

EXERCISE 2.2

Q.1 Find the cube roots of $-1, 8, -27, 64$.

(i) Cube roots of -1

Solution:

$$\text{Let } x = (-1)^{\frac{1}{3}}$$

$$x^3 = -1$$

$$x^3 + 1 = 0$$

$$x^3 + (1)^3 = 0$$

$$\therefore (a^3 + b^3) = (a + b)(a^2 - ab + b^2)$$

$$(x + 1)[x^2 - (x)(1) + 1^2] = 0$$

$$(x + 1)(x^2 - x + 1) = 0$$

$$x + 1 = 0 \text{ or}$$

$$\boxed{x = -1} \text{ or } \boxed{x^2 - x + 1 = 0}$$

Now we solve $x^2 - x + 1 = 0$ by formula

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

$$a = 1, b = -1, c = 1$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2 \times 1}$$

$$= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(1)}}{2 \times 1}$$

$$= \frac{1 \pm \sqrt{1 - 4}}{2}$$

$$= \frac{1 \pm \sqrt{-3}}{2}$$

$$= -1 \left(\frac{-1 \pm \sqrt{-3}}{2} \right)$$

$$x = -1 \left(\frac{-1 + \sqrt{-3}}{2} \right); x = -1 \left(\frac{-1 - \sqrt{-3}}{2} \right)$$

$$x = -1\omega \quad \text{or} \quad x = -1(\omega^2)$$

$$x = -\omega \quad \text{or} \quad x = -\omega^2$$

So, cube roots of -1 are $-1, -\omega$ and $-\omega^2$

(ii) Cube roots of 8

Solution:

$$\text{Let } x = (8)^{\frac{1}{3}}$$

$$x^3 = 8$$

$$x^3 - 8 = 0$$

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

$$\therefore (a^3 - b^3) = (a - b)(a^2 + ab + b^2)$$

$$(x - 2)[x^2 + (x)(2) + 2^2] = 0$$

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

$$x - 2 = 0 \text{ or } x^2 + 2x + 4 = 0$$

$$x = 2$$

Now we solve $x^2 + 2x + 4 = 0$ by formula

$$a = 1, b = 2, c = 4$$

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

$$= \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(4)}}{2 \times 1}$$

$$= \frac{-2 \pm \sqrt{4 - 16}}{2}$$

$$= \frac{-2 \pm \sqrt{-12}}{2}$$

$$= \frac{-2 \pm \sqrt{4 \times (-3)}}{2}$$

$$= \frac{-2 \pm \sqrt{4} \sqrt{-3}}{2}$$

$$= \frac{-2 \pm 2\sqrt{-3}}{2}$$

$$x = \frac{2(-1 \pm \sqrt{-3})}{2}$$

$$x = 2 \left(\frac{-1 + \sqrt{-3}}{2} \right), \quad x = 2 \left(\frac{-1 - \sqrt{3}}{2} \right)$$

$$x = 2\omega, \quad x = 2\omega^2$$

So cube roots of 8 are $2, 2\omega, 2\omega^2$

(iii) Cube roots of -27

Solution:

$$\text{Let } x = (-27)^{\frac{1}{3}}$$

$$x^3 = -27$$

$$x^3 + 27 = 0$$

$$x^3 + 3^3 = 0$$

$$\therefore (a^3 + b^3) = (a+b)(a^2 - ab + b^2)$$

$$(x+3)[x^2 - (x)(3) + 3^2] = 0$$

$$\text{Either } (x+3)(x^2 - 3x + 9) = 0$$

$$x+3=0 \quad \text{or} \quad x^2 - 3x + 9 = 0$$

Now we solve $x^2 - 3x + 9 = 0$ by formula

$$a = 1, \quad b = -3, \quad c = 9$$

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

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(9)}}{2 \times 1}$$

$$x = \frac{3 \pm \sqrt{9 - 36}}{2}$$

$$x = \frac{3 \pm \sqrt{-27}}{2}$$

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

$$x = \frac{3 \pm 3\sqrt{-3}}{2}$$

$$x = -3 \left(\frac{-1 \pm \sqrt{-3}}{2} \right)$$

$$x = -3 \left(\frac{-1 + \sqrt{-3}}{2} \right) \quad \text{or} \quad x = -3 \left(\frac{-1 - \sqrt{-3}}{2} \right)$$

$$x = -3\omega \quad \text{or} \quad x = -3\omega^2$$

So cube roots of -27 are -3 , -3ω and $-3\omega^2$

(iv) Cube roots of 64

Solution:

$$\text{Let } x = (64)^{\frac{1}{3}}$$

$$x^3 = 64$$

$$x^3 - 64 = 0$$

$$x^3 - 4^3 = 0$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$(x-4)[x^2 + (x)(4) + 4^2] = 0$$

$$(x-4)(x^2 + 4x + 16) = 0$$

$$\text{Either } x-4=0 \quad \text{or} \quad x^2 + 4x + 16 = 0$$

$$x = 4$$

Now we solve $x^2 + 4x + 16 = 0$ by formula

$$a = 1, \quad b = 4, \quad c = 16$$

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

$$x = \frac{-4 \pm \sqrt{4^2 - 4 \times 1 \times 16}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{16 - 64}}{2}$$

$$x = \frac{-4 \pm \sqrt{-48}}{2}$$

$$x = \frac{-4 \pm \sqrt{16(-3)}}{2}$$

$$x = \frac{-4 \pm 4\sqrt{-3}}{2}$$

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

Either

$$x = 4 \left(\frac{-1 + \sqrt{-3}}{2} \right) \quad \text{or} \quad x = 4 \left(\frac{-1 - \sqrt{-3}}{2} \right)$$

$$\text{Here } \omega = \frac{-1 + \sqrt{-3}}{2}, \quad \omega^2 = \frac{-1 - \sqrt{-3}}{2}$$

Therefore,

$$x = 4\omega, \quad \text{or} \quad x = 4\omega^2$$

So cube roots of 64 are 4 , 4ω and $4\omega^2$

Q.2 Evaluate

(i) $(1 - \omega - \omega^2)^7$

Solution: $(1 - \omega - \omega^2)^7$

$$= [1 - (\omega + \omega^2)]^7$$

$$\because 1 + \omega + \omega^2 = 0 \\ \omega + \omega^2 = -1$$

$$= [1 - (-1)]^7$$

$$= (1+1)^7$$

$$= 2^7$$

$$= 128$$

(ii) $(1 - 3\omega - 3\omega^2)^5$

Solution: $(1 - 3\omega - 3\omega^2)^5$

$$= [1 - 3(\omega + \omega^2)]^5$$

$$\because 1 + \omega + \omega^2 = 0 \\ \omega + \omega^2 = -1$$

$$= [1 - 3(-1)]^5$$

$$= (1+3)^5$$

$$= 4^5 = 1024$$

(iii) $(9 + 4\omega + 4\omega^2)^3$

Solution: $(9 + 4\omega + 4\omega^2)^3$

$$= [9 + 4(\omega + \omega^2)]^3$$

$$= [9 + 4(-1)]^3 \quad (\because \omega + \omega^2 = -1)$$

$$= [9 - 4]^3$$

$$= 5^3$$

$$= 125$$

(iv) $(2 + 2\omega - 2\omega^2)(3 - 3\omega + 3\omega^2)$

Solution: $(2 + 2\omega - 2\omega^2)(3 - 3\omega + 3\omega^2)$

$$= [2(1 + \omega - \omega^2)][3(1 - \omega + \omega^2)]$$

$$= [2(1 + \omega - \omega^2)][3(1 + \omega^2 - \omega)]$$

$$\because 1 + \omega + \omega^2 = 0$$

$$1 + \omega = -\omega^2 \quad 1 + \omega^2 = -\omega$$

$$\therefore = [2(-\omega^2) - 2\omega^2][3(-\omega) - 3\omega]$$

$$= (-2\omega^2 - 2\omega^2)(-3\omega - 3\omega)$$

$$= (-4\omega^2)(-6\omega)$$

$$= 24\omega^3 \quad \text{As } \omega^3 = 1$$

$$= 24(1)$$

$$= 24$$

(v) $(-1 + \sqrt{-3})^6 + (-1 - \sqrt{-3})^6$

Solution:

$$(-1 + \sqrt{-3})^6 + (-1 - \sqrt{-3})^6 \dots\dots(i)$$

As $\frac{-1 + \sqrt{-3}}{2} = \omega \quad \text{and} \quad \frac{-1 - \sqrt{-3}}{2} = \omega^2$

$$-1 + \sqrt{-3} = 2\omega \quad \text{and} \quad -1 - \sqrt{-3} = 2\omega^2$$

Now equation (i) becomes

$$= (2\omega)^6 + (2\omega^2)^6$$

$$= 2^6 \omega^6 + 2^6 \omega^{12}$$

$$= 2^6 [(\omega^3)^2 + (\omega^3)^4]$$

$$\text{As } \omega^3 = 1$$

$$= 2^6 [(1)^2 + (1)^4]$$

$$= 64(1+1)$$

$$= 64(2)$$

$$= 128$$

(vi) $\left(\frac{-1 + \sqrt{-3}}{2}\right)^9 + \left(\frac{-1 - \sqrt{-3}}{2}\right)^9$

Solution:

$$\left(\frac{-1 + \sqrt{-3}}{2}\right)^9 + \left(\frac{-1 - \sqrt{-3}}{2}\right)^9 \dots\dots(i)$$

As $\frac{-1 + \sqrt{-3}}{2} = \omega \quad \text{and} \quad \frac{-1 - \sqrt{-3}}{2} = \omega^2$

Now equation (i) becomes

$$= (\omega)^9 + (\omega^2)^9$$

$$= \omega^9 + \omega^{18}$$

$$= (\omega^3)^3 + (\omega^3)^6$$

$$= (1)^3 + (1)^6$$

$$\text{As } \omega^3 = 1$$

$$= 1+1$$

$$= 2$$

(vii) $\omega^{37} + \omega^{38} - 5$

Solution:

$$\omega^{37} + \omega^{38} - 5$$

$$= \omega^{36} \omega + \omega^{36} \omega^2 - 5$$

$$= (\omega^3)^{12} \omega + (\omega^3)^{12} \omega^2 - 5$$

$$= (1)^{12} \omega + (1)^{12} \omega^2 - 5 \quad \text{As } \omega^3 = 1$$

$$= 1\omega + 1\omega^2 - 5$$

$$= (\omega + \omega^2) - 5$$

$$= (-1) - 5$$

$$\text{As } 1 + \omega + \omega^2 = 0$$

$$= -1 - 5 = -6$$

$$\omega + \omega^2 = -1$$

(viii) $\omega^{-13} + \omega^{-17}$

Solution:

$$\begin{aligned}
 & \omega^{-13} + \omega^{-17} \\
 &= \frac{1}{\omega^{13}} + \frac{1}{\omega^{17}} \\
 &= \frac{1}{\omega^{12}\omega} + \frac{1}{\omega^{15}\omega^2} \\
 &= \frac{1}{(\omega^3)^4\omega} + \frac{1}{(\omega^3)^5\omega^2} \\
 &= \frac{1}{(1)^4\omega} + \frac{1}{(1)^5\omega^2} \quad \because \omega^3 = 1 \\
 &= \frac{1}{\omega} + \frac{1}{\omega^2} \\
 &= \frac{\omega^2 + \omega}{(\omega)(\omega^2)} \\
 &= \frac{-1}{\omega^3} \quad \because 1 + \omega + \omega^2 = 0 \\
 & \quad \omega + \omega^2 = -1 \\
 &= \frac{-1}{1} \\
 &= -1
 \end{aligned}$$

Q.3. Prove that,

$$x^3 + y^3 = (x+y)(x+\omega y)(x+\omega^2 y) \quad 02(032)$$

Solution: Let,

$$\text{R.H.S.} = (x+y)(x+\omega y)(x+\omega^2 y)$$

$$= (x+y)(x^2 + \omega^2 xy + \omega xy + \omega^3 y^2)$$

$$= (x+y)[x^2 + (\omega^2 + \omega)xy + \omega^3 y^2]$$

$$\because 1 + \omega + \omega^2 = 0 \Rightarrow \omega + \omega^2 = -1 \quad \text{and} \quad \omega^3 = 1$$

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

$$= (x+y)(x^2 - xy + y^2)$$

Using Formula: $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

$$= x^3 + y^3 = \text{L.H.S.}$$

Q.4. Prove that

$$\overline{x^3 + y^3 + z^3 - 3xyz} = (x+y+z)(x+\omega y+\omega^2 z)(x+\omega^2 y+\omega z)$$

Solution:

Let: R.H.S

$$= (x+y+z)(x+\omega y+\omega^2 z)(x+\omega^2 y+\omega z)$$

$$= (x+y+z)(x^2 + \omega^2 xy + \omega xz +$$

$$\omega yx + \omega^3 y^2 + \omega^2 yz + \omega^2 xz + \omega^4 zy + \omega^3 z^2)$$

$$= (x+y+z)[(x^2 + \omega^3 y^2 + \omega^3 z^2 +$$

$$(\omega^2 + \omega)xy + (\omega^2 + \omega^4)yz + (\omega + \omega^2)zx]$$

$$\because 1 + \omega + \omega^2 = 0 \Rightarrow \omega + \omega^2 = -1 \quad \text{and} \quad \omega^3 = 1$$

$$= (x+y+z)[x^2 + 1y^2 + 1z^2 + (-1)xy + (\omega^2 + \omega^3\omega)yz + (-1)zx]$$

$$= (x+y+z)[x^2 + 1y^2 + 1z^2 + (-1)xy + (\omega^2 + 1\omega)yz + (-1)zx]$$

$$= (x+y+z)(x^2 + y^2 + z^2 - xy - yz - zx)$$

$$= x^3 + y^3 + z^3 - 3xyz = \text{L.H.S}$$

Using Formula

$$(a+b+c)(a^2+b^2+c^2-ab-bc-ca) = a^3+b^3+c^3-3abc$$

Q.5. Prove that

02(034)

$$(1+\omega)(1+\omega^2)(1+\omega^4)(1+\omega^8) \dots 2n \text{ factors} = 1$$

Solution:

Let L.H.S.

$$= (1+\omega)(1+\omega^2)(1+\omega^4)(1+\omega^8) \dots 2n \text{ factors}$$

$$= (1+\omega)(1+\omega^2)(1+\omega\omega^3)(1+\omega^6\omega^2) \dots 2n \text{ factors}$$

$$\because \omega^3 = 1 \Rightarrow \omega^6 = (\omega^3)^2 = (1)^2 = 1$$

$$= (1+\omega)(1+\omega^2)(1+\omega)(1+\omega^2) \dots 2n \text{ factors}$$

$$= [(1+\omega)(1+\omega^2)][(1+\omega)(1+\omega^2)] \dots n \text{ factors}$$

$$= [(1+\omega)(1+\omega^2)]^n$$

$$= [1 + \omega^2 + \omega + \omega^3]^n$$

$$= [1 + \omega + \omega^2 + \omega^3]^n$$

$$\because 1 + \omega + \omega^2 = 0 \\ \omega^3 = 1$$

$$= [0 + 1]^n$$

$$= [1]^n$$

$$= 1 = \text{R. H. S} \Rightarrow \text{L.H.S} = \text{R.H.S}$$

Roots and coefficients of a quadratic equation.

We know that $\frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $\frac{-b - \sqrt{b^2 - 4ac}}{2a}$

Are roots of the equation $ax^2 + bx + c = 0$ where a , b are coefficients of x^2 and x respectively. While c is the constant term.

Relation between roots and co-efficients of a quadratic equation.

If $\alpha = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $\beta = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$

then we can find the sum and the product of the roots as follows.

Sum of the roots

$$\alpha + \beta = \frac{-b + \sqrt{b^2 - 4ac}}{2a} + \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$$\alpha + \beta = \frac{-b + \sqrt{b^2 - 4ac} - b - \sqrt{b^2 - 4ac}}{2a}$$

$$\alpha + \beta = \frac{-2b}{2a} = -\frac{b}{a}$$

Product of the roots

$$\alpha\beta = \left(\frac{-b + \sqrt{b^2 - 4ac}}{2a} \right) \left(\frac{-b - \sqrt{b^2 - 4ac}}{2a} \right)$$

$$\alpha\beta = \frac{(-b)^2 - (\sqrt{b^2 - 4ac})^2}{4a^2}$$

$$\alpha\beta = \frac{b^2 - (b^2 - 4ac)}{4a^2}$$

$$\alpha\beta = \frac{b^2 - b^2 + 4ac}{4a^2} = \frac{4ac}{4a^2} = \frac{c}{a}$$

If we denote the sum of roots and product of roots by S and P respectively, then

$$S = \frac{-b}{a} = -\frac{\text{Co-efficient of } x}{\text{Co-efficient of } x^2}$$

$$P = \frac{c}{a} = \frac{\text{constant term}}{\text{Co-efficient of } x^2}$$

The sum and the product of the roots of a given quadratic equation without solving it.

Example 1: Without solving, find the sum and product of the roots of the equations.

(a) $3x^2 - 5x + 7 = 0$ (b) $x^2 + 4x - 9 = 0$

Solution: (a) Let α and β be the roots of the equation $3x^2 - 5x + 7 = 0$

$$\text{Then sum of roots} = \alpha + \beta = -\frac{b}{a} = -\left(\frac{-5}{3}\right) = \frac{5}{3}$$

$$\text{and product of roots} = \alpha\beta = \frac{c}{a} = \frac{7}{3}$$

(b) Let α and β be the roots of the equation $x^2 + 4x - 9 = 0$

$$\text{Then } \alpha + \beta = -\frac{b}{a} = -\frac{4}{1} = -4$$

$$\text{and } \alpha\beta = \frac{c}{a} = \frac{-9}{1} = -9$$

To find unknown values involved in a given quadratic equation.

The procedure is illustrated through the following examples.

(a) Sum of the roots is equal to a multiple of the product of the roots.

Example 1:

Find the value of h , if the sum of the roots is equal to 3-times the product of the roots of the equation $3x^2 + (9 - 6h)x + 5h = 0$.

Solution: Let α , β be the roots of the equation

$$3x^2 + (9 - 6h)x + 5h = 0$$

$$\text{Then } \alpha + \beta = -\frac{b}{a} = -\left(\frac{9 - 6h}{3}\right) = \frac{6h - 9}{3}$$

$$\alpha\beta = \frac{c}{a} = \frac{5h}{3}$$

$$\text{Since } \alpha + \beta = 3(\alpha\beta)$$

$$\frac{6h - 9}{3} = 3\left(\frac{5h}{3}\right)$$

$$\text{or } \frac{3(2h - 3)}{3} = 5h$$

$$2h - 3 = 5h \Rightarrow 2h - 5h = 3$$

$$-3h = 3 \Rightarrow h = \frac{3}{-3} = -1$$

(b) Sum of the squares of the roots is equal to a given number.

Example 2:

Find p , if the sum of the squares of the roots of the equation $4x^2 + 3px + p^2 = 0$ is unity.

Solution:

If α, β are the roots of $4x^2 + 3px + p^2 = 0$

$$\text{Then } \alpha + \beta = -\frac{b}{a} = -\frac{3p}{4}$$

$$\text{and } \alpha\beta = \frac{c}{a} = \frac{p^2}{4}$$

$$\text{Since } \alpha^2 + \beta^2 = 1 \quad (\text{Given})$$

$$(\alpha + \beta)^2 - 2\alpha\beta = 1$$

$$\Rightarrow \left(\frac{-3p}{4}\right)^2 - 2\left(\frac{p^2}{4}\right) = 1$$

$$\text{or } \frac{9p^2}{16} - \frac{p^2}{2} = 1$$

$$\Rightarrow 9p^2 - 8p^2 = 16$$

$$\Rightarrow p^2 = 16 \Rightarrow p = \pm 4$$

(c) Two roots differ by a given number.

Example 3: Find h , if the roots of the equation $x^2 - hx + 10 = 0$ differ by 3.

Solution: Let α and $\alpha - 3$ be the roots of $x^2 - hx + 10 = 0$.

$$\text{Then } \alpha + \alpha - 3 = -\frac{b}{a} = -\left(\frac{-h}{1}\right) = h$$

$$2\alpha - 3 = h$$

$$\Rightarrow 2\alpha = h + 3$$

$$\Rightarrow \alpha = \frac{h+3}{2} \dots\dots\dots(i)$$

$$\alpha(\alpha - 3) = \frac{c}{a} = \frac{10}{1} = 10$$

$$\text{and or } \alpha(\alpha - 3) = 10 \dots\dots(ii)$$

Putting value of α from equation (i) in equation (ii), we get

$$\left(\frac{h+3}{2}\right)\left(\frac{h+3}{2} - 3\right) = 10$$

$$\Rightarrow \left(\frac{h+3}{2}\right)\left(\frac{h+3-6}{2}\right) = 10$$

$$\left(\frac{h+3}{2}\right)\left(\frac{h-3}{2}\right) = 10$$

$$\frac{(h)^2 - (3)^2}{4} = 10$$

$$\Rightarrow h^2 - 9 = 40, \text{ that is,}$$

$$h^2 = 49 \Rightarrow \boxed{h = \pm 7}$$

(d) Roots satisfy a given relation

Example 4:

Find p , if the roots α, β of the equation $x^2 - 5x + p = 0$, satisfy the relation $2\alpha + 5\beta = 7$.

Solution: If α, β are the roots of the equation $x^2 - 5x + p = 0$.

$$\text{Then } \alpha + \beta = -\frac{b}{a} = -\left(\frac{-5}{1}\right) = 5$$

$$\alpha + \beta = 5 \Rightarrow \beta = 5 - \alpha \dots\dots\dots(i)$$

$$\text{and } \alpha\beta = \frac{c}{a} = \frac{p}{1} = p \Rightarrow \alpha\beta = p \dots\dots(ii)$$

$$\text{Since } 2\alpha + 5\beta = 7 \quad (\text{Given}) \dots\dots\dots(iii)$$

Put the value of β from equation (i) in equation (iii)

$$2\alpha + 5(5 - \alpha) = 7$$

$$2\alpha + 25 - 5\alpha = 7$$

$$-3\alpha = 7 - 25, \text{ that is}$$

$$-3\alpha = -18 \Rightarrow \boxed{\alpha = 6} \dots\dots\dots(iv)$$

Put $\alpha = 6$ in equation (i)

$$\beta = 5 - \alpha$$

$$\beta = 5 - 6 = -1 \Rightarrow \boxed{\beta = -1}$$

Put the value of α and β in equation.... (ii)

$$\alpha\beta = p$$

$$6(-1) = p \Rightarrow \boxed{p = -6}$$

(e) Both sum and product of the roots are equal to a given number.

Example 5: Find m , if sum and product of the roots of the equation

$5x^2 + (7 - 2m)x + 3 = 0$ is equal to a given number, say λ .

Solution: Let α, β be the roots of the equation

$$5x^2 + (7 - 2m)x + 3 = 0$$

$$\text{Then } \alpha + \beta = -\frac{b}{a} = -\frac{7 - 2m}{5} = \frac{2m - 7}{5}$$

$$\text{and } \alpha\beta = \frac{c}{a} = \frac{3}{5}$$

$$\text{Let } \alpha + \beta = \lambda \dots\dots(i) \text{ and } \alpha\beta = \lambda \dots\dots(ii)$$

Then from (i) and (ii)

$$\alpha + \beta = \alpha\beta, \text{ that is,}$$

$$\frac{2m - 7}{5} = \frac{3}{5}$$

$$\Rightarrow 2m - 7 = 3$$

$$\Rightarrow 2m = 10$$

$$\Rightarrow m = 5$$