Mathematics 9th Class
New Book (2025)

EXERCISE # 1.1

Question # 1

Identify each of the following as a rational or irrational number:

(i) 2.353535

Sol. 2.353535 is a terminating and recurring decimal number, therefore it is a rational number.

(ii) $0.\overline{6}$

Sol. $0.\overline{6} = 0.66666.....$ is a non-terminating and recurring number, therefore it is a rational number.

(iii) $2.236067...$

Sol. $2.236067...$ is a non-terminating and non recurring number, therefore it is a Irrational number.

(iv) $\sqrt{7}$

Sol. $\sqrt{7} = \frac{\sqrt{7}}{1} = \frac{p}{q}$ $p \notin Z$, $q \in Z$

$\sqrt{7}$ not belongs to integer

e.g $Z = \{0, \pm 1, \pm 2, \pm 3, \ldots\ldots\}$

Therefore $\sqrt{7}$ is a Irrational number.

(v) e

Sol. $e = 2.71828\ldots$ is a non-terminating and non-recurring decimal number therefore, it is a Irrational number.

(vi) π

Sol $\pi = 3.14159\ldots\ldots$ is a non-terminating and non-recurring decimal number therefore, it is a Irrational number.

(vii) $5+\sqrt{11}$

Sol. $5+\sqrt{11}$ 5 is rational because

$5 = \frac{5}{1} = \frac{p}{q}$ $p = 5 \in Z$ and $q = 1 \in Z$

and $\sqrt{11}$ is Irrational because

$\sqrt{11} = \frac{\sqrt{11}}{1} = \frac{p}{q}$ $p = \sqrt{11} \notin Z$ and $q = 1 \in Z$

So Sum of rational and Irrational number is equal to $\boxed{\text{Irrational}}$. Ans.

(viii) $\sqrt{3}+\sqrt{13}$

Sol. $\sqrt{3}+\sqrt{11}$ $\sqrt{3}$ is Irrational because

$\sqrt{3} = \frac{\sqrt{3}}{1} = \frac{p}{q}$ $p = \sqrt{3} \notin Z$ and $q = 1 \in Z$

Similarly $\sqrt{11}$ is Irrational because

$\sqrt{11} = \frac{\sqrt{11}}{1} = \frac{p}{q}$ $p = \sqrt{11} \notin Z$ and $q = 1 \in Z$

So Sum of two Irrational numbers are also equal to $\boxed{\text{Irrational}}$ number.

Ans.

(ix) $\frac{15}{4}$

Sol. $\frac{15}{4} = \frac{p}{q}$ $\quad p = 15 \in Z$ and $q = 4 \in Z$

So $\frac{15}{4}$ is a $\boxed{\text{Rational}}$ number.

Ans.

(x) $(2-\sqrt{2})(2+\sqrt{2})$

Sol.

$(2-\sqrt{2})(2+\sqrt{2})$

Apply formula $(a-b)(a+b) = (a)^2 - (b)^2$

$= (2)^2 - (\sqrt{2})^2$

$= 4 - 2$

$= 2$

$2 = \frac{2}{1} = \frac{p}{q}$

$p = 2 \in Z$ and

$q = 1 \in Z$ So

$(2-\sqrt{2})(2+\sqrt{2})$ is a $\boxed{\text{Rational number.}}$

Ans.

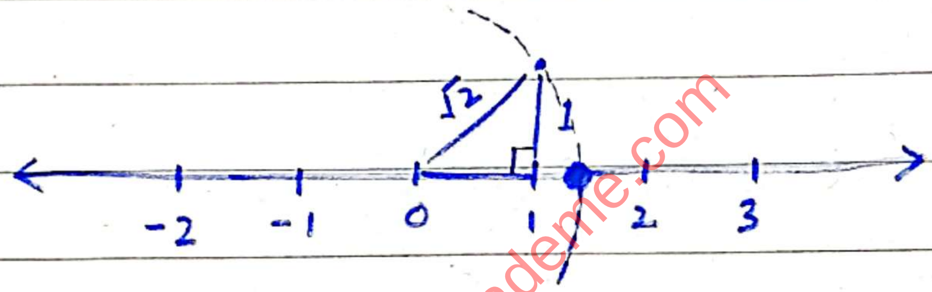
Exercise # 1.1

Question # 2

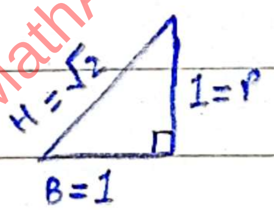
Represent the following numbers on number line :

(i) $\sqrt{2}$

Sol.



Let Base = B = 1
Perpendicular = P = 1
Hypotenuse = ?



$H^2 = B^2 + P^2$

$H^2 = 1^2 + 1^2$

$H^2 = 1 + 1$

$H^2 = 2$

$\sqrt{H^2} = \sqrt{2}$

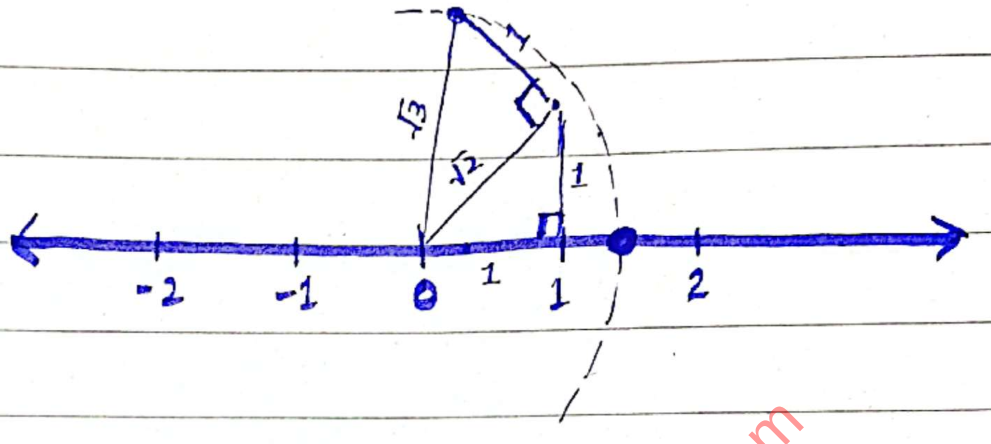
$\boxed{H = \sqrt{2}}$

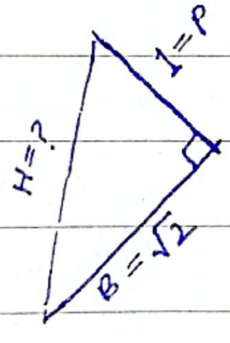
From figure, first we find hypotenous then open compess of length $\sqrt{2}$ cm and draw arc on the number line.

EXERCISE # 1.1 Question # 2 (ii)

Represent $\sqrt{3}$ on number line

Sol.





$$H^2 = B^2 + P^2$$

$$H^2 = (\sqrt{2})^2 + (1)^2$$

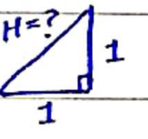
$$H^2 = 2 + 1$$

$$H^2 = 3$$

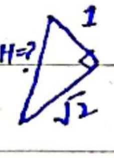
$$\sqrt{H^2} = \sqrt{3}$$

$$\boxed{H = \sqrt{3}}$$

1st of all we find $\sqrt{2}$ from



then we find $\sqrt{3}$

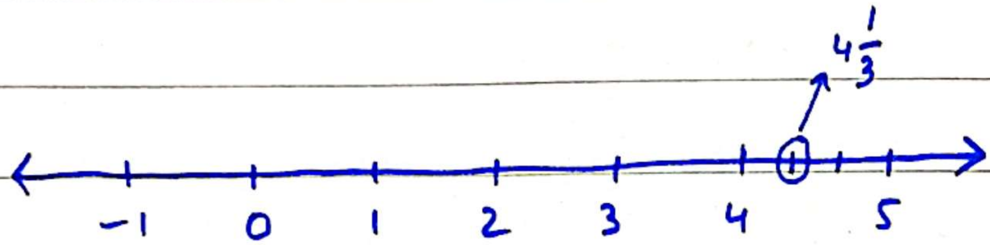


Then open compass of length $\sqrt{3}$ and draw arc on the number line.

EXERCISE # 1.1 — Question # 2(iii)

Represent $4\frac{1}{3}$ on number line:

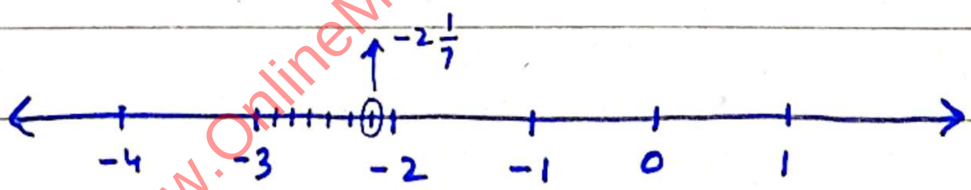
Sol.



Question # 2(iv)

Represent $-2\frac{1}{7}$ on number line:

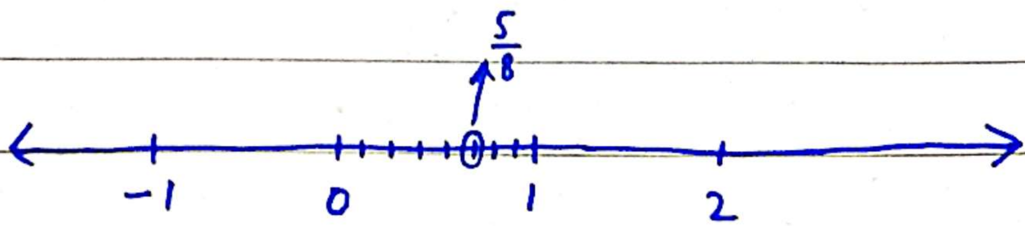
Sol.



Question # 2(v)

Represent $\frac{5}{8}$ on number line:

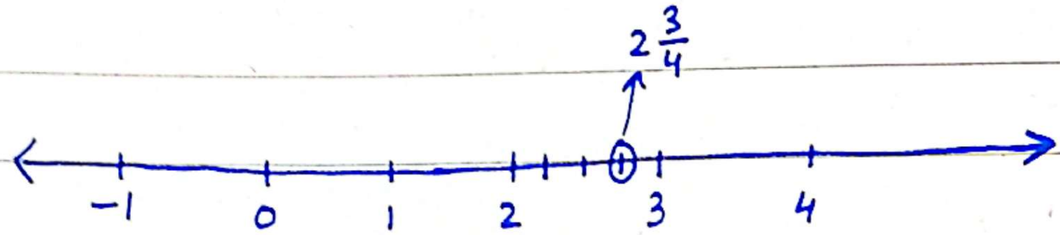
Sol.



EXERCISE # 1.1 — Question # 2(vi)

Represent $2\frac{3}{4}$ on number line:

Sol.



Question # 3

Express the following as a rational number $\frac{p}{q}$ where p and q are integers and $q \neq 0$.

Q # 3(i)

$0.\overline{4}$

Sol.

let $x = 0.\overline{4}$

$x = 0.4444\ldots \longrightarrow (1)$

Multiply by 10 on both side

$10 \times x = 10 \times 0.4444\ldots$

$$10x = 4.444\ldots \longrightarrow (2)$$

Subtract equation (1) from equation (2)

$$10x - x = 4.444\ldots - 0.4444\ldots$$

$$9x = 4$$

$$\boxed{x = \frac{4}{9}}$$ Answer.

Hence $\frac{4}{9}$ is Required Rational number.

(Question # 3(ii))

Express $0.\overline{37}$ as a rational number.

Sol. Let

$$x = 0.\overline{37}$$

$$x = 0.373737\ldots \longrightarrow (1)$$

Multiply by 100 on both side

$$100 \times x = 100 \times 0.373737\ldots$$

$$100x = 37.3737\ldots \longrightarrow (2)$$

Subtract equation (1) from equation (2)

$$100x - x = 37.3737\ldots - 0.373737\ldots$$

$$99x = 37$$

$$\boxed{x = \frac{37}{99}}$$ Answer.

Hence $\frac{37}{99}$ is Required Rational number.

Question # 3 (iii)

Express $0.\overline{21}$ as a rational number

Sol.

Let $x = 0.\overline{21}$

$x = 0.212121\ldots \longrightarrow (1)$

Multiply by 100 on both side

$100 \times x = 100 \times 0.212121\ldots$

$100x = 21.2121\ldots \longrightarrow (2)$

Subtract equation (1) from equation (2)

$100x - x = 21.2121\ldots - 0.212121\ldots$

$99x = 21$

$$\boxed{x = \frac{21}{99}}$$ Answer.

Hence $\frac{21}{99}$ is Required Rational number.

EXERCISE # 1.1 (Question # 4)

Name the property used in the following :

(i) $(a+4)+b = a+(4+b)$

Sol. Associative property over addition.

(ii) $\sqrt{2}+\sqrt{3} = \sqrt{3}+\sqrt{2}$

Sol. Commutative property over addition.

(iii) $x - x = 0$

Sol. $(x)+(-x)=0$ Additive inverse.

(iv) $a(b+c) = ab+ac$

Sol. left distributive property of multiplication over addition

e.g $a\times(b+c) = a\times b + a\times c$

(v) $16+0 = 16$

Sol. Additive identity

(vi) $100 \times 1 = 100$

Sol Multiplicative Identity

(vii) $4 \times (5 \times 8) = (4 \times 5) \times 8$

Sol. Associative property over multiplication.

Question # 5

Name the property used in the following:

(i) $-3 < -1 \Rightarrow 0 < 2$

Sol. Additive property e.g $-3 < -1$

$-3 + 3 < -1 + 3$

$0 < 2$

(ii) If $a < b$ then $\frac{1}{a} > \frac{1}{b}$

Sol. Reciprocal property e.g. $3 < 5$

then $\frac{1}{3} > \frac{1}{5}$

(iii) If $a < b$ then $a+c < b+c$

Sol. Additive property e.g

$3 < 5$

$3+2 < 5+2$

$5 < 7$

(iv) If $ac < bc$ and $c > 0$

then $a < b$

Sol. Multiplicative property e.g $c = 2 > 0$

$3(2) < 5(2)$

then

$3 < 5$

(v) If $ac < bc$ and $c < 0$

then $a > b$

$a = -3$, $b = -5$

Sol. Multiplicative property e.g & $c = -2 < 0$

$-3(-2) < -5(-2)$

$+6 < +10$

then

$-3 > -5$

(vi) Either $a > b$ or $a = b$ or $a < b$

Sol. Trichotomy property

Question # 6

Find two rational numbers between:

(i) $\frac{1}{3}$ and $\frac{1}{4}$

Sol. Let 1st Rational number between $\frac{1}{3}$ and $\frac{1}{4}$ is

Formula

$$\frac{\text{1st No.} + \text{2nd No.}}{2}$$

$$= \frac{\frac{1}{3} + \frac{1}{4}}{2}$$

$$= \frac{1}{2}\left(\frac{1}{3} + \frac{1}{4}\right)$$

$$= \frac{1}{2}\left(\frac{4+3}{12}\right)$$

$$= \frac{1}{2}\left(\frac{7}{12}\right)$$

$$= \boxed{\frac{7}{24}}$$ Answer.

$$\begin{array}{r|l} 2 & 3, 4 \\ \hline 2 & 3, 2 \\ \hline 3 & 3, 1 \\ \hline & 1, 1 \end{array}$$

$LCM = 2 \times 2 \times 3$

$= 12$ ✓

$\frac{1}{3}, \frac{7}{24}, \frac{1}{4}$

Now find 2nd Rational number by taking numbers $\frac{7}{24}$ and $\frac{1}{4}$

$$= \frac{\frac{7}{24} + \frac{1}{4}}{2}$$

$$= \frac{1}{2}\left(\frac{7}{24} + \frac{1}{4}\right)$$

2	24, 4
2	12, 2
2	6, 1
3	3, 1
	1, 1

$$= \frac{1}{2}\left(\frac{7+6}{24}\right)$$

LCM = $2 \times 2 \times 2 \times 3$

4 8 24

$$= \frac{1}{2}\left(\frac{13}{24}\right)$$

$$= \boxed{\frac{13}{48}}$$ Answer.

$\frac{1}{3}, \frac{7}{24}, \frac{13}{48}, \frac{1}{4}$ ✓

Question # 6 (ii)

Find two rational numbers between:

3 and 4.

Sol.

Let 1st Rational number between 3 and 4 is

$$= \frac{3+4}{2}$$

$$= \boxed{\frac{7}{2}}$$ Answer.

$3, \frac{7}{2}, 4$ ✓

Now find 2nd Rational number by taking numbers $\frac{7}{2}$ and 4

$$= \frac{\frac{7}{2} + 4}{2}$$

$$= \frac{1}{2}\left(\frac{7}{2} + 4\right)$$

$$= \frac{1}{2}\left(\frac{7}{2} + \frac{4}{1}\right)$$

$$= \frac{1}{2}\left(\frac{7+8}{2}\right)$$

$$= \frac{1}{2}\left(\frac{15}{2}\right)$$

$= \boxed{\frac{15}{4}}$ Answer. $\quad 3, \frac{7}{2}, \frac{15}{4}, 4$

Question # 6 (iii)

Find two rational numbers between:

$\frac{3}{5}$ and $\frac{4}{5}$

Sol. Let 1st Rational number between $\frac{3}{5}$ and $\frac{4}{5}$ is

$$= \frac{\frac{3}{5} + \frac{4}{5}}{2}$$

$$= \frac{1}{2}\left(\frac{3}{5} + \frac{4}{5}\right)$$

$$= \frac{1}{2}\left(\frac{3+4}{5}\right)$$

$$= \frac{1}{2}\left(\frac{7}{5}\right)$$

$$= \boxed{\frac{7}{10}}$$ Answer.

$\frac{3}{5}, \frac{7}{10}, \frac{4}{5}$

Now find 2nd Rational number by taking numbers $\frac{7}{10}$ and $\frac{4}{5}$

$$= \frac{\frac{7}{10} + \frac{4}{5}}{2}$$

$$= \frac{1}{2}\left(\frac{7}{10} + \frac{4}{5}\right)$$

$$= \frac{1}{2}\left(\frac{7+8}{10}\right)$$

$$\begin{array}{r|l} 5 & 10, 5 \\ \hline 2 & 2, 1 \\ \hline & 1, 1 \end{array}$$

$LCM = 5 \times 2$

$= 10$

$$= \frac{1}{2}\left(\frac{15}{10}\right)$$

$$= \frac{15}{20}$$ Divided by 5

$$= \boxed{\frac{3}{4}}$$ Answer.

$\frac{3}{5}, \frac{7}{10}, \frac{3}{4}, \frac{4}{5}$

EXERCISE # 1.2

Question # 1

(i) Rationalize the denominator of following $\frac{13}{4+\sqrt{3}}$

Sol. $\frac{13}{4+\sqrt{3}}$

$$= \frac{13}{(4+\sqrt{3})} \times \frac{(4-\sqrt{3})}{(4-\sqrt{3})}$$

$$= \frac{13(4-\sqrt{3})}{(4)^2-(\sqrt{3})^2}$$

$$= \frac{13(4-\sqrt{3})}{16-3}$$

$$= \frac{\cancel{13}(4-\sqrt{3})}{\cancel{13}}$$

$$= \boxed{4-\sqrt{3}} \quad \text{Ans.}$$

(ii) Rationalize $\frac{\sqrt{2}+\sqrt{5}}{\sqrt{3}}$

Sol. $\frac{\sqrt{2}+\sqrt{5}}{\sqrt{3}}$

$$= \frac{(\sqrt{2}+\sqrt{5})}{(\sqrt{3})} \times \frac{(\sqrt{3})}{(\sqrt{3})}$$

$$= \frac{(\sqrt{2}+\sqrt{5})\sqrt{3}}{(\sqrt{3})^2}$$

$$= \frac{(\sqrt{2} + \sqrt{5})(\sqrt{3})}{3}$$

$$= \frac{\sqrt{2}\sqrt{3} + \sqrt{5}\sqrt{3}}{3}$$

$$= \frac{\sqrt{2\times 3} + \sqrt{5\times 3}}{3}$$

$$= \boxed{\frac{\sqrt{6} + \sqrt{15}}{3}} \quad \text{Ans.}$$

(iii) Rationalize $\frac{\sqrt{2}-1}{\sqrt{5}}$

Sol. $\frac{\sqrt{2}-1}{\sqrt{5}}$

$$= \frac{(\sqrt{2}-1)}{(\sqrt{5})} \times \frac{(\sqrt{5})}{(\sqrt{5})}$$

$$= \frac{(\sqrt{2}-1)(\sqrt{5})}{(\sqrt{5})^2}$$

$$= \frac{\sqrt{2}\sqrt{5} - 1\sqrt{5}}{5}$$

$$= \frac{\sqrt{2\times 5} - \sqrt{5}}{5}$$

$$= \boxed{\frac{\sqrt{10} - \sqrt{5}}{5}} \quad \text{Ans.}$$

(iv) Rationalize $\dfrac{6-4\sqrt{2}}{6+4\sqrt{2}}$

Sol. $\dfrac{(6-4\sqrt{2})}{(6+4\sqrt{2})}$

$$= \frac{(6-4\sqrt{2})}{(6+4\sqrt{2})} \times \frac{(6-4\sqrt{2})}{(6-4\sqrt{2})}$$

$$= \frac{(6-4\sqrt{2})(6-4\sqrt{2})}{(6)^2-(4\sqrt{2})^2}$$

$$= \frac{(6)(6)-(6)(4\sqrt{2})-(4\sqrt{2})(6)+(4\sqrt{2})(4\sqrt{2})}{36-(4)^2(\sqrt{2})^2}$$

$$= \frac{36-24\sqrt{2}-24\sqrt{2}+16\sqrt{2}\sqrt{2}}{36-16(2)}$$

$$= \frac{36-48\sqrt{2}+16(\sqrt{2})^2}{36-32}$$

$$= \frac{36-48\sqrt{2}+32}{4}$$

$$= \frac{68-48\sqrt{2}}{4}$$

$$= \frac{4(17-12\sqrt{2})}{4} = \boxed{17-12\sqrt{2}} \text{ Ans.}$$

(v) Rationalize $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

Sol.

$$\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$$

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

$$= \frac{(\sqrt{3}-\sqrt{2})^2}{(\sqrt{3})^2-(\sqrt{2})^2}$$

using formula $(a+b)(a-b) = a^2-b^2$

$$= \frac{(\sqrt{3})^2+(\sqrt{2})^2-2(\sqrt{3})(\sqrt{2})}{3-2}$$

using formula $(a-b)^2 = a^2+b^2-2ab$

$$= \frac{3+2-2\sqrt{3\times 2}}{1}$$

$$= \frac{5-2\sqrt{6}}{1}$$

$$= \boxed{5-2\sqrt{6}}$$ Ans.

(vi) $\dfrac{4\sqrt{3}}{\sqrt{7}+\sqrt{5}}$

Sol.

$$\frac{4\sqrt{3}}{\sqrt{7}+\sqrt{5}}$$

$$= \frac{4\sqrt{3}}{(\sqrt{7}+\sqrt{5})} \times \frac{(\sqrt{7}-\sqrt{5})}{(\sqrt{7}-\sqrt{5})}$$

$$= \frac{4\sqrt{3}(\sqrt{7}-\sqrt{5})}{(\sqrt{7})^2-(\sqrt{5})^2}$$

using formula $(a+b)(a-b) = a^2-b^2$

$$= \frac{4\sqrt{3}(\sqrt{7}-\sqrt{5})}{7-5}$$

$$= \frac{\overset{2}{\cancel{4}}\sqrt{3}(\sqrt{7}-\sqrt{5})}{\cancel{2}}$$

$$= \boxed{2\sqrt{3}(\sqrt{7}-\sqrt{5})} \text{ Ans.}$$

OR

$$= 2\sqrt{3}\sqrt{7} - 2\sqrt{3}\sqrt{5}$$

$$= 2\sqrt{3\times7} - 2\sqrt{3\times5}$$

$$= 2\sqrt{21} - 2\sqrt{15}$$

$$= \boxed{2(\sqrt{21}-\sqrt{15})} \text{ Ans}$$

EXERCISE # 1.2

Question # 2

Simplify the following

(i) $\left(\frac{81}{16}\right)^{-\frac{3}{4}}$

Sol.

$$\left(\frac{81}{16}\right)^{-\frac{3}{4}}$$

$$= \left(\frac{16}{81}\right)^{\frac{3}{4}}$$

$$\begin{array}{r|l} 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

$16 = 2 \times 2 \times 2 \times 2$

$16 = 2^4$

$$= \left(\frac{2^4}{3^4}\right)^{\frac{3}{4}}$$

$$\begin{array}{r|l} 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$81 = 3 \times 3 \times 3 \times 3$

$81 = 3^4$

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

$$= \frac{2^3}{3^3}$$

$$= \frac{2 \times 2 \times 2}{3 \times 3 \times 3}$$

4 8

9 27

$$= \boxed{\frac{8}{27}} \quad \text{Ans.}$$

Question # 2 (ii)

Simplify

$$\left(\frac{3}{4}\right)^{-2} \div \left(\frac{4}{9}\right)^{3} \times \frac{16}{27}$$

Sol.

$$\left(\frac{3}{4}\right)^{-2} \div \left(\frac{4}{9}\right)^{3} \times \frac{16}{27}$$

$$= \left(\frac{4}{3}\right)^{2} \div \left(\frac{4}{9}\right)^{3} \times \frac{16}{27}$$ DMAS

$$= \left(\frac{4}{3}\right)^{2} \times \left(\frac{9}{4}\right)^{3} \times \frac{16}{27}$$

$$= \frac{(4)^2}{(3)^2} \times \frac{(9)^3}{(4)^3} \times \frac{16}{27}$$

$$= \frac{\cancel{4}\times\cancel{4}}{\cancel{3}\times\cancel{3}} \times \frac{{}^{3}\cancel{9}\times{}^{3}\cancel{9}\times 9}{\cancel{4}\times\cancel{4}\times 4} \times \frac{16}{27}$$

$$= \frac{3\times 3\times \cancel{9}}{\cancel{4}} \times \frac{\cancel{16}}{\cancel{27}}$$

$$= \frac{3\times \cancel{3}\times 4}{\cancel{3}}$$

$$= \boxed{12}$$ Ans.

Question 2 (iii)

Simplify

$$(0.027)^{-\frac{1}{3}}$$

Sol.

$$(0.027)^{-\frac{1}{3}}$$

$$= \left(\frac{0,027}{1000}\right)^{-\frac{1}{3}}$$

$$= \left(\frac{27}{1000}\right)^{-\frac{1}{3}}$$

$$= \left(\frac{1000}{27}\right)^{\frac{1}{3}}$$

$$= \left(\frac{10^3}{3^3}\right)^{\frac{1}{3}}$$

$$= \frac{(10^{\cancel{3}})^{\frac{1}{\cancel{3}}}}{(3^{\cancel{3}})^{\frac{1}{\cancel{3}}}}$$

$$= \boxed{\frac{10}{3}}$$ Ans.

10	1000
10	100
10	10
	1

$1000 = 10 \times 10 \times 10$

$1000 = 10^3$

3	27
3	9
3	3
	1

$27 = 3 \times 3 \times 3$

$27 = (3)^3$

Question #2 (iv)

Simplify

$$\sqrt[7]{\frac{x^{14}\times y^{21}\times z^{35}}{y^{14}z^{7}}}$$

Sol.

$$\sqrt[7]{\frac{x^{14}\times y^{21}\times z^{35}}{y^{14}z^{7}}}$$

$$=\left(\frac{x^{14}\times y^{21}\times z^{35}}{y^{14}z^{7}}\right)^{\frac{1}{7}}$$

$$=\frac{(x^{14})^{\frac{1}{7}}\times(y^{21})^{\frac{1}{7}}\times(z^{35})^{\frac{1}{7}}}{(y^{14})^{\frac{1}{7}}(z^{7})^{\frac{1}{7}}}$$

$$=\frac{x^{2}\times y^{3}\times z^{5}}{y^{2}\ z^{1}}$$

$$=\frac{x.x.\cancel{y}.\cancel{y}.y.\cancel{z}.z.z.z.z}{\cancel{y}.\cancel{y}.\cancel{z}}$$

$$=\boxed{x^{2}yz^{4}}$$ Ans.

EXERCISE # 1.2

Question # 2 (v)

Simplify $\dfrac{5\cdot(25)^{n+1}-25\cdot(5)^{2n}}{5\cdot(5)^{2n+3}-(25)^{n+1}}$

Sol.

$$\frac{5\cdot(25)^{n+1}-25\cdot(5)^{2n}}{5\cdot(5)^{2n+3}-(25)^{n+1}}$$

$$=\frac{5^1\cdot(5^2)^{n+1}-5^2\cdot(5)^{2n}}{5^1\cdot(5)^{2n+3}-(5^2)^{n+1}}$$

$$=\frac{5^1\cdot5^{2n+2}-5^2\cdot5^{2n}}{5^1\cdot5^{2n+3}-5^{2n+2}}$$

$$=\frac{5^{1+2n+2}-5^{2+2n}}{5^{1+2n+3}-5^{2n+2}}$$

$$=\frac{5^{2n+3}-5^{2n+2}}{5^{2n+4}-5^{2n+2}}$$

$2n+3$
$=(2n+2)+1$

$2n+4$
$=(2n+2)+2$

$$=\frac{5^{(2n+2)+1}-5^{2n+2}}{5^{(2n+2)+2}-5^{2n+2}}$$

Taking common

$$=\frac{5^{2n+2}\cdot5^1-5^{2n+2}}{5^{2n+2}\cdot5^2-5^{2n+2}}=\frac{\cancel{5^{2n+2}}(5^1-1)}{\cancel{5^{2n+2}}(5^2-1)}=\frac{4}{25-1}=\frac{4}{24}$$

$$=\boxed{\frac{1}{6}}\ \text{Ans.}$$

Question # 2 (vi)

Simplify

$$\frac{(16)^{x+1} + 20(4^{2x})}{2^{x-3} \times 8^{x+2}}$$

Sol.

$$\frac{(16)^{x+1} + 20(4^{2x})}{2^{x-3} \times 8^{x+2}}$$

$$= \frac{(2^4)^{x+1} + 20(2^2)^{2x}}{2^{x-3} \times (2^3)^{x+2}}$$

$$= \frac{2^{4x+4} + 20(2)^{4x}}{2^{x-3} \times 2^{3x+6}}$$

$$= \frac{2^{4x} \cdot 2^4 + 20(2)^{4x}}{2^{x-3+3x+6}}$$

$$= \frac{2^{4x}[2^4 + 20]}{2^{4x+3}}$$

$$= \frac{\cancel{2^{4x}}[16+20]}{\cancel{2^{4x}} \cdot 2^3} = \frac{36}{8} = \boxed{\frac{9}{2}} \text{ Ans.}$$

Divided by 4

$$\begin{array}{r|l} 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

$16 = 2^4$

$$\begin{array}{r|l} 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

$4 = 2^2$

$$\begin{array}{r|l} 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

$8 = 2^3$

$$\begin{array}{r} +6 \\ -3 \\ \hline +3 \end{array} \qquad \begin{array}{r} x \\ +3x \\ \hline 4x \end{array}$$

Question # 2 (vii)

Simplify

$$(64)^{-\frac{2}{3}} \div (9)^{-\frac{3}{2}}$$

Sol.

$$(64)^{-\frac{2}{3}} \div (9)^{-\frac{3}{2}}$$

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

$$= 4^{-2} \div 3^{-3}$$

$$= \frac{1}{4^2} \div \frac{1}{3^3}$$

$$= \frac{1}{16} \div \frac{1}{27}$$

$$= \frac{1}{16} \times \frac{27}{1}$$

$$= \frac{1 \times 27}{16 \times 1}$$

$$= \boxed{\frac{27}{16}} \text{ Ans.}$$

$$\begin{array}{r|l} 4 & 64 \\ \hline 4 & 16 \\ \hline 4 & 4 \\ \hline & 1 \end{array}$$

$64 = 4^3$

$$\begin{array}{r|l} 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$9 = 3^2$

$4^2 = 4 \times 4$

$\boxed{4^2 = 16}$

$3^3 = 3 \times 3 \times 3$

$\boxed{3^3 = 27}$

Question # 2(viii)

Simplify

$$\frac{3^n \times 9^{n+1}}{3^{n-1} \times 9^{n-1}}$$

Sol.

$$\frac{3^n \times 9^{n+1}}{3^{n-1} \times 9^{n-1}}$$

$$\begin{array}{r|l} 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$9 = 3 \times 3$

$9 = 3^2$

$$= \frac{3^n \times (3^2)^{n+1}}{3^{n-1} \times (3^2)^{n-1}}$$

$$= \frac{3^n \times 3^{2n+2}}{3^{n-1} \times 3^{2n-2}}$$

$$= \frac{3^{n+2n+2}}{3^{n-1+2n-2}}$$

$$= \frac{3^{3n+2}}{3^{3n-3}}$$

$$= \frac{\cancel{3^{3n}} \cdot 3^2}{\cancel{3^{3n}} \cdot 3^{-3}}$$

$$= 3^2 \cdot 3^3$$

$$= 3^{2+3}$$

$$= 3^5 = 3 \times 3 \times 3 \times 3 \times 3 = \boxed{243} \text{ Ans.}$$

9, 27, 81, 243

Question # 2 (ix)

Simplify

$$\frac{5^{n+3} - 6.5^{n+1}}{9 \times 5^n - 4 \times 5^n}$$

Sol.

$$\frac{5^{n+3} - 6.5^{n+1}}{9 \times 5^n - 4 \times 5^n}$$

$$= \frac{5^n.5^3 - 6.5^n.5^1}{9 \times 5^n - 4 \times 5^n}$$

$5^3 = 5 \times 5 \times 5$

$25 \quad 125$

$5^3 = 125$

$$= \frac{5^n.125 - 30.5^n}{9 \times 5^n - 4 \times 5^n}$$

$$= \frac{\cancel{5^n}(125 - 30)}{\cancel{5^n}(9 - 4)}$$

$$= \frac{95}{5}$$

$$\begin{array}{r} 19 \\ 5\overline{)95} \\ -5 \\ \hline 45 \\ -45 \\ \hline \times \end{array}$$

$$= \boxed{19}$$ Ans.

Question # 3 (ii)

If $x = 3+\sqrt{8}$ then find the value of $x+\frac{1}{x}$

Sol. $\boxed{x = 3+\sqrt{8}}$

Now find $\frac{1}{x}$

$$\frac{1}{x} = \frac{1}{3+\sqrt{8}}$$

$$\frac{1}{x} = \frac{1}{(3+\sqrt{8})} \times \frac{(3-\sqrt{8})}{(3-\sqrt{8})}$$

$$\frac{1}{x} = \frac{1(3-\sqrt{8})}{(3)^2-(\sqrt{8})^2}$$

Applying formula $(a+b)(a-b) = a^2-b^2$

$$\frac{1}{x} = \frac{3-\sqrt{8}}{9-8}$$

$3^2 = 3\times3$
$3^2 = 9$

$$\frac{1}{x} = \frac{3-\sqrt{8}}{1}$$

$$\boxed{\frac{1}{x} = 3-\sqrt{8}}$$

Now find $x+\frac{1}{x}$

$$x+\frac{1}{x} = (3+\sqrt{8})+(3-\sqrt{8})$$

$$x+\frac{1}{x} = 3+\cancel{\sqrt{8}}+3-\cancel{\sqrt{8}}$$

$$\boxed{x+\frac{1}{x} = 6}$$ Ans.

(ii) $x - \frac{1}{x} = ?$

Sol.

We know that

$$x = 3 + \sqrt{8} \quad \& \quad \frac{1}{x} = 3 - \sqrt{8}$$

$$x - \frac{1}{x} = (3 + \sqrt{8}) - (3 - \sqrt{8})$$

$$x - \frac{1}{x} = \cancel{3} + \sqrt{8} - \cancel{3} + \sqrt{8}$$

$$x - \frac{1}{x} = \sqrt{8} + \sqrt{8}$$

$$x - \frac{1}{x} = 1\sqrt{8} + 1\sqrt{8}$$

$$x - \frac{1}{x} = (1 + 1)\sqrt{8}$$

✓ $\sqrt{8} + \sqrt{8} = 2\sqrt{8}$

$(\sqrt{8})(\sqrt{8}) = (\sqrt{8})^2$

$$\boxed{x - \frac{1}{x} = 2\sqrt{8}}$$

(iii) $x^2 + \frac{1}{x^2} = ?$

Sol. We know that

$$x + \frac{1}{x} = 6$$

Taking square on both side

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

Applying formula $(a+b)^2 = (a)^2 + (b)^2 + 2(a)(b)$

$$(x)^2 + \left(\frac{1}{x}\right)^2 + 2(\cancel{x})\left(\frac{1}{\cancel{x}}\right) = 36$$

$$x^2 + \frac{1}{x^2} + 2 = 36$$

$$x^2 + \frac{1}{x^2} = 36 - 2$$

$$\boxed{x^2 + \frac{1}{x^2} = 34}$$ Ans.

(iv) $x^2 - \frac{1}{x^2} = ?$

Sol. We know that

$$(a)^2 - (b)^2 = (a+b)(a-b)$$

put $a = x$ & $b = \frac{1}{x}$

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

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

we already solve $x + \frac{1}{x} = 6$ & $x - \frac{1}{x} = 2\sqrt{8}$

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

$$\boxed{x^2 - \frac{1}{x^2} = 12\sqrt{8}}$$ Ans.

(v) $x^4 + \frac{1}{x^4} = ?$

Sol. We know that

$$x^2 + \frac{1}{x^2} = 34$$

Taking square on both side

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (34)^2$$

Applying formula

$(a+b)^2 = (a)^2 + (b)^2 + 2(a)(b)$

$$(x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2(\cancel{x^2})\left(\frac{1}{\cancel{x^2}}\right) = 1156$$

$$x^4 + \frac{1}{x^4} + 2 = 1156$$

$$x^4 + \frac{1}{x^4} = 1156 - 2$$

$$\boxed{x^4 + \frac{1}{x^4} = 1154}$$ Ans.

(vi) $\left(x - \frac{1}{x}\right)^2 = ?$

Sol. We know that

$$x - \frac{1}{x} = 2\sqrt{8}$$

Taking square on both side

$$\left(x - \frac{1}{x}\right)^2 = \left(2\sqrt{8}\right)^2$$

$$\left(x - \frac{1}{x}\right)^2 = (2)^2\left(\sqrt{8}\right)^2$$

$$\left(x - \frac{1}{x}\right)^2 = (4)(8)$$

$$\boxed{\left(x - \frac{1}{x}\right)^2 = 32}$$ Ans.

Question # 4

Find the rational numbers p and q such that

$$\frac{8-3\sqrt{2}}{4+3\sqrt{2}} = p+q\sqrt{2}$$

Sol.

$$\frac{8-3\sqrt{2}}{4+3\sqrt{2}} = p+q\sqrt{2}$$

$$\frac{(8-3\sqrt{2})}{(4+3\sqrt{2})} \times \frac{(4-3\sqrt{2})}{(4-3\sqrt{2})} = p+q\sqrt{2}$$

Applying formula $(a+b)(a-b) = a^2-b^2$

$$\frac{(8-3\sqrt{2})(4-3\sqrt{2})}{(4)^2-(3\sqrt{2})^2} = p+q\sqrt{2}$$

$$\frac{(8)(4)-(8)(3\sqrt{2})-(3\sqrt{2})(4)+(3\sqrt{2})(3\sqrt{2})}{16-(3)^2(\sqrt{2})^2} = p+q\sqrt{2}$$

$$\frac{32-24\sqrt{2}-12\sqrt{2}+9(\sqrt{2})^2}{16-9(2)} = p+q\sqrt{2}$$

$$\frac{32-36\sqrt{2}+9(2)}{16-18} = p+q\sqrt{2}$$

$$\frac{32-36\sqrt{2}+18}{-2} = p+q\sqrt{2}$$

$$\frac{50-36\sqrt{2}}{-2} = p+q\sqrt{2}$$

$$\frac{50}{-2} - \frac{36\sqrt{2}}{-2} = p+q\sqrt{2}$$

$$-25 + 18\sqrt{2} = p + q\sqrt{2}$$

Comparing both side

$$\boxed{p = -25}, \quad \boxed{q = 18}$$

Ans.

Question # 5

Simplify the following

(i) $$\frac{(25)^{\frac{3}{2}} \times (243)^{\frac{3}{5}}}{(16)^{\frac{5}{4}} \times (8)^{\frac{4}{3}}}$$

Sol.

$$\frac{(25)^{\frac{3}{2}} \times (243)^{\frac{3}{5}}}{(16)^{\frac{5}{4}} \times (8)^{\frac{4}{3}}}$$

$$= \frac{(5^{\cancel{2}})^{\frac{3}{\cancel{2}}} \times (3^{\cancel{5}})^{\frac{3}{\cancel{5}}}}{(2^{\cancel{4}})^{\frac{5}{\cancel{4}}} \times (2^{\cancel{3}})^{\frac{4}{\cancel{3}}}}$$

$$= \frac{5^3 \times 3^3}{2^5 \times 2^4}$$

$$= \frac{125 \times 27}{32 \times 16}$$

$\because 3^3 = 3 \times 3 \times 3$

9, 27

$3^3 = 27$

$$= \boxed{\frac{3375}{512}}$$

Answer.

$$\begin{array}{c|c} 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$25 = 5 \times 5$

$25 = 5^2$

$$\begin{array}{c|c} 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$243 = 3 \times 3 \times 3 \times 3 \times 3$

$243 = 3^5$

$$\begin{array}{c|c} 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

$16 = 2 \times 2 \times 2 \times 2$

$16 = 2^4$

$$\begin{array}{c|c} 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

$8 = 2 \times 2 \times 2$

$8 = 2^3$

{Question # 5 (ii)}

Simplify

$$\frac{54 \times \sqrt[3]{(27)^{2x}}}{9^{x+1} + 216(3^{2x-1})}$$

Sol.

$$\frac{54 \times \sqrt[3]{(27)^{2x}}}{9^{x+1} + 216(3^{2x-1})}$$

$$= \frac{54 \times \left((27)^{2x}\right)^{\frac{1}{3}}}{9^{x+1} + 216(3^{2x-1})}$$

$$= \frac{54 \times (27)^{\frac{2x}{3}}}{(3^2)^{x+1} + 216(3^{2x}.3^{-1})}$$ $2x \times \frac{1}{3} = \frac{2x}{3}$

$$= \frac{54 \times (3^3)^{\frac{2x}{3}}}{3^{2x+2} + 216\left(\frac{3^{2x}}{3^1}\right)}$$ $27 = 3^3$

$$= \frac{54 \times 3^{2x}}{3^{2x+2} + 72(3^{2x})}$$

$$= \frac{54 \times 3^{2x}}{3^{2x}.3^2 + 72(3^{2x})}$$

Divided by 27

$$= \frac{54 \times \cancel{3^{2x}}}{\cancel{3^{2x}}(3^2+72)} = \frac{54}{9+72} = \frac{54}{81} = \boxed{\frac{2}{3}}$$ Ans.

Question # 5 (iii)

Simplify $\sqrt{\dfrac{(216)^{\frac{2}{3}} \times (25)^{\frac{1}{2}}}{(0.04)^{-3/2}}}$

Sol.

$$\sqrt{\frac{(216)^{\frac{2}{3}} \times (25)^{\frac{1}{2}}}{(0.04)^{-3/2}}}$$

$$= \sqrt{\frac{(6^3)^{\frac{2}{3}} \times (5^2)^{\frac{1}{2}}}{\left(\frac{0{,}04}{100}\right)^{-3/2}}}$$

$$\begin{array}{r|l} 6 & 216 \\ \hline 6 & 36 \\ \hline 6 & 6 \\ \hline & 1 \end{array}$$

$216 = 6 \times 6 \times 6$

$216 = 6^3$

$$= \sqrt{\frac{6^2 \times 5^1}{\left(\frac{4}{100}\right)^{-3/2}}}$$

$$\begin{array}{r|l} 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$25 = 5 \times 5$

$25 = 5^2$

$$= \sqrt{\frac{6^2 \times 5}{\left(\frac{1}{25}\right)^{-3/2}}}$$

$$= \sqrt{\frac{6^2 \times 5}{\left(\frac{25}{1}\right)^{3/2}}}$$

$$= \sqrt{\frac{6^2 \times 5}{(5^2)^{3/2}}}$$

$$= \sqrt{\frac{6^2 \times 5}{5^3}} = \sqrt{\frac{6^2 \times \cancel{5}}{5 \times 5 \times \cancel{5}}} = \sqrt{\frac{6^2}{5^2}} = \frac{\sqrt{6^2}}{\sqrt{5^2}} = \boxed{\frac{6}{5}}$$

Ans.

Question # 5(iv)

Simplify

$$\left(a^{\frac{1}{3}}+b^{\frac{2}{3}}\right)\times\left(a^{\frac{2}{3}}-a^{\frac{1}{3}}b^{\frac{2}{3}}+b^{\frac{4}{3}}\right)$$

Sol.

$$\left(a^{\frac{1}{3}}+b^{\frac{2}{3}}\right)\times\left(a^{\frac{2}{3}}-a^{\frac{1}{3}}b^{\frac{2}{3}}+b^{\frac{4}{3}}\right)$$

$$= a^{\frac{1}{3}}\left(a^{\frac{2}{3}}-a^{\frac{1}{3}}b^{\frac{2}{3}}+b^{\frac{4}{3}}\right)+b^{\frac{2}{3}}\left(a^{\frac{2}{3}}-a^{\frac{1}{3}}b^{\frac{2}{3}}+b^{\frac{4}{3}}\right)$$

$$= a^{\frac{1}{3}}a^{\frac{2}{3}}-a^{\frac{1}{3}}a^{\frac{1}{3}}b^{\frac{2}{3}}+a^{\frac{1}{3}}b^{\frac{4}{3}}+b^{\frac{2}{3}}a^{\frac{2}{3}}-b^{\frac{2}{3}}a^{\frac{1}{3}}b^{\frac{2}{3}}+b^{\frac{2}{3}}b^{\frac{4}{3}}$$

$$= a^{\frac{1}{3}+\frac{2}{3}}-a^{\frac{1}{3}+\frac{1}{3}}b^{\frac{2}{3}}+a^{\frac{1}{3}}b^{\frac{4}{3}}+a^{\frac{2}{3}}b^{\frac{2}{3}}-a^{\frac{1}{3}}b^{\frac{2}{3}+\frac{2}{3}}+b^{\frac{2}{3}+\frac{4}{3}}$$

$$= a^{\frac{1+2}{3}}-a^{\frac{1+1}{3}}b^{\frac{2}{3}}+a^{\frac{1}{3}}b^{\frac{4}{3}}+a^{\frac{2}{3}}b^{\frac{2}{3}}-a^{\frac{1}{3}}b^{\frac{2+2}{3}}+b^{\frac{2+4}{3}}$$

$$= a^{\frac{3}{3}}-a^{\frac{2}{3}}b^{\frac{2}{3}}+\cancel{a^{\frac{1}{3}}b^{\frac{4}{3}}}+a^{\frac{2}{3}}b^{\frac{2}{3}}-\cancel{a^{\frac{1}{3}}b^{\frac{4}{3}}}+b^{\frac{6}{3}}$$

$$= a^{\frac{3}{3}}+b^{\frac{6}{3}}$$

$$= a^{1}+b^{2}$$

$$= \boxed{a+b^{2}} \quad \text{Answer.}$$

EXERCISE # 1.3

Question # 1

The sum of three consecutive integers is forty-two, find the three integers.

Sol. Let three consecutive integer are :

$x \quad , \quad x+1 \quad , \quad x+2$

According to given condition

$(x)+(x+1)+(x+2) = 42$

$x + x + 1 + x + 2 = 42$

$3x + 3 = 42$

$3x = 42 - 3$

$3x = 39$

$x = \frac{39}{3}$

$\boxed{x = 13}$

$$\begin{array}{r|l} & 13 \\ 3 & 39 \\ & -3 \\ \hline & 9 \\ & -9 \\ \hline & \times \end{array}$$

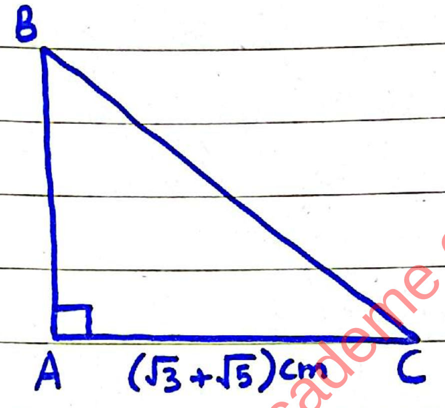
1st integer $= x = \boxed{13}$

2nd integer $= x+1 = 13+1 = \boxed{14}$

3rd integer $= x+2 = 13+2 = \boxed{15}$ Ans.

(Question #2)

The diagram shows right angled ΔABC in which the length of $\overline{AC}$ is $(\sqrt{3}+\sqrt{5})$ cm. The area of ΔABC is $(1+\sqrt{15})\,cm^2$. Find the length $\overline{AB}$ in the form $(a\sqrt{3}+b\sqrt{5})$ cm, where a and b are integers.



Sol.

$$\overline{AC} = (\sqrt{3}+\sqrt{5})\,cm$$

$$\text{Area of } \Delta ABC = (1+\sqrt{15})\,cm^2$$

$$\overline{AB} = ?$$

Formula

$$\text{Area of } \Delta ABC = \frac{\text{Base} \times \text{height}}{2}$$

$$\text{Area of } \Delta ABC = \frac{\overline{AC} \times \overline{AB}}{2}$$

$$(1+\sqrt{15})\,cm^2 = \frac{(\sqrt{3}+\sqrt{5})\,cm \times \overline{AB}}{2}$$

$$\frac{2(1+\sqrt{15})\,cm^2}{(\sqrt{3}+\sqrt{5})\,\cancel{cm}} = \overline{AB}$$

Solved by: Bashir Ahmad Mubashar (M.Phil, M.Ed)

$$\overline{AB} = \frac{2(1+\sqrt{15})}{(\sqrt{3}+\sqrt{5})} cm$$

$$\overline{AB} = \frac{2(1+\sqrt{15})}{(\sqrt{3}+\sqrt{5})} \times \frac{(\sqrt{3}-\sqrt{5})}{(\sqrt{3}-\sqrt{5})} cm$$

$$\overline{AB} = \frac{2[(1)(\sqrt{3})-(1)(\sqrt{5})+(\sqrt{15})(\sqrt{3})-(\sqrt{15})(\sqrt{5})]}{(\sqrt{3})^2-(\sqrt{5})^2} cm$$

$$\overline{AB} = \frac{2[\sqrt{3}-\sqrt{5}+\sqrt{15\times3}-\sqrt{15\times5}]}{3-5} cm$$

$$\overline{AB} = \frac{\cancel{2}[\sqrt{3}-\sqrt{5}+\sqrt{45}-\sqrt{75}]}{-\cancel{2}} cm$$

$$\overline{AB} = -[\sqrt{3}-\sqrt{5}+\sqrt{45}-\sqrt{75}] cm$$

$$\overline{AB} = (-\sqrt{3}+\sqrt{5}-\sqrt{45}+\sqrt{75}) cm$$

$$\overline{AB} = (-\sqrt{3}+\sqrt{5}-\sqrt{9\times5}+\sqrt{25\times3}) cm$$

$$\overline{AB} = (-\sqrt{3}+\sqrt{5}-\sqrt{9}\sqrt{5}+\sqrt{25}\sqrt{3}) cm$$

$$\overline{AB} = (-\sqrt{3}+\sqrt{5}-3\sqrt{5}+5\sqrt{3}) cm \quad \because \sqrt{9}=3, \ \sqrt{25}=5$$

$$\overline{AB} = (-1\sqrt{3}+5\sqrt{3}+1\sqrt{5}-3\sqrt{5}) cm$$

$$\overline{AB} = (4\sqrt{3}-2\sqrt{5}) cm$$

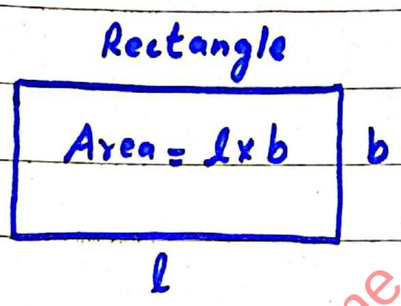
Answer.

Question #3

A rectangle has sides of length $2+\sqrt{18}$ m and $\left(5-\frac{4}{\sqrt{2}}\right)$ m. Express the area of the rectangle in the form $a+b\sqrt{2}$, where a and b are integers.

Sol.

Let



$$l = (2+\sqrt{18})\text{ m}$$

$$b = \left(5-\frac{4}{\sqrt{2}}\right)\text{ m}$$

Area of Rectangle = ?

Area of Rectangle = length × breath

$$A = l \times b$$

$$A = (2+\sqrt{18})\times\left(5-\frac{4}{\sqrt{2}}\right)$$

$$A = (2)(5) - (2)\left(\frac{4}{\sqrt{2}}\right) + (\sqrt{18})(5) - (\sqrt{18})\left(\frac{4}{\sqrt{2}}\right)$$

$$A = 10 - (\sqrt{2})^{2}\left(\frac{4}{\cancel{\sqrt{2}}}\right) + (\sqrt{9\times 2})(5) - (\sqrt{9\times 2})\left(\frac{4}{\sqrt{2}}\right)$$

$$A = 10 - (\sqrt{2})(4) + (\sqrt{9}\sqrt{2})(5) - (\sqrt{9}\cancel{\sqrt{2}})\left(\frac{4}{\cancel{\sqrt{2}}}\right)$$

$A = 10 - 4\sqrt{2} + (3\sqrt{2})(5) - (3)(4) \quad \because \sqrt{9} = 3$

$A = 10 - 4\sqrt{2} + 15\sqrt{2} - 12$

$A = 10 - 12 - 4\sqrt{2} + 15\sqrt{2}$

$A = -2 + 11\sqrt{2}$

$A = (-2 + 11\sqrt{2})\, m^2$

or $A = (11\sqrt{2} - 2)\, m^2$ Answer

Question # 4

Find two numbers whose sum is 68 and difference is 22.

Sol.

Let two numbers are: x, y

According to given condition

$x + y = 68$ & $x - y = 22$

Add these equations

$$\begin{aligned} x + \cancel{y} &= 68 \\ x - \cancel{y} &= 22 \\ \hline 2x \quad &= 90 \end{aligned}$$

$$2x = 90$$

$$x = \frac{90}{2}$$

$$\boxed{x = 45}$$ Ans.

put the value of x in equation

$$x + y = 68$$

$$45 + y = 68$$

$$y = 68 - 45$$

$$\boxed{y = 23}$$ Ans.

$$2x = 90$$

$$x = \frac{90}{2}$$

$$\boxed{x = 45} \text{ Ans.}$$

put the value of x in equation

$$x + y = 68$$

$$45 + y = 68$$

$$y = 68 - 45$$

$$\boxed{y = 23} \text{ Ans.}$$

(Question # 5)

The weather in Lahore was unusally warm during summer of 2024. The TV new reported temperature as high as 48°C. By using the formula, $\left({}^\circ F = \frac{9}{5}{}^\circ C + 32\right)$ Find the temperature as Fahrenheit scale.

Sol. Temperature in °C = 48°C
Temperature in °F = ?

By Using formula

$$°F = \frac{9}{5}°C + 32$$

put $°C = 48$

$$°F = \frac{9}{5}(48) + 32$$

$$°F = \frac{432}{5} + 32$$

$$°F = 86.4 + 32$$

$$\boxed{°F = 118.4}$$ Ans.

$\overset{4}{48} \times 9 = 432$

$432 \div 5 = 86.4$: $432 - 40 = 32$, $32 - 30 = 20$, $20 - 20 = 0$

Question #6

The sum of the ages of father and son is 72 years. Six year ago, the father's age was 2 times the age of the son. What was son's age six year ago?

Sol. let age of son = S
and age of father = F

According to question

$$S + F = 72 \longrightarrow (1)$$

Before 6 years ago their ages were:

age of son = $S-6$

age of father = $F-6$

According to given condition

Father's age was 2 times the age of the son.

$F-6 = 2(S-6)$

$F-6 = 2S-12$

$F = 2S-12+6$

$F = 2S-6 \longrightarrow$ (2)

Put the value of "F" in equation (1)

$S+F = 72$

$S+(2S-6) = 72$

$S+2S-6 = 72$

$3S = 72+6$

$3S = 78$

$S = \frac{78}{3}$

$$\begin{array}{r} 26 \\ 3\overline{)78} \\ -6 \\ \hline 18 \\ -18 \\ \hline \times \end{array}$$

$\boxed{S = 26 \text{ years}}$ Ans.

Question # 7

Mirha bought a toy for Rs 1500 and sold 1520. What was her profit percentage?

Sol.

Cost Price = C.P = 1500 Rs
Sale Price = S.P = 1520 Rs
Profit % = ?

Formula

$$\text{Profit \%} = \frac{\text{Profit}}{C.P} \times 100\%$$

$$\text{Profit \%} = \frac{S.P - C.P}{C.P} \times 100\%$$

$$\text{Profit \%} = \frac{1520 - 1500}{1500} \times 100\%$$

$$\text{Profit \%} = \frac{20}{15\cancel{00}} \times 1\cancel{00}\%$$

$$\text{Profit \%} = \frac{20}{15}\%$$

$$\text{Profit \%} = 1.333\%$$

$$\boxed{\text{Profit \%} = 1.33\%}$$

Answer.

$$\begin{array}{r|l} & 1.333 \\ \hline 15 & 20 \\ & -15 \\ \hline & 50 \\ & -45 \\ \hline & 50 \\ & -45 \\ \hline & 50 \\ & -45 \\ \hline & 5 \end{array}$$

Question # 8

The annual income of Tayyab is Rs 960000 while the exempted amount is Rs 130000. How much tax would he have to pay at the rate of 0.75 % ?

Sol.

Annual Income = 960000 Rs

Exempted amount = 130000 Rs

Taxable income = 960000 − 130000

= 830000 Rs

Tax Rate = 0.75 %

Tax amount = ?

Tax amount = (Taxable income) × (Tax Rate)

Tax amount = (830000) × (0.75 %)

$$\text{Tax amount} = 830000 \times \left(\frac{0.75}{100} \cdot \frac{1}{100}\right)$$

$$\text{Tax amount} = 83\cancel{0000} \times \frac{75}{1\cancel{0000}}$$

Tax amount = 83 × 75

$$\begin{array}{r} 83 \\ \times 75 \\ \hline 415 \\ 581\times \\ \hline 6225 \end{array}$$

$$\boxed{\text{Tax amount} = 6225 \text{ Rs}}$$

Ans.

Question # 9

Find the compound markup on Rs 375000 for one year at the rate of 14% compounded annually.

Sol.

Let

Principal amount = $P = 375000$ Rs

Time = t = One year = 1 year

Rate = R = 14%

Compount Mark up = ?

Formula

$$\text{Compound Mark up} = P \times R \times t$$

$$\text{Compount Mark up} = 375000 \times 14\% \times 1$$

$$\text{Compount Mark up} = 3750\cancel{00} \times \frac{14}{1\cancel{00}} \times 1$$

$$= 3750 \times 14 \times 1$$

$$= 3750 \times 14$$

$$= \boxed{52500 \text{ Rs}} \text{ Ans.}$$

Rough work

$$\begin{array}{r} 3750 \\ \times\ 14 \\ \hline 15000 \\ 3750\times \\ \hline 52500 \\ \hline \end{array}$$