

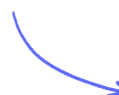
Non-Calculator Questions

Further Graphs & Tangents

Types of Graphs / Drawing Graphs from Tables / Solving Equations from Graphs / Finding Gradients of Tangents

Medium (7 questions)	/24
Hard (5 questions)	/59
Very Hard (3 questions)	/44
Total Marks	/127

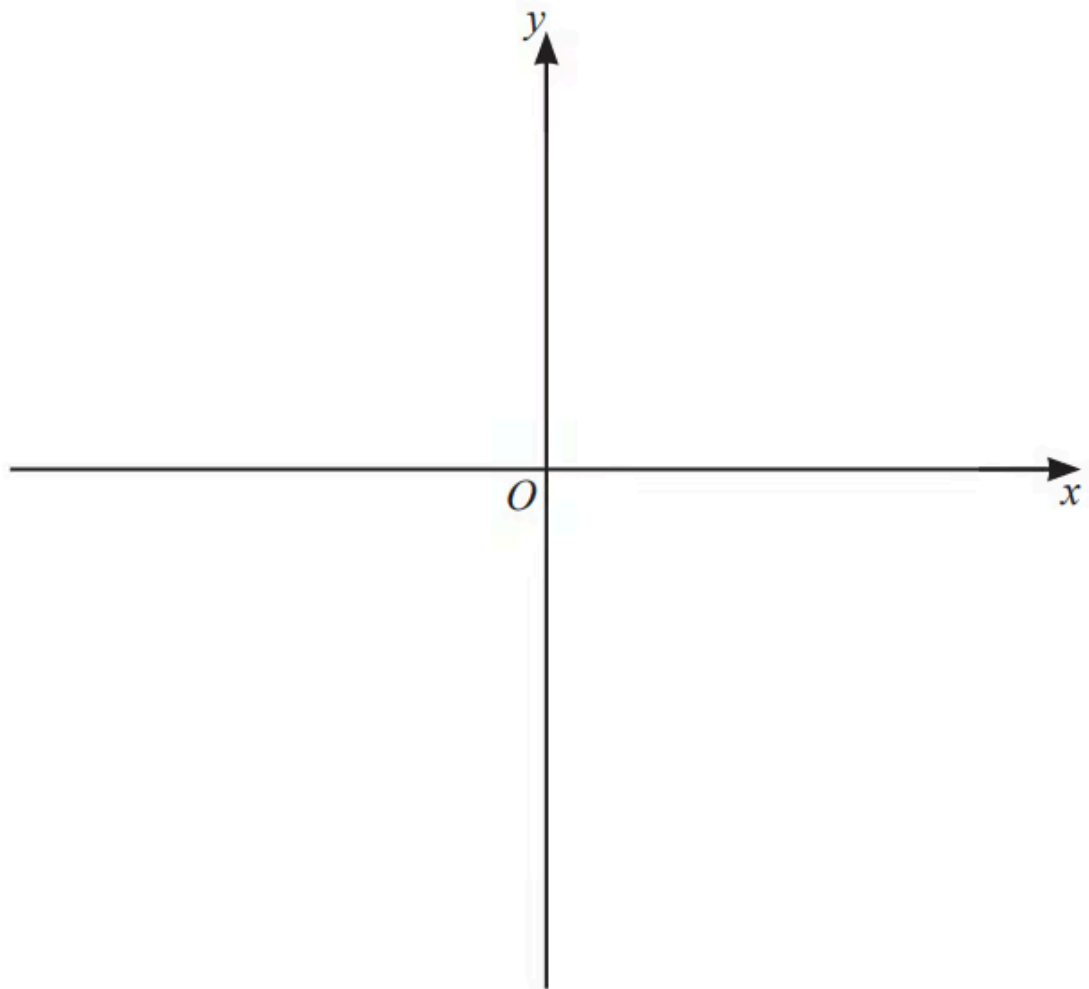
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Medium Questions

- 1 On the diagram, sketch the graph of $y = (x + 1)(x - 3)^2$.

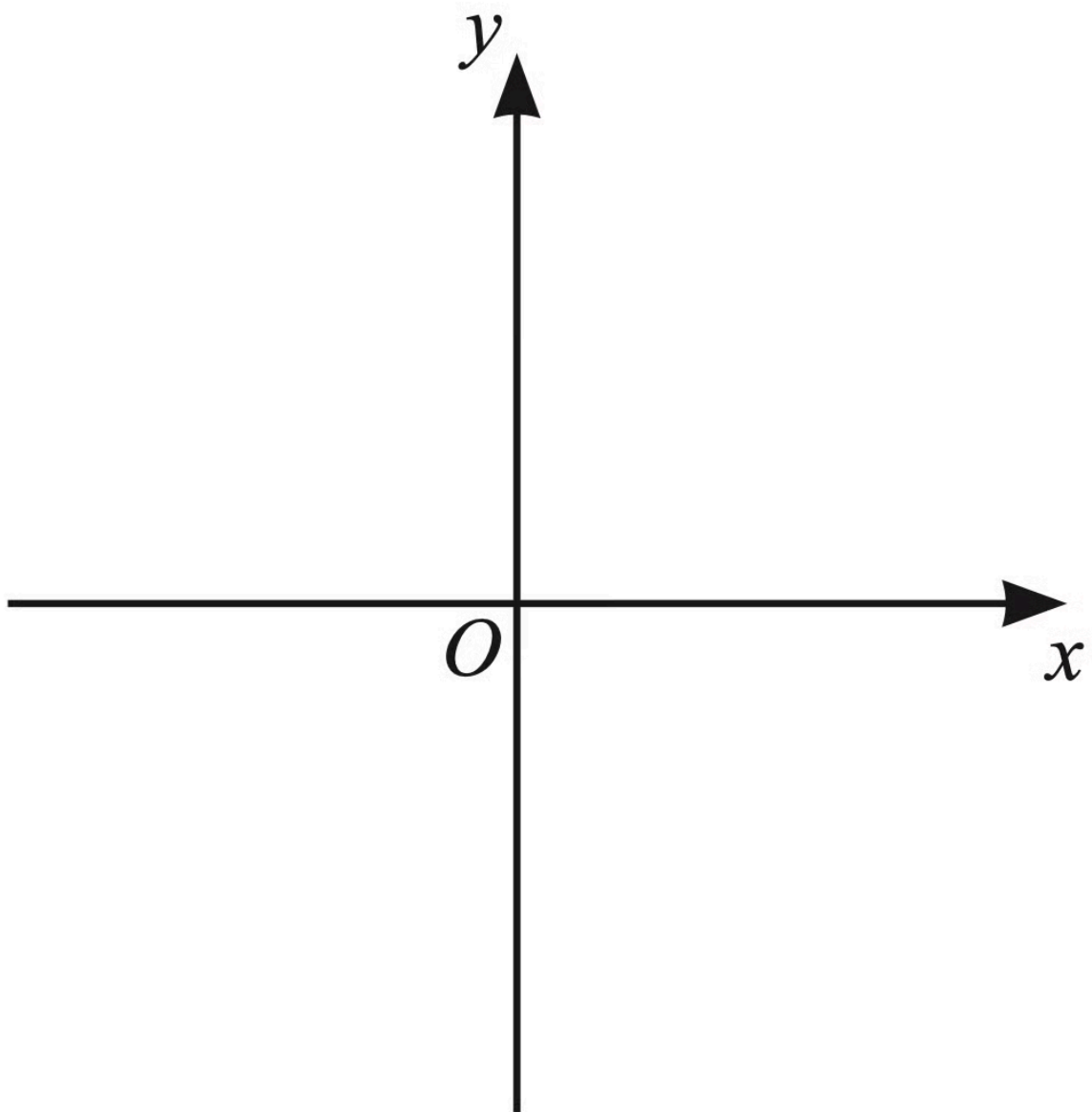
Label the values where the graph meets the x -axis and the y -axis.



(4 marks)

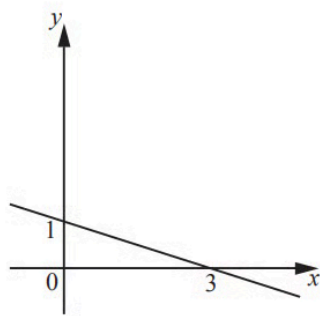
- 2 Sketch the graph of the function.

$$y = \frac{1}{x}$$

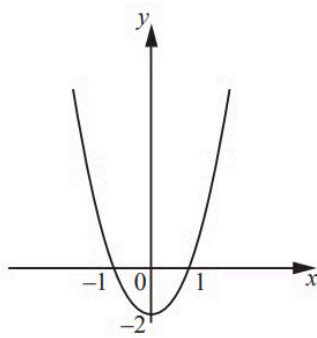


(2 marks)

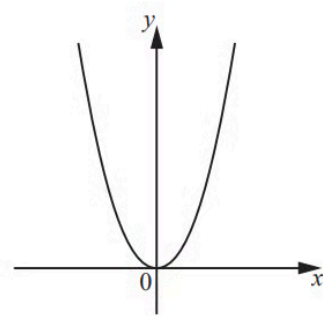
3 The diagrams A, B, C, D, E and F are six graphs of different functions.



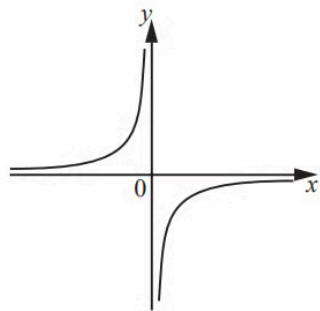
A



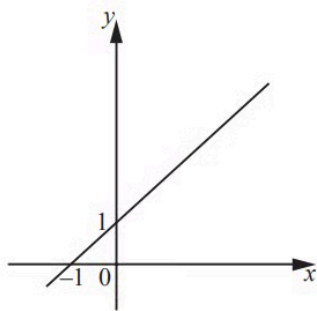
B



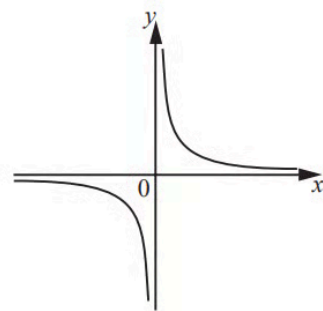
C



D



E



F

Complete the table to identify the correct graph for each function. One has been done for you.

Function	$y = x + 1$	$y = 1 - \frac{x}{3}$	$y = 2x^2$	$y = -\frac{4}{x}$
Diagram	E			

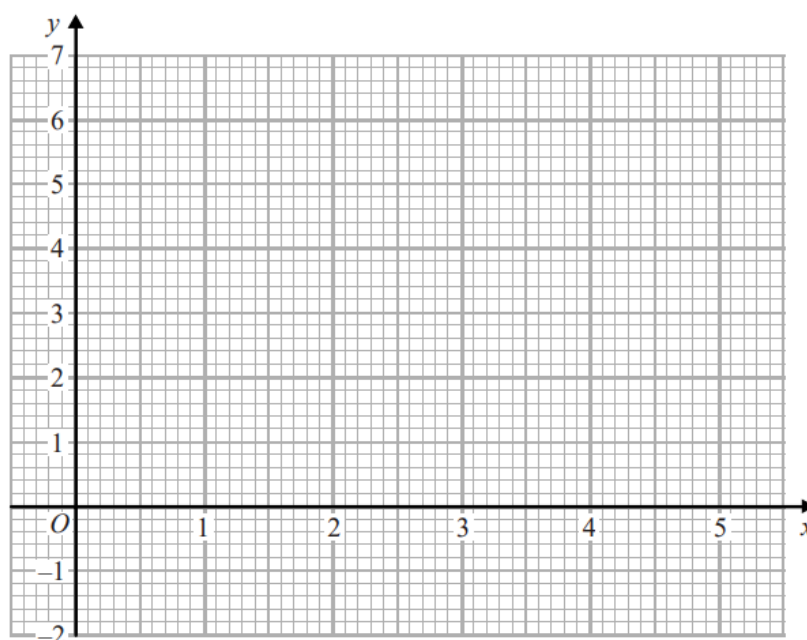
(3 marks)

4 (a) Complete the table of values for $y = x^2 - 5x + 6$

x	0	1	2	3	4	5
y	6		0	0	2	

(1 mark)

(b) On the grid, draw the graph of $y = x^2 - 5x + 6$ for $0 \leq x \leq 5$



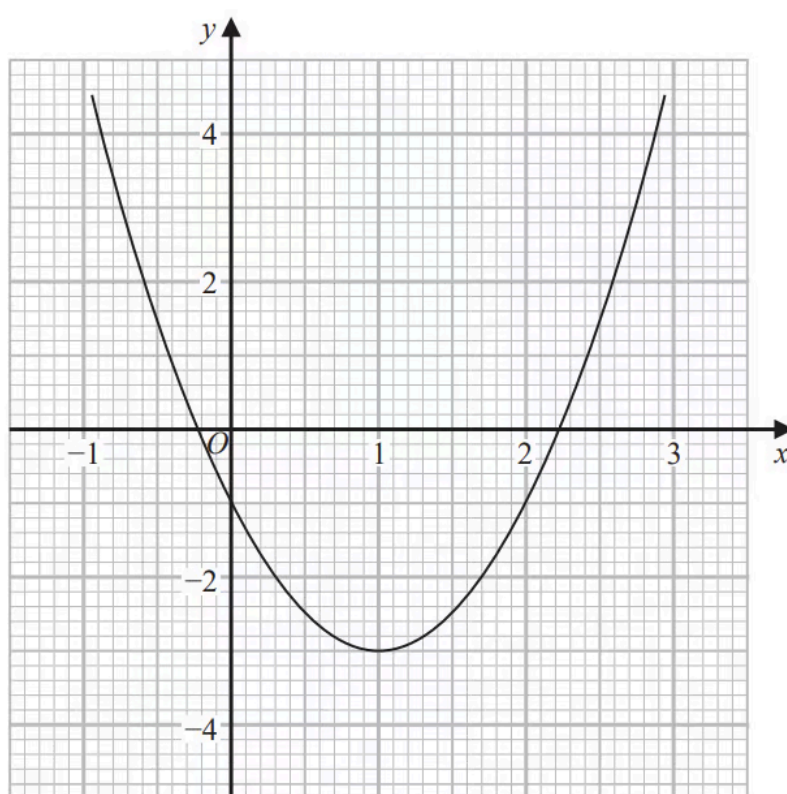
(2 marks)

(c) By drawing a suitable straight line on the grid, find estimates for the solutions of the equation

$$x^2 - 5x = x - 7$$

(3 marks)

5 (a) Part of the graph of $y = 2x^2 - 4x - 1$ is shown on the grid.



Use the graph to find estimates for the solutions of the equation $2x^2 - 4x - 1 = 0$

Give your solutions correct to one decimal place.

(2 marks)

(b) By drawing a suitable straight line on the grid, find estimates for the solutions of the equation $x^2 - x - 1 = 0$

Show your working clearly.

Give your solutions correct to one decimal place.

(3 marks)

6 The curve $y = x^2 - 2x + 1$ is drawn on a grid.

A line is drawn on the same grid.

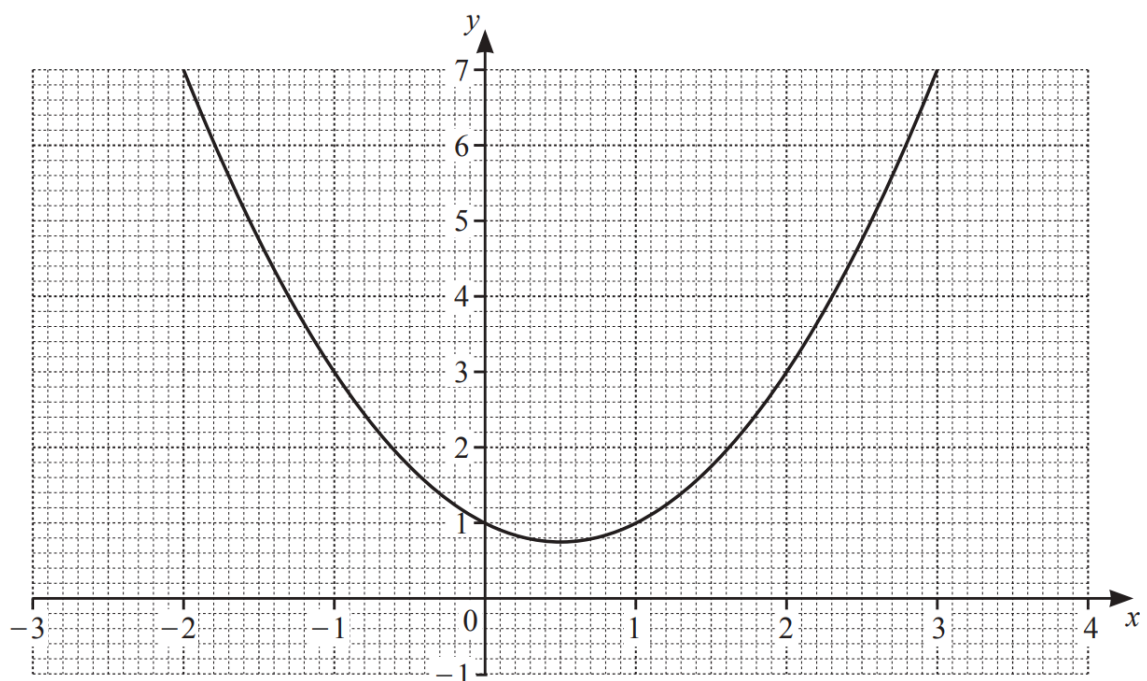
The points of intersection of the line and the curve are used to solve the equation $x^2 - 7x + 5 = 0$.

Find the equation of the line in the form $y = mx + c$.

$y = \dots\dots\dots$

(1 mark)

7 The graph of $y = x^2 - x + 1$ is shown on the grid.



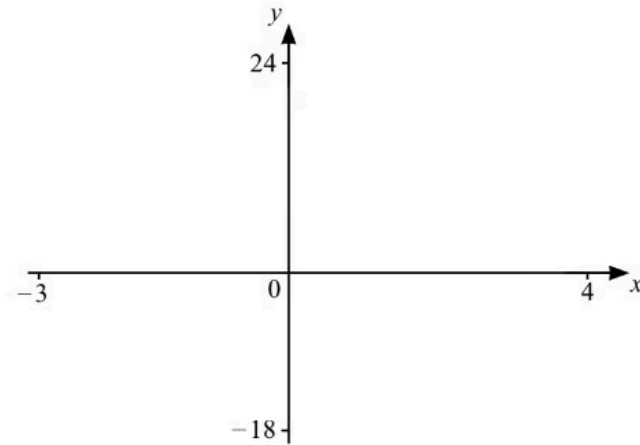
By drawing a suitable line on the grid, solve the equation $x^2 - 2x - 2 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$

(3 marks)

Hard Questions

1 (a)



$$f(x) = x(x + 2)(x - 3)$$

On the diagram, sketch the graph of $y = f(x)$ for $-3 \leq x \leq 4$
Show the values of the intersections with the axes.

(3 marks)

(b) Expand and simplify.

$$x(x + 2)(x - 3)$$

(3 marks)

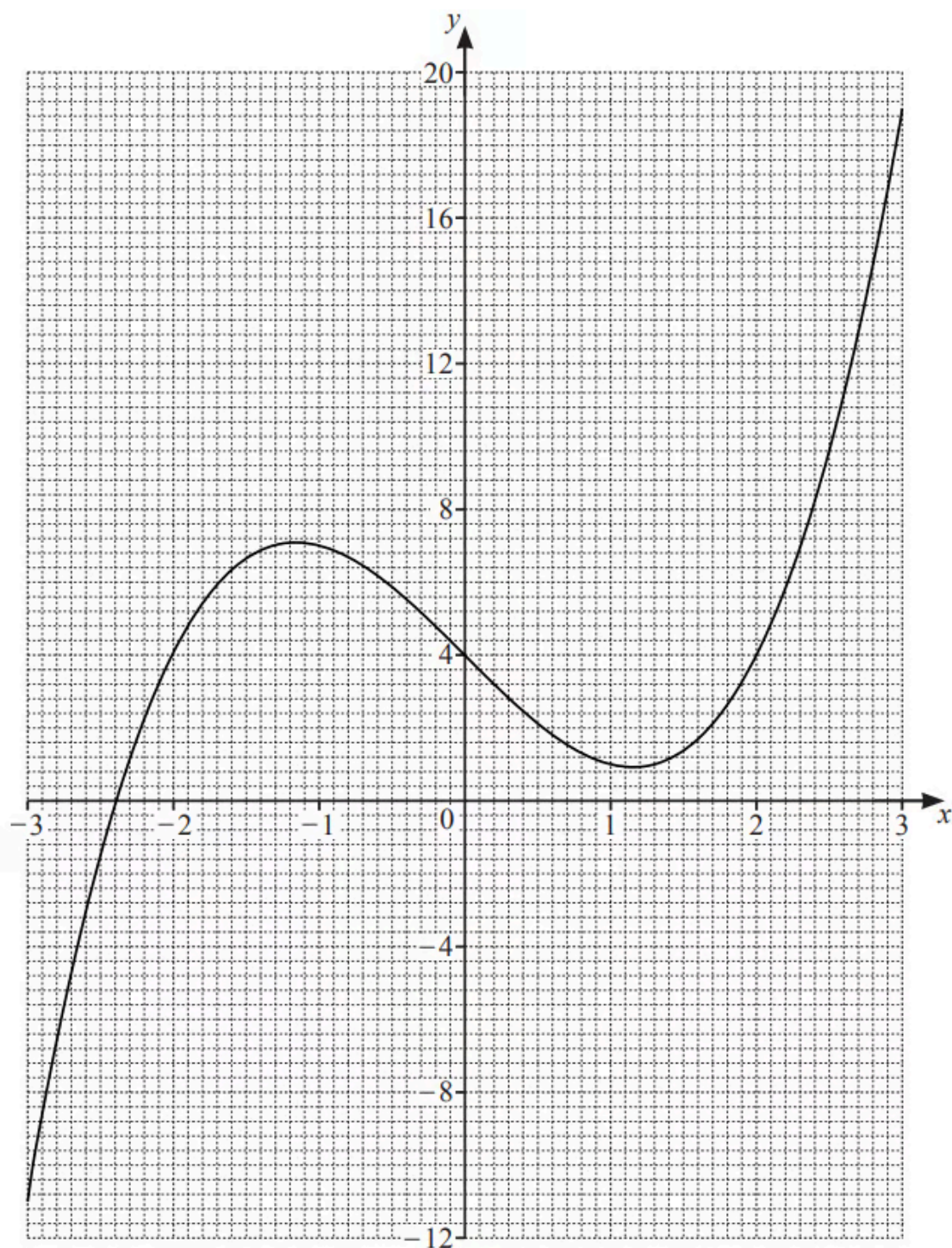
(c) A is the point $(1, -6)$.

The tangent to the graph of $y = f(x)$ at A meets the y -axis at B .

Find the coordinates of B .

(5 marks)

2 (a) The diagram shows the graph of $y = f(x)$ for $-3 \leq x \leq 3$.



i) Solve $f(x) = 14$.

$x = \dots\dots\dots$ [1]

ii) By drawing a suitable tangent, find an estimate of the gradient of the graph at the point $(-2, 4)$.

[3]

(4 marks)

(b) By drawing a suitable straight line on the grid, solve $f(x) = 2x - 2$ for $-3 \leq x \leq 3$.

$x =$

(3 marks)

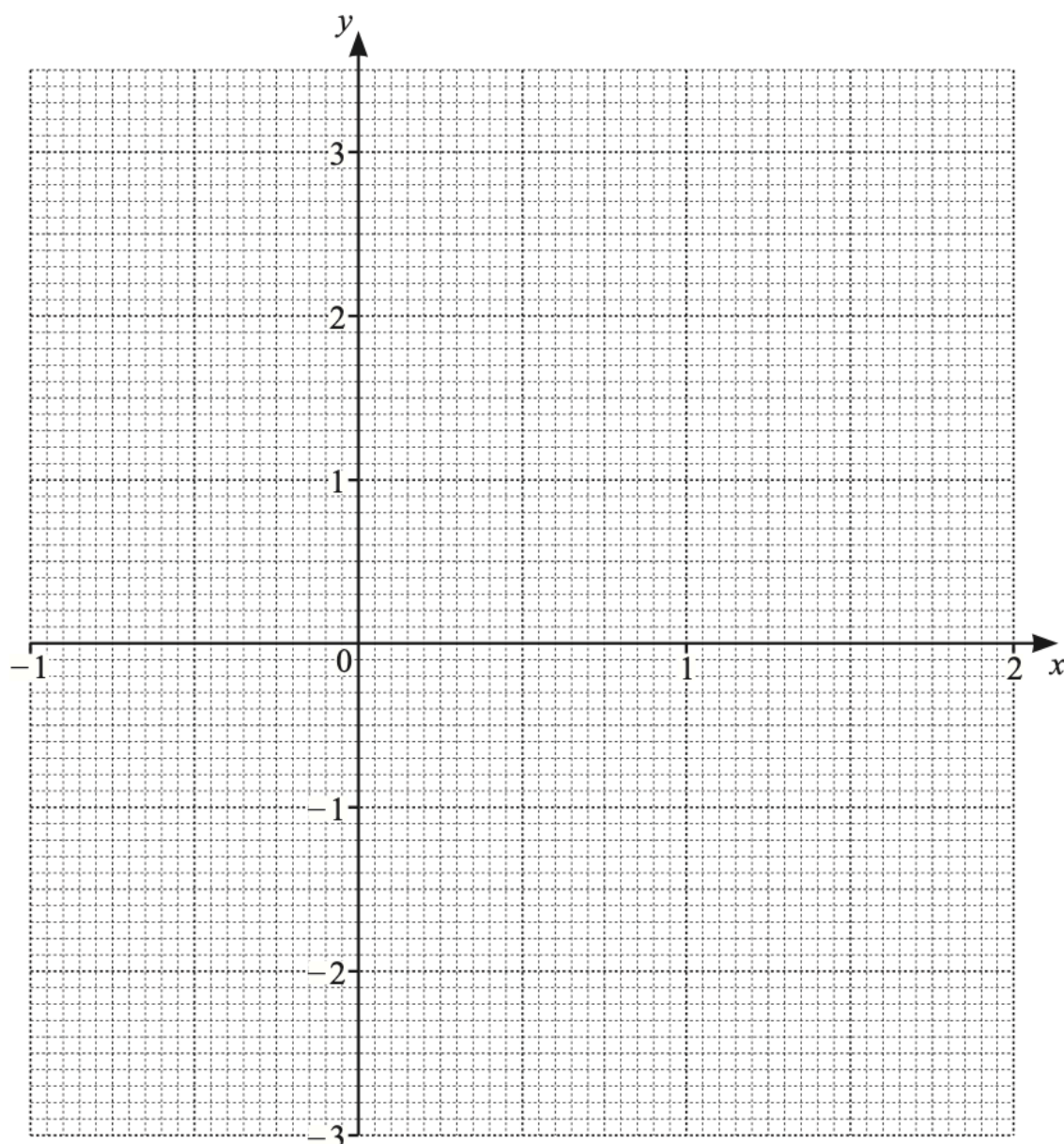
3 (a) The table shows some values for $y = 2x^3 - 4x^2 + 3$.

x	-1	-0.5	0	0.5	1	1.5	2
y	-3	1.75				0.75	3

Complete the table.

(3 marks)

(b) Draw the graph of $y = 2x^3 - 4x^2 + 3$ for $-1 \leq x \leq 2$.



(4 marks)

(c) i) Use your graph to solve the equation $2x^3 - 4x^2 + 3 = 1.5$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

ii) The equation $2x^3 - 4x^2 + 3 = k$ has only one solution for $-1 \leq x \leq 2$.

Write down a possible integer value of k .

[1]

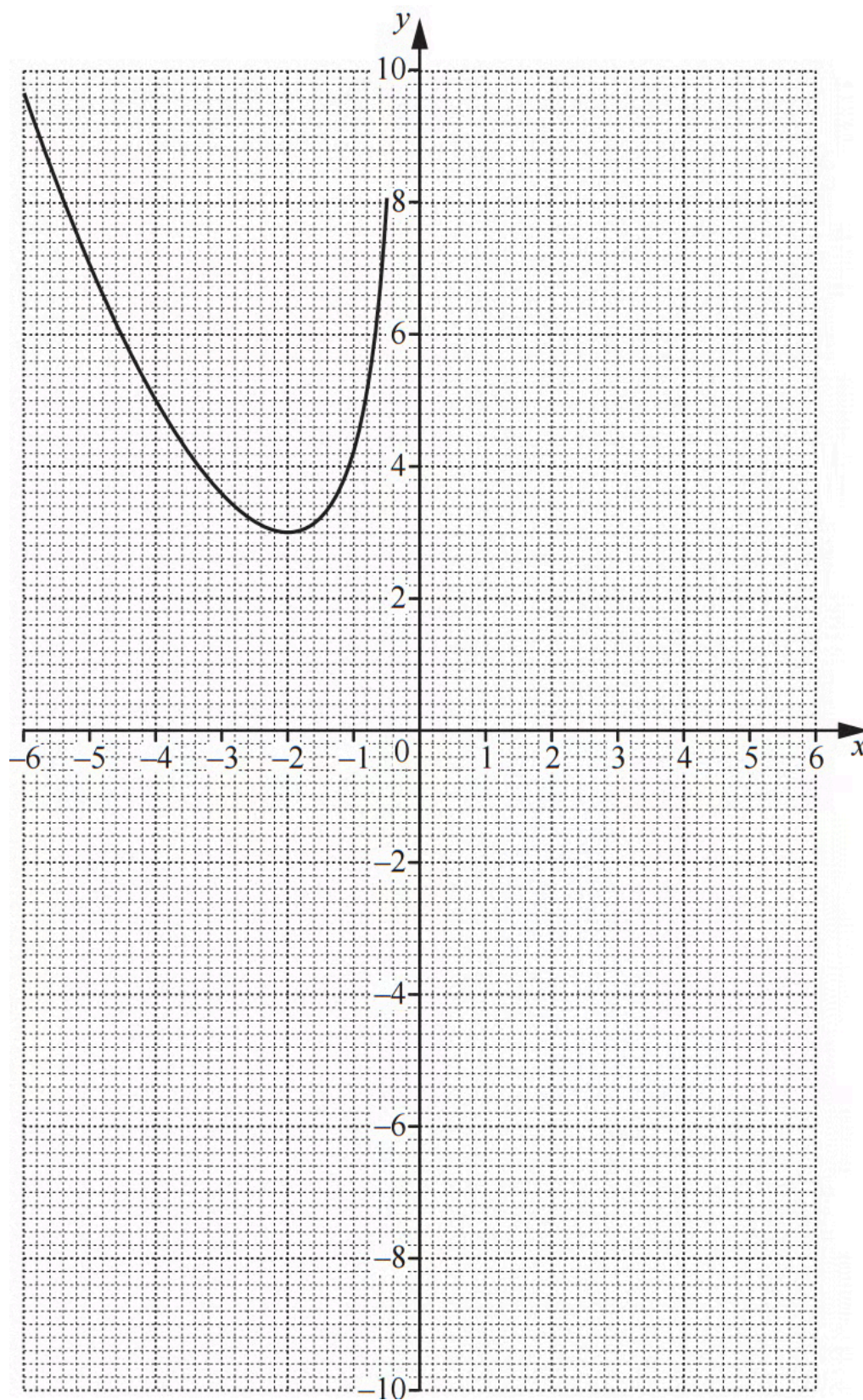
(4 marks)

4 (a) $f(x) = \frac{x^2}{4} - \frac{4}{x}, x \neq 0$ Complete the table for $f(x)$.

x	0.5	1	2	3	4	5	6
$f(x)$	-7.9	-3.8		0.9		5.5	8.3

(2 marks)

(b) The graph of $y = f(x)$ for $-6 \leq x \leq -0.5$ is drawn on the grid.



On the same grid, draw the graph of $y = f(x)$ for $0.5 \leq x \leq 6$.

(3 marks)

(c) By drawing a suitable tangent, estimate the gradient of the graph of $y = f(x)$ at the point $(-4, 5)$.

(3 marks)

(d) $g(x) = \frac{9}{x}, x \neq 0$ Complete the table for $g(x)$.

x	-4	-3	-2	-1		1	2	3	4
$g(x)$	-2.3		-4.5	-9		9	4.5		2.3

(1 mark)

(e) On the same grid, draw the graph of $y = g(x)$ for $-4 \leq x \leq -1$ and $1 \leq x \leq 4$.

(4 marks)

(f) i) Use your graphs to find the value of x when $f(x) = g(x)$.

$x = \dots\dots\dots$ [1]

ii) Write down an inequality to show the **positive** values of x for which $f(x) > g(x)$.

[1]

(2 marks)

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

Complete the table

x	0	1	2	3	4
y		2	4	8	

[2]

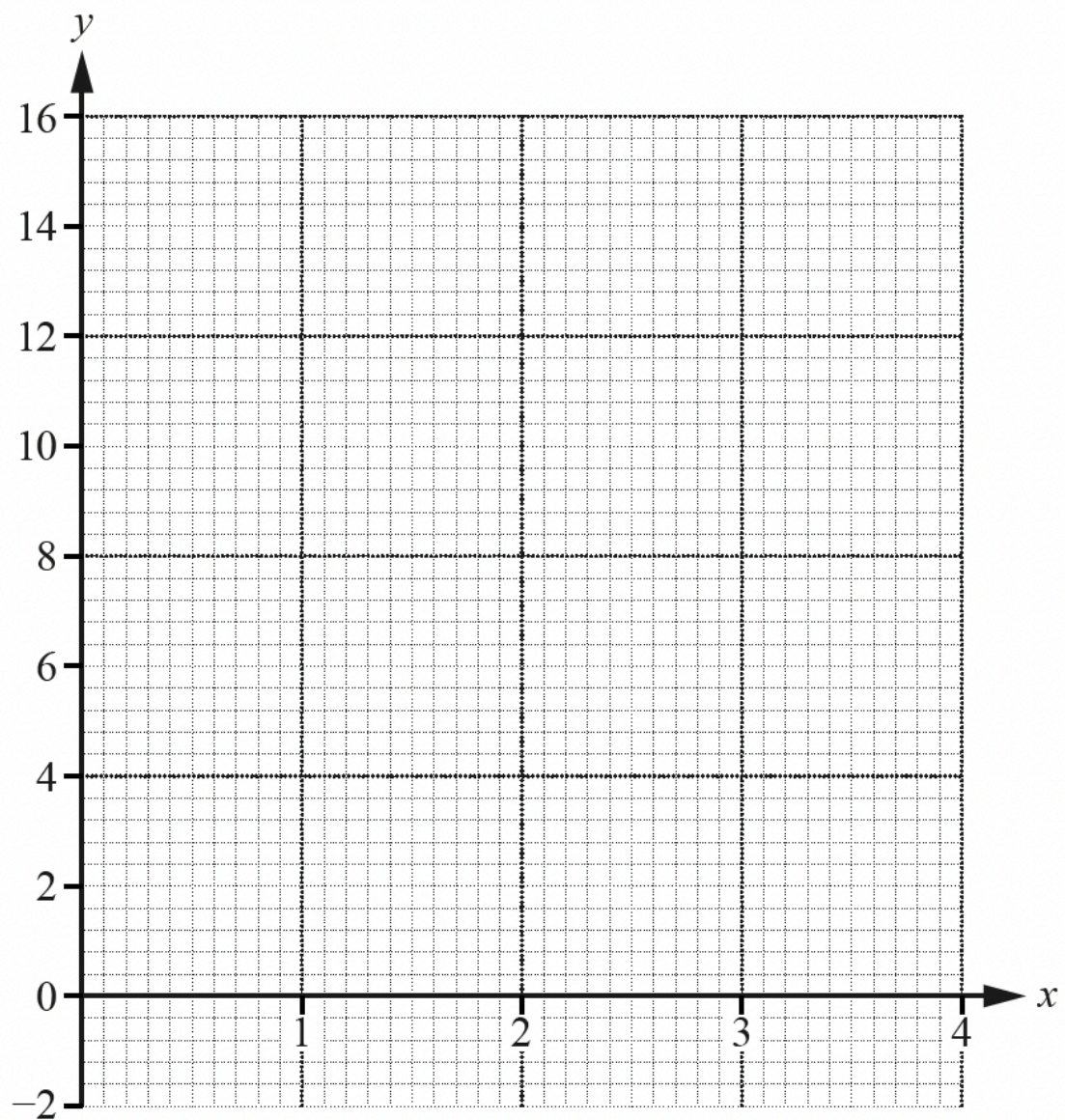
ii) $y = 14 - x^2$ Complete the table

x	0	1	2	3	4
y		13	10	5	

[2]

(4 marks)

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



(6 marks)

(c) Use your graphs to solve the equations.

i) $2^x = 12$

$x = \dots\dots\dots$ [1]

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

$x = \dots\dots\dots$ [1]

(2 marks)

- (d)** i) On the grid, draw the line from the point $(4, 2)$ that has a gradient of -4 .

[1]

- ii) Complete the statement.

This straight line is a $\dots\dots\dots$ to the graph of $y = 14 - x^2$ at the point $(\dots\dots, \dots\dots)$.

[2]

(3 marks)

Very Hard Questions

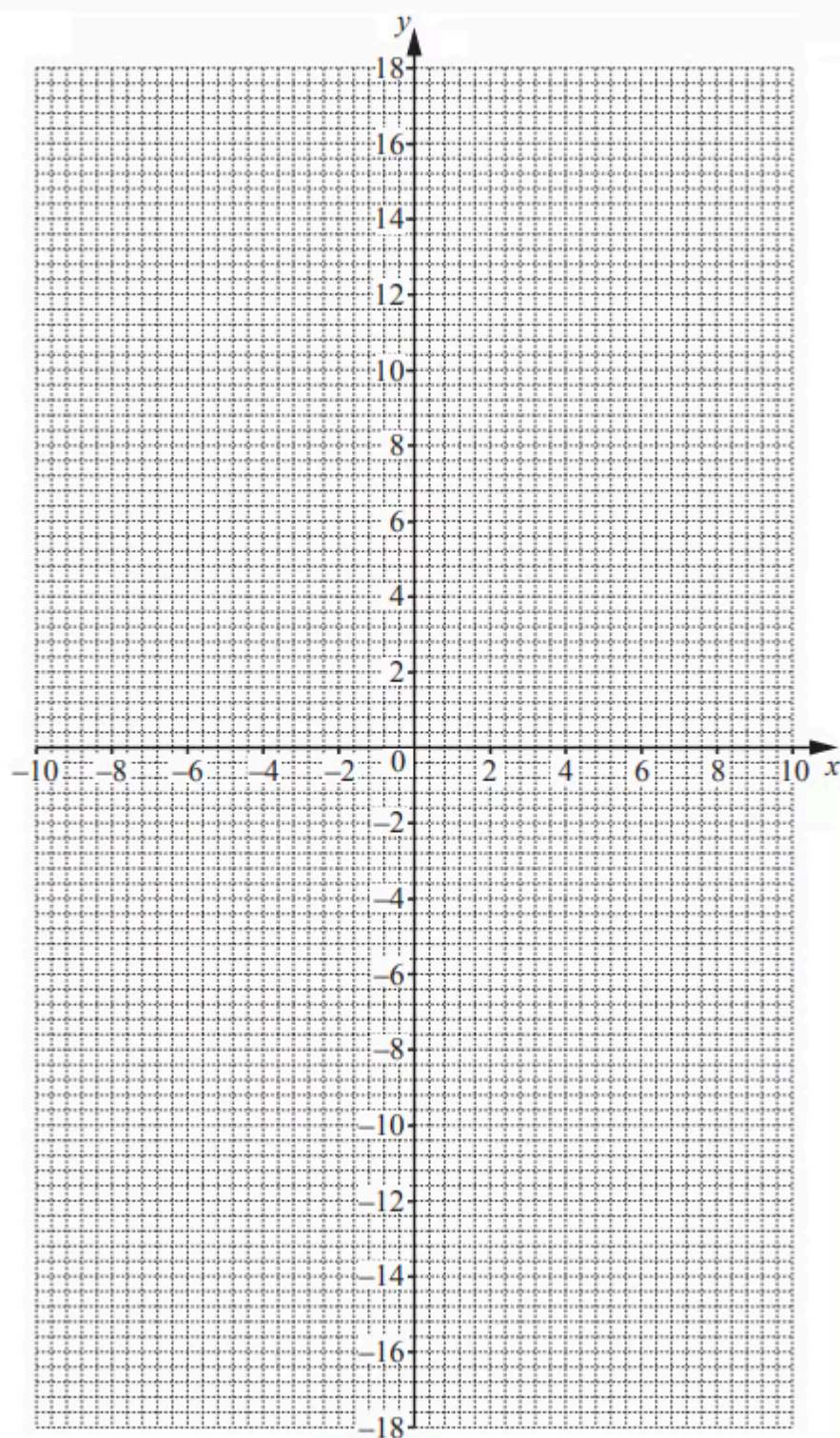
1 (a) $f(x) = \frac{20}{x} + x, \quad x \neq 0$

Complete the table.

x	-10	-8	-5	-2	-1.6		1.6	2	5	8	10
$f(x)$	-12	-10.5	-9	-12	-14.1		14.1	12			12

(2 marks)

(b) On the grid, draw the graph of $y = f(x)$ for $-10 \leq x \leq -1.6$ and $1.6 \leq x \leq 10$.



(5 marks)

(c) Using your graph, solve the equation $f(x) = 11$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$

(2 marks)

(d) k is a prime number and $f(x) = k$ has no solutions.

Find the possible values of k .

(2 marks)

(e) The gradient of the graph of $y = f(x)$ at the point $(2, 12)$ is -4 .

Write down the coordinates of the other point on the graph of $y = f(x)$ where the gradient is -4 .

($\dots\dots\dots$, $\dots\dots\dots$)

(1 mark)

(f) i) The equation $f(x) = x^2$ can be written as $x^3 + px^2 + q = 0$.

Show that $p = -1$ and $q = -20$.

[2]

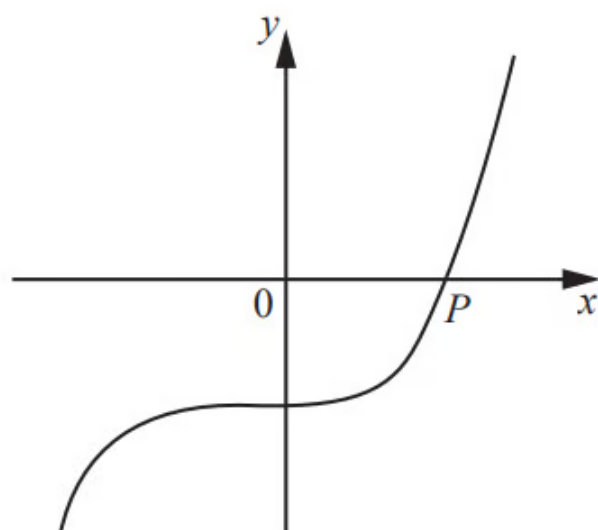
ii) On the grid, draw the graph of $y = x^2$ for $-4 \leq x \leq 4$.

[2]

iii) Using your graphs, solve the equation $x^3 - x^2 - 20 = 0$.

$x = \dots\dots\dots$ [1]

iv)



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The diagram shows a **sketch** of the graph of $y = x^3 - x^2 - 20$. P is the point $(n, 0)$.

Write down the value of n .

$n = \dots\dots\dots$ [1]

(6 marks)

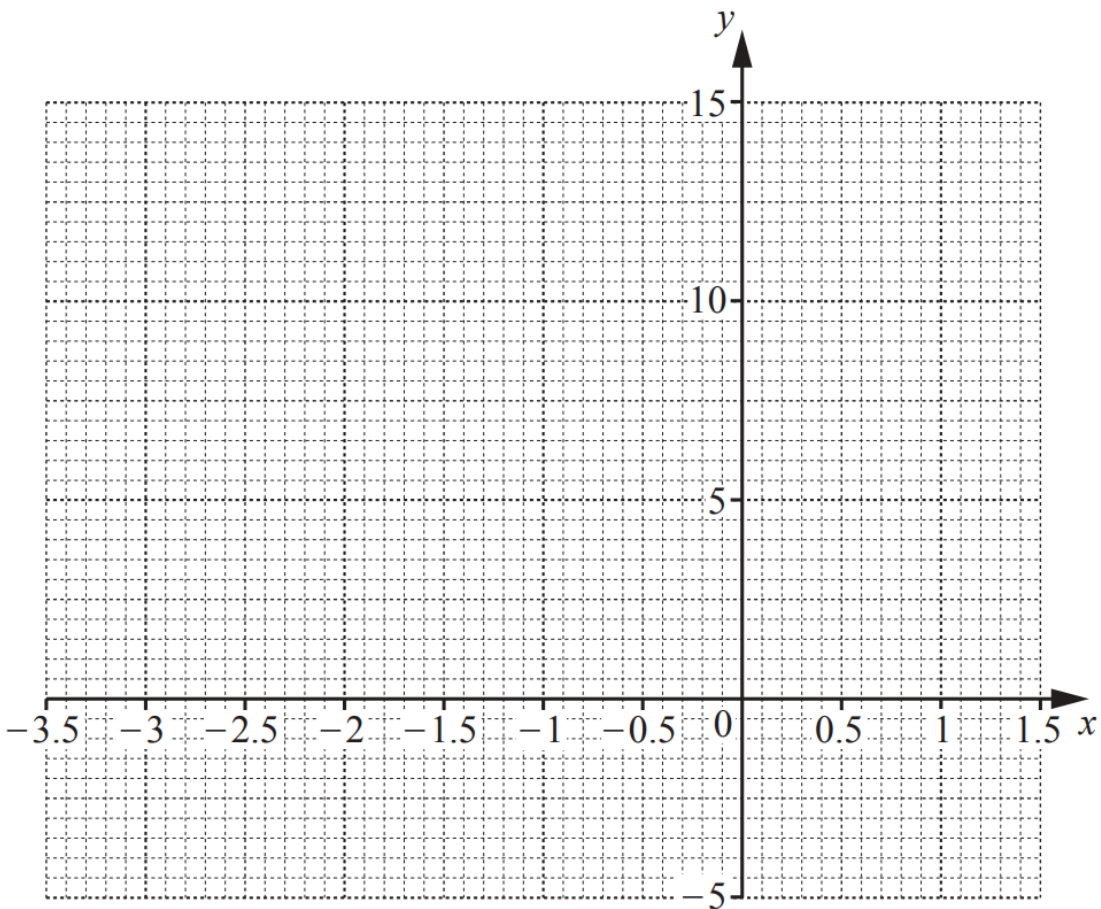
2 (a) The table shows some values for $y = x^3 + 3x^2 + 2$.

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

Complete the table.

(3 marks)

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



(4 marks)

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

$x = \dots\dots\dots$

(1 mark)

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

$x = \dots\dots\dots$

(2 marks)

- (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 .

$k = \dots\dots\dots$

(1 mark)

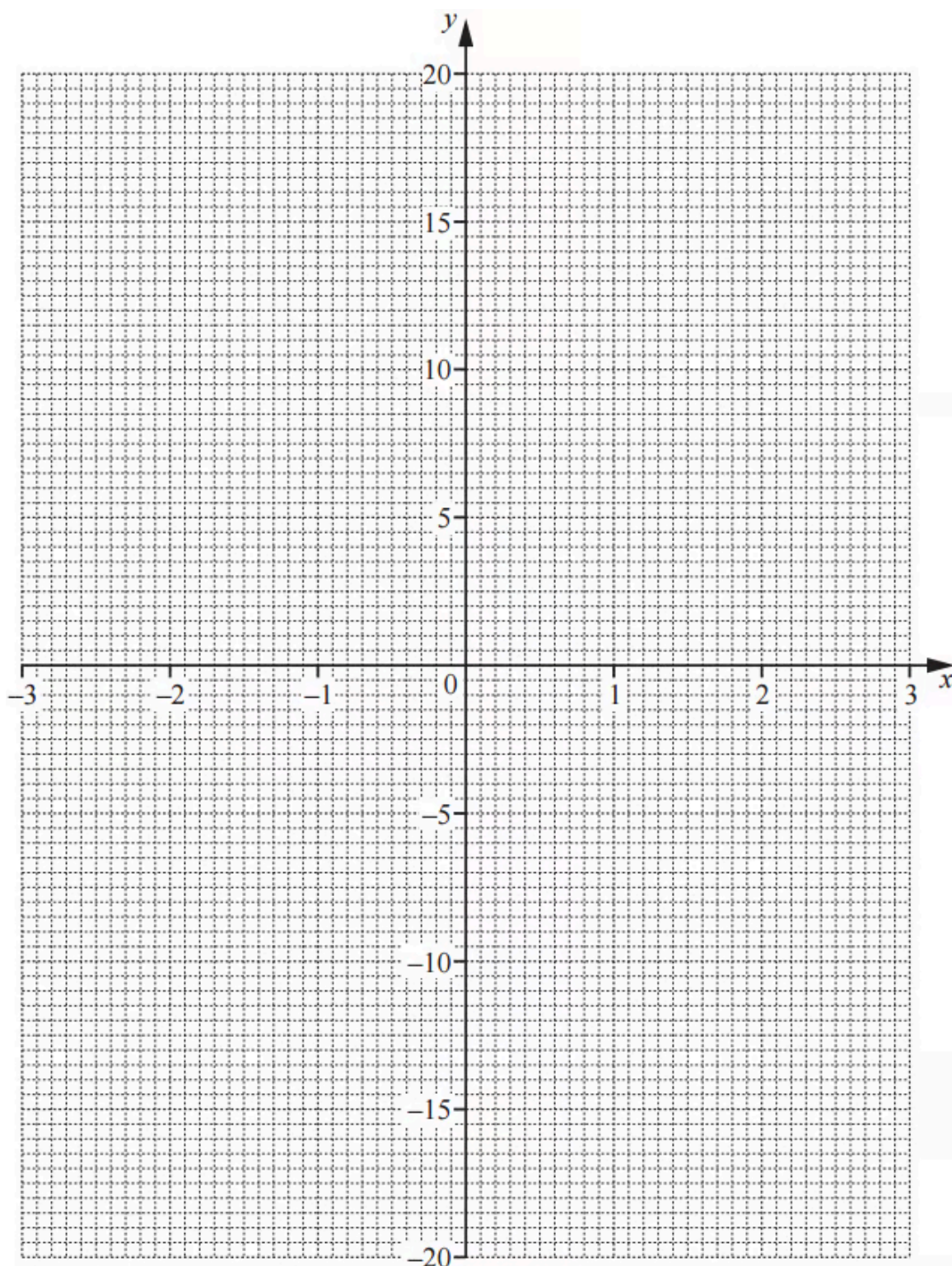
3 (a) The table shows some values of $y = x^3 - 3x - 1$.

x	-3	-2.5	-2	-1.5	-1	0	1	1.5	2	2.5	3
y	-19	-9.1		0.1	1	-1	-3	-2.1	1	7.1	

Complete the table of values.

(2 marks)

(b) Draw the graph of $y = x^3 - 3x - 1$ for $-3 \leq x \leq 3$.



(4 marks)

(c) A straight line through $(0, -17)$ is a tangent to the graph of $y = x^3 - 3x - 1$.

i) On the grid, draw this tangent.

[1]

ii) Find the co-ordinates of the point where the tangent meets your graph.

(.....,) [1]

iii) Find the equation of the tangent. Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

(5 marks)

(d) By drawing a suitable straight line on the grid, solve the equation $x^3 - 6x - 3 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$

(4 marks)