

# CHAPTER FOUR

## QUADRATIC EQUATION

### Introduction:

A quadratic equation is an equation which is of the form  $ax^2 + bx + c = 0$ .

Examples are:

1.  $2x^2 + 4x + 1 = 0$
2.  $5x^2 - 4x - 2 = 0$
3.  $x^2 - x + 6 = 0$

For the determination of the truth set, the roots or the solution set of a quadratic equation, two methods can be used, and these are:

- (i) By completing the squares
- (ii) By using the formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**QUESTION 1: Find the roots or the truth set of the quadratic equation  $x^2 + 5x + 6 = 0$**

**SOLUTION**

### METHOD 1

$$x^2 + 5x + 6 = 0$$

$$\Rightarrow ( \quad ) ( \quad ) = 0$$

$$\Rightarrow (x) (x \quad ) = 0$$

We next consider all the factors of 6 and fix each set of factors in turn into the above and in each case, multiply the contents of the two brackets.

If the answer we get is the same as the given equation, then we proceed or continue working and if not, then we must try the other sets of factors.

The set of factors of 6 are:

-1 and -6

2 and 3

3 and 2

-6 and -1

Fixing of the first set of factors  $\Rightarrow$  i.e. (-1 and -6) into  $(x \quad \quad \quad)(x \quad \quad \quad) = 0$

$$\Rightarrow (x - 1)(x - 6) = 0.$$

**Multiplying them out**

$$\Rightarrow x^2 - 6x - x + 6 = 0$$

$$\Rightarrow x^2 - 7x + 6 = 0$$

Since  $x^2 - 7x + 6 = 0$  is not the same as  $x^2 + 5x + 6$ , which is the given equation, then -1 and -6 will not work.

We then substitute the next set of factors i.e. 2 and 3 into  $(x \quad \quad \quad)(x \quad \quad \quad) = 0$

$$\Rightarrow (x + 2)(x + 3) = 0$$

Multiply this out  $\Rightarrow$

$$x^2 + 3x + 2x + 6 = 0$$

$$\Rightarrow x^2 + 5x + 6 = 0$$

Since this is the same as the given equation, we proceed with the work.

$$\text{From } (x + 2)(x + 3) = 0$$

$$\Rightarrow (x + 2) = 0 \Rightarrow x = 0 - 2$$

$$\Rightarrow x = -2, \text{ or } (x + 3) = 0$$

$$\Rightarrow x = 0 - 3 = -3$$

The truth set or roots is  $\{x: x = -2 \text{ or } x = -3\}$

NB: This method which is a try and error method is known as completing the square method.105

## **METHOD 2**

If  $ax^2 + bx + c = 0$ ,

$$\text{Then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The given equation is  $x^2 + 5x + 6 = 0$ .

$$\Rightarrow 1x^2 + 5x + 6 = 0.$$

Comparing this with  $ax^2 + bx + c = 0$ .

$$\Rightarrow a = 1, b = 5 \text{ and } c = 6.$$

$$\Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(6)}}{2(1)}$$

$$\Rightarrow x = \frac{-5 \pm \sqrt{25 - 24}}{2}$$

$$\Rightarrow x = \frac{-5 \pm \sqrt{1}}{2}$$

Since  $\sqrt{1} = 1$ , then

$$\frac{x = -5 \pm 1}{2}$$

(i) Considering the positive sign

$$\Rightarrow \frac{x = -5 + 1}{2} = \frac{-4}{2} = -2.$$

(ii) Considering the negative sign

$$\Rightarrow x = \frac{-5-1}{2} = \frac{-6}{2}$$

$$\Rightarrow x = -3.$$

$\therefore$  The roots or the truth set is  $\{x: x = -2 \text{ or } x = -3\}$ .

**QUESTION 2: Determine the truth set of the equation  $x^2 + 6x + 8 = 0$ .**

### **SOLUTION**

#### **METHOD (1)**

$$x^2 + 6x + 8 = 0$$

$$(x \quad \quad \quad) (x \quad \quad \quad) = 0.$$

The set of factors of 8 are

(1) 1 and 8

(2) -2 and -4

(3) 8 and 1

(4) -4 and -2

(5) 2 and 4

(6) 4 and 2

(7) -1 and -8

(8) -8 and -1

Substitute 1 and 8 into  $(x \quad \quad \quad) (x \quad \quad \quad) = 0$

$$\Rightarrow (x+1) (x+8) = 0,$$

$$\Rightarrow x^2 + 8x + x + 8 = 0,$$

$$\Rightarrow x^2 + 9x + 8 = 0.$$

Since  $x^2 + 9x + 8 = 0$  is not the same as the given equation which is  $x^2 + 6x + 8$ , we try the next set of factors which are  $-2$  and  $-4$ ,

$$\Rightarrow (x - 2) (x - 4) = 0,$$

$$\Rightarrow x^2 - 4x - 2x + 8 = 0,$$

$$\Rightarrow x^2 - 6x + 8 = 0,$$

Which is also different from the given equation i.e.

$$x^2 + 6x + 8 = 0.$$

We therefore try  $2$  and  $4$ ,

$$\Rightarrow (x + 2) (x + 4) = 0,$$

$$\Rightarrow x^2 + 4x + 2x + 8 = 0,$$

$$\Rightarrow x^2 + 6x + 8 = 0.$$

Since this is the same as the given equation

$$\Rightarrow (x + 2) (x + 4) = 0,$$

$$\Rightarrow x + 2 = 0 \quad \Rightarrow x = 0 - 2,$$

$$\Rightarrow x = -2, \text{ or } (x + 4) = 0,$$

$$\Rightarrow x = 0 - 4 \quad \Rightarrow x = -4.$$

The roots or truth set is given by  $\{x: x = -2 \text{ or } x = -4\}$ .

### **METHOD (2)**

$$x^2 + 6x + 8 = 0$$

$$\Rightarrow 1x^2 + 6x + 8 = 0.$$

Comparing this with  $ax^2 + bx + c = 0$ .

$\Rightarrow a = 1, b = 6 \text{ and } c = 8.$

$$\text{From } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-6 \pm \sqrt{6^2 - 4(1)(8)}}{2(1)}$$

$$\Rightarrow x = \frac{-6 \pm \sqrt{36 - 32}}{2}$$

$$\Rightarrow x = \frac{-6 \pm \sqrt{4}}{2}$$

$$\Rightarrow x = \frac{-6 \pm 2}{2}$$

(i) Considering the positive sign

$$\Rightarrow x = \frac{-6 + 2}{2} = \frac{-4}{2} = -2.$$

(ii) Considering the negative sign

$$\Rightarrow x = \frac{-6 - 2}{2} = \frac{-8}{2} = -4.$$

The truth set =  $\{x: x = -2 \text{ or } x = -4\}.$

**QUESTION 3: Determine the values of  $x$ , which satisfy the equation  $2x^2 + 8x + 6 = 0$ .**

### **SOLUTION**

#### **METHOD (i)**

Since 2 is attached to the  $x^2$ , then this 2 must be attached to one of the  $x$  within the brackets.

$$\Rightarrow (2x) (x \quad) = 0.$$

The factors of 6 are 2 and 3, 3 and 2, -2 and -3, -3 and -2, 1 and 6, 6 and 1, -1 and -6 as well as -6 and -1. Now let us try the set 2 and 3  $\Rightarrow (2x + 2) (x + 3) = 0$ ,

$$\Rightarrow 2x^2 + 6x + 2x + 6 = 0,$$

$$\Rightarrow 2x^2 + 8x + 6 = 0,$$

Which is the same as the given equation i.e.  $2x^2 + 8x + 6 = 0$ .

$$\therefore (2x + 2)(x + 3) = 0,$$

$$\Rightarrow 2x + 2 = 0 \Rightarrow 2x = 0 - 2 = -2.$$

$$\therefore 2x = -2 \Rightarrow x = \frac{-2}{2} = -1,$$

$$\text{or } (x + 3) = 0 \Rightarrow x = 0 - 3 = -3.$$

The roots or the values of x which satisfy the given equation is given by  $\{x: x = -3 \text{ or } x = -1\}$ .

### **Method (2)**

Comparing  $2x^2 + 8x + 6 = 0$

with  $ax^2 + bx + c = 0$ ,

$$\Rightarrow a = 2, b = 8 \text{ and } c = 6, \text{ and from } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-8 \pm \sqrt{8^2 - 4(2)(6)}}{2(2)}$$

$$\Rightarrow x = \frac{-8 \pm \sqrt{64 - 48}}{4}$$

$$\Rightarrow x = \frac{-8 \pm \sqrt{16}}{4}$$

$$\Rightarrow x = \frac{-8 \pm 4}{4}.$$

Considering the positive sign

$$\Rightarrow x = \frac{-8 + 4}{4} = \frac{-4}{4} = -1.$$

Considering the negative sign

$$\Rightarrow x = \frac{-8 - 4}{4} = \frac{-12}{4}$$

$$\Rightarrow x = -3.$$

The truth set =  $\{x: x = -1 \text{ or } x = -3\}$ .

**QUESTION 4: Find the truth set of the equation  $22x + 10 = -4x^2$**

**SOLUTION**

$$22x + 10 = -4x^2$$

$$\Rightarrow 22x + 10 + 4x^2 = 0,$$

$$\Rightarrow 4x^2 + 22x + 10 = 0.$$

Since 4 is attached to the  $x^2$ , then 4 must be attached to one of the  $x$  within the brackets.

$$\Rightarrow (4x \quad \quad)(x \quad \quad) = 0.$$

The factors of 10 are 1 and 10, 2 and 5, 5 and 2, 10 and 1, -1 and -10, -10 and -1, -2 and -5, -5 and -2. Trying the first set of factors i.e. 1 and 10  $\Rightarrow (4x + 1)(x + 10) = 0$ ,

$$\Rightarrow 4x^2 + 40x + x + 10 = 0,$$

$$\Rightarrow 4x^2 + 41x + 10 = 0.$$

But this is different from  $4x^2 + 22x + 10 = 0$ , which is the given equation. Trying the next set i.e. 2 and 5  $\Rightarrow (4x + 2)(x + 5) = 0$ ,

$$\Rightarrow 4x^2 + 20x + 2x + 10 = 0,$$

$$\Rightarrow 4x^2 + 22x + 10 = 0 \text{ which is the same as the given equation. Therefore } (4x + 2)(x + 5) = 0,$$

$$\Rightarrow 4x + 2 = 0 \Rightarrow 4x = -2,$$

$$\Rightarrow x = \frac{-2}{4} = -0.5, \text{ or } x + 5 = 0 \Rightarrow x = -5.$$

The truth set =  $\{x: x = -0.5 \text{ or } x = -5\}$ .

**QUESTION 5: Solve the equation  $-3x = 10 - x^2$**



## **SOLUTION**

$$\text{Since } -3x = 10 - x^2$$

$$\Rightarrow -3x - 10 + x^2 = 0,$$

$$\Rightarrow x^2 - 3x - 10 = 0. \text{ The given equation is therefore the same as } x^2 - 3x - 10 = 0.$$

$$(\quad)(\quad) = 0.$$

The factors of -10 are -5 and 2, 2 and -5, 1 and -10, -10 and 1.

$$\text{Trying } -5 \text{ and } 2 \Rightarrow (x - 5)(x + 2) = 0,$$

$$\Rightarrow x^2 + 2x - 5x - 10 = 0,$$

$$\Rightarrow x^2 - 3x - 10 = 0, \text{ which is the same the given equation i.e } x^2 - 3x - 10 = 0,$$

$$\Rightarrow (x - 5)(x + 2) = 0,$$

$$\Rightarrow x - 5 = 0, \Rightarrow x = 5, \text{ or } x + 2 = 0, \Rightarrow x = -2.$$

$$\therefore \text{ Truth set} = \{x: x = 5 \text{ or } x = -2\}$$

## **METHOD 2**

$$\text{Comparing } 1x^2 - 3x - 10 = 0$$

$$\text{With } ax^2 + bx + c = 0 \Rightarrow a = 1, b = -3 \text{ and } c = -10.$$

$$\text{From } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-10)}}{2(1)}$$

$$\Rightarrow x = \frac{3 \pm \sqrt{9 - 4(-10)}}{2}$$

$$\Rightarrow x = \frac{3 \pm \sqrt{9+40}}{2},$$

$$\Rightarrow x = \frac{3 \pm \sqrt{49}}{2},$$

$$\Rightarrow x = \frac{3 \pm 7}{2}. \text{ Considering the positive sign } \Rightarrow x = \frac{3+7}{2} = \frac{10}{2} = 5.$$

$$\text{Considering the negative sign } \Rightarrow x = \frac{3-7}{2} = \frac{-4}{2} = -2.$$

Truth set =  $\{x: x = 5 \text{ or } x = -2\}$ .

### QUESTION 6:

**Determine the truth set of  $3x^2 + 14x - 5 = 0$ .**

### SOLUTION

$$(3x \quad \quad)(x \quad \quad) = 0.$$

Factors of -5 are 1 and -5, -5 and 1, 5 and -1, -1 and 5.

$$\text{Trying 1 and -5 } \Rightarrow (3x + 1)(x - 5) = 0,$$

$$\Rightarrow 3x^2 - 15x + x - 5 = 0,$$

$$\Rightarrow 3x^2 - 14x - 5 = 0 \text{ which differs from the given equation i.e. } 3x^2 + 14x - 5 = 0.$$

We therefore try -5 and 1

$$\Rightarrow (3x - 5)(x + 1) = 0,$$

$$\Rightarrow 3x^2 + 3x - 5x - 5 = 0,$$

$$\Rightarrow 3x^2 - 2x - 5 = 0, \text{ which also differs from the given equation. We next try -1 and 5}$$

$$\Rightarrow (3x - 1)(x + 5) = 0,$$

$$\Rightarrow 3x^2 + 15x - x - 5 = 0,$$

$$\therefore 3x^2 + 14x - 5 = 0, \text{ which is similar to the given equation.}$$

$$\therefore (3x - 1)(x + 5) = 0,$$

$$\Rightarrow 3x - 1 = 0 \Rightarrow 3x = 1, \Rightarrow x = \frac{1}{3}$$

= 0.33, or  $x + 5 = 0$ ,  $\Rightarrow x = -5$ . Truth set =  $\{x: x = 0.33 \text{ or } x = 5\}$ .

## **METHOD 2**

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

with  $ax^2 + bx + c = 0$ ,

$\Rightarrow a = 3$ ,  $b = 14$  and  $c = -5$ .

$$\text{From } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-14 \pm \sqrt{14^2 - 4(3)(-5)}}{2(3)}$$

$$\Rightarrow x = \frac{-14 \pm \sqrt{196 - 4(-15)}}{6}$$

$$\therefore x = \frac{-14 \pm \sqrt{196 + 60}}{6}$$

$$\Rightarrow x = \frac{-14 \pm \sqrt{256}}{6},$$

$$\Rightarrow x = \frac{-14 \pm 16}{6}.$$

Considering the positive sign

$$\Rightarrow x = \frac{-14 + 16}{6} = \frac{2}{6} = \frac{1}{3} = 0.33.$$

Considering the negative sign

$$\Rightarrow x = \frac{-14 - 16}{6} = \frac{-30}{6} = -5.$$

$\therefore$  Truth set =  $\{x: x = 0.33 \text{ or } x = -5\}$ .

**QUESTION 7: Determine the truth set of the equation  $x^2 - 4x - 12 = 0$ .**

**SOLUTION**

**METHOD 1**

$$x^2 - 4x - 12 = 0$$

$$(x \quad \quad)(x \quad \quad) = 0.$$

The factors of -12 are -3 and 4, 3 and -4, -2 and 6, 6 and -2, -1 and 12, 4 and -3, -4 and 3, 6 and -2, 12 and -1, 1 and -12.

(i) Trying -3 and 4  $\Rightarrow (x - 3)(x + 4) = 0$ ,

$$\Rightarrow x^2 + 4x - 3x - 12 = 0,$$

$$\Rightarrow x^2 + x - 12 = 0 \text{ which differs from the given equation.}$$

(ii) Trying 3 and -4  $\Rightarrow (x + 3)(x - 4) = 0$ ,

$$\Rightarrow x^2 - 4x + 3x - 12 = 0,$$

$$\Rightarrow x^2 - x - 12 = 0, \text{ which differs from the given equation.}$$

(iii) Trying -2 and 6  $\Rightarrow (x - 2)(x + 6) = 0$ ,

$$\Rightarrow x^2 + 6x - 2x - 12 = 0,$$

$$\Rightarrow x^2 + 4x - 12 = 0, \text{ which differs from the given equation.}$$

(iv) Trying 2 and -6  $\Rightarrow (x + 2)(x - 6) = 0$ ,

$$\Rightarrow x^2 - 6x + 2x - 12 = 0,$$

$$\Rightarrow x^2 - 4x - 12 = 0.$$

Since this is similar to the given equation  $\Rightarrow (x + 2)(x - 6) = 0$ ,  $\Rightarrow x + 2 = 0 \Rightarrow x = -2$ , or  $(x - 6) = 0 \Rightarrow x = 6$ .

Truth set =  $\{x: x = -2 \text{ or } x = 6\}$ .

## **METHOD 2**

$x^2 - 4x - 12 = 0$  can also be written as  $1x^2 - 4x - 12 = 0$ .

Comparing  $1x^2 - 4x - 12 = 0$  with  $ax^2 + bx + c = 0$

$\Rightarrow a = 1, b = -4$  and  $c = -12$ .

From  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$\Rightarrow x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-12)}}{2(1)}$$

$$\therefore x = \frac{4 \pm \sqrt{16 - (4)(-12)}}{2}$$

$$\Rightarrow x = \frac{4 \pm \sqrt{16 + 48}}{2}$$

$$\Rightarrow x = \frac{4 \pm \sqrt{64}}{2},$$

$$\Rightarrow x = \frac{4 \pm 8}{2}.$$

Consider the positive sign

$$\Rightarrow x = \frac{4 + 8}{2} = \frac{12}{2} = 6,$$

$$\Rightarrow x = 6.$$

Considering the negative sign

$$\Rightarrow x = \frac{4 - 8}{2} = \frac{-4}{2} = -2.$$

The roots or truth set =

$$\{x: x = 6 \text{ or } x = -2\}$$

NB: -3 and 4 are factors of -12. It is necessary to interchange them to get 4 and -3 and try them also. This is due to the fact that even though  $(x - 3)(x + 4) = 0$  may not work, but  $(x + 4)(x - 3) = 0$  may work.

Also  $(x + 2)(x + 3) = 0$  may not work but  $(x + 3)(x + 2)$  may work.

**QUESTION 8: Determine the truth set of the equation  $4x^2 - 2x - 12 = 0$ .**

**SOLUTION**

**METHOD 1**

$$4x^2 - 2x - 12 = 0.$$

$$(4x \quad \quad)(x) = 0.$$

The factors of -12 are 1 and -12, 4 and -3, 6 and -2, -2 and 6, -4 and 3, -1 and 12, -12 and 1, -3 and 4 etc. Trying 1 and -12  $\Rightarrow (4x + 1)(x - 12) = 0$

$$\Rightarrow 4x^2 - 48x + x - 12 = 0,$$

$$\Rightarrow 4x^2 - 47x - 12 = 0, \text{ which differs from the given equation.}$$

$$\text{Trying 4 and -3} \Rightarrow (4x + 4)(x - 3) = 0.$$

$$\therefore 4x^2 - 12x + 4x - 12 = 0$$

$$\Rightarrow 4x^2 - 8x - 12x = 0, \text{ which differs from the given equation.}$$

$$\text{Trying 6 and -2} \Rightarrow (4x + 6)(x - 2) = 0$$

$$\Rightarrow 4x^2 - 8x + 6x - 12 = 0$$

$$\Rightarrow 4x^2 - 2x - 12 = 0, \text{ which is the same as the given equation.}$$

$$\therefore (4x + 6)(x - 2) = 0 \Rightarrow 4x + 6 = 0 \Rightarrow 4x = -6,$$

$$\Rightarrow x = \frac{-6}{4} = -1.5, \text{ or } (x - 2) = 0 \Rightarrow x = 2.$$

$$\text{Truth set} = \{x: x = -1.5 \text{ or } x = 2\}.$$

**METHOD 2**

Comparing  $4x^2 - 2x - 12 = 0$  with  $ax^2 + bx + c = 0$

$$\Rightarrow a = 4, b = -2 \text{ and } c = -12.$$

$$\text{From } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(4)(-12)}}{2(4)}$$

$$\Rightarrow x = \frac{+2 \pm \sqrt{4+192}}{8}$$

$$\Rightarrow x = \frac{2 \pm \sqrt{196}}{8} = \frac{2 \pm 14}{8}.$$

Considering the positive sign

$$\Rightarrow x = \frac{2 + 14}{8} = \frac{16}{8} = 2,$$

Considering the negative sign

$$\Rightarrow x = \frac{2 - 14}{8} = \frac{-12}{8} = -1.5.$$

**QUESTION 9: Find the truth set or the roots of  $6x^2 - 20x + 6 = 0$ .**

**SOLUTION**

$$6x^2 - 20x + 6 = 0.$$

$$(6x \quad ) (x) = 0.$$

The factors of 6 are -3 and -2, -2 and -3, -1 and -6, -6 and -1, 3 and 2, 2 and 3, 1 and 6 as well as 6 and 1.

Trying the factors -3 and -2

$$\Rightarrow (6x - 3)(x - 2) = 0,$$

$$\Rightarrow 6x^2 - 12x - 3x + 6 = 0 \Rightarrow 6x^2 - 15x + 6 = 0, \text{ which differs from the given equation i.e. } 6x^2 - 20x + 6 = 0.$$

Now trying -2 and -3

$$\Rightarrow (6x - 2)(x - 3) = 0$$

$$\Rightarrow 6x^2 - 18x - 2x + 6 = 0,$$

$$\Rightarrow 6x^2 - 20x + 6 = 0, \text{ which is the same as the given equation.}$$

$$\therefore (6x - 2)(x - 3) = 0$$

$$\Rightarrow 6x - 2 = 0 \Rightarrow 6x = 2, \Rightarrow x = \frac{2}{6},$$

$$\Rightarrow x = \frac{1}{3} = 0.33, \text{ or } x - 3 = 0 \Rightarrow x = 3.$$

$$\text{Truth set} = \{x: x = 0.33 \text{ or } x = 3\}.$$

## **METHOD 2**

$$\text{Comparing } 6x^2 - 20x + 6 = 0$$

$$\text{with } ax^2 + bx + c = 0,$$

$$\Rightarrow a = 6, b = -20 \text{ and } c = 6.$$

$$\text{From } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4(6)(6)}}{2(6)}$$

$$\Rightarrow x = \frac{20 \pm \sqrt{400 - 144}}{12}$$

$$\Rightarrow x = \frac{20 \pm \sqrt{256}}{12}$$

$$\therefore x = \frac{20 \pm 16}{12}.$$

Considering the positive sign

$$\Rightarrow x = \frac{20 + 16}{12} \Rightarrow x = \frac{36}{12} \Rightarrow x = 3.$$

Considering the negative sign

$$\Rightarrow x = \frac{20 - 16}{12} \Rightarrow x = \frac{4}{12} = \frac{1}{3} = 0.33.$$



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**QUESTIONS:**

**QUESTION 1: Find the truth set of the equation  $x^2 + 6x + 8 = 0$ .**

**Answer:**  $\{x: x = -2 \text{ or } x = -4\}$ .

**QUESTION 2: Find the truth set of the equation  $x^2 - 2x - 3 = 0$ .**

**Answer:**  $\{x: x = 3 \text{ or } x = -1\}$ .

**QUESTION 3: What are the roots of the equation  $2x^2 - 9x + 4 = 0$ .**

**Answer:**  $\{x: x = 0.5 \text{ or } x = 4\}$ .

**QUESTION 4: Determine the solution set of the equation  $3x^2 - x = 10$ .**

**Answer:**  $\{x: x = -1.6 \text{ or } x = 2\}$ .

**QUESTION 5: Determine the truth set of the equation  $-2x^2 = 4x - 6$ .**

**Answer:**  $\{x: x = 1 \text{ or } x = -3\}$ .

**QUESTION 6: Given that  $x^2 - 6x + 5 = 0$ , find  $x$ .**

**Answer:**  $\{x: x = 5 \text{ or } x = 1\}$

**QUESTION 7**

**: Find the solution set of the equation  $0 = -x - 2 + 3x^2$ .**

**Answer:**  $\{x: x = 0.66 \text{ or } x = 1\}$ .