PROJECT MATHS

Text & Tests

Leaving 3 Certificate

chapter 17

Graphing Functions

Section 17.3 Using and interpreting quadratic graphs

Exercise 17.3

Pg 482

1. The curve on the right is the graph of the function

$$f(x) = x^2 - 1.$$

Use the graph to find

(i) the value of $f(x)$ when $x = 2$ $f(2) = 3$

(ii) the value of $f(x)$ when $x = -2$ $f(-2) = 3$

(iii) the minimum point of the curve

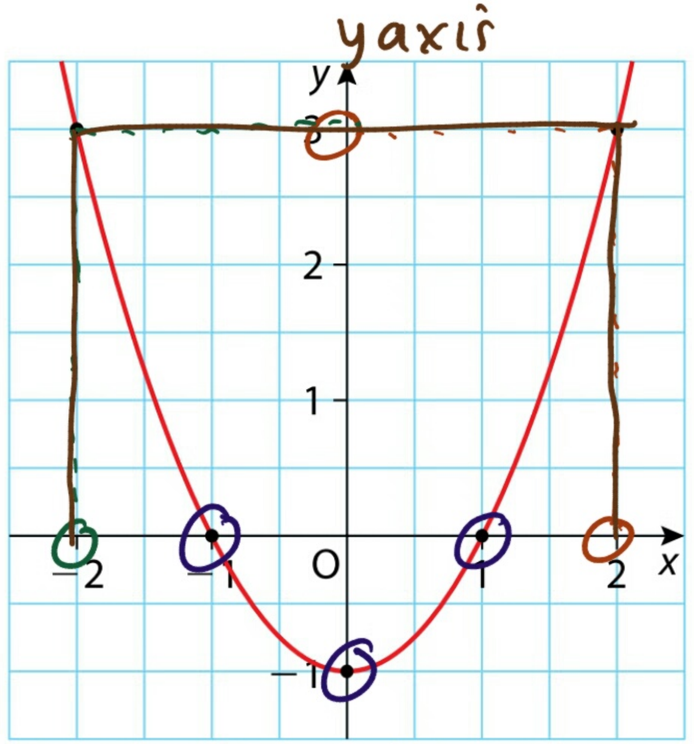
(iv) the values of x when $f(x) = 0$ Roots - cuts x axis $(-1, 0)$ $(1, 0)$

(v) the values of x when $f(x) = 3$. $y = 3$ $(-2, 0)$ $(2, 0)$

$f(2) = (2)^2 - 1$

$4 - 1$

$= 3$

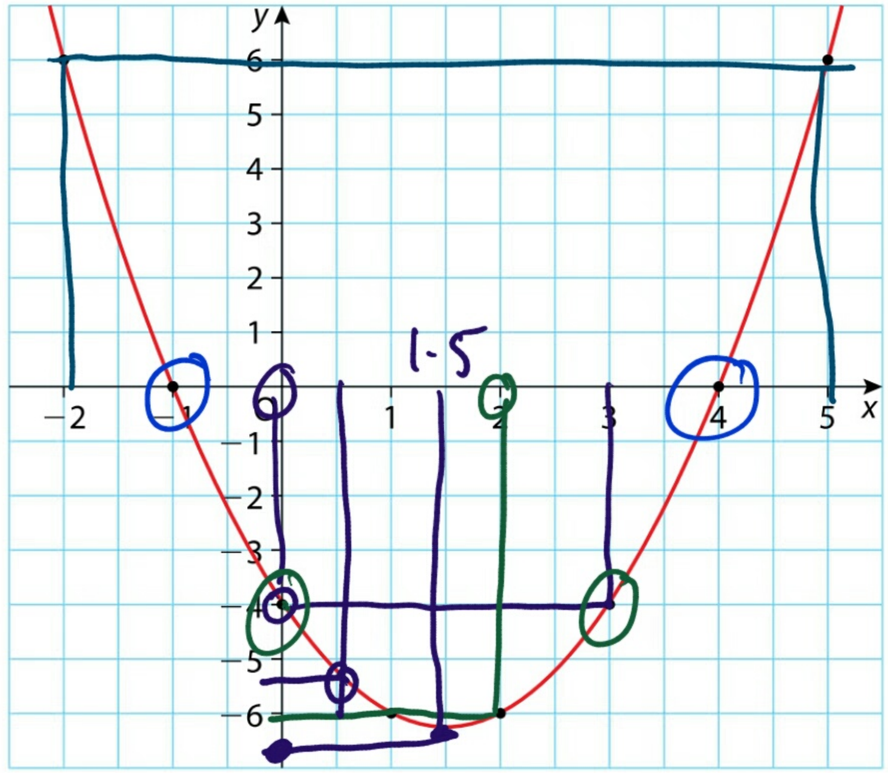


Min Turning Point $(0, -1)$

Exercise 17.3

2. Shown below is the graph of the function

$f(x) = x^2 - 3x - 4$ in the domain $-2 \leqslant x \leqslant 5$.



HW
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Q 5

y
f(x)=y

Use the graph shown to write down

(i) the values of x for which $f(x) = 0$ $-1, 4$

(ii) the values of x for which $f(x) = 6$ $-2, 5$

(iii) the values of x for which $f(x) = -4$ $0, 3$ $(0, -4)$ $(3, -4)$

(iv) the value of $f(2)$ $= -6$

(v) the value of $f\left(\frac{1}{2}\right)$ -5.2

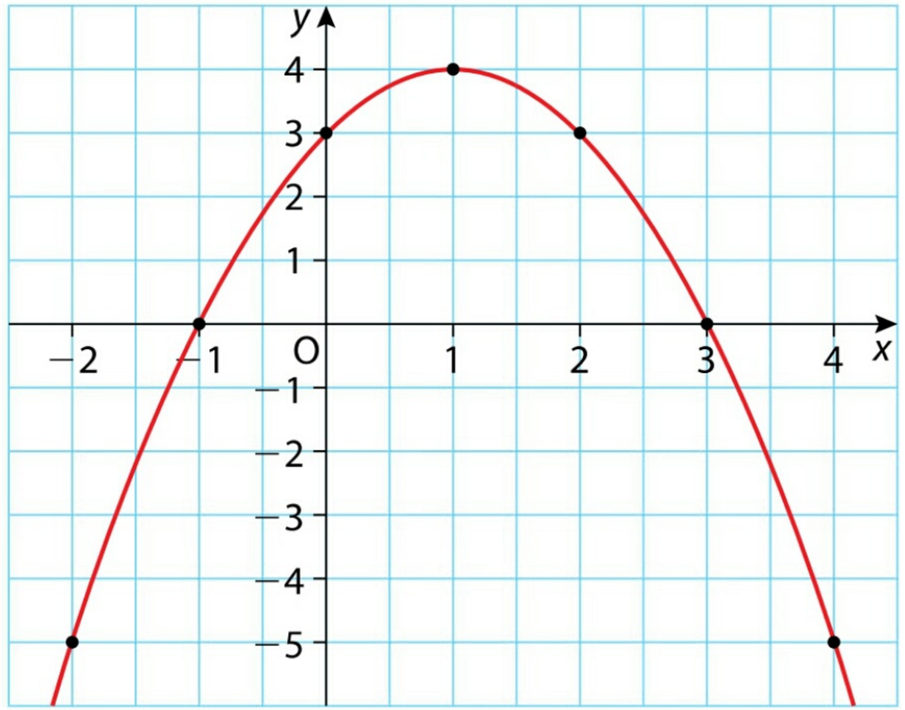
(vi) the coordinates of the minimum point of the curve $(1.5; -6.2)$

(vii) the minimum value of $f(x)$. -6.2

Exercise 17.3

3. Drawn below is a graph of the function

$f: x \to 3 + 2x - x^2$, for $-2 \leqslant x \leqslant 4$, $x \in R$.



Use the graph to write down

(i) the roots of the equation $f(x) = 0$

(ii) the values of x for which $f(x) = 3$

(iii) the value of $f\left(2\frac{1}{2}\right)$

(iv) the maximum value of $f(x)$

(v) the coordinates of the maximum point of $f(x)$

(vi) the range of values of x for which $f(x)$ is increasing

(vii) the range of values of x for which $f(x)$ is positive

(viii) the equation of the axis of symmetry of the curve.

Exercise 17.3

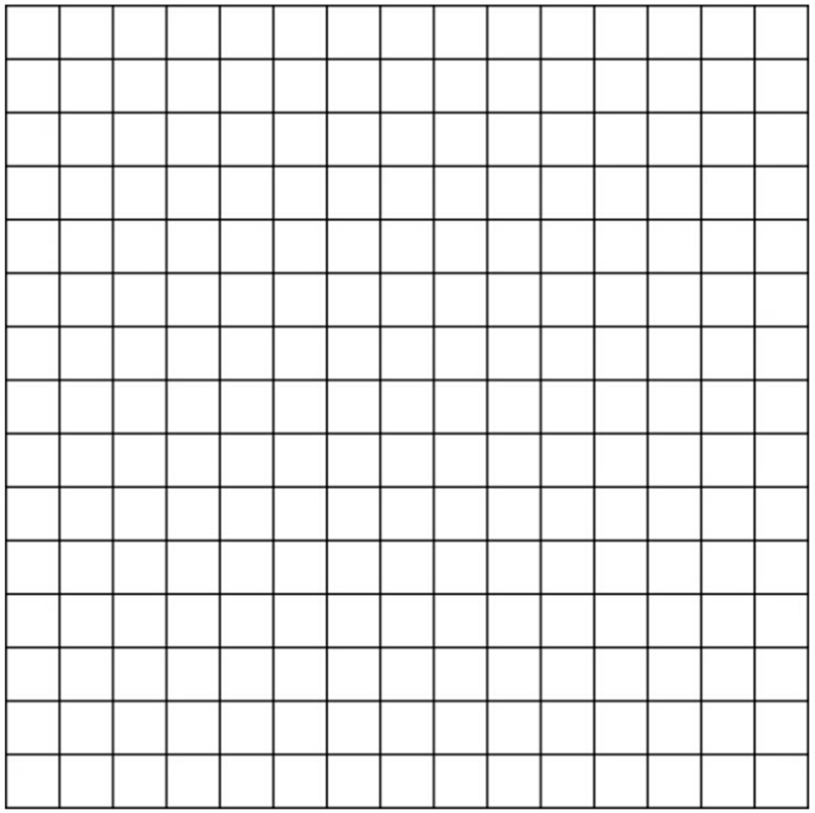
4. Draw the graph for the function $f(x) = 2x^2 - x - 3$ in the domain $-2 \leqslant x \leqslant 3$.
Use your graph to find

(i) the values of x for which $f(x) = 0$

(ii) the values of x for which $f(x) = 6$

(iii) the coordinates of the minimum point of the curve

(iv) the values of x for which $f(x) < 0$.



Exercise 17.3

curve

5. The graphs of the functions $f(x) = x^2$ and $g(x) = 2x + 3$ are shown on the right.
line

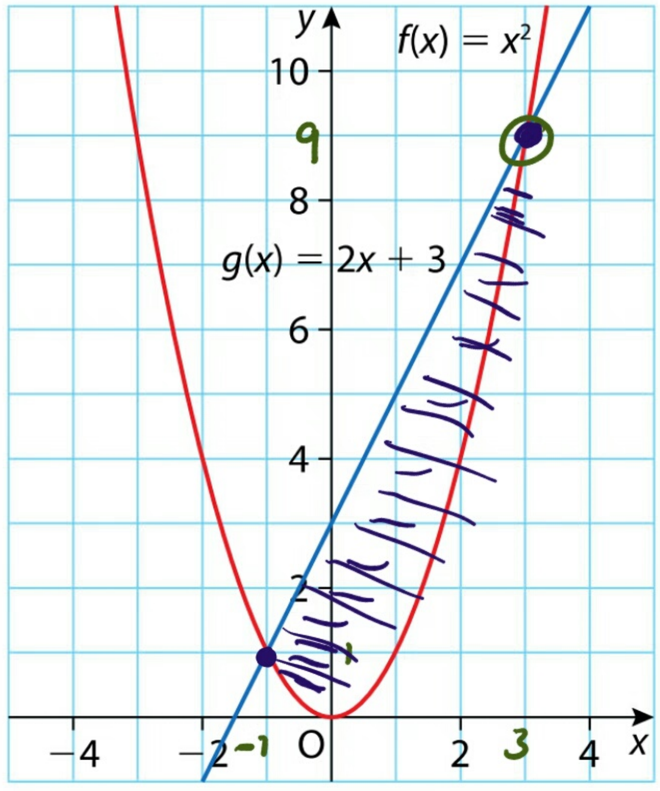
(i) Write down the coordinates of the points where the curve and line meet. (-1, 1) (3, 9)

(ii) Solve the equation $x^2 = 2x + 3$.

(iii) What is the connection between the answers in (i) and (ii) above? Same x values.

(iv) Explain the meaning of the equation $f(x) = g(x)$. where line + curve intersect. x values.

(v) Use the graph to find the range of values of x for which $f(x) < g(x)$.



$x^2 = 2x + 3$ Solve.

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

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

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

Factors $(x - 3)(x + 1) = 0$ $+1x$, $-3x$, $-2x$

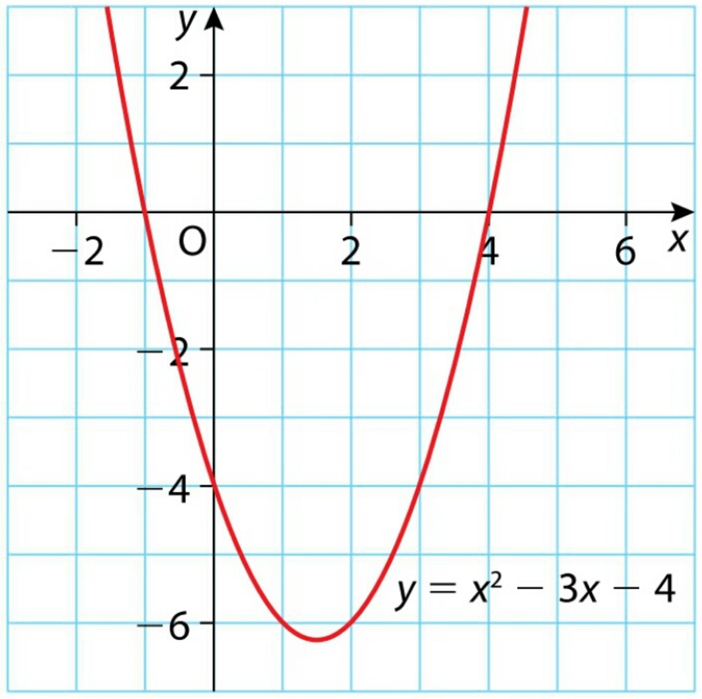
$x - 3 = 0$ $\quad x + 1 = 0$

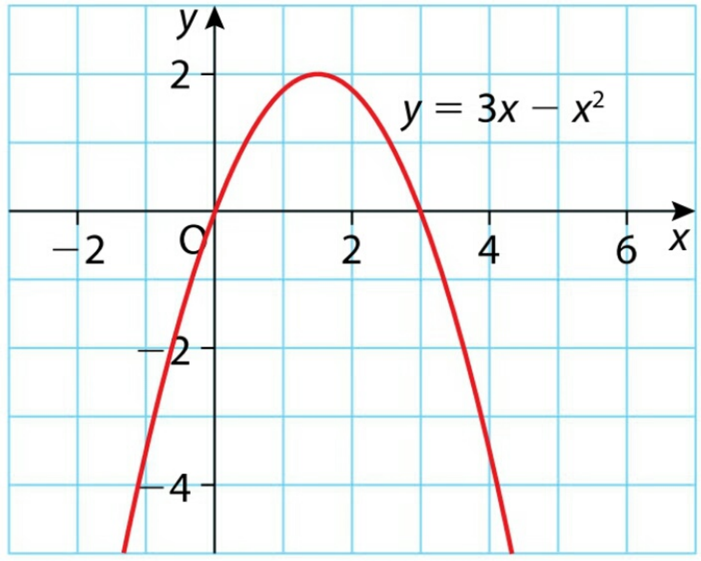
$x = 3$ $\quad x = -1$

$-1 \leq x \leq 3$

Exercise 17.3

6. Here are two graphs:





Use the graphs to solve these equations:

(i) $3x - x^2 = 0$

(ii) $x^2 - 3x - 4 = 0$

(iii) $3x - x^2 = -3$

(iv) $x^2 - 3x - 4 = -2$.

Exercise 17.3

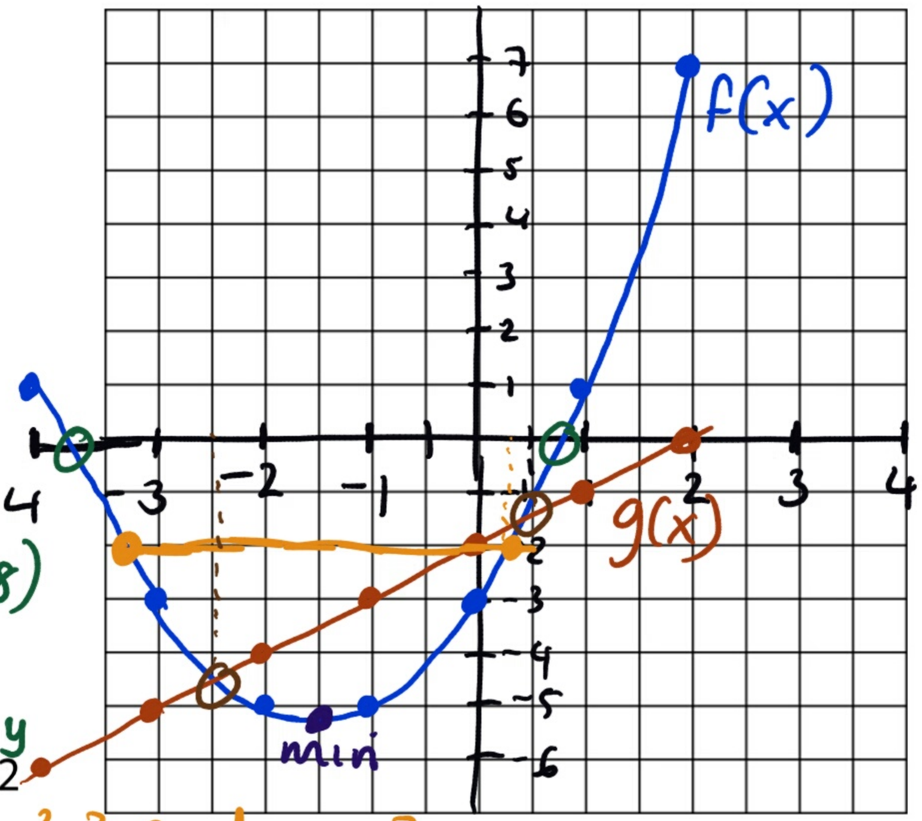
7. Using the same axes and the same scales, graph the functions ① $f: x \to x^2 + 3x - 3$ and ② $g: x \to x - 2$ in the domain $-4 \leqslant x \leqslant 2, x \in R$.

① f(x)

x	f(x)
−4	1
−3	−3
−2	−5
−1	−5
0	−3
1	1
2	7

② g(x)

x	f(x)
−4	−6
−3	−5
−2	−4
−1	−3
0	−2
1	−1
2	0



Use the graph to estimate

(i) the roots of the equation $x^2 + 3x - 3 = 0$ — cuts. x axis

(ii) the roots of the equation $x^2 + 3x - 3 = -2$

(iii) the roots of the equation $f(x) = g(x)$

(iv) the minimum value of $f(x)$.

(-4) and (1·8) x — f(x)

y — x = -3·3 and x = ·7

(2·5, 4·5) y — (1, -1·5)

min (-1·5; -5·3)

What is the meaning of $f(x) < g(x)$?

values below the line g(x)

Now use your graph to find the range of values of x for which $f(x) < g(x)$.

$-2{\cdot}5 \leq x \leq 1$

Quadratic Graphs and Real Life Problems.

Method

(1) Use your calculator in mode 3 to get the points on the graph.

(2) Draw the graph - on an axis go up / down by the same unit ie 1, 2, 3 or 2, 4, 6.

(3) When given the value of x or told $f(x)$ go out on the x axis (horizontal line) to touch the graph and read the answer off the y axis.

(4) When given a value for y of $f(x) = y$, go up or down on the y axis (vertical line) and read answer off the x axis.

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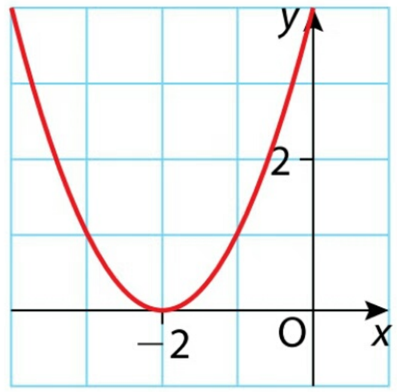
Exercise 17.3

8. The equation of the given curve is $y = (x + 2)^2$.

(i) Solve the equation $(x + 2)^2 = 0$.

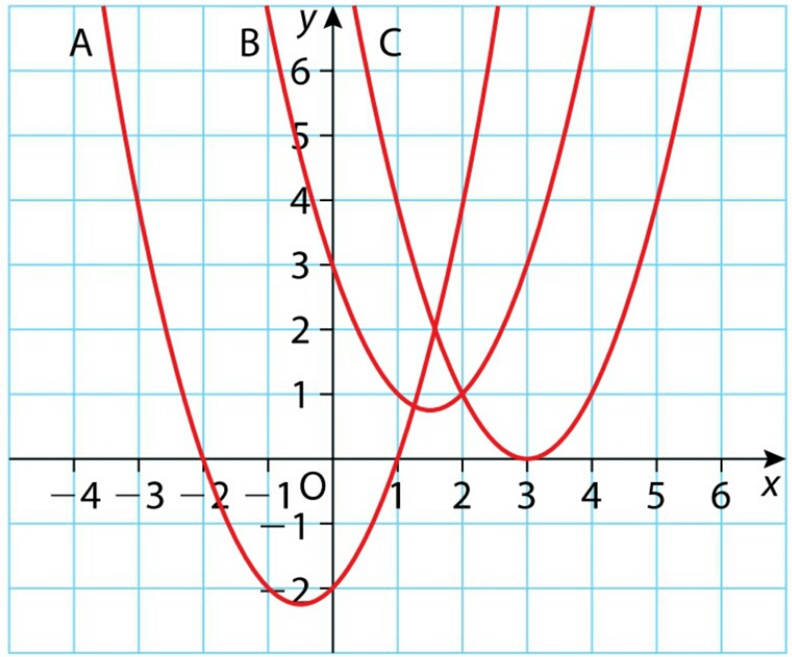
(ii) Did you get one or two values for x?

(iii) If you got one value only, the value for x that you found is called a **repeated root**.
Explain how the graph reflects this repeated root.



Exercise 17.3

9. The diagram below shows the graphs of $y = x^2 + x - 2$, $y = x^2 - 6x + 9$ and $y = x^2 - 3x + 3$.



(i) By substituting $x = 0$ (or any other value of x) into each equation, work out which graph corresponds to which equation.

(ii) Which function has a repeated root?

(iii) Use the graph to solve the equation

$$x^2 + x - 2 = x^2 - 6x + 9.$$

Answers 17.3

1. (i) 3 (ii) 3 (iii) (0, −1)
(iv) −1, 1 (v) −2, 2

2. (i) $x = -1, 4$ (ii) $x = -2, 5$ (iii) $x = 0, 3$
(iv) −6 (v) −5.25 (vi) (1.5, −6.25)
(vii) −6.25

3. (i) −1, 3 (ii) 0, 2 (iii) 1.75
(iv) 4 (v) (1, 4)
(vi) $-2 < x < 1$
(vii) $-1 < x < 3$
(viii) $x = 1$

4. (−2, 7), (−1, 0), (0, −3), (1, −2), (2, 3), (3, 12)
(i) $-1, 1\frac{1}{2}$ (ii) 2.4, −1.9
(iii) $(\frac{1}{4}, -3\frac{1}{8})$ (iv) $-1 < x < 1\frac{1}{2}$

5. (i) (−1, 1), (3, 9) (ii) −1, 3
(iii) same x-values
(iv) x-values of points of intersection of $f(x)$ and $g(x)$
(v) $-1 < x < 3$

6. (i) 0, 3 (ii) −1, 4
(iii) −0.8, 3.8 (iv) 3.6, −0.6

7. (i) −3.8, 0.8 (ii) −3.3, 0.3
(iii) −2.4, 0.4
(iv) −5.25; curve is below the line
(v) $-2.4 < x < 0.4$

8. (i) $x = -2$ (ii) one
(iii) x-axis is tangent to the curve at $x = -2$

9. (i) $A: y = x^2 + x - 2$; $B: y = x^2 - 3x + 3$;
$C: y = x^2 - 6x + 9$
(ii) $y = x^2 - 6x + 9$
(iii) $x = 1.6$