8.4

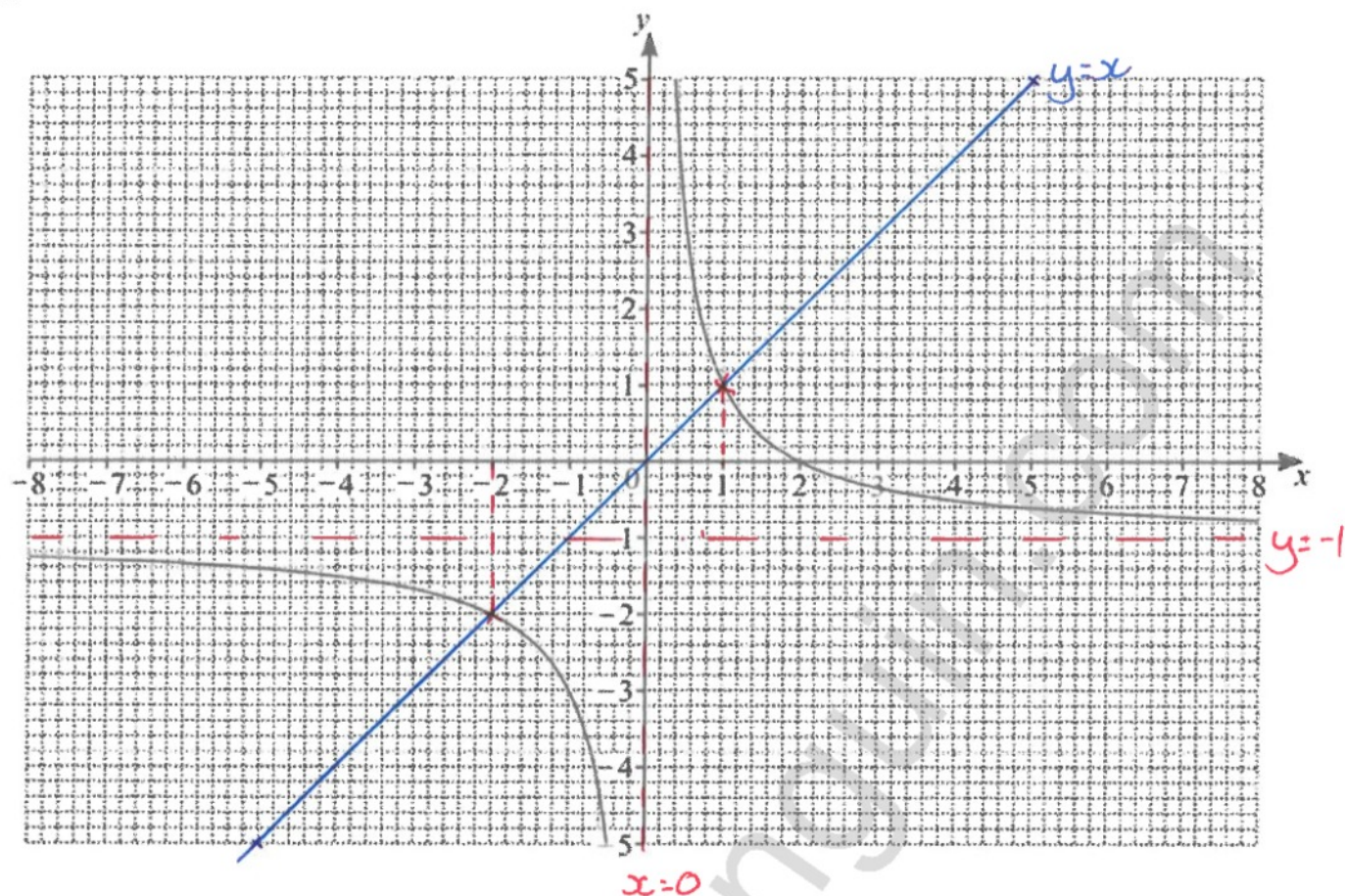
(a) Complete the table.

[2]

(b) On the grid, draw the graph of $y = x^3 + 4x^2 - 4$ for $-4.5 \leq x \leq 1.5$.



[4]



The diagram shows the graph of $y = \frac{2}{x} - 1$.

- (a) Write down the coordinates of the point where the graph crosses the x-axis.

(2 , 0) [1]

- (b) Write down the equation of each asymptote.

$$x = 0$$

$$y = -1$$

[2]

- (c) By drawing a suitable straight line on the grid, solve $\frac{2}{x} - x - 1 = 0$.
make the equation given into the equation of the line:

$$\frac{2}{x} - x - 1 = 0$$

$+x$ $+x$

$$\frac{2}{x} - 1 = x$$

same as
equation of line

plot $y = x$

$$x = -2 \text{ or } x = 1$$

[3]

2 (a) (i) $y = 2^x$

Complete the table.

x	0	1	2	3	4
y	1	2	4	8	16

[2]

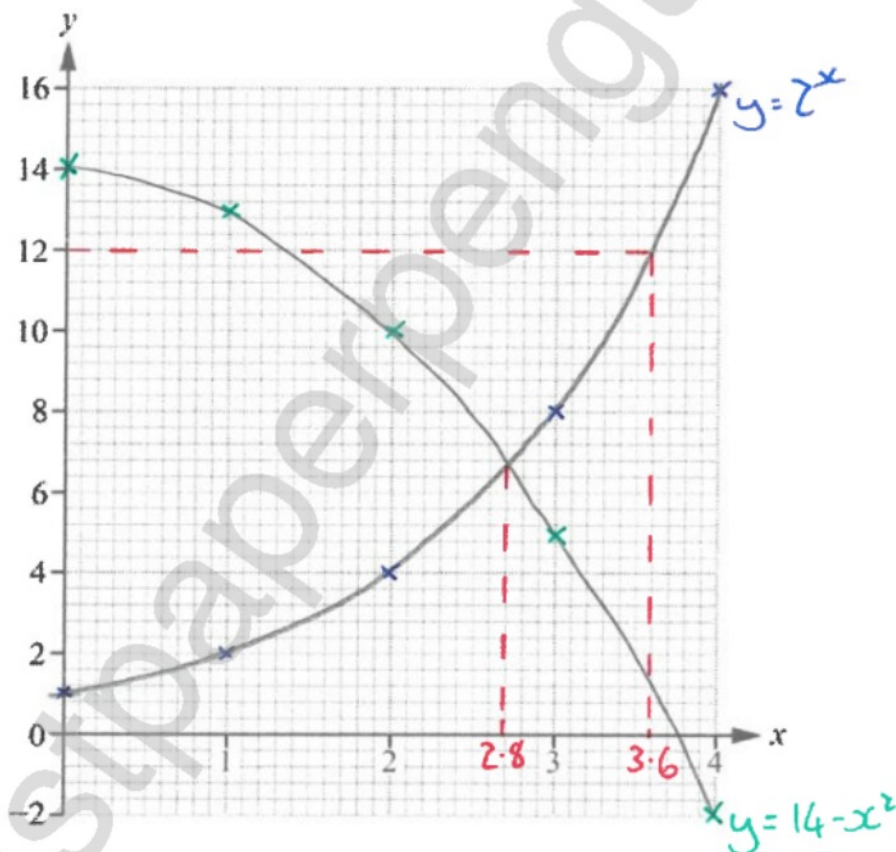
(ii) $y = 14 - x^2$

Complete the table.

x	0	1	2	3	4
y	14	13	10	5	-2

[2]

(b) On the grid, draw the graphs of $y = 2^x$ and $y = 14 - x^2$ for $0 \leq x \leq 4$.



[6]

(c) Use your graphs to solve the equations.

(i) $2^x = 12$

$x = 3.6$ [1]

(ii) $2^x = 14 - x^2$

$x = 2.8$ [1]

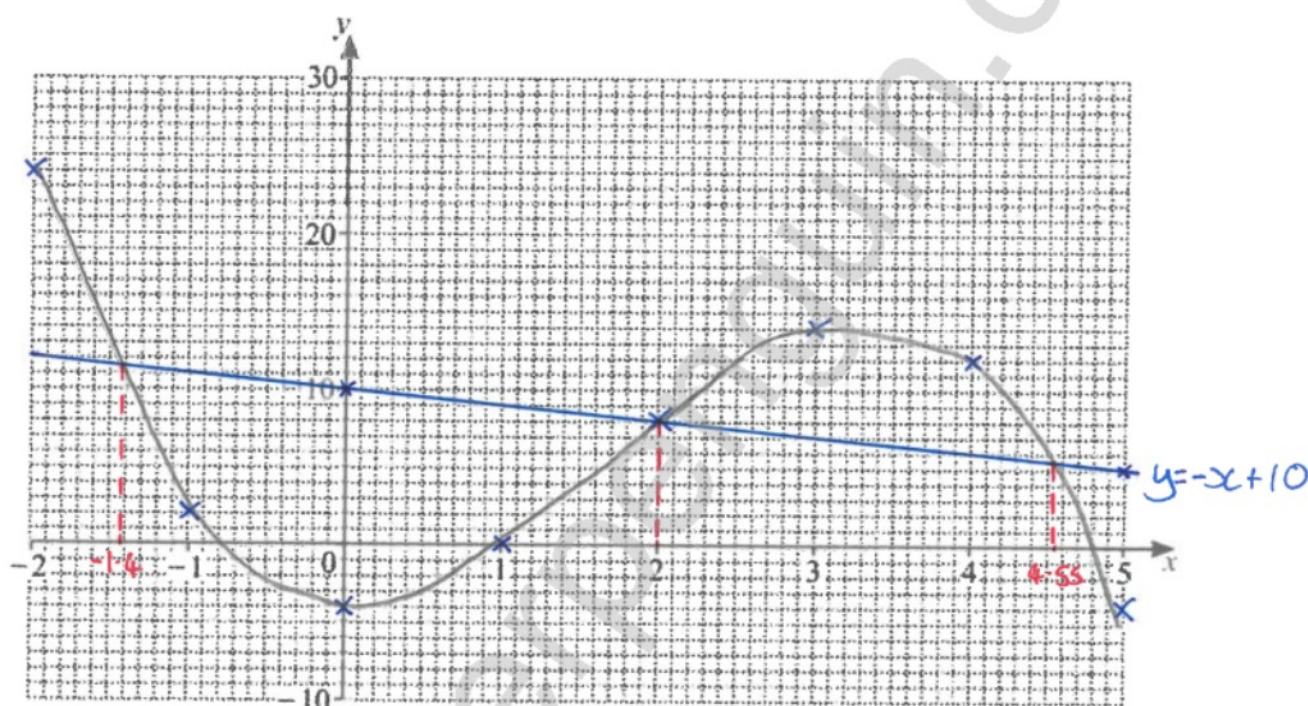
14 The table shows some values for $y = 5x^2 - x^3 - 4$.

x	-2	-1	0	1	2	3	4	5
y	24	2	-4	0	8	14	12	-4

(a) Complete the table.

[3]

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



[4]

(c) By drawing a suitable straight line on the grid, solve the equation $x^3 - 5x^2 - x + 14 = 0$.

Rearrange to give the equation of the line.

$$x^3 - 5x^2 - x + 14 = 0$$

$$-x^3 + 5x^2 + x - 14 = 0$$

$$5x^2 - x^3 + x - 4 = 10$$

$$5x^2 - x^3 - 4 = -x + 10$$

same as graph

$$x = -1.4 \text{ or } x = 2 \text{ or } x = 4.55$$

[4]

- 2 The table shows some values for $y = x^2 - \frac{1}{3x}$, $x \neq 0$.
The y -values are rounded to 1 decimal place.

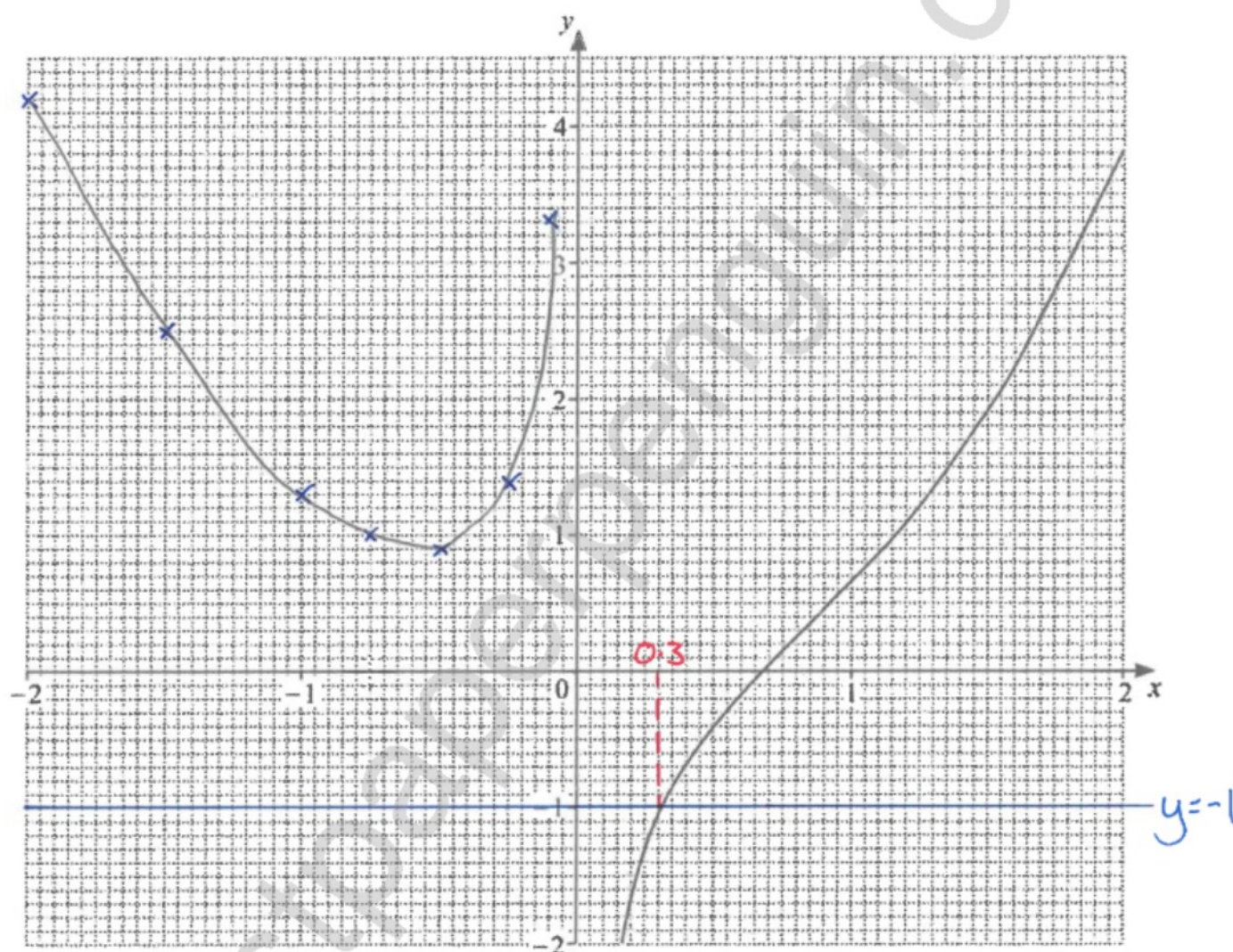
x	-2	-1.5	-1	-0.75	-0.5	-0.25	-0.1
y	4.2	2.5	1.3	1.0	0.9	1.4	3.3

(a) Complete the table.

[2]

(b) On the grid, draw the graph of $y = x^2 - \frac{1}{3x}$ for $-2 \leq x \leq -0.1$.

The graph of $y = x^2 - \frac{1}{3x}$ for $x > 0$ has been drawn for you.



[4]

(c) By drawing a suitable line on the grid, solve the equation $x^2 - \frac{1}{3x} + 1 = 0$.

$$x^2 - \frac{1}{3x} + 1 = 0$$

$$x^2 - \frac{1}{3x} = -1$$

$$x = 0.3$$

[2]

Same as graph
plot $y = -1$

- 5 The table shows some values of $y = \frac{1}{2x} - \frac{x}{4}$ for $0.15 \leq x \leq 3.5$.

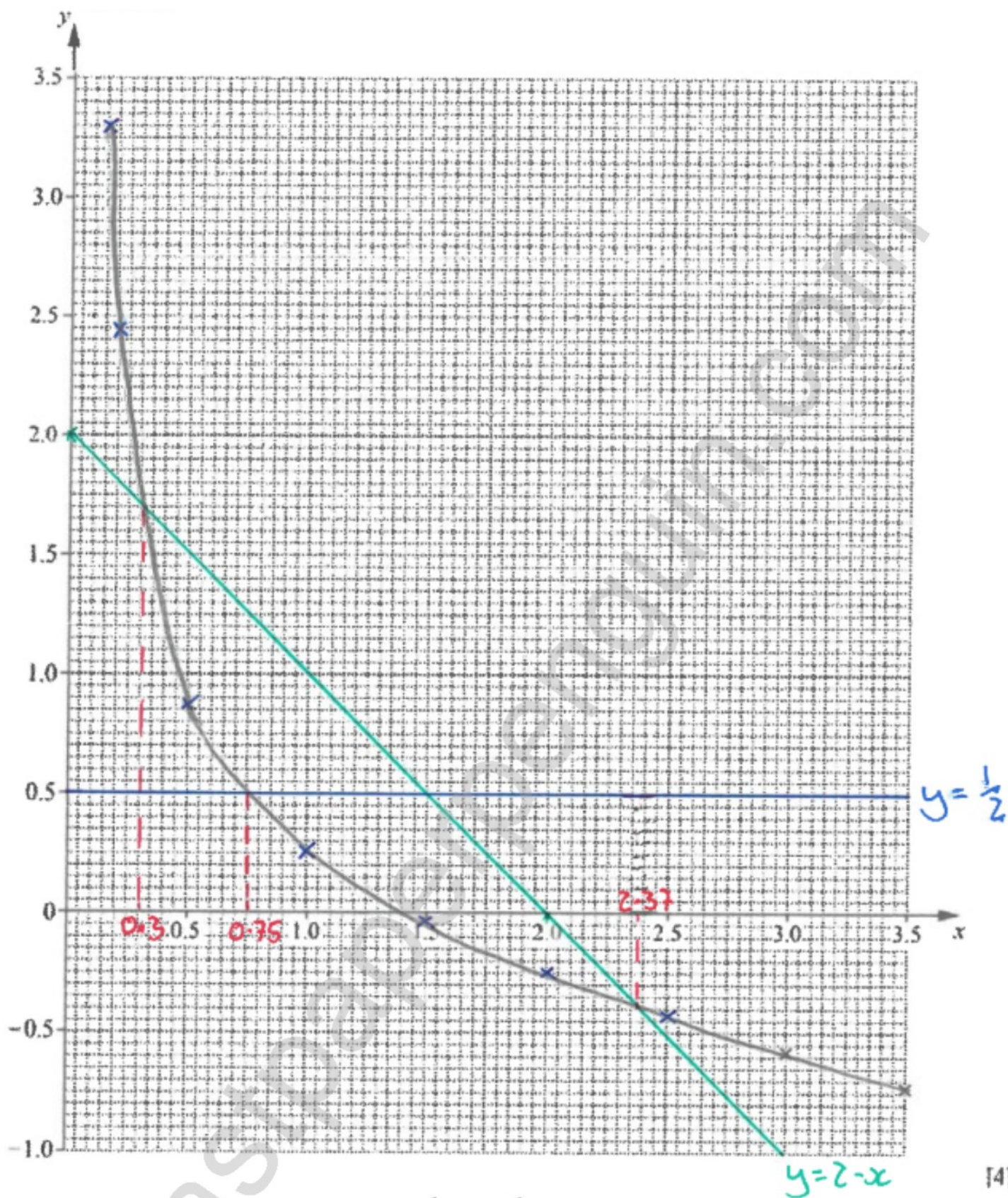
x	0.15	0.2	0.5	1	1.5	2	2.5	3	3.5
y	3.30	2.45	0.88	0.25	-0.04	-0.25	-0.43	-0.58	-0.73

(a) Complete the table.

[3]

- (b) On the grid, draw the graph of $y = \frac{1}{2x} - \frac{x}{4}$ for $0.15 \leq x \leq 3.5$.

The last two points have been plotted for you.



(c) Use your graph to solve the equation $\frac{1}{2x} - \frac{x}{4} = \frac{1}{2}$ for $0.15 \leq x \leq 3.5$.

↑
plot $y = \frac{1}{2}$

$x = 0.75$ [1]

(d) (i) On the grid, draw the line $y = 2 - x$.

[2]

(ii) Write down the x co-ordinates of the points where the line $y = 2 - x$ crosses the graph of

$y = \frac{1}{2x} - \frac{x}{4}$ for $0.15 \leq x \leq 3.5$.

$x = 0.3$ and $x = 2.37$ [2]

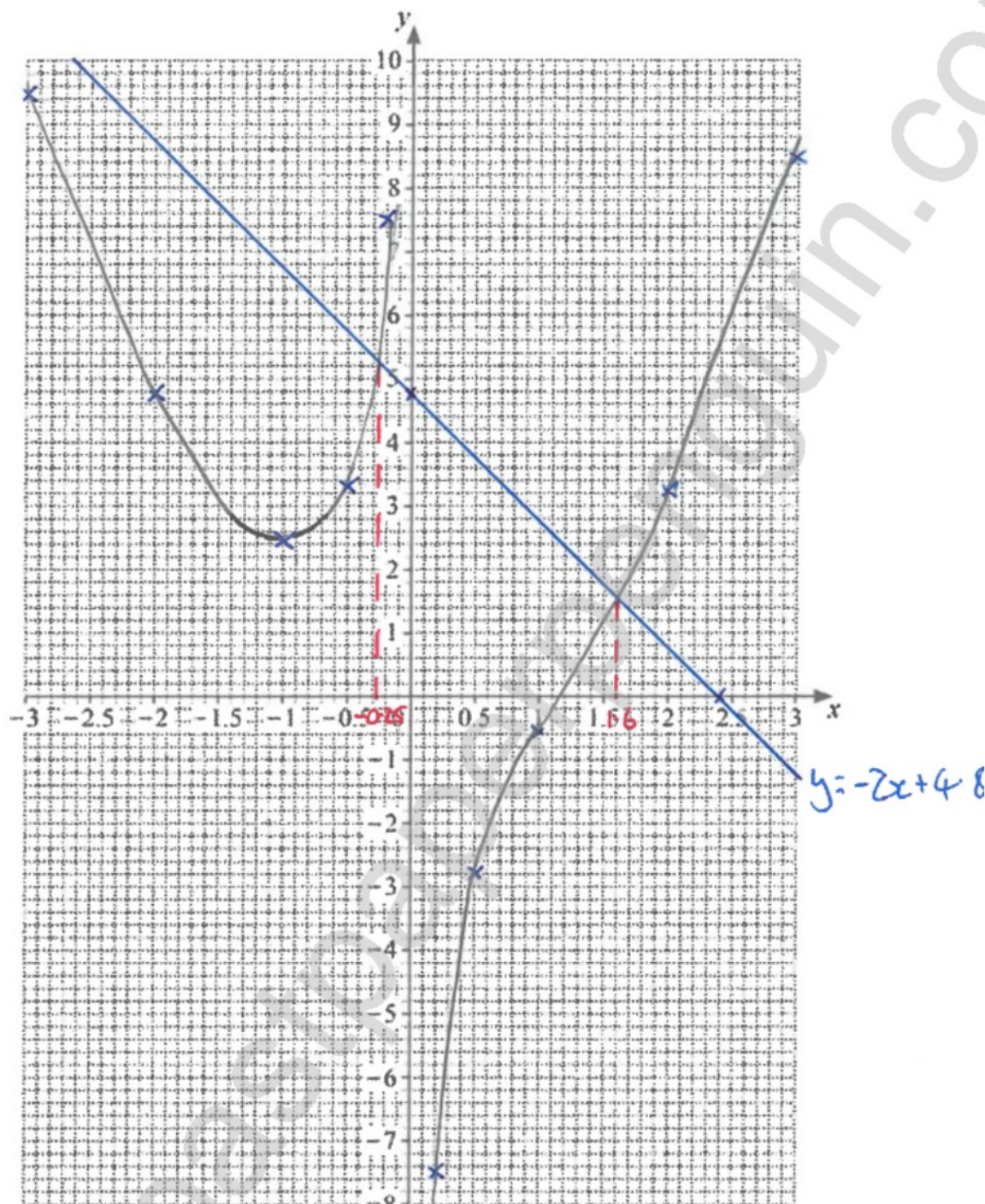
- 6 The table shows some values for $y = x^2 - \frac{3}{2x}$, $x \neq 0$, given correct to 1 decimal place.

x	-3	-2	-1	-0.5	-0.2	0.2	0.5	1	2	3
y	9.5	4.75	2.5	3.3	7.5	-7.5	-2.8	-0.5	3.3	8.5

(a) (i) Complete the table.

[3]

(ii) On the grid, draw the graph of $y = x^2 - \frac{3}{2x}$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$.



- (b) By drawing a suitable straight line on the grid, solve the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$.

plot $y = -2x + 4.8$

$x = -0.25$ or $x = 1.6$ [4]

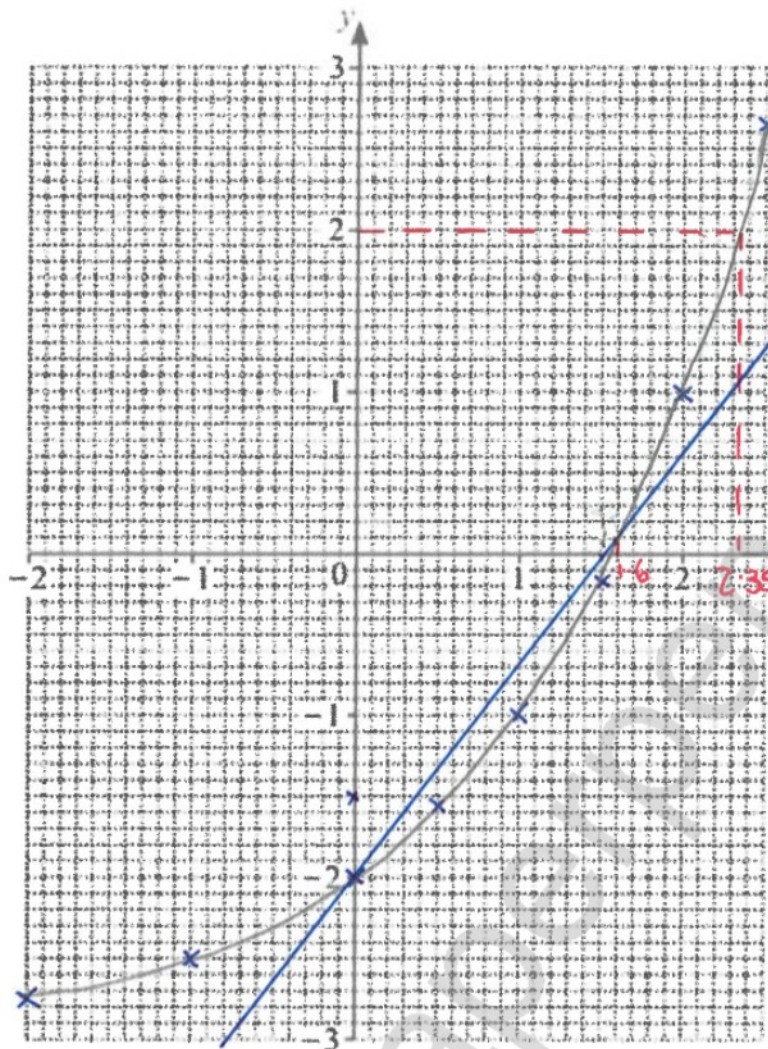
10 The table shows some values for $y = 2^x - 3$.

x	-2	-1	0	0.5	1	1.5	2	2.5
y	-2.75	-2.5	-2	-1.58	-1	-0.17	1	2.66

(a) Complete the table.

[3]

(b) On the grid, draw the graph of $y = 2^x - 3$ for $-2 \leq x \leq 2.5$.



[4]

(c) Use your graph to solve the equation $2^x - 3 = 2$.

$$x = 2.35 \quad [1]$$

(d) By drawing a suitable straight line, solve the equation $2^x - x - 1.5 = 0$.

$$2^x - x - 1.5 = 0$$

$$2^x - 1.5 = x$$

$$x = 0 \text{ or } x = 1.6 \quad [4]$$

$$2^x - 3 = x - 1.5$$

↑ same as graph
↑ plot $y = x - 1.5$

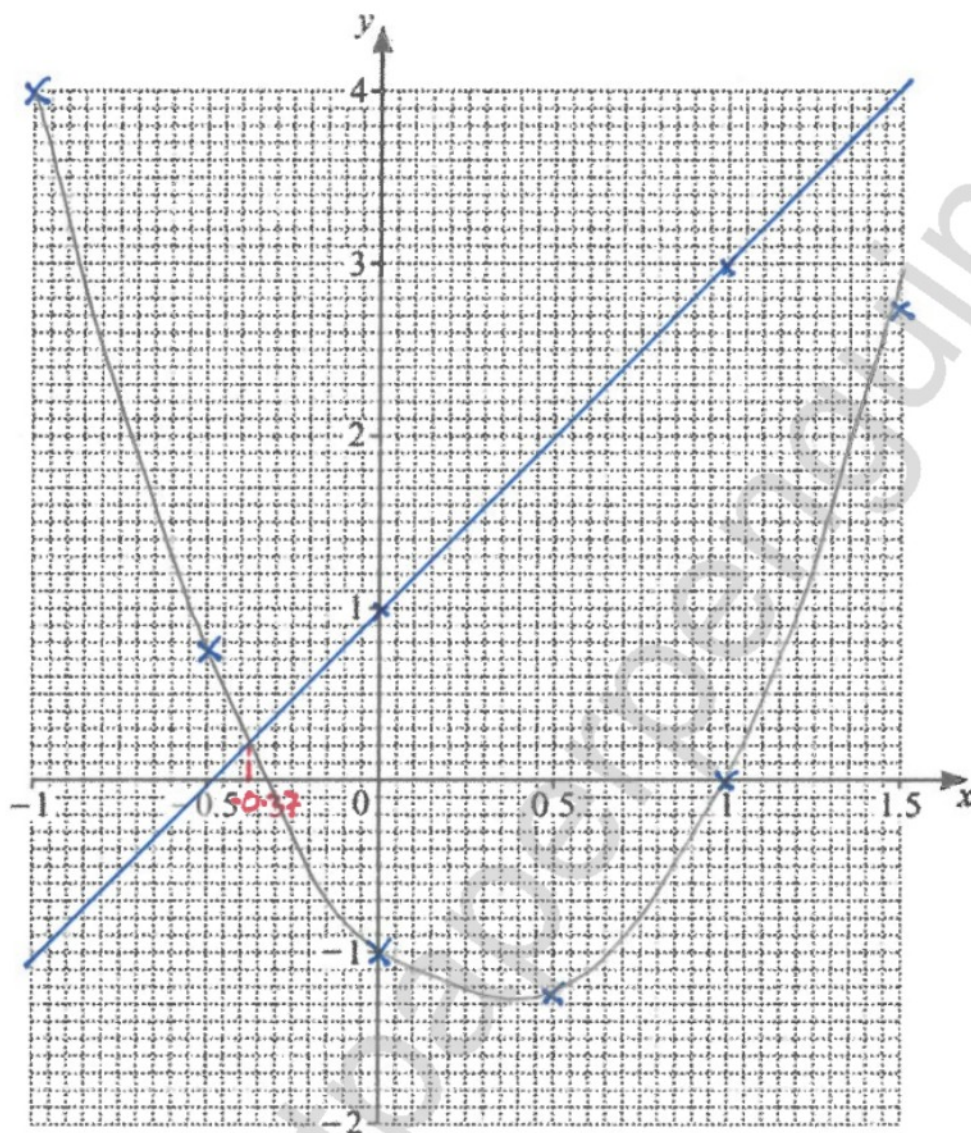
20 The table shows some values for $y = 3x^2 - 2x - 1$.

x	-1	-0.5	0	0.5	1	1.5
y	4	0.75	-1	-1.25	0	2.75

(a) Complete the table.

[1]

(b) On the grid, draw the graph of $y = 3x^2 - 2x - 1$ for $-1 \leq x \leq 1.5$.



[3]

(c) By drawing a suitable straight line, solve the equation $3x^2 - 4x - 2 = 0$ for $-1 \leq x \leq 1.5$.

$$3x^2 - 4x - 2 = 0$$

$$+2x \quad +2x$$

$$3x^2 - 2x - 2 = 2x$$

$$+1 \quad +1$$

$$3x^2 - 2x - 1 = 2x + 1$$

↑

same as graph

← plot $y = 2x + 1$

$$x = -0.37 \dots \dots \dots [3]$$

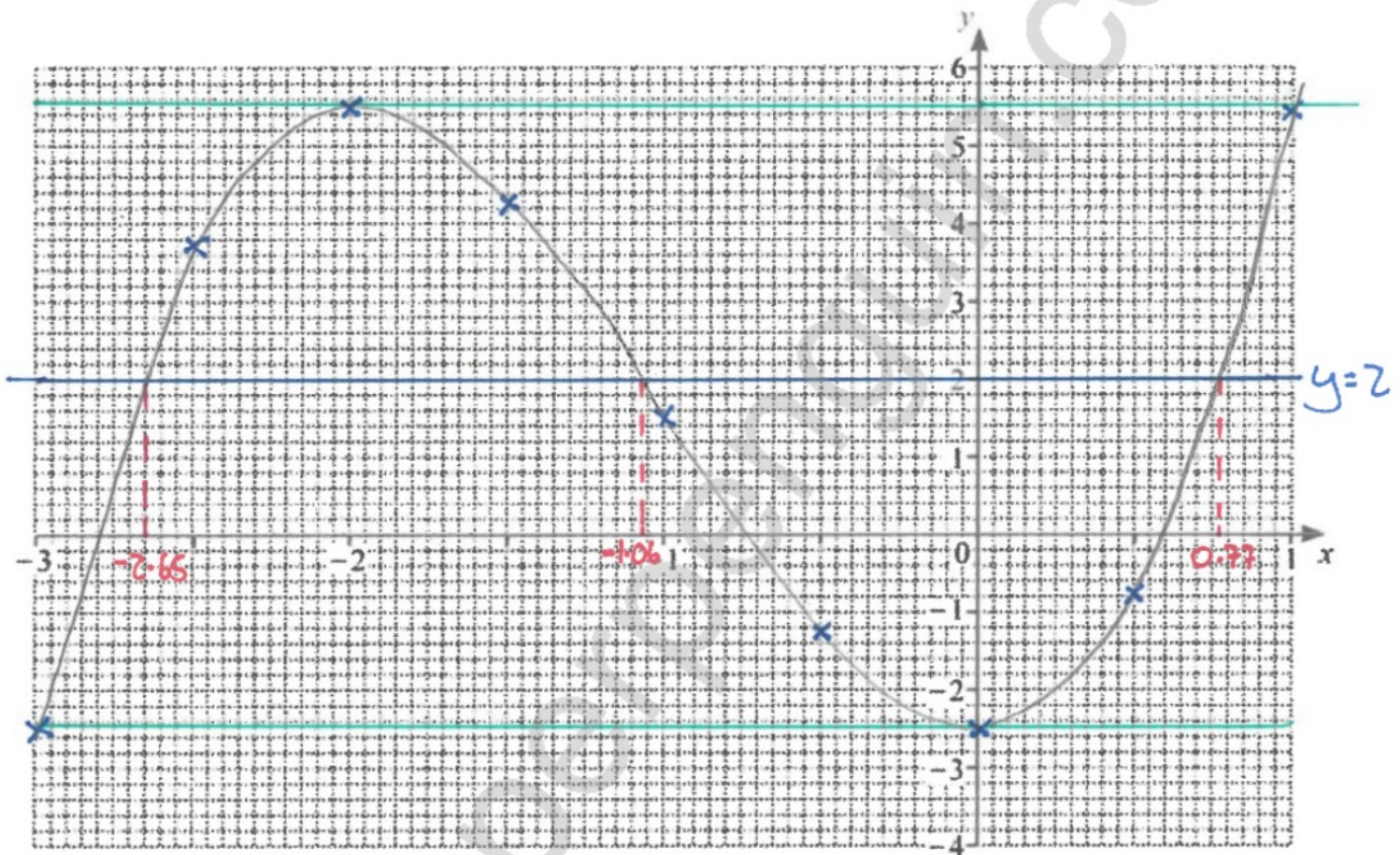
10 The table shows some values for $y = 2x^3 + 6x^2 - 2.5$.

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1
y	-2.5	3.75	5.5	4.25	1.5	-1.25	-2.5	-0.75	5.5

(a) Complete the table.

[3]

(b) On the grid, draw the graph of $y = 2x^3 + 6x^2 - 2.5$ for $-3 \leq x \leq 1$.



[4]

(c) By drawing a suitable line on the graph, solve the equation $2x^3 + 6x^2 = 4.5$.

$$2x^3 + 6x^2 = 4.5$$

$$2x^3 + 6x^2 - 2.5 = 2$$

$$2x^3 + 6x^2 - 2.5 = 2 \quad \text{plot } y=2 \quad x = -2.65 \text{ or } x = -1.06 \text{ or } x = 0.77 \quad [3]$$

Same as graph

(d) The equation $2x^3 + 6x^2 - 2.5 = k$ has exactly two solutions.

Write down the two possible values of k .

The two green lines are the only lines that can be drawn horizontally which touch the graph in only two places. They are $y = 5.5$ and $y = -2.5$

$$k = 5.5 \text{ or } k = -2.5 \quad [2]$$

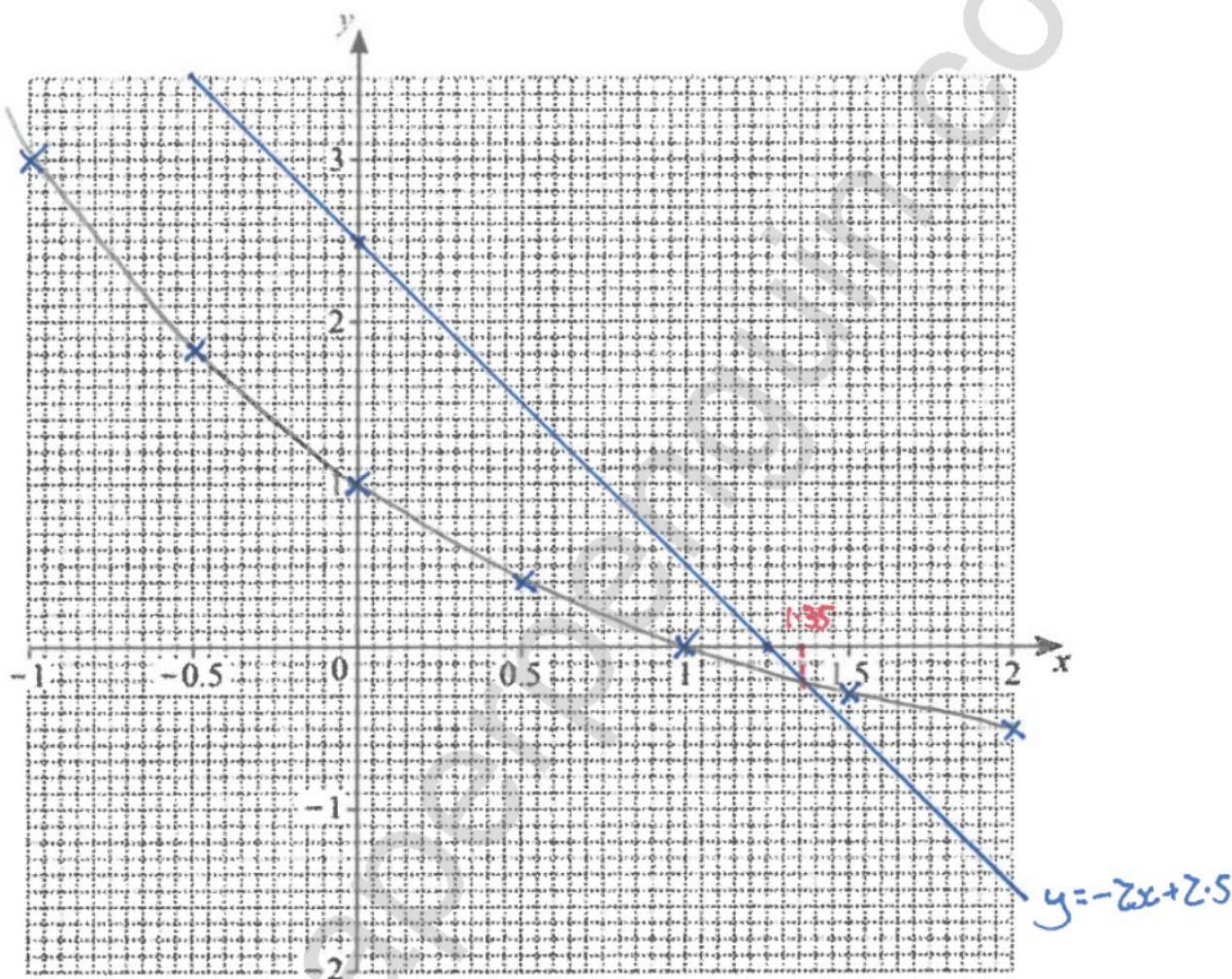
2 The table shows some values for $y = 2 \times 0.5^x - 1$.

x	-1	-0.5	0	0.5	1	1.5	2
y	3	1.83	1	0.41	0	-0.29	-0.5

(a) (i) Complete the table.

[2]

(ii) On the grid, draw the graph of $y = 2 \times 0.5^x - 1$ for $-1 \leq x \leq 2$.



[4]

(b) By drawing a suitable straight line, solve the equation $2 \times 0.5^x + 2x - 3.5 = 0$ for $-1 \leq x \leq 2$.

$$2 \times 0.5^x + 2x - 3.5 = 0$$

$$2 \times 0.5^x - 3.5 = -2x$$

$$2 \times 0.5^x - 1 = -2x + 2.5$$

Same as graph $\rightarrow$ $x = 1.35$ [3]

Handwritten notes: "plot $y = -2x + 2.5$ " with an arrow pointing to the line, and "asymptote is at $y = -1$ " with an arrow pointing to the horizontal asymptote of the curve.

(c) There are no solutions to the equation $2 \times 0.5^x - 1 = k$ where k is an integer.

Complete the following statements.

The highest possible value of k is -1 .

The equation of the asymptote to the graph of $y = 2 \times 0.5^x - 1$ is $y = -1$. [2]

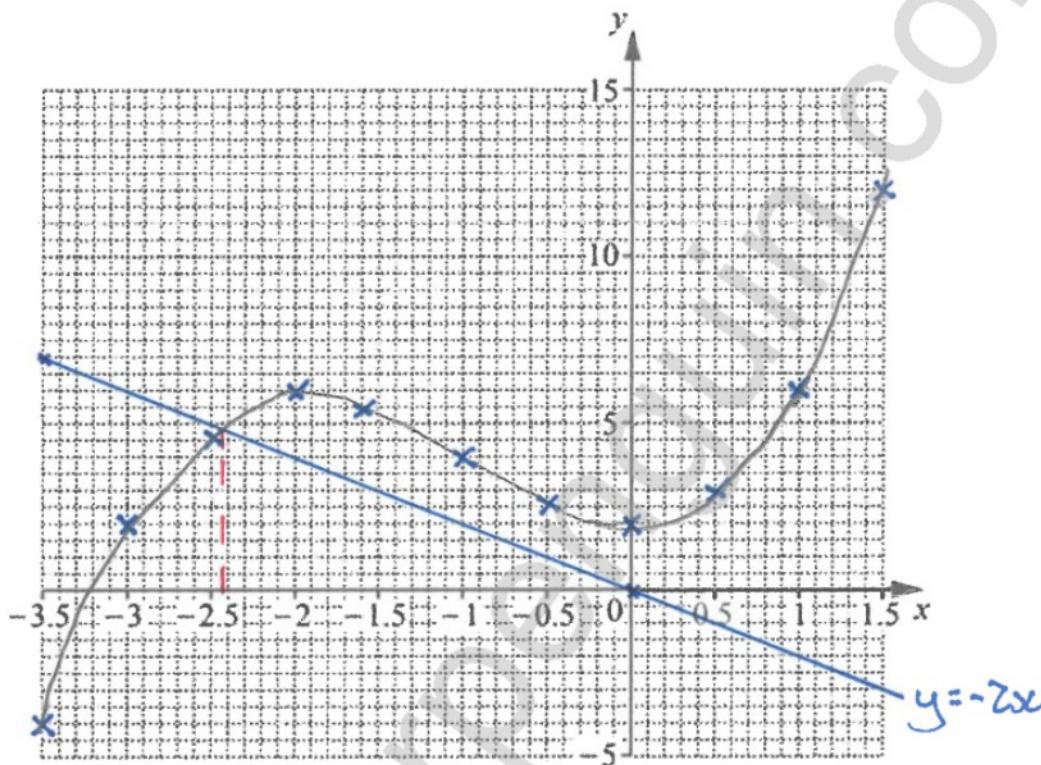
2 The table shows some values for $y = x^3 + 3x^2 + 2$.

x	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5
y	-4.1	2	5.1	6	5.4	4	2.6	2	2.9	6	12.1

(a) Complete the table.

[3]

(b) On the grid, draw the graph of $y = x^3 + 3x^2 + 2$ for $-3.5 \leq x \leq 1.5$.



[4]

(c) Use your graph to solve the equation $x^3 + 3x^2 + 2 = 0$ for $-3.5 \leq x \leq 1.5$.

$x = -3.25$ [1]

(d) By drawing a suitable straight line, solve the equation $x^3 + 3x^2 + 2x + 2 = 0$ for $-3.5 \leq x \leq 1.5$.

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

same as graph $\rightarrow x^3 + 3x^2 + 2 = -2x \leftarrow \text{plot } y = -2x \quad x = -2.4$ [2]

(e) For $-3.5 \leq x \leq 1.5$, the equation $x^3 + 3x^2 + 2 = k$ has three solutions and k is an integer.

Write down a possible value of k .

$k = 4$ [1]
(or 3 or 5)

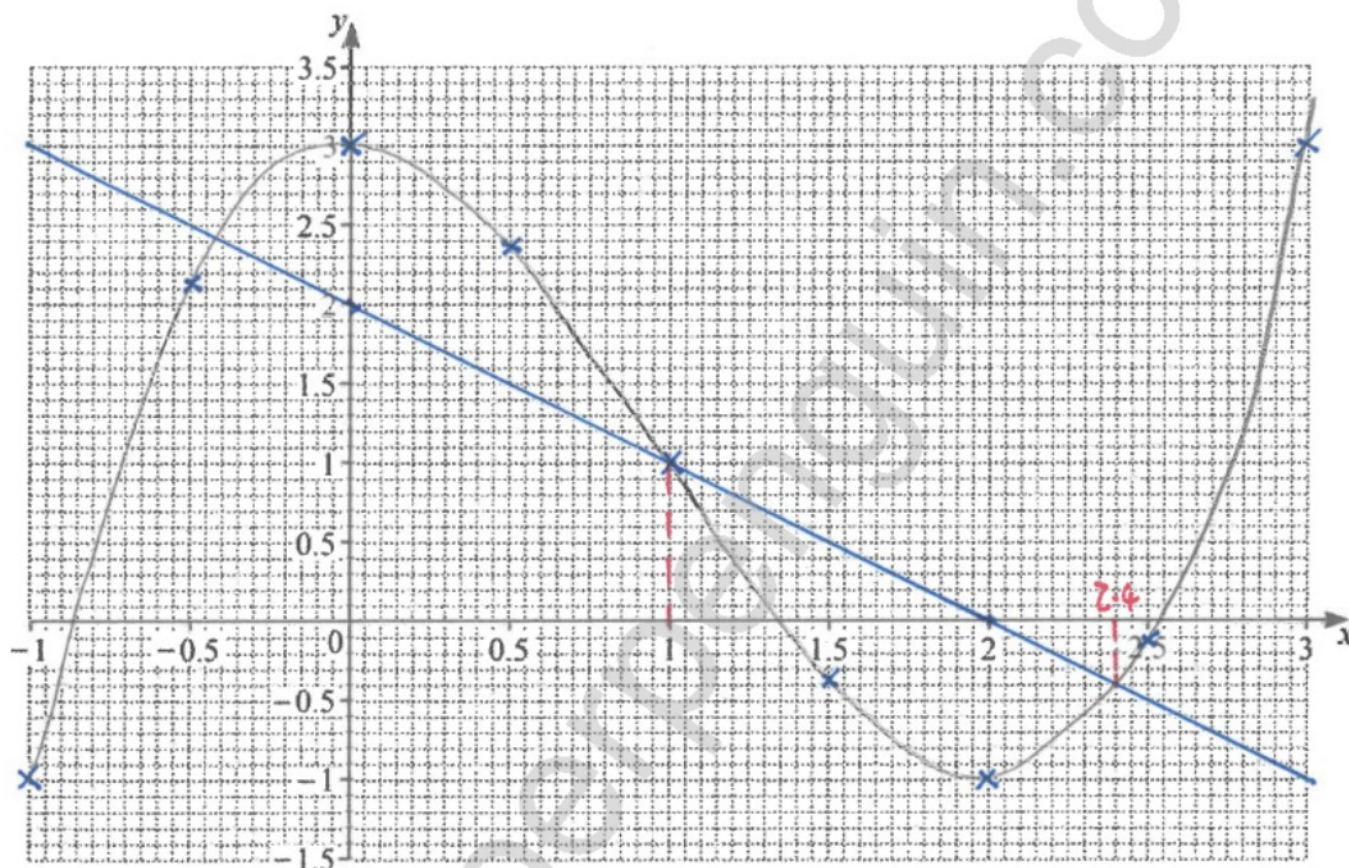
- 5 The table shows some values for $y = x^3 - 3x^2 + 3$.

x	-1	-0.5	0	0.5	1	1.5	2	2.5	3
y	-1	2.125	3	2.375	1	-0.375	-1	-0.125	3

(a) Complete the table.

[3]

(b) On the grid, draw the graph of $y = x^3 - 3x^2 + 3$ for $-1 \leq x \leq 3$.



[4]

(c) By drawing a suitable straight line on the grid, solve the equation $x^3 - 3x^2 + x + 1 = 0$.

$$x^3 - 3x^2 + x + 1 = 0$$

$$\underline{x=1} \text{ or } \underline{x=2.4}$$

$$x^3 - 3x^2 + 1 = -x$$

$$x^3 - 3x^2 + 3 = -x + 2$$

$$x^3 - 3x^2 + 3 = -x + 2$$

↑
same as
graph

↑
plot $y = -x + 2$

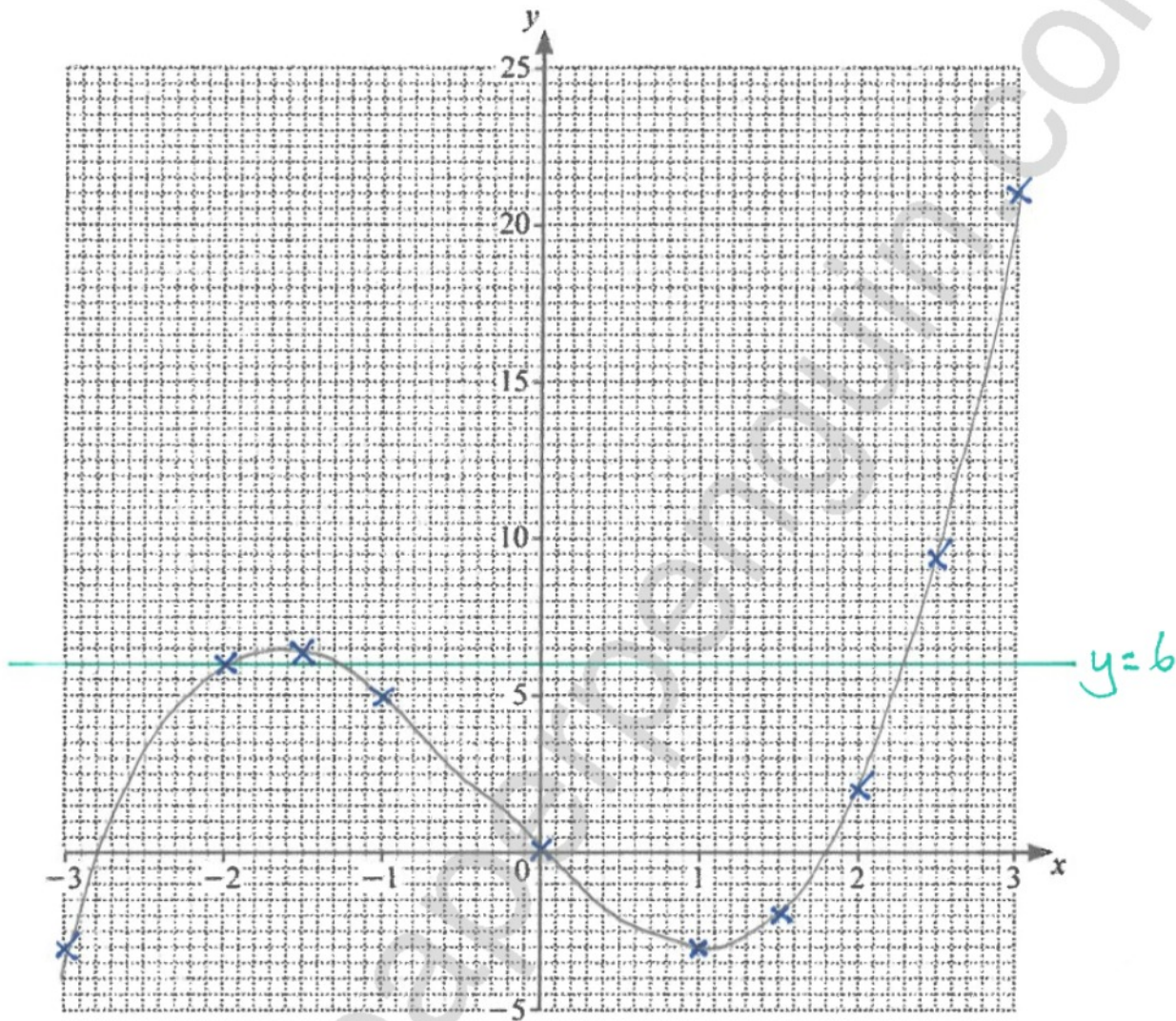
- 3 The table shows some values for $y = x^3 + x^2 - 5x$.

x	-3	-2	-1.5	-1	0	1	1.5	2	2.5	3
y	-3	6	6.4	5	0	-3	-1.9	2	9.4	21

(a) Complete the table.

[3]

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



[4]

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

$$x = -2.8 \text{ or } x = 0 \text{ or } x = 1.8 \quad [2]$$

(e) Write down the largest value of the integer k , so that the equation $x^3 + x^2 - 5x = k$ has three solutions for $-3 \leq x \leq 3$.

See line on graph $y=6$. Anywhere above this, the line would cross in fewer than 3 places.

$$k = 6 \quad [1]$$

$$y = x^2 + \frac{1}{x}, \quad x \neq 0$$

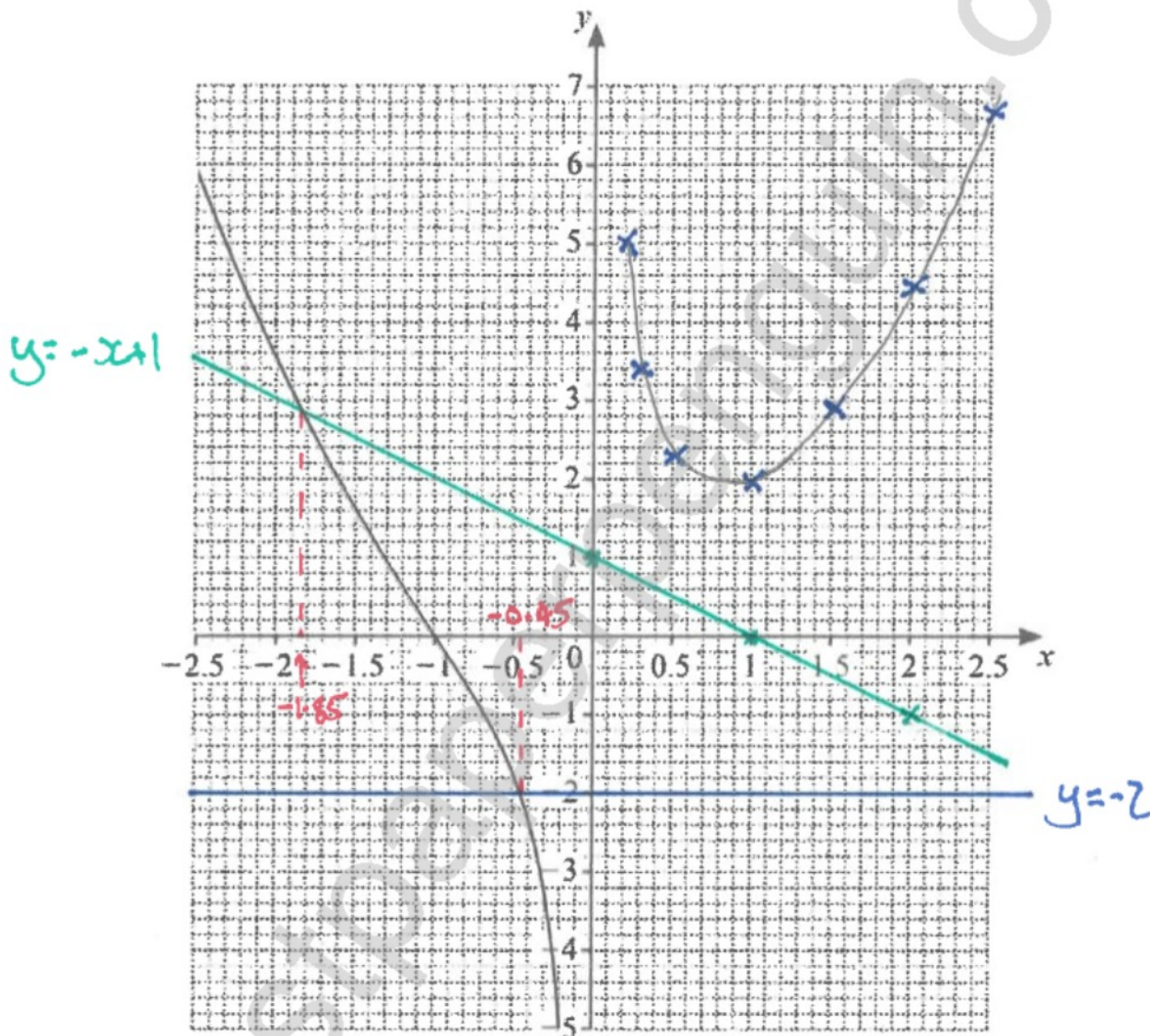
(a) Complete the table.

x	0.2	0.3	0.5	1	1.5	2	2.5
y	5.0	3.4	2.3	2	2.9	4.5	6.7

[2]

(b) On the grid, draw the graph of $y = x^2 + \frac{1}{x}$ for $0.2 \leq x \leq 2.5$.

The graph of $y = x^2 + \frac{1}{x}$ for $-2.5 \leq x \leq -0.2$ has been drawn for you.



[4]

(c) By drawing suitable straight lines on the grid, solve the following equations.

(i) $x^2 + \frac{1}{x} = -2$

plot $y = -2$

$x = -0.45$ [1]

(ii) $x^2 + \frac{1}{x} + x - 1 = 0$

$x^2 + \frac{1}{x} + x - 1 = 0$

$x^2 + \frac{1}{x} - 1 = -x$

plot $y = -x + 1$

same as graph

$x^2 + \frac{1}{x} = -x + 1$

$x = -1.65$ [2]

(d) k is an integer and the equation $x^2 + \frac{1}{x} = k$ has three solutions.

Write down a possible value of k .

$k = 3$ [1]

(or 4, 5, 6, ...)

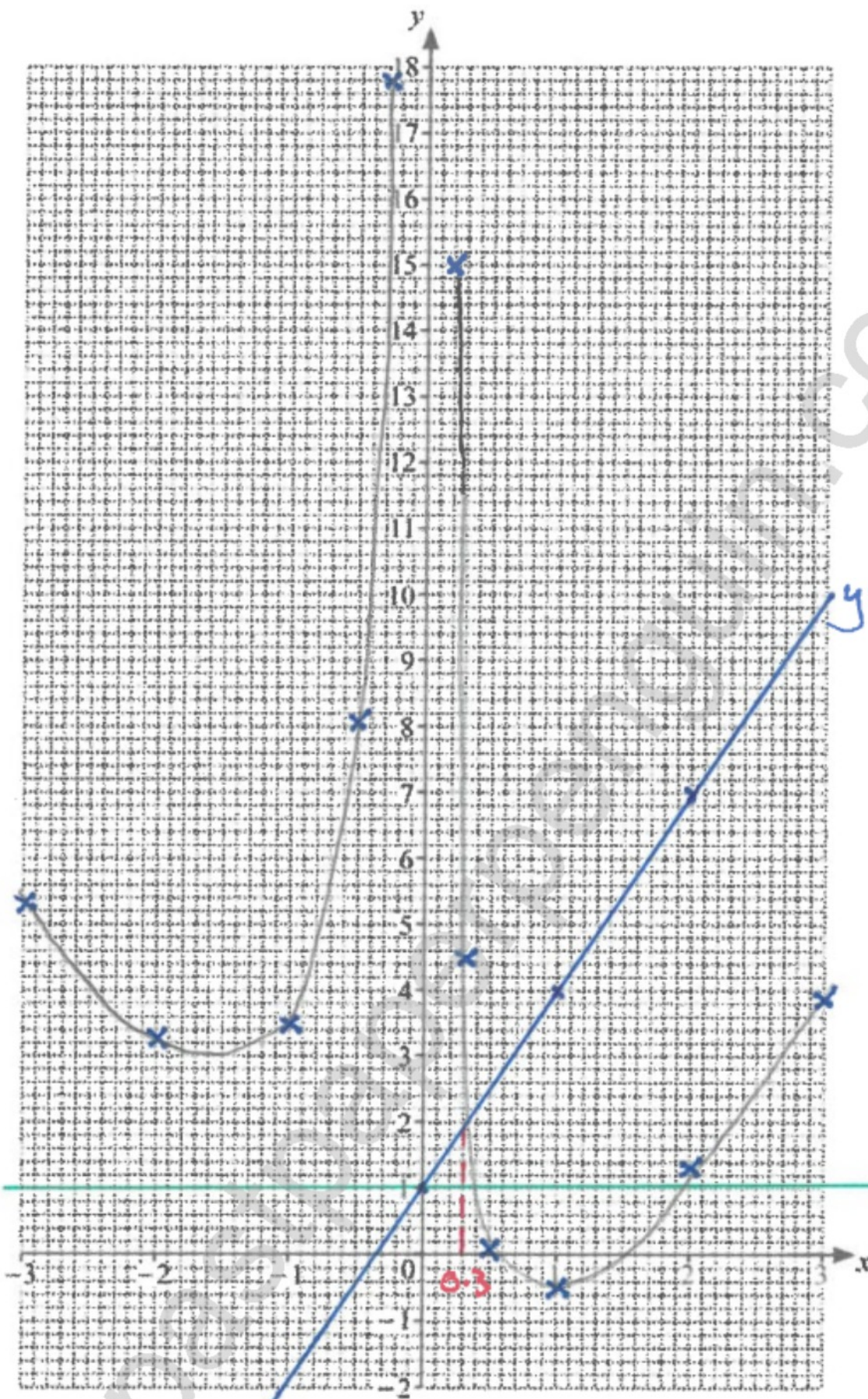
5 The table shows some values of $y = \frac{x^2}{2} + \frac{1}{x^2} - \frac{2}{x}$, $x \neq 0$.

x	-3	-2	-1	-0.5	-0.3		0.2	0.3	0.5	1	2	3
y	5.3	3.3	3.5	8.1	17.8		15.0	4.5	0.1	-0.5	1.3	3.9

(a) Complete the table.

[3]

(b) On the grid, draw the graph of $y = \frac{x^2}{2} + \frac{1}{x^2} - \frac{2}{x}$ for $-3 \leq x \leq -0.3$ and $0.2 \leq x \leq 3$.



- (d) Find the smallest positive integer value of k for which $\frac{x^2}{2} + \frac{1}{x^2} - \frac{2}{x} = k$ has two solutions for $-3 \leq x \leq -0.3$ and $0.2 \leq x \leq 3$.

See $y=1$ on graph - crosses in two

places, so $k=1$ (note: 0 is neither positive nor negative) [1]

- (e) (i) By drawing a suitable straight line, solve $\frac{x^2}{2} + \frac{1}{x^2} - \frac{2}{x} = 3x+1$ for $-3 \leq x \leq -0.3$ and $0.2 \leq x \leq 3$.

same as graph

plot $y=3x+1$

$x = 0.3$ [3]