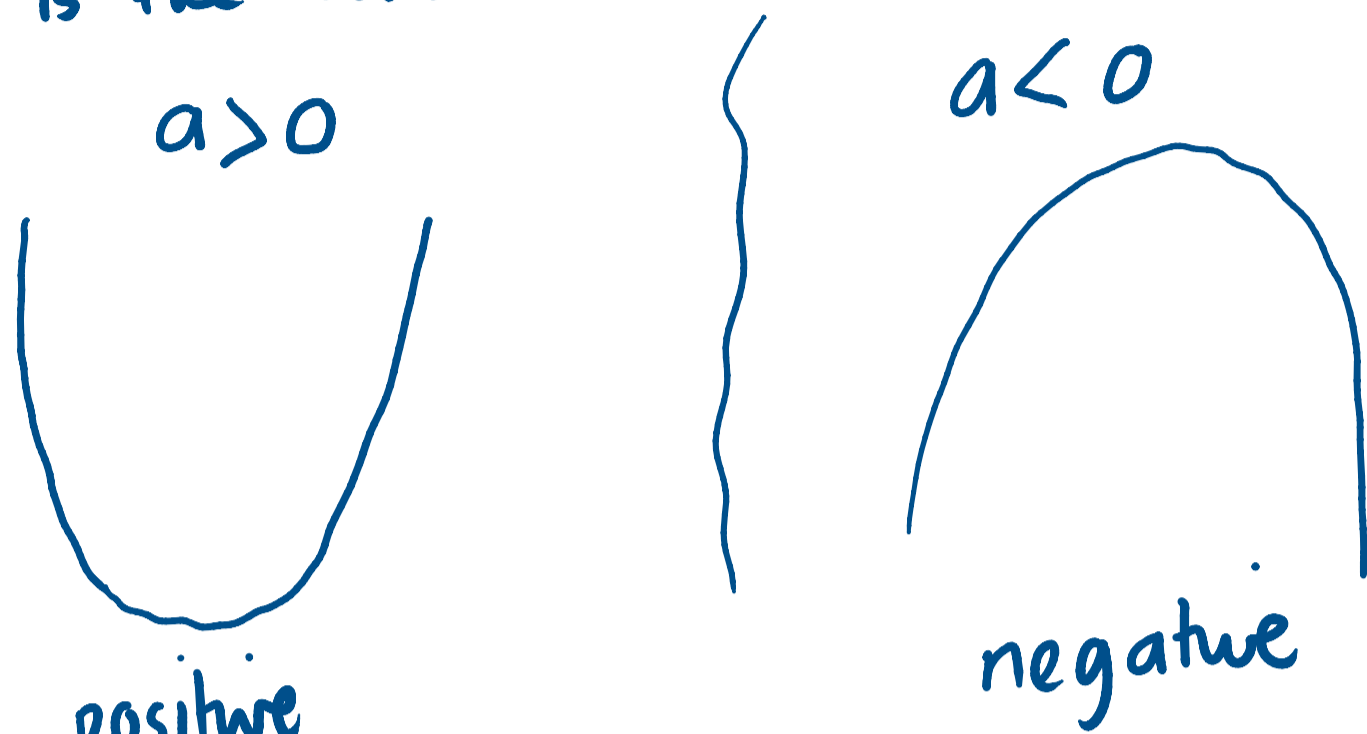


# Quadratic Equations

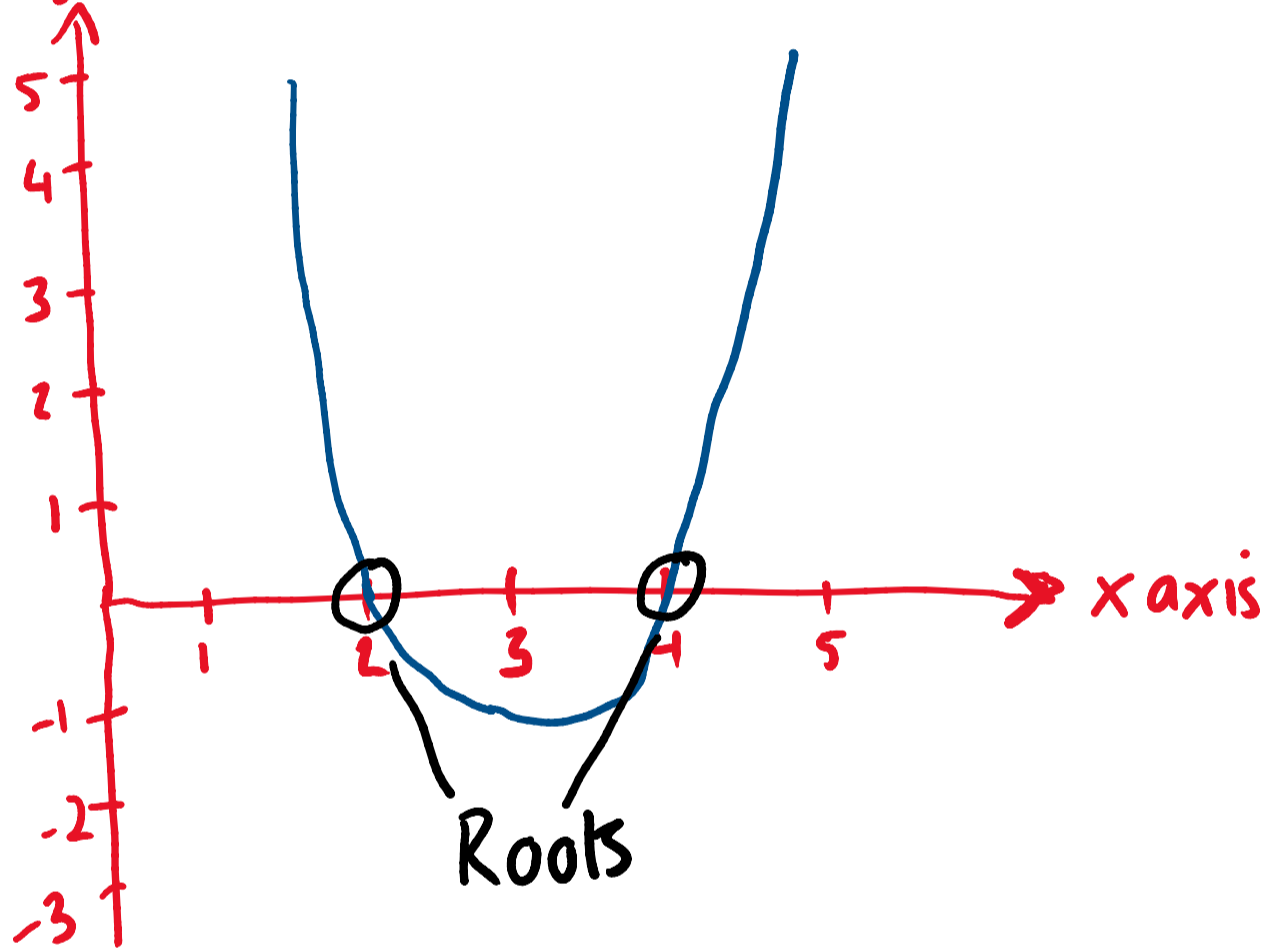
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A quadratic will always be in the form  $ax^2 + bx + c$ , where  $a, b$  and  $c \in \mathbb{R}$ .

$a$  is the coefficient of  $x^2$   
 $b$  is the coefficient of  $x$   
 $c$  is the constant.



positive  
y axis



positive  
quadratic.

NOTE: The roots of the quadratic is where it cuts the x axis

Eg 1 Factorize  $x^2 + 7x + 10$

a)  $(x + 5)(x + 2)$   $\begin{matrix} +2x \\ +5x \\ +7x \end{matrix}$

$$\begin{array}{cc} x^2 & 10 \\ / \quad \backslash & / \quad \backslash \\ x & x & 5 & 2 \end{array}$$

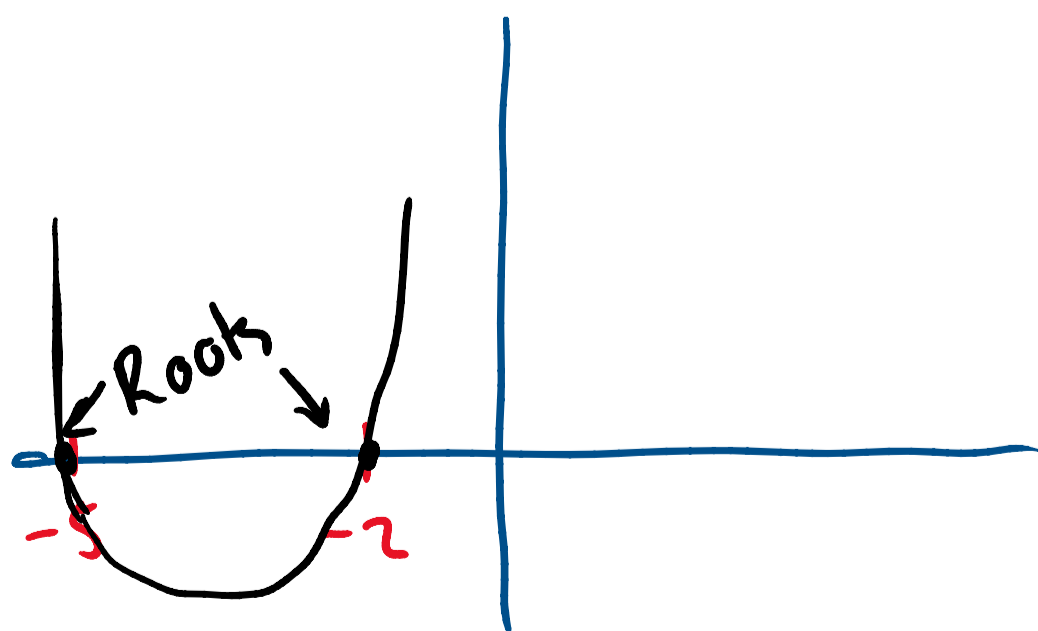
- b) Hence, solve the equation  $x^2 + 7x + 10 = 0$
- Method: 1) Take the factors of the quadratic and put both of the equal to zero (0).  
 2) Solve both equations to find the two values of  $x$ .

$$(x+5)(x+2) = 0$$

$$x+5=0 \qquad x+2=0$$

$$-5 \mid x = -5 \mid -5 \quad -2 \mid x = -2 \mid -2$$

The roots of  $x^2 + 7x + 10$  are



$$x = -5 \text{ and } x = -7.$$

$$\text{Q11)} \quad x^2 + 12x + 35 = 0$$

$$(x + 5)(x + 7) = 0$$

$$\begin{array}{cc} x^2 & 35 \\ / \quad \backslash & / \quad \backslash \\ x \quad x & 5 \quad 7 \end{array}$$

$$\begin{array}{l} + 7x \\ + \underline{5x} \\ + 12x \end{array}$$

$$x + 5 = 0$$

$$x = -5$$

$$x + 7 = 0$$

$$x = -7$$

Two Roots,

H/W Pg 140

Q 3, 6, 9, 12



T&T2 8.1  
Solving...

chapter

8

## Quadratic equations

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### Section 8.1 Solving quadratic equations using factors

### Example 1

Solve the equation  $x^2 - 5x - 14 = 0$ .

### Example 2

Solve these equations:

(i)  $2x^2 - 9x = 0$

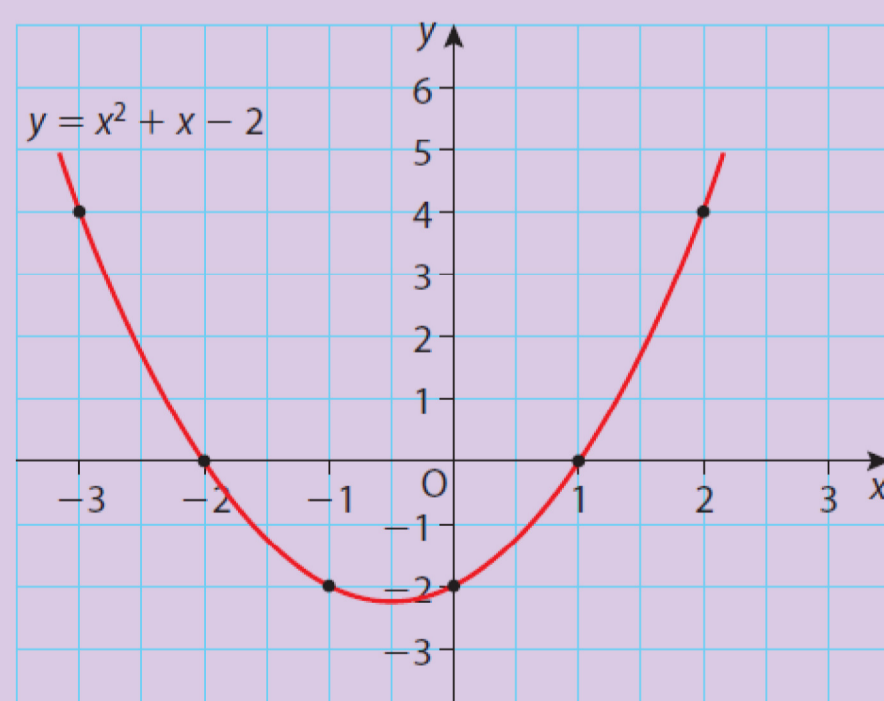
(ii)  $4x^2 - 25 = 0$

### Discussion

The curve on the right is called a parabola.

It is the graph of  $y = x^2 + x - 2$ .

- ▶ Factorise  $x^2 + x - 2$  and then solve the equation  $x^2 + x - 2 = 0$ .
- ▶ Can you use the graph to solve the equation  $x^2 + x - 2 = 0$ ?
- ▶ What is the link between the two sets of answers?
- ▶ Now explain the meaning of the roots of a quadratic equation.



## Exercise 8.1

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Solve the following quadratic equations:

1.  $(x - 2)(x - 4) = 0$

Solve the following quadratic equations:

2.  $(x - 4)(x + 2) = 0$

Solve the following quadratic equations:

3.  $(x - 6)(x + 4) = 0$

Solve the following quadratic equations:

**4.**  $(x - 4)(2x - 3) = 0$

Solve the following quadratic equations:

**5.**  $(x + 3)(6x - 9) = 0$

Solve the following quadratic equations:

**6.**  $(2x - 1)(x + 4) = 0$

Solve the following quadratic equations:

**7.**  $x(x - 3) = 0$

Solve the following quadratic equations:

**8.**  $x(x + 5) = 0$

Solve the following quadratic equations:

**9.**  $2x(x + 3) = 0$

Solve the following quadratic equations:

**10.**  $x^2 + 7x + 10 = 0$

Solve the following quadratic equations:

**11.**  $x^2 + 12x + 35 = 0$

Solve the following quadratic equations:

**12.**  $x^2 + 14x + 48 = 0$

Solve the following quadratic equations:

**13.**  $x^2 - 5x + 6 = 0$

Solve the following quadratic equations:

**14.**  $x^2 - 8x + 15 = 0$

Solve the following quadratic equations:

**15.**  $x^2 - 10x + 21 = 0$



Solve the following quadratic equations:

**16.**  $x^2 - x - 12 = 0$

Solve the following quadratic equations:

**17.**  $x^2 - 3x - 10 = 0$

Solve the following quadratic equations:

**18.**  $x^2 + 3x - 28 = 0$

Solve the following quadratic equations:

**19.**  $2x^2 - 5x + 2 = 0$

Solve the following quadratic equations:

**20.**  $2x^2 - 3x - 2 = 0$

Solve the following quadratic equations:

**21.**  $2x^2 - x - 6 = 0$

Solve the following quadratic equations:

**22.**  $2x^2 + 5x + 2 = 0$

Solve the following quadratic equations:

**23.**  $3x^2 - 7x + 2 = 0$

Solve the following quadratic equations:

**24.**  $3x^2 + x - 10 = 0$

Solve the following quadratic equations:

**25.**  $3x^2 + 10x - 8 = 0$

Solve the following quadratic equations:

**26.**  $3x^2 - 13x - 10 = 0$

Solve the following quadratic equations:

**27.**  $3x^2 + 19x - 14 = 0$

Solve the following quadratic equations:

**28.**  $4x^2 - 12x + 5 = 0$

Solve the following quadratic equations:

**29.**  $5x^2 - 13x - 6 = 0$

Solve the following quadratic equations:

**30.**  $5x^2 - 13x + 6 = 0$

Solve the following quadratic equations:

**31.**  $x^2 - 6x = 0$

Solve the following quadratic equations:

**32.**  $2x^2 - 5x = 0$

Solve the following quadratic equations:

**33.**  $3x^2 - 4x = 0$

Solve the following quadratic equations:

**34.**  $4x^2 - x = 0$

Solve the following quadratic equations:

**35.**  $5x^2 - 6x = 0$

Solve the following quadratic equations:

**36.**  $3x^2 - 7x = 0$

Solve the following quadratic equations:

**37.**  $x^2 - 9 = 0$

Solve the following quadratic equations:

**38.**  $x^2 - 25 = 0$

Solve the following quadratic equations:

**39.**  $4x^2 - 1 = 0$



Solve the following quadratic equations:

**40.**  $4x^2 - 25 = 0$

Solve the following quadratic equations:

**41.**  $9x^2 - 16 = 0$

Solve the following quadratic equations:

**42.**  $4x^2 - 49 = 0$

Solve the following quadratic equations:

**43.**  $2x(x - 2) = 3(x + 10)$

Solve the following quadratic equations:

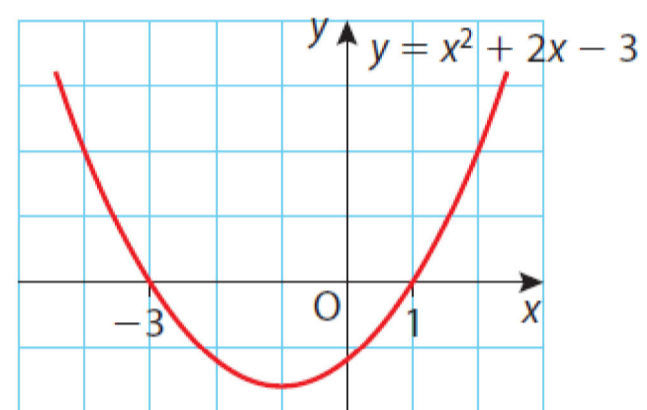
**44.**  $(x - 2)(x - 3) = 20$

Solve the following quadratic equations:

**45.**  $(2x - 5)(x - 2) = 15$

**46.** Solve the equation  $(x - 8)(x - 2) = 2x(x - 5)$ .

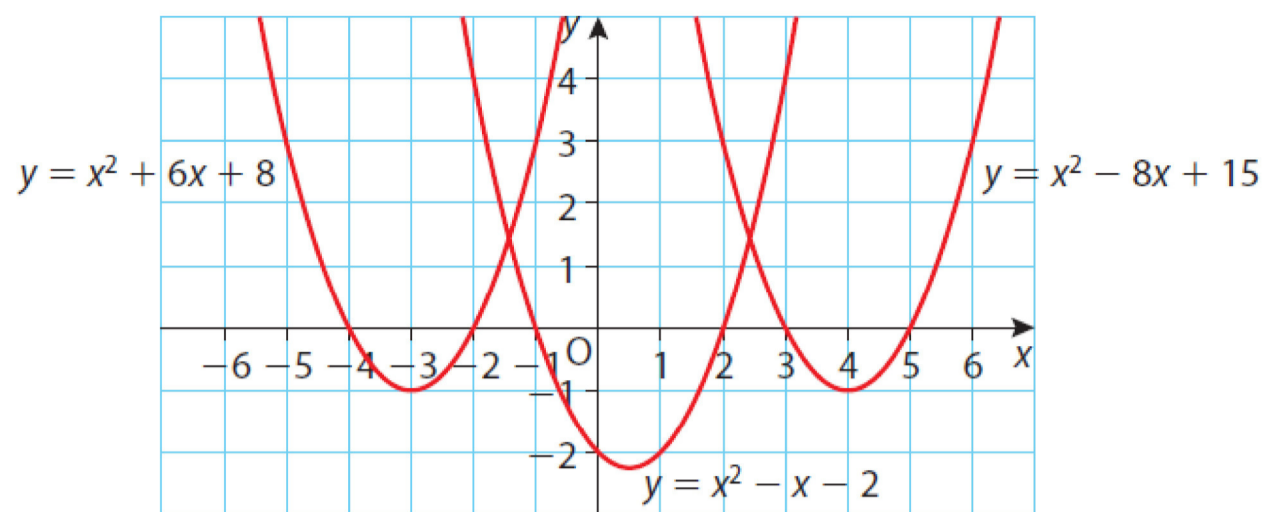
**47.** Write down the roots of the equation  $x^2 + 2x - 3 = 0$  by referring to the graph shown.



**48.** Write down the values of  $x$  where the graph of each of these functions crosses the  $x$ -axis. (You do not need to draw the graphs.)

- (i)  $y = (x - 4)(x + 5)$       (ii)  $y = (x + 2)(x + 4)$       (iii)  $y = (x - 5)(x - 6)$

49. Three parabolas are shown here.



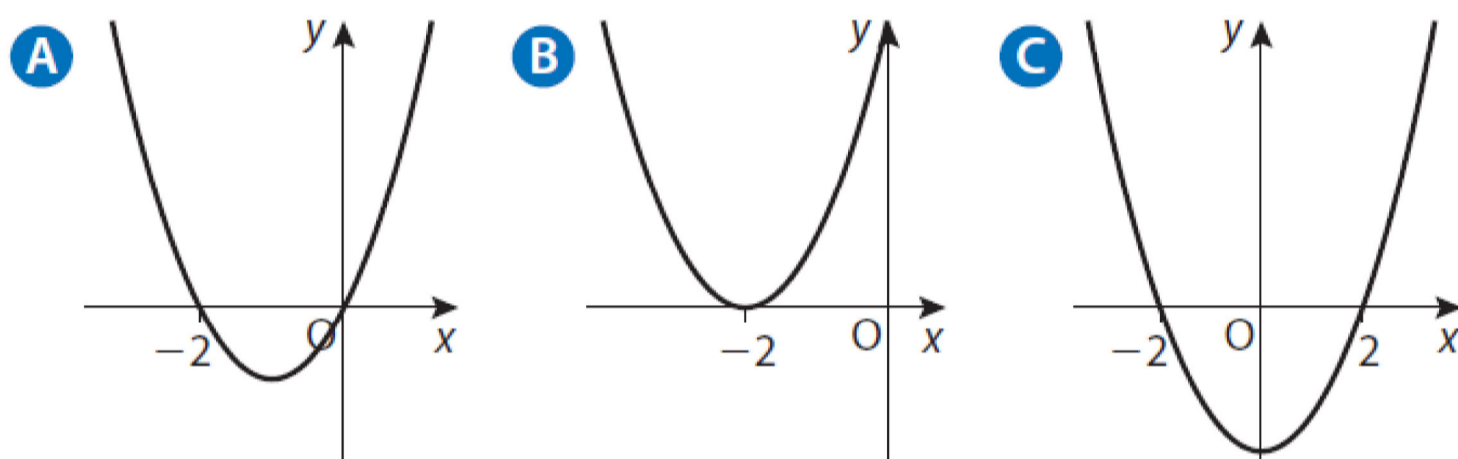
Use the graphs above to solve the following equations (each has two solutions).

- (i)  $x^2 - 8x + 15 = 0$       (ii)  $x^2 + 6x + 8 = 0$       (iii)  $x^2 - x - 2 = 0$

50. (i) How many values of  $x$  make  $(x + 2)^2 = 0$ ?

(ii) One of these sketches shows  $y = (x + 2)^2$ . Which one?

Explain your answer.



## Answers

### Exercise 8.1

- |                        |                       |                       |
|------------------------|-----------------------|-----------------------|
| 1. $x = 2, 4$          | 2. $x = -2, 4$        | 3. $x = -4, 6$        |
| 4. $\frac{3}{2}, 4$    | 5. $-3, \frac{3}{2}$  | 6. $-4, \frac{1}{2}$  |
| 7. $0, 3$              | 8. $-5, 0$            | 9. $-3, 0$            |
| 10. $-5, -2$           | 11. $-7, -5$          | 12. $-8, -6$          |
| 13. $2, 3$             | 14. $3, 5$            | 15. $3, 7$            |
| 16. $-3, 4$            | 17. $-2, 5$           | 18. $-7, 4$           |
| 19. $\frac{1}{2}, 2$   | 20. $-\frac{1}{2}, 2$ | 21. $-\frac{3}{2}, 2$ |
| 22. $-2, -\frac{1}{2}$ | 23. $\frac{1}{3}, 2$  | 24. $-2, \frac{5}{3}$ |
| 25. $-4, \frac{2}{3}$  | 26. $-\frac{2}{3}, 5$ | 27. $-7, \frac{2}{3}$ |

## Answers

28.  $\frac{1}{2}, \frac{5}{2}$       29.  $\frac{-2}{5}, 3$       30.  $\frac{3}{5}, 2$   
31.  $0, 6$       32.  $0, \frac{5}{2}$       33.  $0, \frac{4}{3}$   
34.  $0, \frac{1}{4}$       35.  $0, \frac{6}{5}$       36.  $0, \frac{7}{3}$   
37.  $\pm 3$       38.  $\pm 5$       39.  $\pm \frac{1}{2}$   
40.  $\pm \frac{5}{2}$       41.  $\pm \frac{4}{3}$       42.  $\pm \frac{7}{2}$   
43.  $\frac{-5}{2}, 6$       44.  $-2, 7$       45.  $\frac{-1}{2}, 5$   
46.  $\pm 4$   
47.  $-3, 1$   
48. (i)  $-5, 4$       (ii)  $-4, -2$   
    (iii)  $5, 6$   
49. (i)  $x = 3, 5$       (ii)  $x = -4, -2$   
    (iii)  $x = -1, 2$   
50. (i) one ( $x = -2$ )      (ii) B