Question pack for Graphs, GCSE Exam

Included:

- 25 Normal Questions, in no particular order of difficulty.
- 10 Challenge Questions
- Exam Tips throughout
- All worked solutions are at the end of the booklet, highlighted in blue.

PLS Suggestion:

- We've included tonnes of questions to help you with your exams. It is completely up to you how you approach them, however, we would suggest doing 4-6 normal questions and one challenge question every time you revise this topic.
- Make a note of your mistakes and go back to the ones you got wrong at the end.
- Good Luck!

Important Information:

- All normal questions vary in difficulty form grade 3 up to grade 7. Challenge questions extend up to grade 9.

- Questions that are in red are non-calculator questions
  For example:

  Question One: Would be a non-calculator question
  Question One: Would be a calculator question

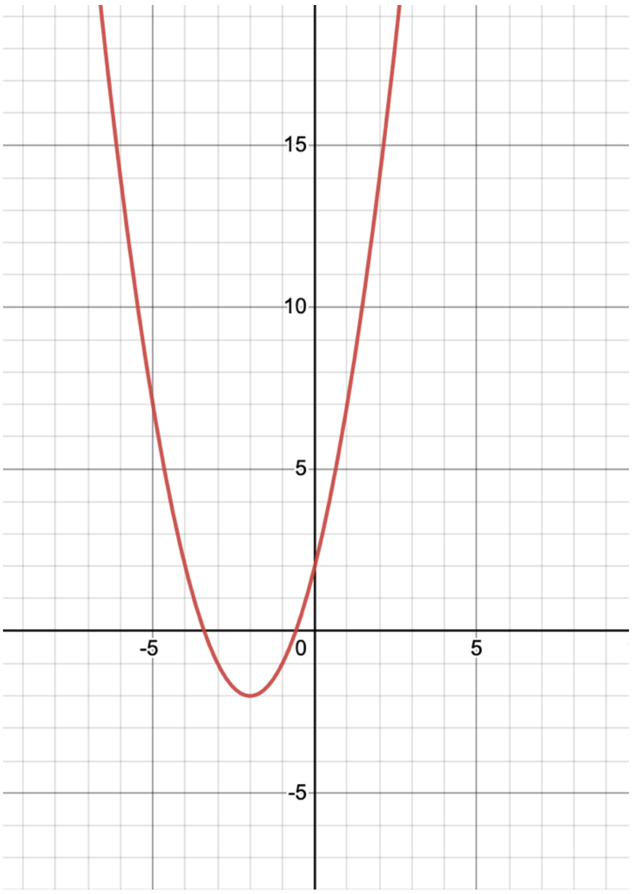
Graphs	*Question No.*
Distance-Time Graphs	17,
Gradients of Curves	8, 10, 15, 16, 22, 23, 24,
Harder Graphs	11, 16,
Quadratic Graphs	2, 5, 9, 13, 19, 20, 21, C4, C5, C8, C9, C10
Real-Life Graphs	4, 17, C2,
Solving Equations	3, 14, 20, 21, C5, C7,
Straight Lines Graphs	1, 8, 10, 15, 18, 22, 23, 24,
Transformations	25, C1, C7,
Trigonometry Graphs	7, 12, 25, C6,
Velocity-Time Graphs	6, C2, C3,

Normal Difficulty Questions

Question 1: A straight line L passes through the points A (1, 1) and B (7, 31). Find the equation of the line L.

Find the equation of the line parallel to L that passes through the point (2, 11).

Question 2: The graph below shows $y = x^2 + 4x + a$. Find a.



Question 3: For the function $y = x^3 - 4x^2 + 2$, complete the table:

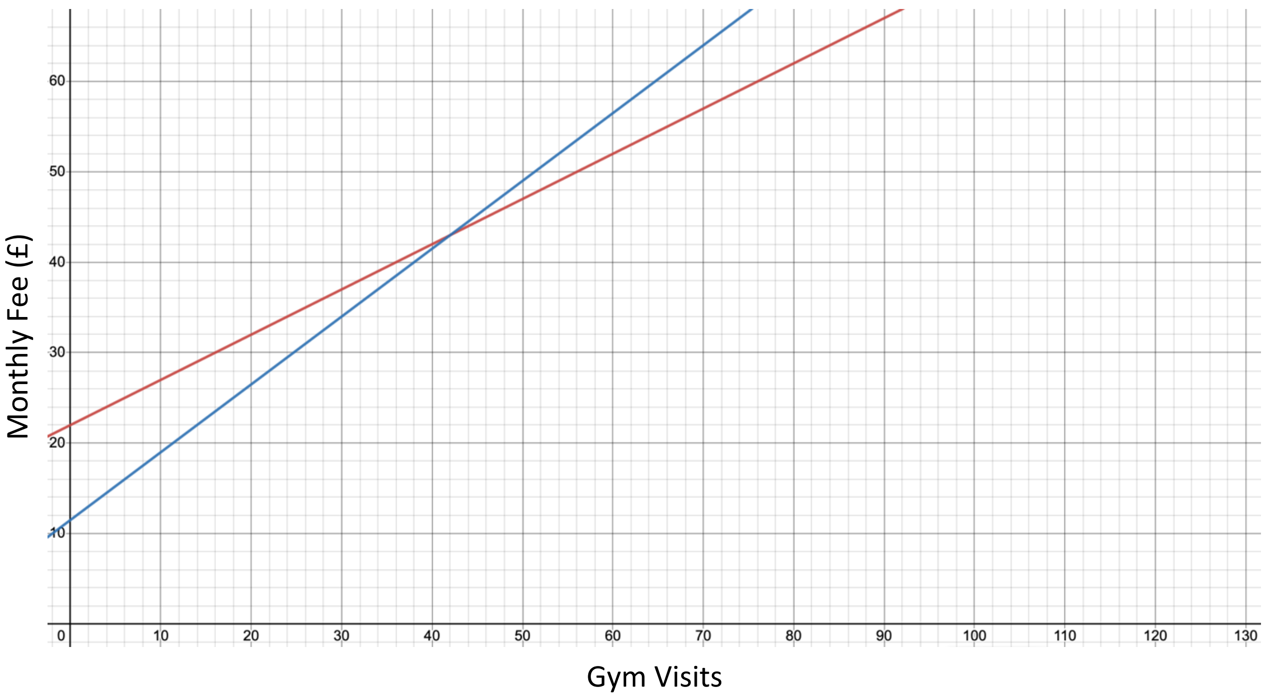
X	-2	-1	0	1	2	3	4	5	6
Y			2	-1					74

Question 4: Gym A offers a plan where members pay £22 a month, plus 50p every time they use the gym.

Gym B offers a plan where members pay £11.50 a month plus 75p every time they use the gym.

The graph below shows this information, Plan A is in red, Plan B in is blue. Use the graph to find the cost for using the gym 20 times / month for each plan.

Next, which plan would you advise Jordan to use, if he goes to the gym twice a day, every day in April.



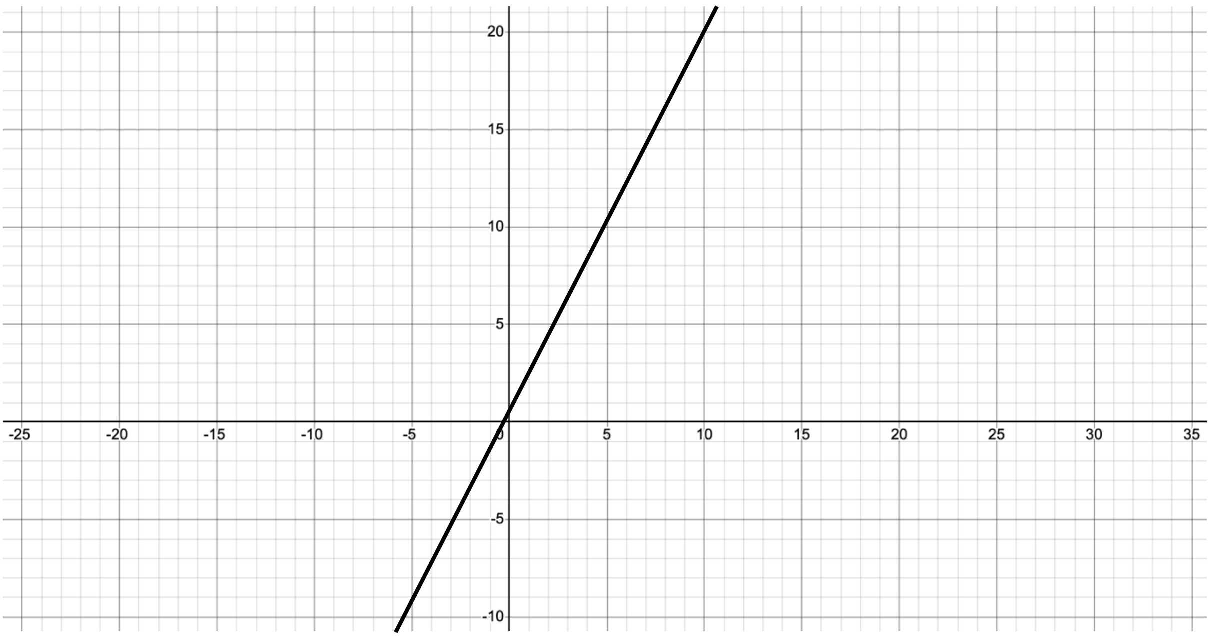
Question 5: Sketch the graph of $y = x^2 - 4x - 1$, labelling all coordinates for the turning point and the axes interceptions.

Question 6: Draw a velocity-time graph for the following scenario:

A car sets off from being stationary.
It accelerates at a constant rate for 15 seconds, reaching 25m/s.
It moves with constant speed for 30 seconds.
The car then accelerates up to 40m/s over 10 seconds.
The car moves at the same speed for 5 seconds.
It now sharply decelerates for 10 seconds, coming to a stop.

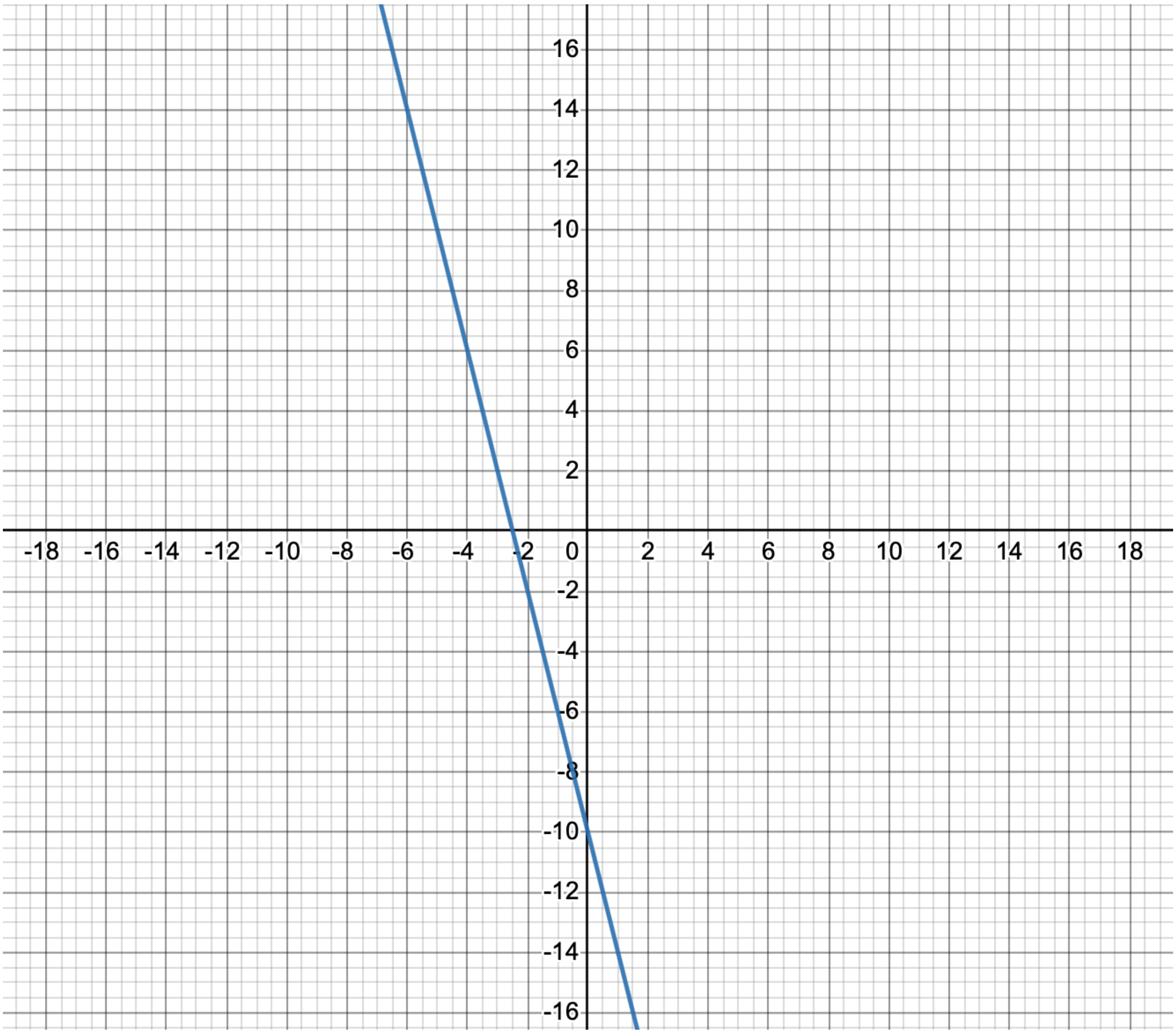
Question 7: Sketch the graph of cos x for $0° \leq x \leq 360°$.

Question 8: Find the gradient of the line drawn on the graph:



Question 9: Find the turning point of $f(x) = x^2 - 12x + 47$.

Question 10: Find the equation of the line shown on the graph below:



Exam Tip - Turning point of a convex curve is another way of saying minimum point.

Question 11: Study the following graph:

Next to each equation below, label which colour it is represented by:

$x^3 + 6$

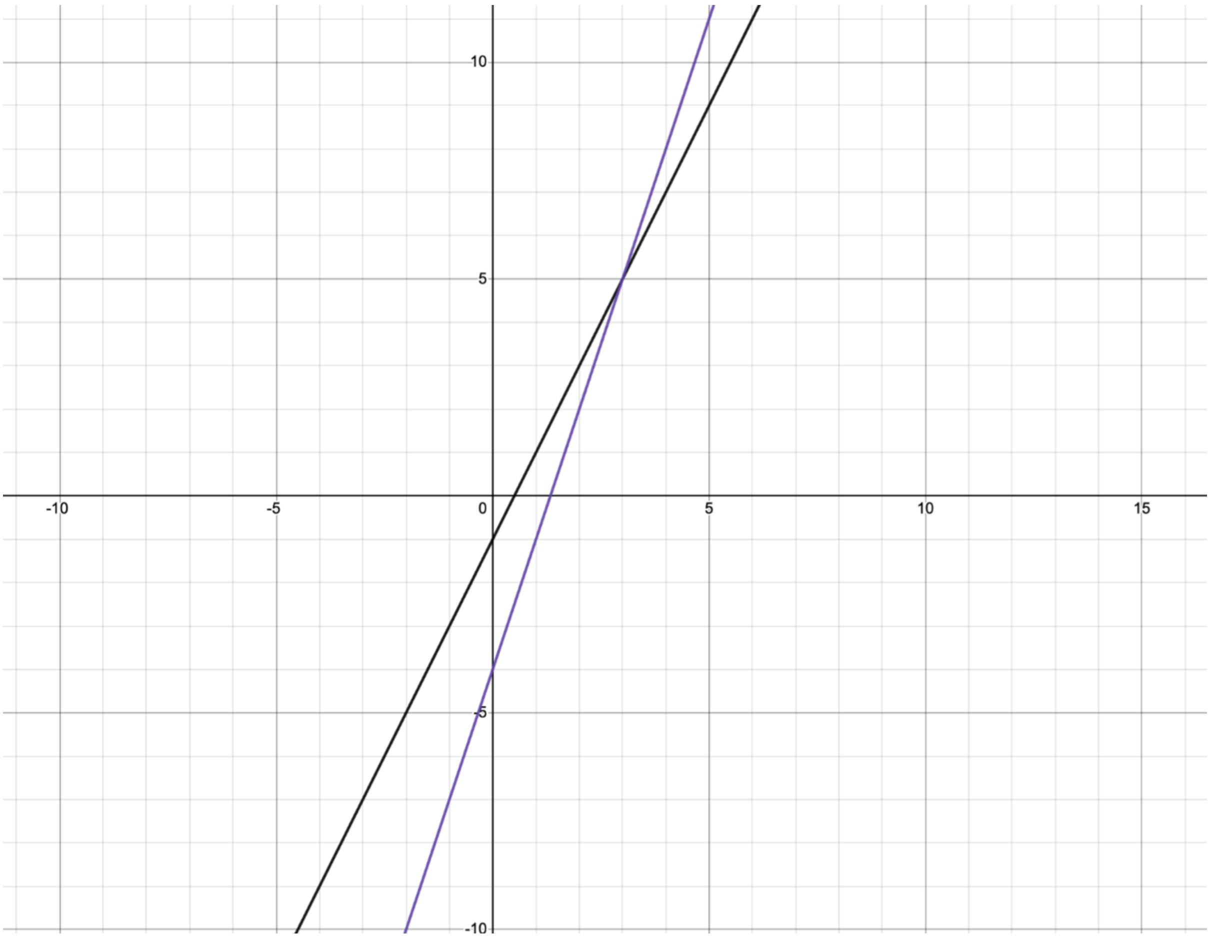
$\left(\frac{7}{2}\right)^x$

$\frac{3}{x}$

Question 12: Draw the graph of sin x for $0° \leq x \leq 360°$.

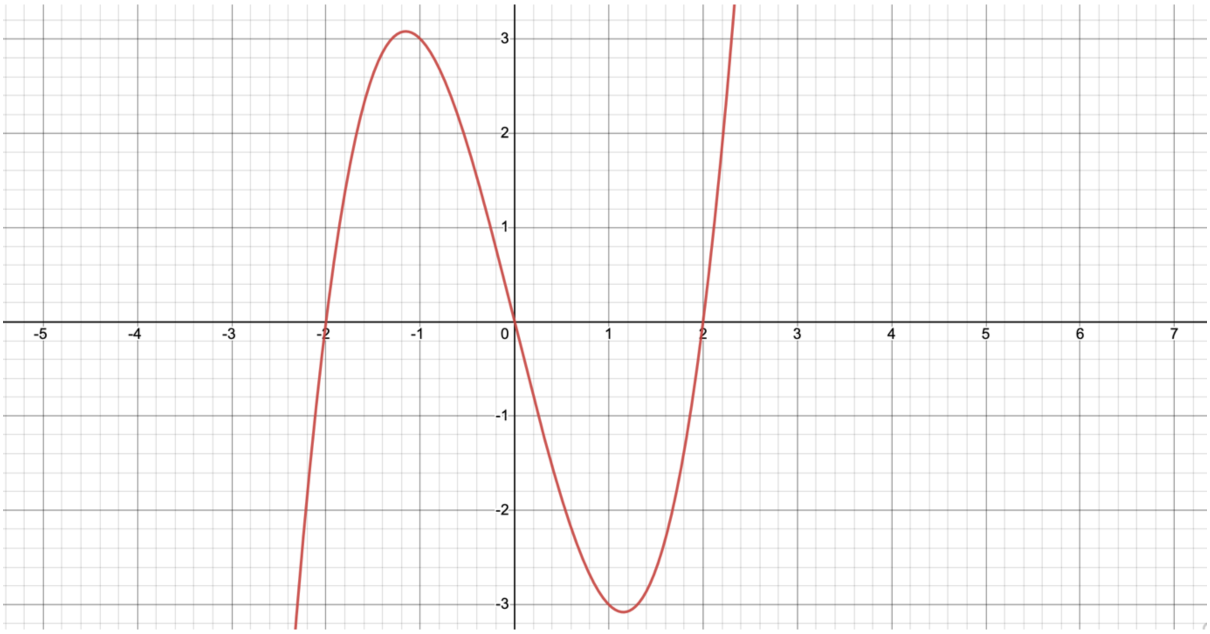
Question 13: Find the turning point of $y = x^2 - 22x + 127$.

Question 14: The graphs of the equations $y = 2x - 1$ and $y = 3x - 4$ are shown below. Using the graphs, write down the solution to the simultaneous equations $y = 2x - 1$ and $y = 3x - 4$.

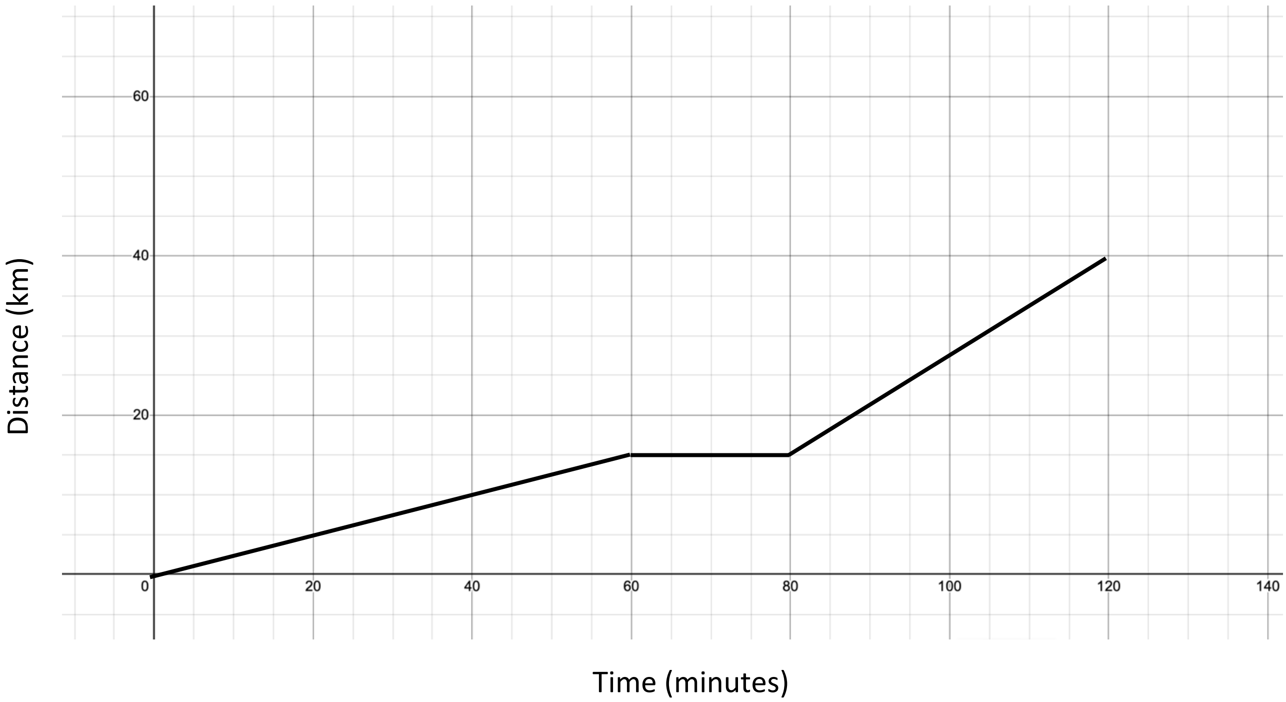


Question 15: Line L passes through the points (2, 5) and (18, 13).
Find the equation of L.

Question 16: The graph of the curve $y = x^3 - 4x$ is drawn below.
Estimate the gradient of the curve at $x = 2$.



Question 17: James goes on a run. He stops for one break throughout his run. By studying the graph below, write down exactly when James had his break as well as how long the break was for.

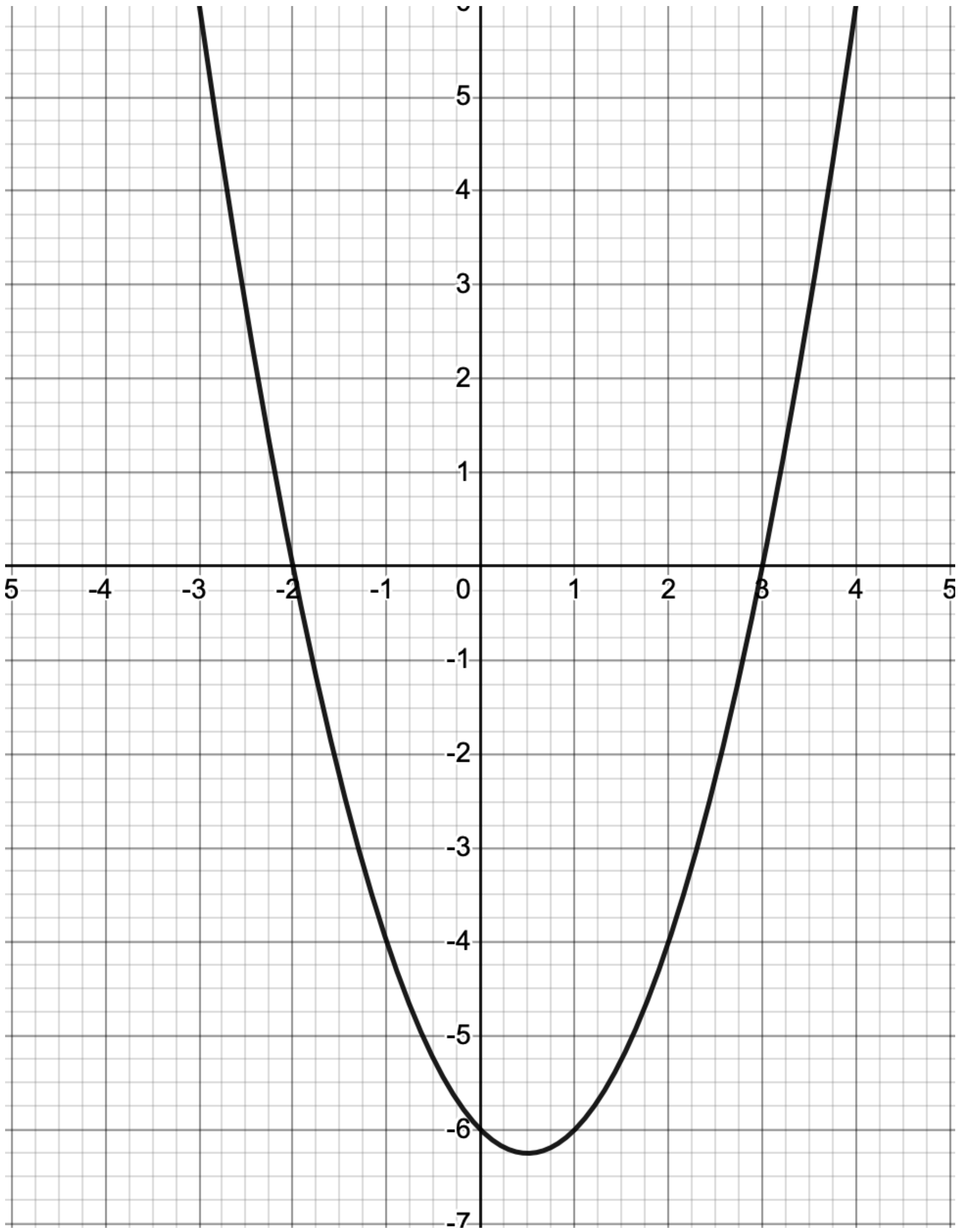


Question 18: Which of these equations does not produce a straight line graph:

$$x^2 - y^2 = 25$$
$$y - 2x = 7$$
$$1 - y = -11x$$

Question 19: Find the turning point of the graph of $y = x^2 - 5$.

Question 20: The graph of $y = x^2 - x - 6$ is drawn below. Using the graph, find the set of values for which $x^2 - x - 6 < 0$.



Exam Tip - If a line has a gradient of 2, the line parallel will also have a gradient of 2. The line perpendicular will have a gradient of $-\frac{1}{2}$.

Question 21: A curve has equation $x^2 + y^2 = 81$. Does this curve pass through the origin?

Question 22: The lines $y = x + 4$ and $y = 2x - 3$ intersect at point M. Line N goes through the point M and is parallel to the line $y = \frac{1}{4}x + 6$. Find the equation of line N.

Question 23: Point A (6, 13) and point B (12, 17) lie on a straight line. Find the coordinates of the midpoint of A and B.

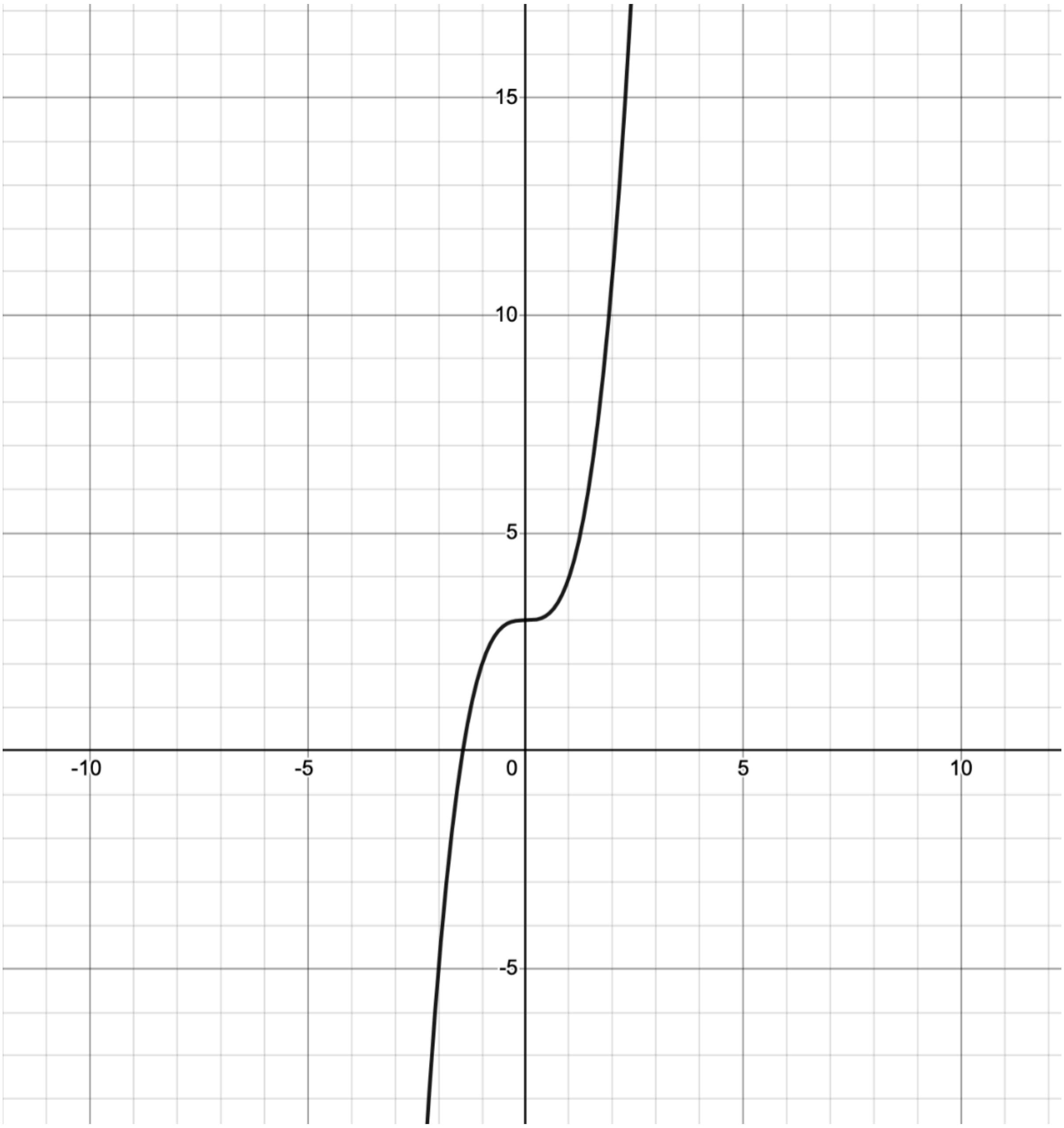
Question 24: A straight line, L, passes through the point (6, 49) and another point (2, 21). Find the equation of L.

Another line, N, is perpendicular to L and passes through the point (14, -5). Find the equation of N.

Question 25: Sketch the graph of sin x for $0° \leq x \leq 360°$. On the same axes, draw the graph of $y = \sin(x - 60)°$.

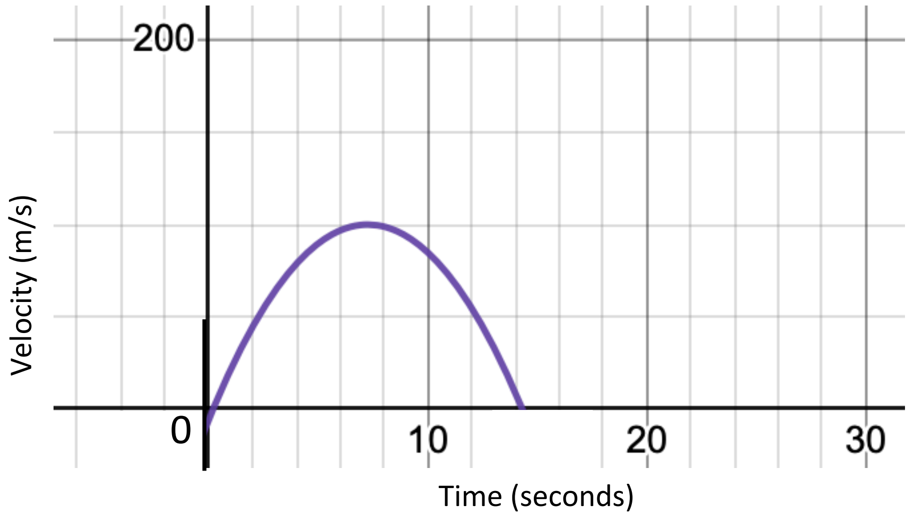
Challenge Questions

Challenge 1: The diagram below shows the graph y = f(x).



Draw the graph of y = f(x + 5) .

Challenge 2: Jason rolls a ball down a hill and records its velocity on the velocity-time graph below. Using seven strips, find the average speed of the ball.



Challenge 3: For the graph below, find the average acceleration between 3 and 4 seconds:

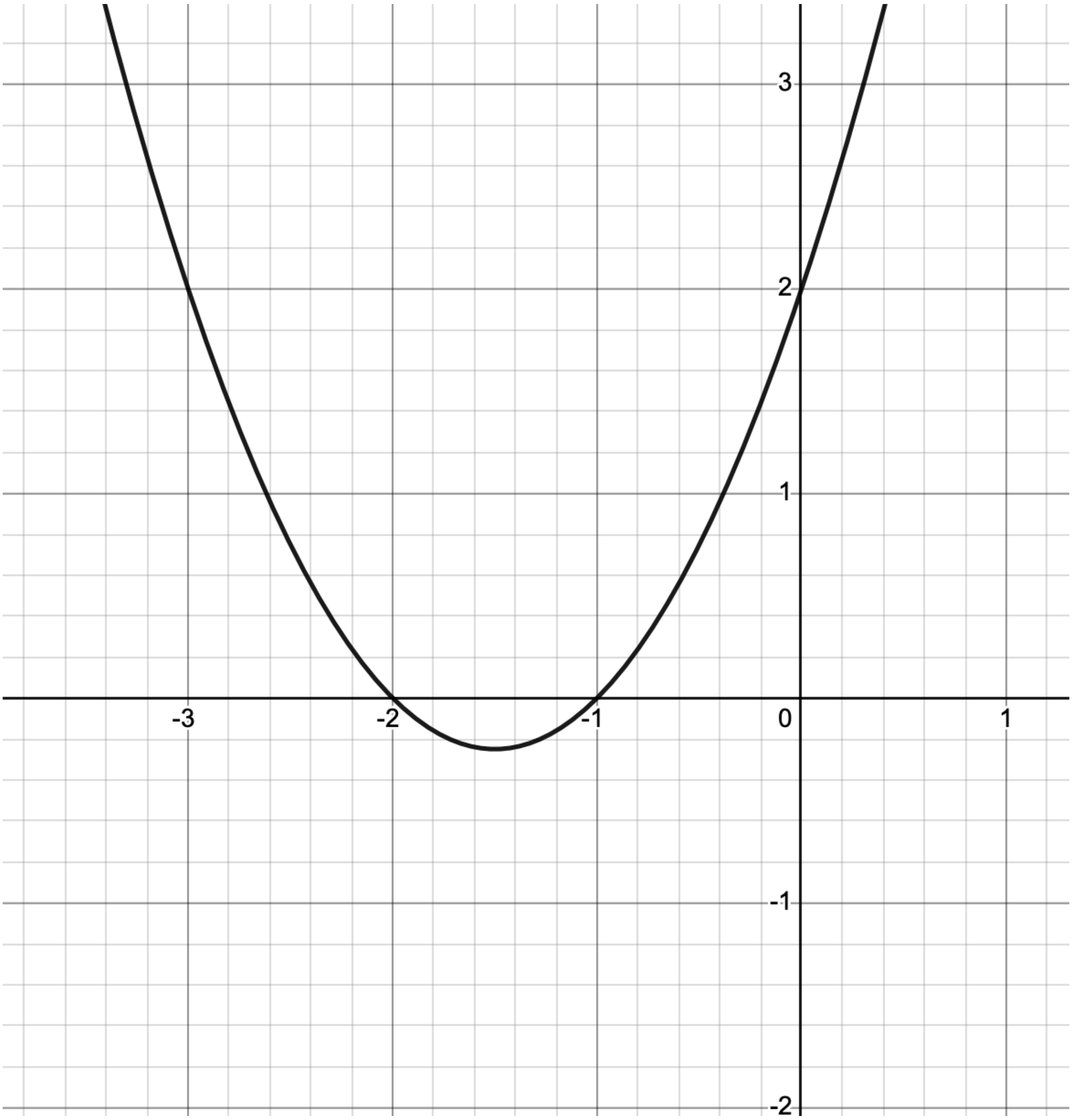
Challenge 4: Find the turning point of the following graph:

$$y = 2x^2 + 4x + 3.$$

Challenge 5: A curve has equation $x^2 + y^2 - 25 = 0$. Find the values of y for which the curve intersects the y axis.

Challenge 6: Sketch the graph of tan x for $-180° \leq x \leq 180°$.

Challenge 7: Study the diagram below which shows the graph f(x).

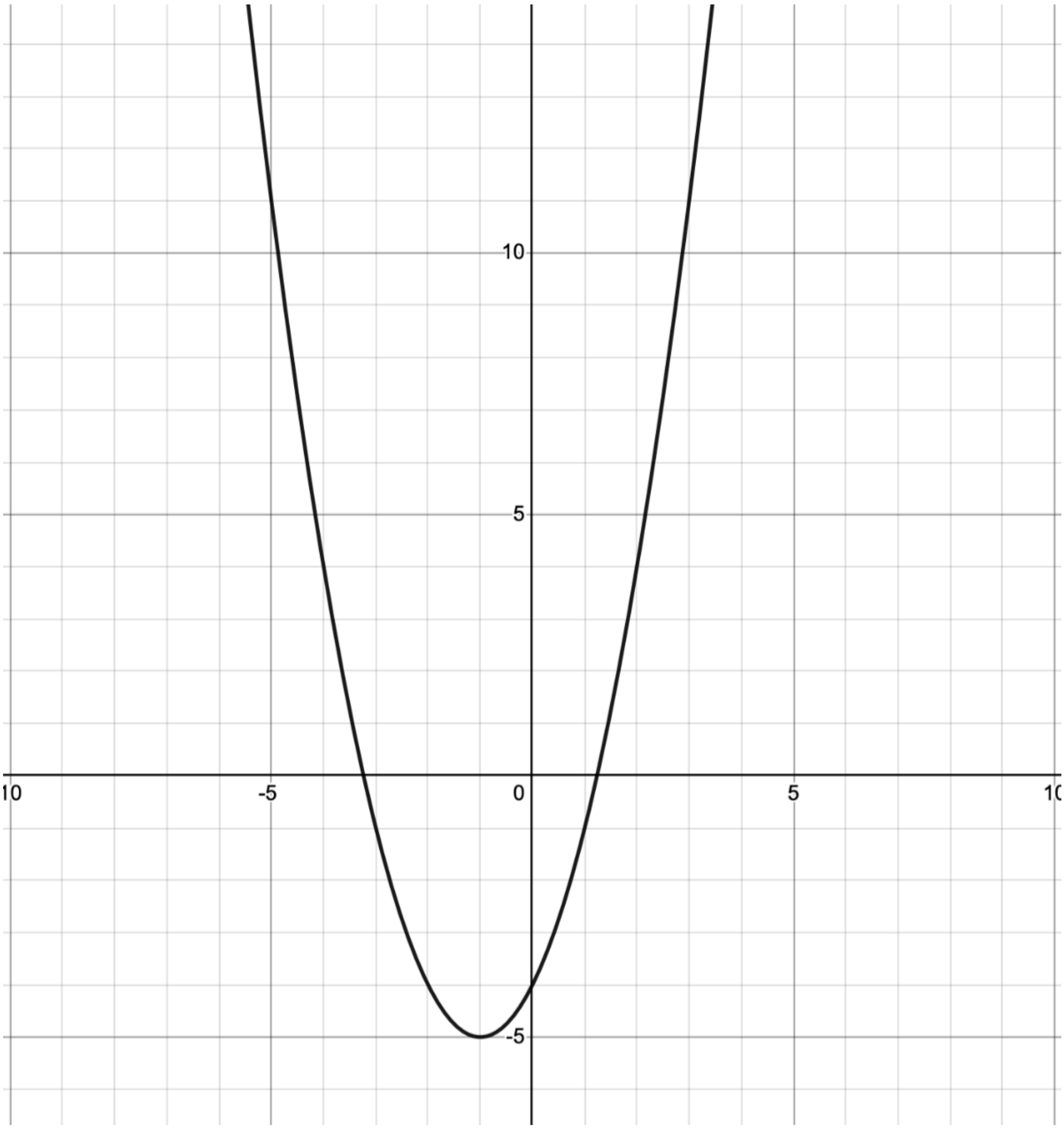


Determine whether the graph for f(x + 2) – 2 has real roots.

Challenge 8: Sketch the graph of $-2x^2 - 6x + 5$, labelling coordinates for the turning point and y intercept.

Challenge 9: Find the turning point of the graph of $x^2 + x - \frac{23}{4}$.

Challenge 10: The graph of $y = x^2 + 2x - 4$ is drawn below. Draw a suitable line to find the solutions of $x^2 + x + 7$.



Answers on next page

(1) $y = mx + c$

$m: \frac{31-1}{7-1} = \frac{30}{6} = 5$

$y = 5x + c$

$31 = 5(7) + c$

$31 = 35 + c$

$c = -4$

$y = 5x - 4$

Parallel to L, so will have

$m = 5$

$y = 5x + c$

$11 = 5(2) + c$

$11 = 10 + c$

$c = 1$

$y = 5x + 1$

(2)

$y = x^2 + 4x + a$

a = y-intercept

$a = 2$

(3)

x	y
−2	−22
−1	−3
0	2
1	−1
2	−6
3	−7
4	2
5	27
6	74

(4) Plan A (red line):

when $x = 20$, $y = 32$

£32 for plan A

Plan B (blue line):

when $x = 20$, $y = 26$

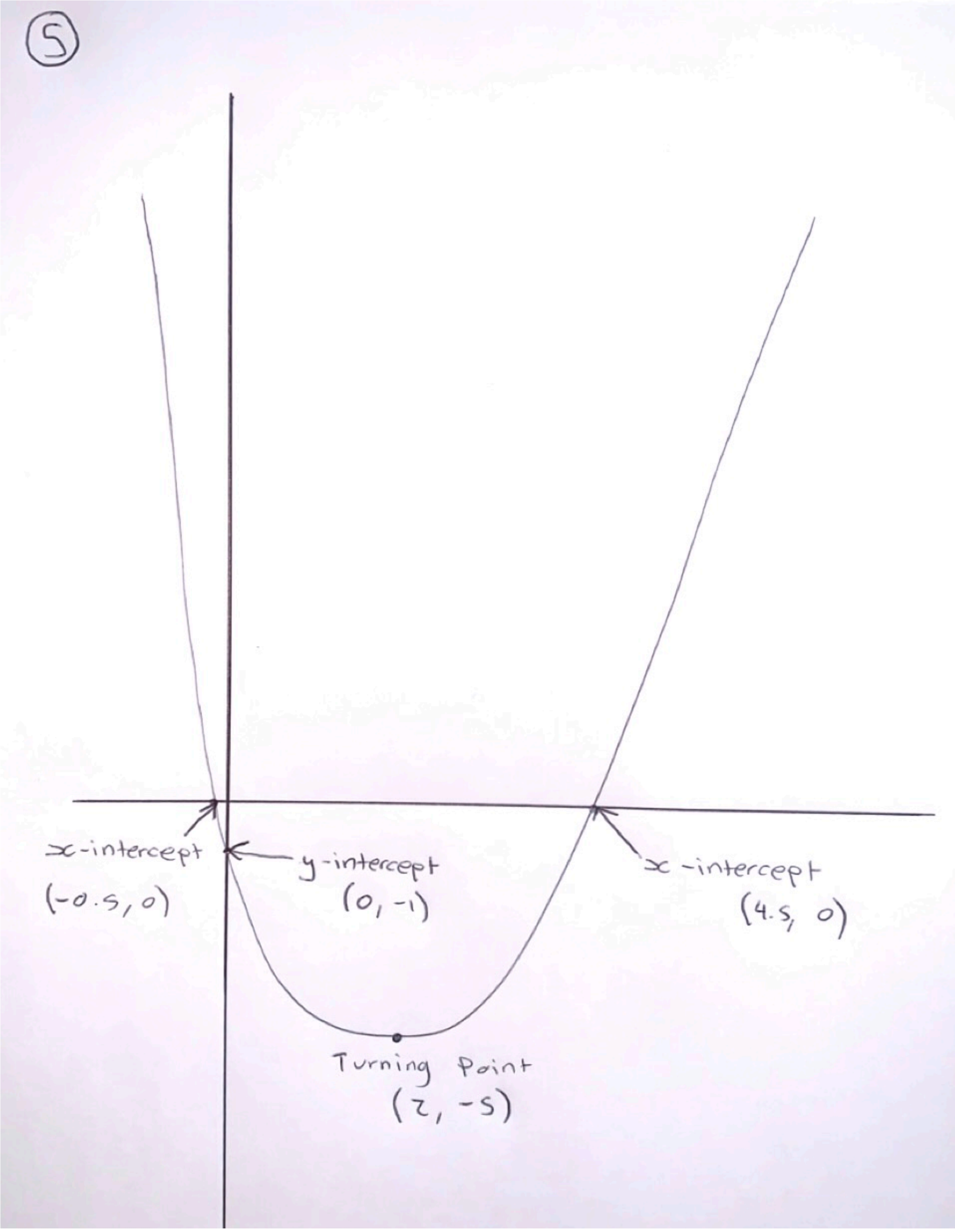
£26 - £27 for plan B

30 days in April

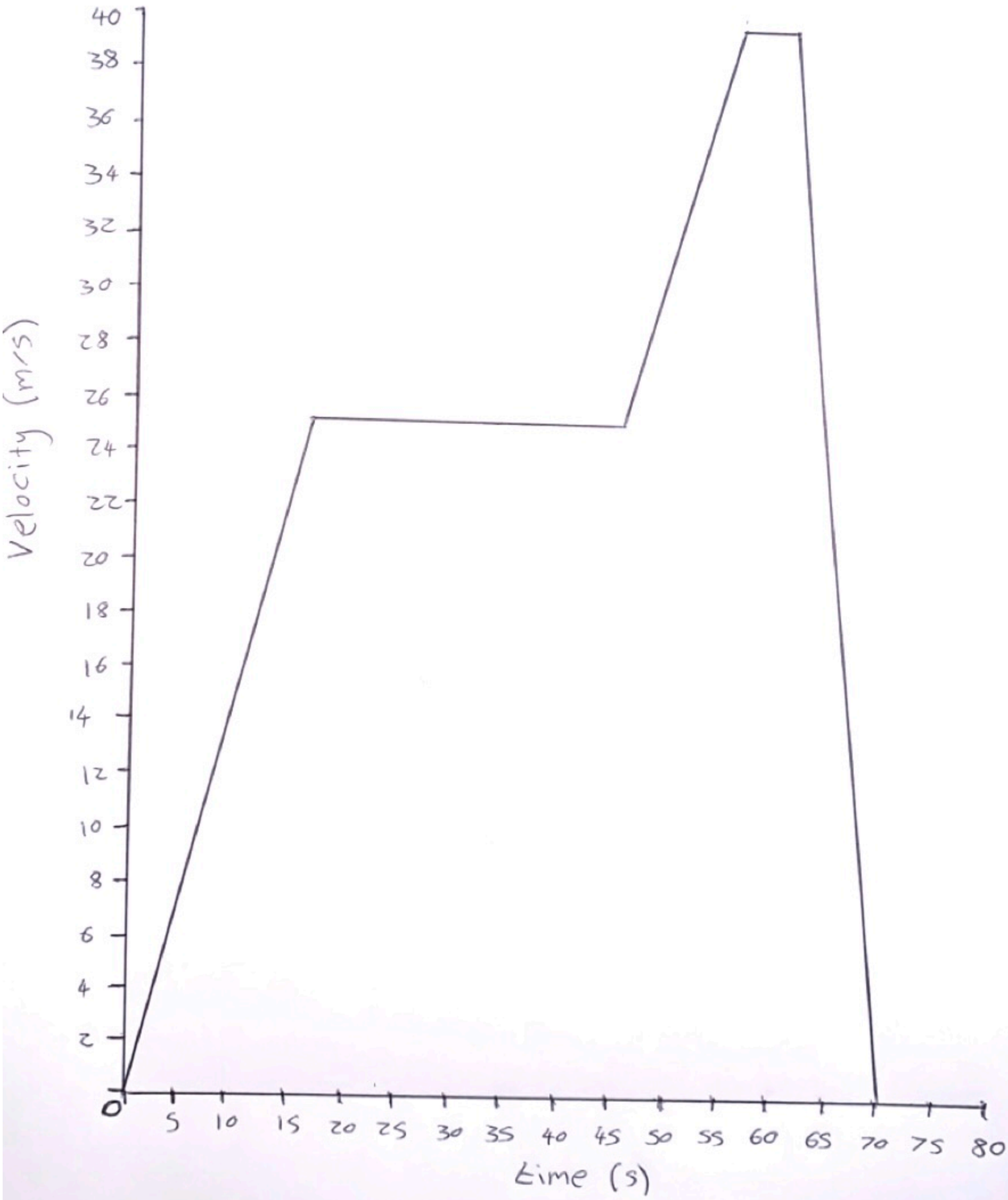
$30 \times 2 = 60$

when $x = 60$, plan A is cheaper

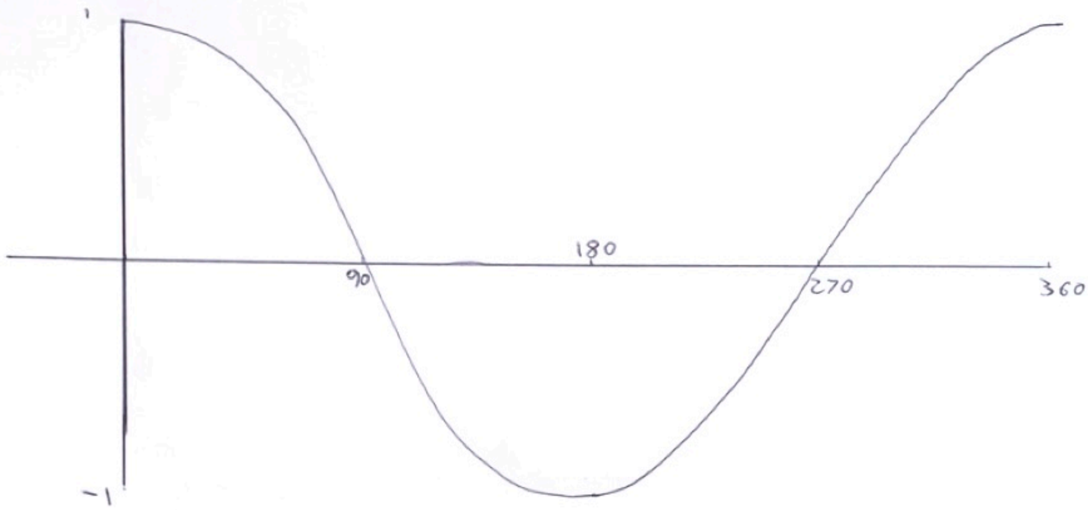
Would recommend plan A to Jordan.


5
x-intercept
(-0.5, 0)
y-intercept
(0, -1)
x-intercept
(4.5, 0)
Turning Point
(2, -5)

6


40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Velocity (m/s)
time (s)

7



8 Find co-ordinates of two points on graph:

(5, 10) and (10, 20)

$$\frac{20-10}{10-5} = \frac{10}{5} = 2$$

gradient = 2

(9)

$f(x) = x^2 - 12x + 47$

$f(x) = (x-6)^2 - (-6)^2 + 47$

$= (x-6)^2 - 36 + 47$

$= (x-6)^2 + 11$

Turning point = (6, 11)

(10) Find two co-ordinates:

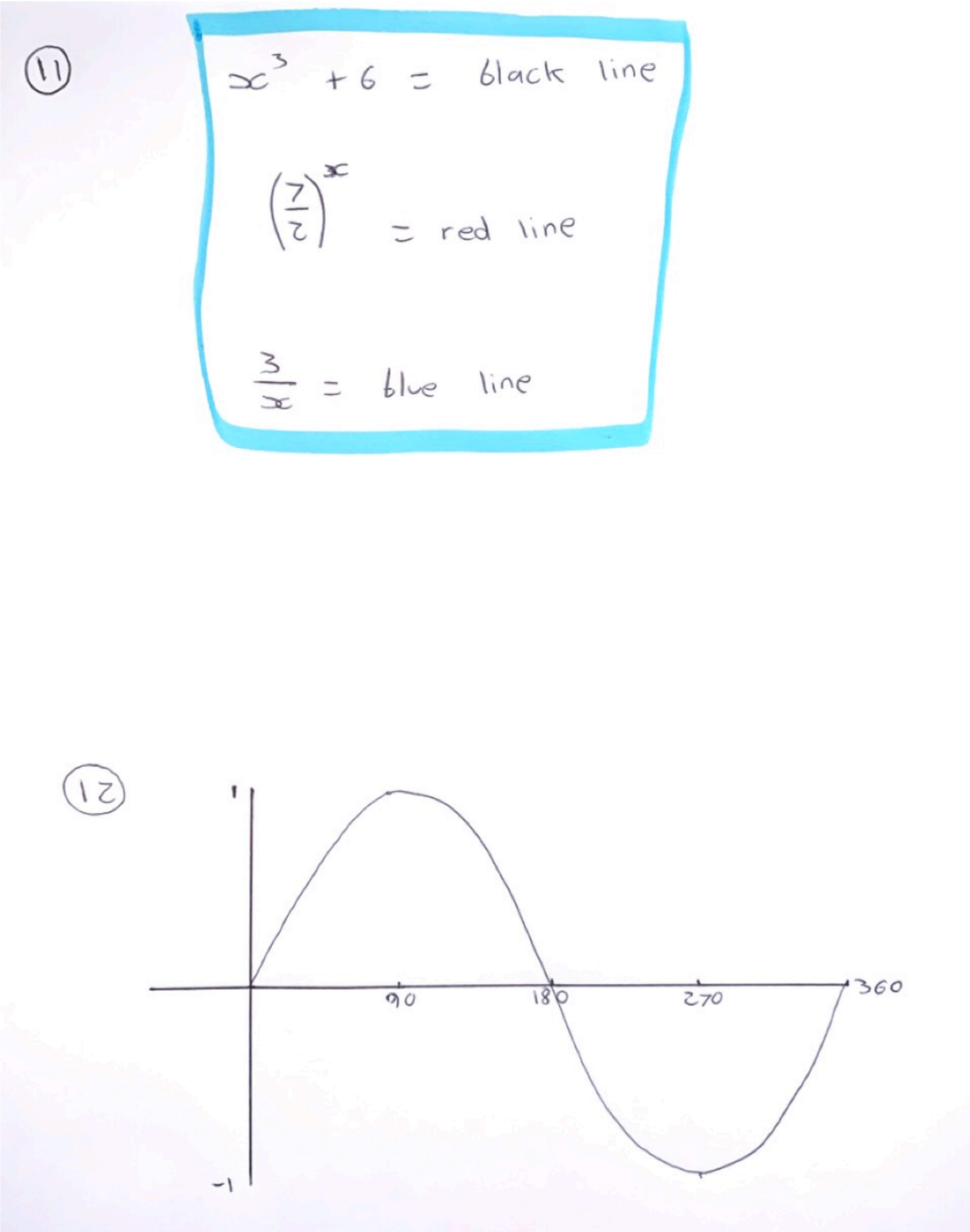
(−6, 14) and (−4, 6)

$\frac{14 - 6}{-6 - -4} = \frac{8}{-2} = -4$

$y = -4x + c$

Look to see y-intercept

$y = -4x - 10$


11
x³ + 6 = black line
(7/2)^x = red line
3/x = blue line
12
1
-1
90
180
270
360

(13)

$y = x^2 - 22x + 127$

$y = (x-11)^2 - (-11)^2 + 127$

$y = (x-11)^2 - 121 + 127$

$y = (x-11)^2 + 6$

Turning point $= (11, 6)$

(14) Solutions = where lines intersect

$x = 3$

$y = 5$

15

gradient: $\frac{13-5}{18-2} = \frac{8}{16} = \frac{1}{2}$

$y = \frac{1}{2}x + c$

using (18, 13)

$y = \frac{1}{2}(18) + c$

$13 = \frac{1}{2}(18) + c$

$13 = 9 + c$

$c = 4$

$y = \frac{1}{2}x + 4$

(16) Draw straight line as tangent to curve at $x = 2$

Work out gradient of line

Should get $m = 8$

(17) James had been running for an hour when he had his break

Break lasted 20 minutes

(18) $x^2 - y^2 = 25$

(19) $y = x^2 - 5$

$y = (x-0)^2 - (0)^2 - 5$

$y = (x-0)^2 + 5$

Turning point $= (0, 5)$

(20) Dealing with < 0 so anywhere that graph is below x-axis

$$-2 < x < 3$$

(21) Origin = $(0, 0)$

$$(0)^2 + (0)^2 \neq 81$$

No, curve does not pass through the origin

(22) $y = x + 4$ $y = 2x - 3$

Find point of intersection

$$x + 4 = 2x - 3$$
$$x = 7$$

$$y = x + 4$$
$$y = (7) + 4$$
$$y = 11$$

Intersection point $= (7, 11)$

Line N has $m = \frac{1}{4}$

$$y = \frac{1}{4}x + c$$
$$11 = \frac{1}{4}(7) + c$$
$$11 = \frac{7}{4} + c$$
$$c = \frac{37}{4}$$

N: $y = \frac{1}{4}x + \frac{37}{4}$

(23)

$$\frac{6+12}{2} = 9$$

$$\frac{13+17}{2} = 15$$

(9, 15)

(24) Equation of L:

$$m = \frac{49 - 21}{6 - 2} = \frac{28}{4} = 7$$

$$y = 7x + c$$

$$21 = 7(2) + c$$

$$c = 7$$

$$y = 7x + 7$$

N is perpendicular to L, so

gradient of $N = -\frac{1}{7}$

$$y = -\frac{1}{7}x + c$$

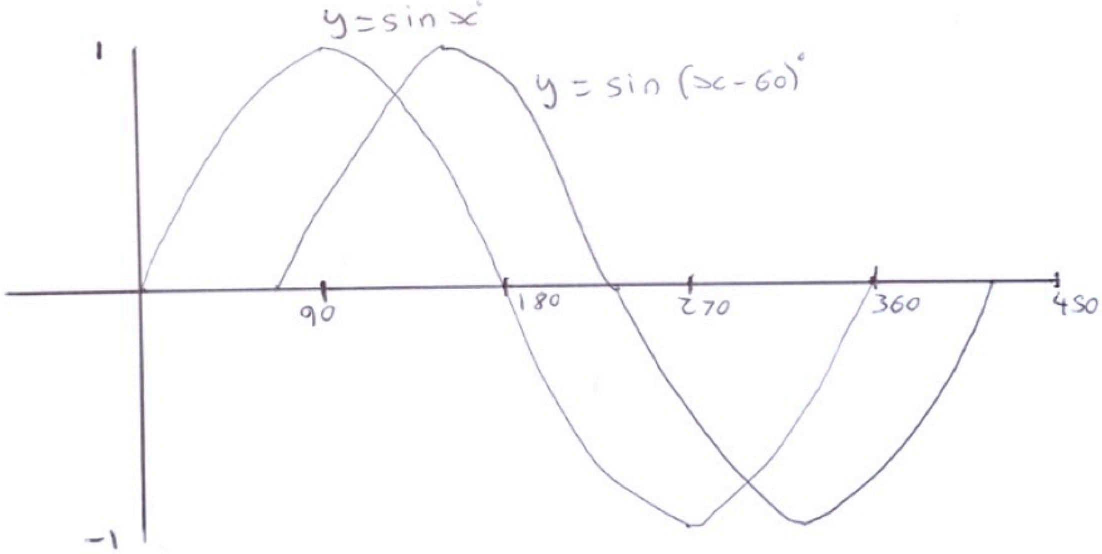
$$-5 = -\frac{1}{7}(14) + c$$

$$-5 = -2 + c$$

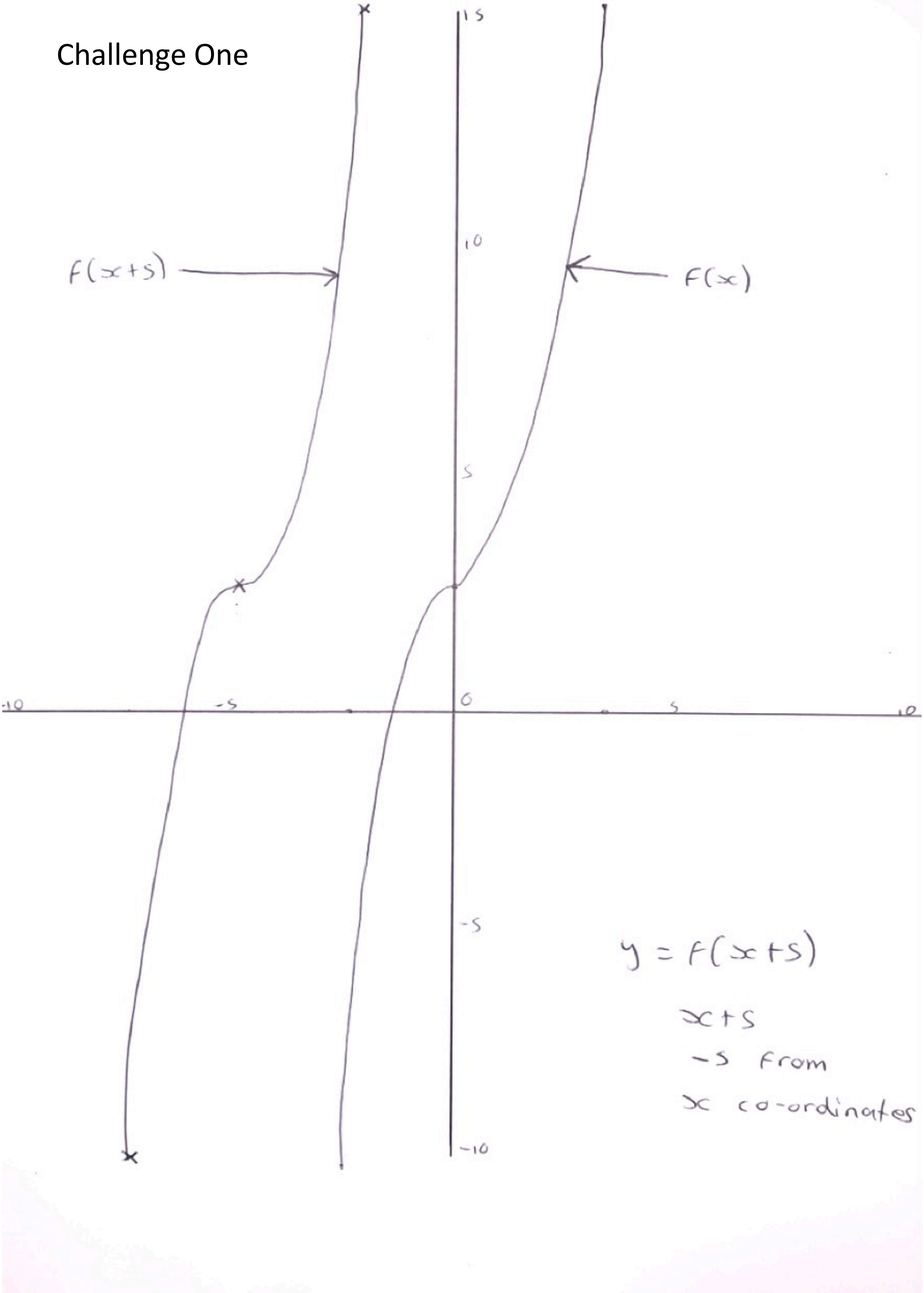
$$c = -3$$

$$y = -\frac{1}{7}x - 3$$

25



Challenge One



Challenge two

A: $2 \times 50 = 100$, $100 \div 2 = 50$

B: $\frac{50 + 75}{2} \times 2 = 125$

C: $(75 + 100) \times \frac{1}{2} \times 2 = 175$

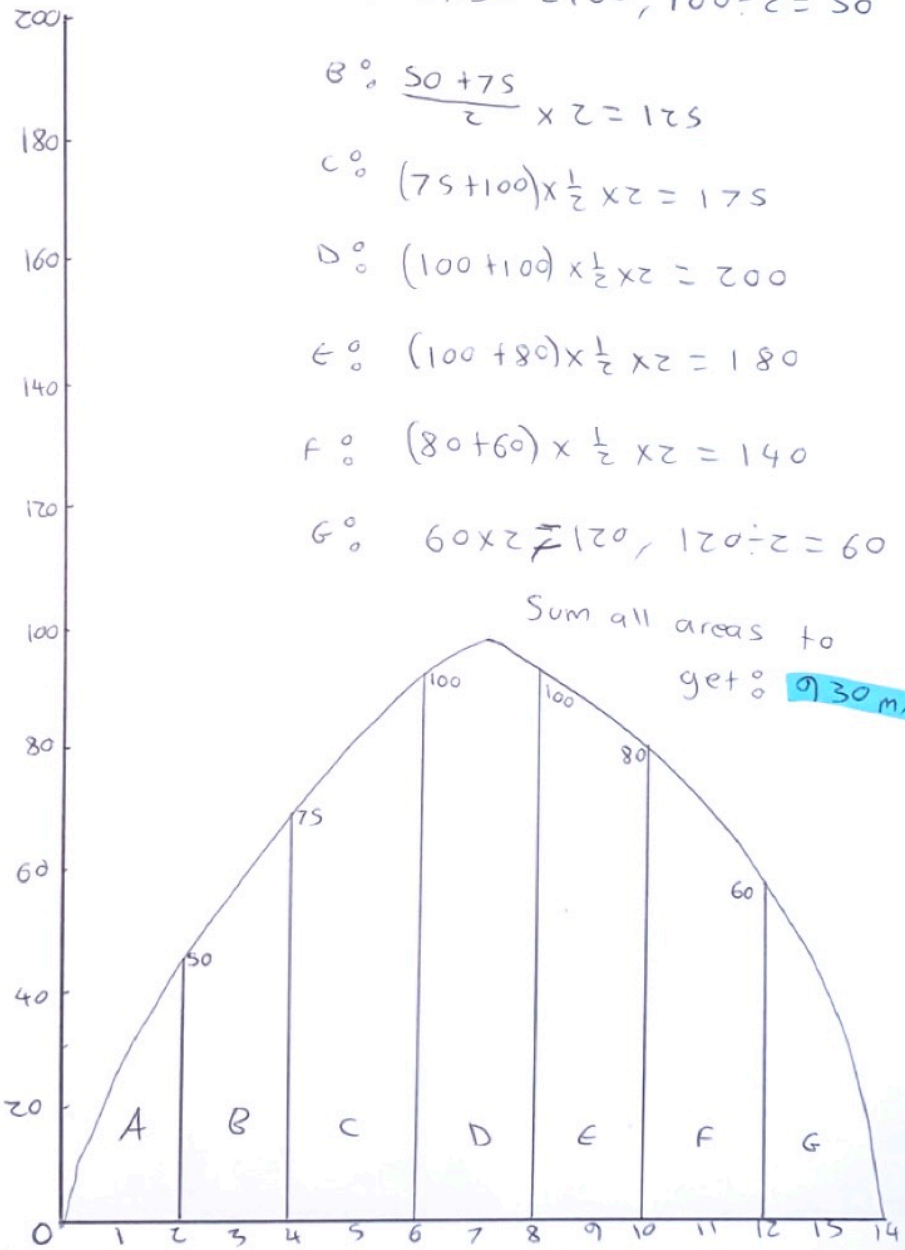
D: $(100 + 100) \times \frac{1}{2} \times 2 = 200$

E: $(100 + 80) \times \frac{1}{2} \times 2 = 180$

F: $(80 + 60) \times \frac{1}{2} \times 2 = 140$

G: $60 \times 2 = 120$, $120 \div 2 = 60$

Sum all areas to get: **930 m/s**



Challenge three

At $x = 3$, $y = 7$

At $x = 4$, $y = 17$

$$\frac{17-7}{4-3} = \frac{10}{1} = 10\ ms^{-2}$$

Challenge four

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

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

$$y = 2((x+1)^2 - (1)^2) + 3$$

$$y = 2(x+1)^2 - 2 + 3$$

$$y = 2(x+1)^2 + 1$$

Turning point = $(-1, 1)$

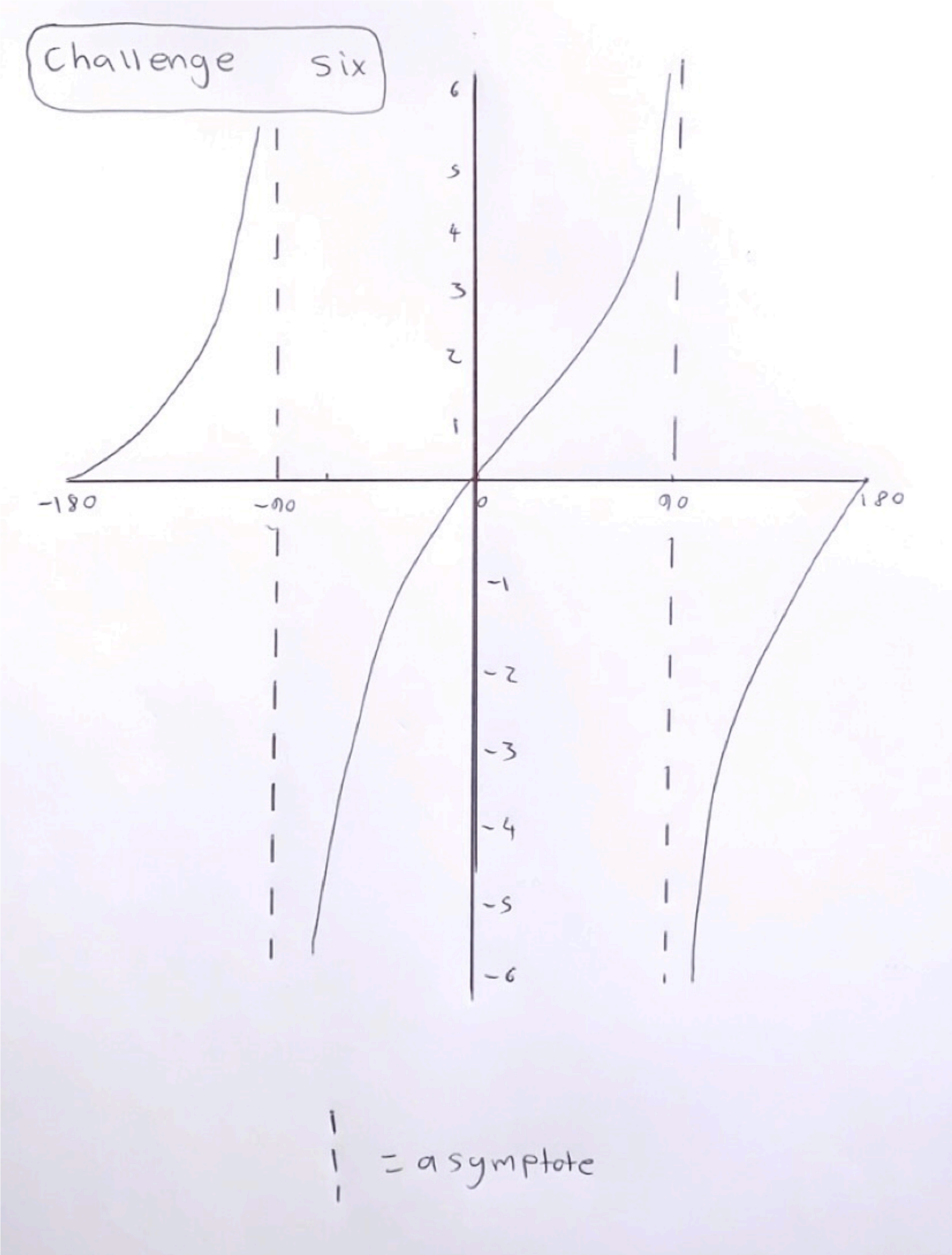
Challenge five

At the point where a line intersects the y-axis, the x co-ordinate $= 0$

$$(0)^2 + y^2 - 25 = 0$$

$$y^2 = 25$$

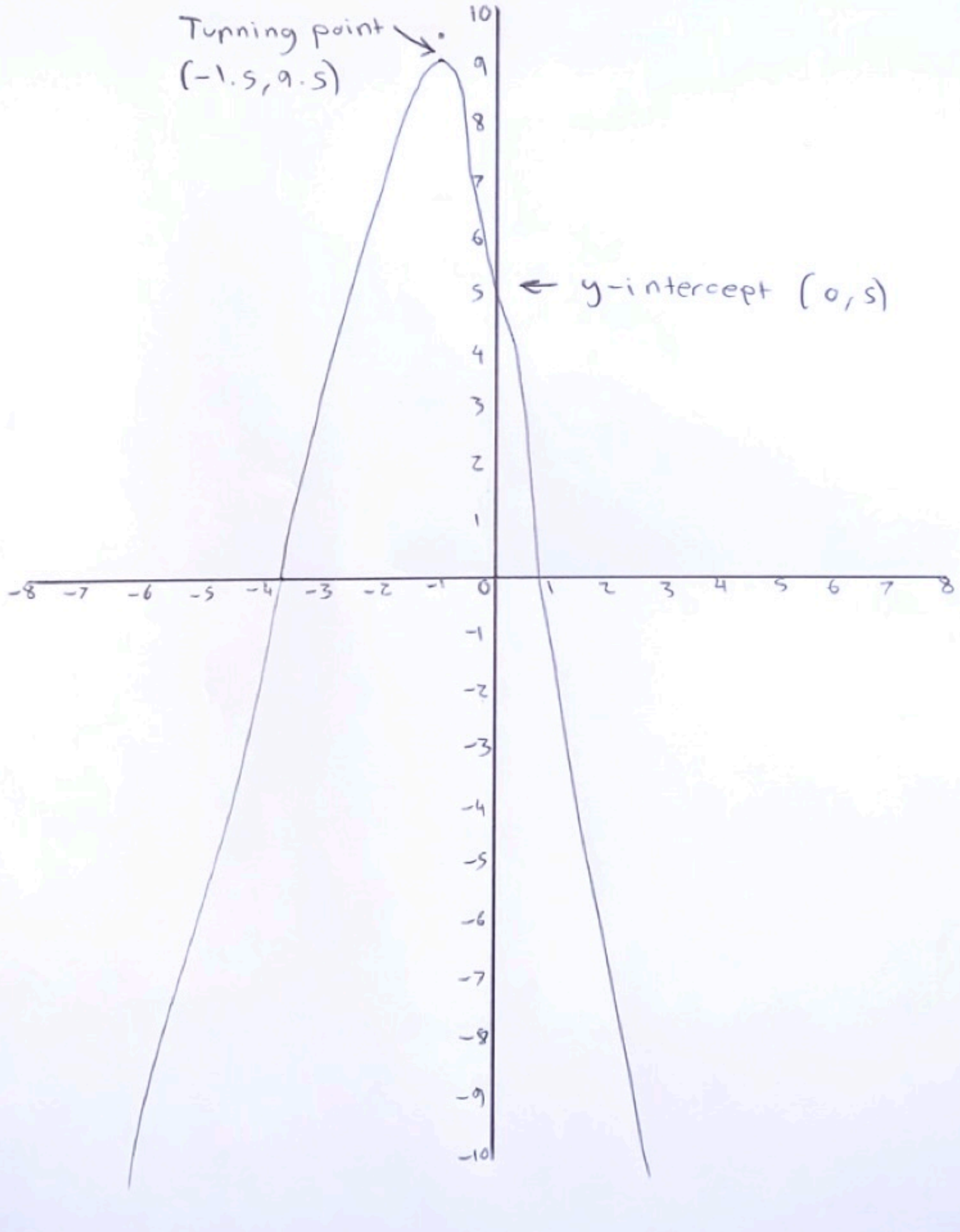
$$y = \pm 5$$


Challenge six
6
5
4
3
2
1
-180
-90
0
90
180
-1
-2
-3
-4
-5
-6
= asymptote

Challenge seven

The graph of $f(x+2)-2$ would still cross x axis twice, so yes it has real roots

Challenge eight



Challenge nine

$$x^2 + x - \frac{23}{4}$$

$$\left(x + \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - \frac{23}{4}$$

$$\left(x+\frac{1}{2}\right)^2 - \frac{1}{4} - \frac{23}{4}$$

$$\left(x+\frac{1}{2}\right)^2 - 6$$

Turning point $= \left(-\frac{1}{2}, -6\right)$

Challenge ten

How do we go from

$$x^2 + x + 7$$

$$\downarrow$$

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

$$x^2 + x + 7 = 0$$

To go from $x \rightarrow 2x$ we $+x$ to both sides

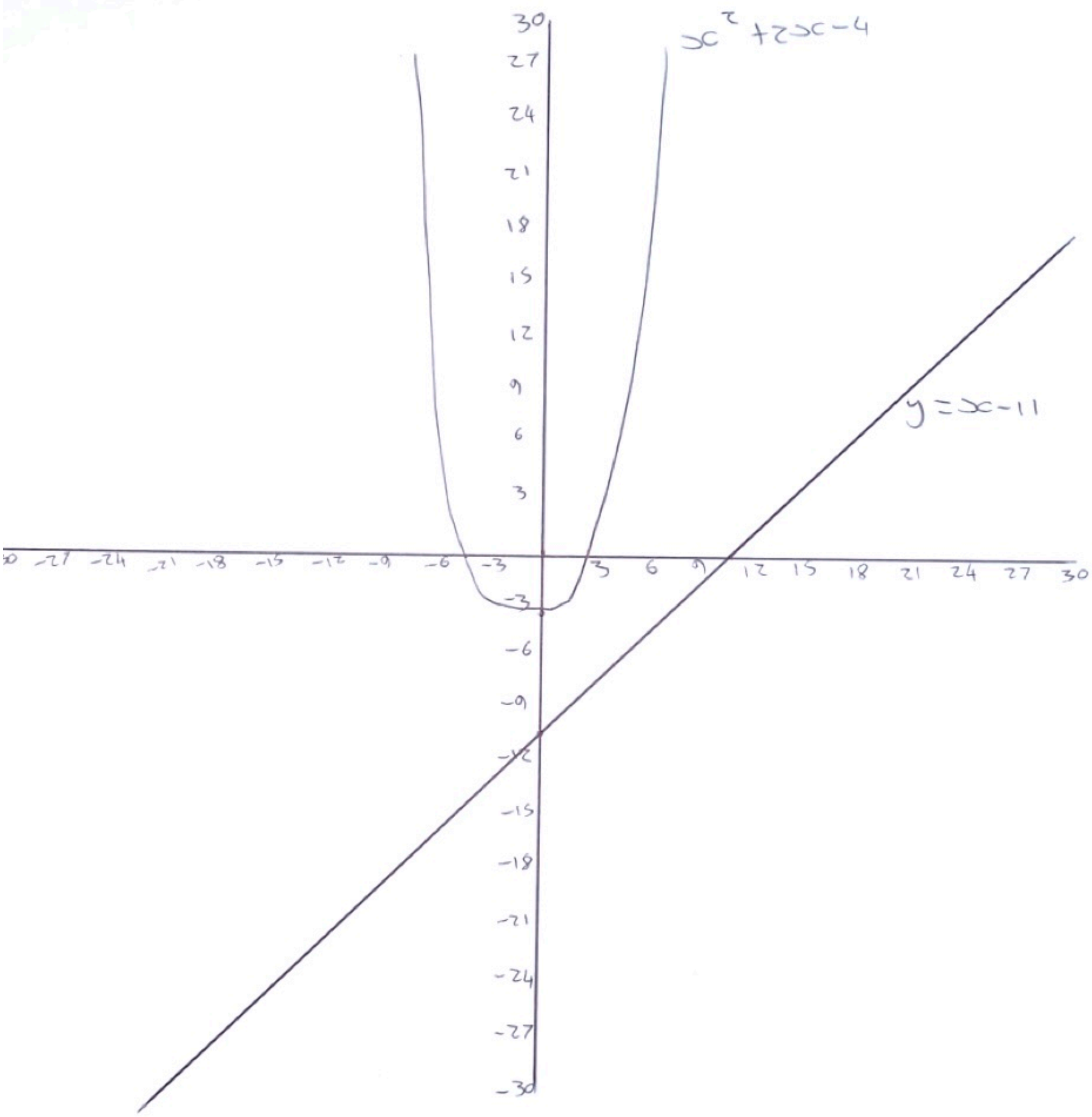
$$x^2 + 2x + 7 = x$$

To go from $7 \rightarrow -4$ we -11 to both sides

$$x^2 + 2x - 4 = x - 11$$

Draw line: $x - 11$

Solution continued ↓



We can see that the lines do not touch, therefore we can infer that there are no solutions to the equation

$$y = x^2 + x + 7$$

We hope this question pack was helpful. We opted for handwritten worked solutions as a pose to standard mark-scheme type answers found elsewhere. If you're still struggling, you can find in-depth video walkthrough solutions for every question in this pack on our website as well as lots more question packs for other GCSE topics.

Also, challenge papers can be found on our website too if you're feeling especially confident with the content.

Thank you
The PLS Tutors

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