CLASS 34

NUMBER SYSTEM & ALGEBRA

✱ Remainder Theorem :-

1. $\frac{17}{6}$ (+5, −1) R = 5.

2. $\frac{27}{10}$ (+7, −3) R = 7

3. $\frac{3}{5}$ (+3, −2) R = 3

4. $\frac{9}{13}$ (+9, −4) R = 9

5. $\frac{13}{9}$ (+4, −5) R = 4

6. $\frac{49}{9}$ (+4, −5) R = 4

7. $\frac{49 \times 65}{9}$ (+4 × +2), R = 8 OR $\frac{49 \times 65}{9} = \frac{35}{9} = 8$

OR $\frac{35}{9} = -1 = 9-1 = 8$

OR $\frac{49 \times 65}{9} = \frac{-28}{9} = -1 \Rightarrow 9-1 = 8$ Ans.

8. $\frac{65}{9}$ (+2, −7) R = 2

9. $\frac{54 \times 73}{8}$ (+6, +1), R = 6 OR $\frac{54 \times 73}{8} = -2 \Rightarrow 8-2 = 6$ Ans.

10. $\frac{1753 \times 1749 \times 83 \times 171}{17}$ (+2, −2, −2, +1) R = 8

$\frac{11 + 12 + 13 + 14 + 15 + 16 + \cdots\cdots 100000}{8}$ (+1, +2, −2, 0, 0, 0), R = 0

$14 = \frac{4 \times 3 \times 2 \times 1}{8}$, R = 0.

$15 = \frac{5 \times 4 \times 3 \times 2 \times 1}{8}$, R = 0

4 से आगे जितने भी factorial है सबका R = 0 आएगा क्योंकि सब में 8 का multiple होगा.

11 $1! + 2! + 3! + \dots\dots 100000$. find unit digit

$$\frac{\overset{+1}{1!} + \overset{+2}{2!} + \overset{-4}{3!} + \overset{+4}{4!} + \overset{0}{5!} \dots 100000}{10}$$

$R=3 \quad \therefore$ unit digit $= 3$

12 $$\frac{\overset{+1}{1!} + \overset{+2}{2!} + \overset{+6}{3!} + \overset{0}{4!} + \dots\dots 1000}{12}$$, find Remainder.

$R = 9$.

13 $12899 \times 96 \times 997$. find last two digits.

$$\frac{\overset{-1}{12899} \times \overset{-4}{96} \times \overset{-3}{997}}{100} = -12 \Rightarrow 100-12 = 88$$

$R=88 \quad \therefore$ last two digit $= 88$.

> → if a no. is divided by 10, the remainder obtained is the unit place of that no.
> → if a no. is divided by 100, the remainer obtained is the last two digit of that no.

14 $$\frac{98 \times 17373 \times 153 \times 96 \times 127}{100}$$, find last two digits.

$$\frac{98 \times 17373 \times 153 \times \overset{24}{\cancel{96}} \times 127}{\cancel{100}\ 25}$$

$$\frac{\overset{-2}{98} \times \overset{-2}{17373} \times \overset{+3}{153} \times \overset{-1}{24} \times \overset{+2}{127}}{25}$$

$= -24 = 25-24 = 1 \times (4) = 4$

↓ starting में 4 से simplify किया था.

Remainder $= 4$

$\therefore$ last two digits $= 04$ Ans

(#) $\frac{24}{9}$, $R = 6$.

Now, $\frac{\overset{8}{\cancel{24}}}{\cancel{9}_3} = \frac{8}{3}$, $R = (+2) \times 3 = 6$

जिस no. से simplify करते है बाद में उसी से multiply करते है तब सही Remainder आयेगा, नहीं तो गलत होगा.

(15) $37 \times 53 \times 65 \times 39 \times 1352 \times 48 \times 73$. find last two digits ?

$$37 \times 53 \times \overset{13}{\cancel{65}} \times 39 \times 1352 \times \overset{12}{\cancel{24}} \times \cancel{48} \times 73$$

$$\cancel{100} \quad \cancel{20} \quad \cancel{10} \; 5$$

5, 4

$$\frac{37 \times 53 \times 13 \times 39 \times 1352 \times 12 \times 73}{5} = \frac{64}{5} = 4$$

(+2, −2, −2, −1, +2, +2, −2)

simplified by 20

$R = 4 \times 20 = 80.$

Last two digits = 80.

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(#) $\frac{(35)^{113}}{9} = (-1)^{113} = -1$, $R = 9-1 = 8$

$\frac{(37)^{113}}{9} = (1)^{113} = +1$

$(-)^{odd} = -$

$(-)^{even} = +$

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(16) $\frac{2^{33}}{9} = \frac{(2^3)^{11}}{9} = \frac{(8)^{11}}{9} = (-1)^{11} = -1 \Rightarrow 9-1 = 8$

(17) $\frac{2^{34}}{9} = \frac{2^1 \times 2^{33}}{9} = \frac{2^1 \times (8)^{11}}{9} = -2 \Rightarrow 9-2 = 7$

(+2, −1)

(18) $\frac{7^{512}}{400} = \frac{(7^4)^{128}}{400} = \frac{\overset{+1}{(2401)^{128}}}{400} = 1$

(19) $\frac{2^{110}}{9} = \frac{2^2 \times 2^{108}}{9} = \frac{4 \times 2^{108}}{9} = \frac{\overset{+4\ \ +1}{4 \times (2^3)^{36}}}{9} = 4$ Ans

CLASS 35

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(20) $\frac{4^{48}}{33} = \frac{(2^2)^{48}}{33} = 2^{96} \rightarrow 2^1 \times 2^{95} \rightarrow 2 \times (2^5)^{19}$

$\rightarrow \frac{\overset{+2}{2} \times \overset{-1}{(32)^{19}}}{33} \rightarrow -2 \rightarrow 33-2 \Rightarrow 31$ Ans.

(21) $\frac{\overset{-1}{(83)^{115}}\ \overset{+12}{+12}}{84} = 11$

(22) $\frac{2^{99}}{16} \rightarrow \frac{2^4 \times 2^{95}}{16} \rightarrow \frac{\cancel{16} \times 2^{95}}{\cancel{16}} \Rightarrow R = 0$

(23) $\frac{2^{99}}{10} = \frac{\cancel{2} \times 2^{98}}{\cancel{10}\ 5} = \frac{2^{98}}{5} = \frac{(2^2)^{49}}{5}$

$\frac{\overset{-1}{(4)^{49}}}{5} = -1 \Rightarrow 5-1 \Rightarrow 4 \times 2 \Rightarrow 8$

simplified by 2 in the starting.

(24) $\frac{5^{500}}{500} = \frac{\cancel{5^3} \times 5^{497}}{\cancel{125} \times 4} = \frac{\overset{+1}{(5)^{497}}}{4} = 1 \times 125 = 125$ Ans

simplified by 125 in starting.

(25) $\dfrac{(35)^{-1}\ 11938769\ \times 7^{-2}}{9} = +2$

(26) $\dfrac{123456789101112131415}{16}$

$\Rightarrow \dfrac{1415}{16} = 7$

$R = 7.$

Any no. divisible by 2 if last 1 digit divides
Any no. divisible by 4 if last 2 digit divides
Any no. divisible by 8 if last 3 digit divides
Any no. divisible by 16 if last 4 digit divides

(27) $\dfrac{12345\ldots\ldots 41 \text{ digits}}{8}$

$\Rightarrow \dfrac{041}{8} \Rightarrow +1$

$R = 1$

1 to 9 → Each no. has 1 digit
After 9 → Each no. has 2 digits (10, 11, 12 ···)

$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$

$\dfrac{41}{-9}$
32 digits

$= \dfrac{32}{2} = 16$ nos

$\therefore \dfrac{12345\ldots\ldots232425}{8}$

$\therefore 8\overline{)425}\,(53$
40
25
24
$R = 1$ Ans

(28) $\frac{1\,2\,3\,4\,\cdots\,57\text{ digits}}{16}$

$57-9 = \frac{48}{2} = 24+9 = 33$ numbers

$\frac{1\,2\,3\,4\,\cdots\,3233}{16} \Rightarrow \frac{3233}{16} \Rightarrow 1$ Ans

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(29) $\frac{1\,2\,3\,4\,5\,\cdots\,76\text{ digits}}{16}$

if 75 digits → $75-9 = \frac{66}{2} = 33+9 = 42$ numbers + 1 digit more ie 4

$\frac{1\,2\,3\,4\,5\,\cdots\,40\,41\,42\,4}{16}$

$\Rightarrow \frac{1424}{16} \Rightarrow R=0$

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(30) $\frac{666666666\cdots\cdots 45\text{ times}}{37}$

7 pairs of 666666 ⇒ 42 times

$\therefore$ 37) 666 (18
37
296
296
R = 0

if Any no. is written 6 times like (111111, 222222, 666666) it will exactly divide by 7, 11, 13, 37.

(#) divide by 3 → sum of all digit divide by 3
9 → sum of all digits divide by 9
27 → sum of All digits divide by 27
6 → Number divide by 2 and 3 both.

(*) Divide by 7

5 3 8 7	6
− 1 2	×2
5 3 7	5
− 1 0	×2
5 2	7
− 1 4	×2
3 8	

→ not divisible by 7

∴ 53876 is not divisible by 7.

7

Any no written like 3737, 2525, 2323 will be divisible by 101.

(#) 6 5 4 3 2 5 7 7

make pairs from Right sides (3 digits)

Add alternate pairs

577 + 65 = 642

subtract from 3rd pair

642
− 432
210 → divisible by 7

∴ 65432577 is divisible by 7.

(#) Divisible by 11

2 3 4 5 6 7 8

add alternate digits = 2+4+6+8 = 20

3+5+7 = 15

Then subtract

20
−15
5 →

if this diff is 0 or multiple of 11, then the no will be divide by 11 otherwise not.

7 1 9 4 0

16
− 5
11 → divisible by 11

∴ 71940 is divisible by 11.

(31) $\frac{10^1 + 10^2 + 10^3 + 10^4 + \ldots\ldots + 10^{100}}{6}$, find Remainder

$\frac{\overset{+4}{10^1} + \overset{+4}{10^2} + \overset{+4}{10^3}}{6} = \frac{12}{6} = 0$

After every 3 terms Remainder will be zero.

∴ So upto 10^{99}. remainder is zero.

$\frac{10^{100}}{6} = 4$

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(32) $\frac{10^1 + 10^2 + 10^3 + \ldots 10^{11}}{6}$

∴ upto 109 remainder is zero.

$\frac{\overset{+4}{10^{10}} + \overset{+4}{10^{11}}}{6} = \frac{8}{6} = 2$

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(33) $(23^{10} - 1024)$ not Divides by

~~A)~~ 5

~~B)~~ 3

C) 4

~~D)~~ 7

$(a^n - b^n)$

$n \rightarrow$ even no.

then this no. divides by $(a-b)$ & $(a+b)$

$(23^{10} - 2^{10})$

$23-2 = 21$

1 3 7

$23+2 = 25$

1 5 25

this no. is not divided by 4.

(34) $(3^{41} + 7^{82})$ not divides by A) 3 ~~B) 4~~ ~~C) 13~~ ~~D) 26~~

$3^{41} + (7^2)^{41}$

$3^{41} + 49^{41}$

$49+3 = 52$

1, 13, 26, 4.

∴ not divided by 3.

$a^n + b^n$
$n \to$ odd
then $a^n + b^n$ divides by $(a+b)$

~~$(+4)^{23}$~~ 0 ~~$(-4)^{23}$~~

(35) $\dfrac{27^{23} + 23^{23} + 19^{23}}{23}$ find Remainder

$= 0$

(OR) $\dfrac{27^{23} + 19^{23}}{23} \Rightarrow 27+19 = 46 \begin{cases} 1 \\ 2 \\ 23 \end{cases}$

$R = 0$

(#) if $(a^n - b^n)$ $n \to$ even divides by $(a-b)$, $(a+b)$ $a^2-b^2=(a+b)(a-b)$	$a^n - b^n$ $n \to$ odd divides by $(a-b)$ $a^3-b^3=(a-b)(a^2+ab+b^2)$	$a^n + b^n$ $n \to$ odd no. divides by $(a+b)$ $a^3+b^3=(a+b)(a^2-ab+b^2)$

(#) $(102)^3 = 106 / 12 / 08 = 1061208$

$(104)^3 = 112 / 48 / 64 = 1124864$

$(105)^3 = 115 / 75 / {}_1 25 = 1157625$

$(106)^3 = 118 / {}_1 08 / {}_2 16 = 1191016$

(36) if $x = 106$

Then $x(x^2-3x+3) = ?$

where 3 appears two times, that means $(a+b)$ or $(a-b)$ का cube होगा ।

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$
$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b3$$

$x(x^2-3x+3)$

$x^3 - 3x^2 + 3x - 1 + 1$

$(x-1)^3 + 1$

$(105)^3 + 1 \Rightarrow 1157625 + 1 \Rightarrow 1157626$ Ans

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(37) if $x = 99$

then $x(x^2+12x+48) = ?$

$x^3 + 12x^2 + 48x + 64 - 64$

$a^3 \quad 3x^2 \cdot 4 \quad 3ab^2 \quad + b^3$

$(x+4)^3 - 64$

$1092727 - 64$

दो बार 3 या 3 का multiple दिखे तो $(a-b)$ या $(a+b)$ का cube बनाओ ।

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(38)

$$\frac{1}{\sqrt[3]{25} - \sqrt[3]{5} + 1} = A\sqrt[3]{25} + B\sqrt[3]{5} + C \qquad A+B+C =$$

$$\frac{1(5^{\frac{1}{3}}+1)}{\left[(5^{\frac{1}{3}})^2 - 5^{\frac{1}{3}} \times 1 + (1)^2\right] \times (5^{\frac{1}{3}}+1)}$$

$a^2 \quad -ab \quad b^2$

$\sqrt[3]{25} = (25)^{\frac{1}{3}}$

$= (5^2)^{\frac{1}{3}}$

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

$= (5^{\frac{1}{3}})^2$

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

$a^3-b3 = (a-b)(a^2+ab+b^2)$

$$\Rightarrow \frac{\sqrt[3]{5}+1}{(5^{\frac{1}{3}})^3+(1)^3} \Rightarrow \frac{2\sqrt[3]{5}+1}{6}$$

$$\Rightarrow \frac{1}{6}\sqrt[3]{5} + \frac{1}{6} = A\sqrt[3]{25} + B\sqrt[3]{5} + C$$

$$\begin{matrix} A & B & C \\ 0 & \frac{1}{6} & \frac{1}{6} \end{matrix} \Rightarrow \boxed{\frac{1}{3}} \quad \underline{\text{Ans.}}$$

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(39) $\dfrac{1}{\sqrt[3]{9}+\sqrt[3]{3}+1} = A\sqrt[3]{9} + B\sqrt[3]{3} + C \;;\; A+B-C = ?$

$$\frac{1\left(3^{\frac{1}{3}}-1\right)}{\left(3^{\frac{1}{3}}-1\right)\left[\left(3^{\frac{1}{3}}\right)^2+3^{\frac{1}{3}}\times 1+(1)^2\right]}$$

$$\Rightarrow \frac{3\sqrt[3]{3}-1}{(3^{\frac{1}{3}})^3-(1)^3}$$

$$\frac{1}{2}\,3\sqrt[3]{3} - \frac{1}{2}$$

$A = 0$

$B = \frac{1}{2}$

$C = -\frac{1}{2}$

$$A+B-C = \frac{1}{2}-\left(-\frac{1}{2}\right) = \boxed{1} \quad \underline{\text{Ans}}$$

(#)

$x = 7+4\sqrt{3}$	$x = \sqrt{3}-\sqrt{2}$	$x = 5-2\sqrt{6}$
$\frac{1}{x} = 7-4\sqrt{3}$	$\frac{1}{x} = \sqrt{3}+\sqrt{2}$	$\frac{1}{x} = 5+2\sqrt{6}$

अगर दो no. के square का diff 1 हो तो उनके conjugate में सिर्फ sign change होगा

(40) $x = \frac{1}{7+4\sqrt{3}}$, $y = \frac{1}{7-4\sqrt{3}}$; $\frac{1}{x+1} + \frac{1}{y+1} = ?$

$\frac{1}{x} = 7-4\sqrt{3}$

$y = \frac{1}{x}$

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

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

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

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(41) $x = (\sqrt{3}+\sqrt{2})^{-3}$ | $y = (\sqrt{3}-\sqrt{2})^{-3}$ | $(x+1)^{-1} + (y+1)^{-1} = ?$

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

$\frac{1}{x} = y$

$\frac{1}{x+1} + \frac{1}{y+1}$

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

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

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(42) $x = 7+4\sqrt{3}$ | $x + \frac{1}{x} = ?$

$\frac{1}{x} = 7-4\sqrt{3}$

$\therefore x + \frac{1}{x} = 14$

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(43) if $x = 14$

$x^5 - 15x^4 + 15x^3 - 15x^2 + 15x$

$x^5 - 14x^4 - x^4 + 14x^3 + x^3 - 14x^2 - x^2 + 14x + x$

$x = 14$

(14) Ans

(44) if $x = 12$

$x^6 - 13x^5 + 13x^4 - 13x^3 + 15x^2 - 13x + 5 = ?$

$x^6 - 13x^5 + 13x^4 - 13x^3 + 13x^2 - 13x + 5 + 2x^2$

$0 \qquad -x + 5 + 2x^2$

$\Rightarrow \quad 2(12)^2 + 5 - 12$

$\Rightarrow 281$

Recurring digit

$0.5555\ldots = 0.\overline{5}$

$0.676767\ldots = 0.\overline{67}$

$0.65\overline{7} = 0.6577\ldots$

$2.6\overline{5} = 2 + 0.6\overline{5}$

$\overline{2}.6\overline{5} = -2 + 0.6\overline{5}$

$0.\overline{5} = \frac{5}{9}$

$0.\overline{56} = \frac{56}{99}$

$0.\overline{567} = \frac{567}{999}$

$0.4\overline{5} = \frac{45-4}{90} = \frac{41}{90}$ → जितने बार → उतनी 9 जिसपे बार नहीं – उतने zero.

$0.5\overline{78} = \frac{578-5}{990} = \frac{573}{990}$

(*) $2.5\overline{78}$

$2 + 0.5\overline{78}$

$2 + \frac{578-5}{990}$

$2 + \frac{573}{990}$

$2\ \frac{573}{990}$

(45) $\sqrt[3]{0.\overline{037}}$

$\Rightarrow \sqrt[3]{\frac{37}{999}} \Rightarrow \sqrt[3]{\frac{1}{27}}$

$\Rightarrow \sqrt[3]{\left(\frac{1}{3}\right)^3} \Rightarrow \frac{1}{3} \Rightarrow 0.\overline{3}$

(46) $\left(0.\overline{11} + 0.\overline{22}\right) \times 3$

$\Rightarrow \left(\frac{11}{99} + \frac{22}{99}\right) \times 3 \Rightarrow \frac{33}{99} \times 3 \Rightarrow 1$

(47) $3.\overline{12} + 5.\overline{34} + 2.\overline{16}$

$3 + \frac{12}{99} + 5 + \frac{34}{99} + 2 + \frac{16}{99}$

$\Rightarrow 10 + \frac{62}{99} \Rightarrow 10\frac{62}{99} \Rightarrow 10.\overline{62}$

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(48) $2.8\overline{56} + 3.\overline{74} + 5.857\overline{6}$

2, 2, 1
LCM = 2

max. nos jinme bar nahi hai (3)	jitna LCM aaya utne nos yahan secure kar lo ↓	jitne bhi le lo, jaruri nahi hai
X X X	X X	X X X X
2.8 5 6	5 6	5 6 5 6
3.7 4 7	4 7	4 7 4 7
5.8 5 7	6 6	6 6 6 6
12.4 6 |	7 0 |	7 0 6 9

$12.46|\overline{70}$ Ans

option se

1) option me sabse pahle ye dekho ke jitna LCM aaya hai (2) utne bar jitne options me hai
2) fir bar se pahle 3 nos pe bar nahi hai.

OR

(1) jitne nos pe bar ho unka LCM lena hai. (2, 2, 1) LCM = 2. Ans me bar 2 nos par hi hoga.

(2) Ab ye dekho sabse jyada kin no. pe bar nahi hai. $5.857\overline{6}$ me 3 nos pe bar nahi hai.
∴ bar se pahle 3 nos ayenge

(49) $2.5\overline{6} + 2.34\overline{5}$

(1, 1) → LCM = 1

×	×	×	LCM	
2. 5	6	6	6	6
2. 3	4	5	5	5
4 · 9	1	2	2	1

$4.91\overline{2}$ Ans.

Number of factors

(#)

(50) 240

2	240
2	120
2	60
2	30
3	15
5	5
	1

$240 \rightarrow 2^4 \times 3^1 \times 5^1$

(1) No. of factors ⇒

$5 \times 2 \times 2 = 20.$

(2) sum of all factors ⇒

$(2^0+2^1+2^2+2^3+2^4) \times (3^0+3^1) \times (5^0+5^1)$

$31 \times 4 \times 6$

$= 744$

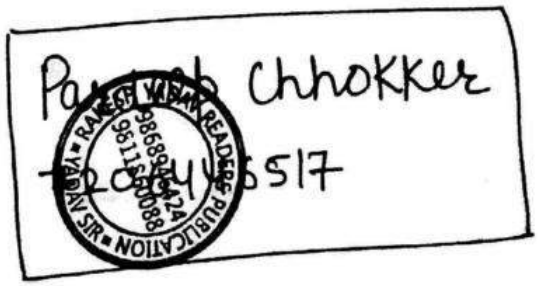
(factors are in GP)

$8 \rightarrow 2^3$

Total factors = power + 1

= 3 + 1 = (4)

$\because 8 \rightarrow 2^3 \times 2^0$



(51) 300

2	300
2	150
3	75
5	25
5	5
	1

$300 \rightarrow 2^2 \times 3^1 \times 5^2$

No. of factors $= 3 \times 2 \times 3 = 18$

sum of all factors $= (2^0+2^1+2^2) \times (3^0+3^1) \times (5^0+5^1+5^2)$

$7 \times 4 \times 31 = 868$ Ans.

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(52) $2^2 \times 3^1 \times 5^2$

No. of even factor $\Rightarrow 2 \times 2 \times 3 = 12$ → (even no. की power में 1 add नहीं करेंगे)

sum of even factor $\Rightarrow (2^1+2^2)(3^0+3^1)(5^0+5^1+5^2)$ → (even की power 0 consider नहीं करेंगे odd को रखेंगे)

$6 \times 4 \times 31 = 744$

No. of odd factor $\Rightarrow 2 \times 3 = 6$ → (even को नहीं लेंगे)

sum of odd factor $\Rightarrow (3^0+3^1)(5^0+5^1+5^2)$ → (even को नहीं लेंगे)

$4 \times 31 = 124$

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(53) $360 \rightarrow 2^3 \times 3^2 \times 5^1$

2	360
2	180
2	90
3	45
3	15
5	5
	1

No. of odd factors $= 3 \times 2 = 6$

Sum of odd factors $= (3^0+3^1+3^2)(5^0+5^1)$

$13 \times 6 = 78$

sum of even factors =

$(2^1+2^2+2^3)(3^0+3^1+3^2)(5^0+5^1)$

$14 \times 13 \times 6 = 1092$

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(54) $1728 \rightarrow 2^6 \times 3^3$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

No. of factors = $7 \times 4 = 28$

Number of Prime factor

(#) $a^x \times b^y \times c^z \ldots$ a, b, c ⇒ prime nos

No. of prime factors = x+y+z

(55) $13^2 \times 7^5 \times 3^8 = 2+5+8 = (15) \rightarrow$ No. of prime factors.

(56) $13^2 \times 7^5 \times 15^8 = 13^2 \times 7^5 \times 3^8 \times 5^8$

$= 2+5+8+8 = (23) \rightarrow$ No. of prime factors.

(#) $\sqrt{a \times \sqrt{a \times \sqrt{a \times \cdots}}}$ ∞

Ans $= a$

(#) $\sqrt{a \times \sqrt{a \times \sqrt{a \times \cdots}}}$ n

Ans $= \boxed{a^{\frac{2^n - 1}{2^n}}}$

(57) $\sqrt{8 \times \sqrt{8 \times \sqrt{8 \times \cdots}}}$ 7th term

$8^{\frac{2^7 - 1}{2^7}} = 8^{\frac{127}{128}}$

(#) $\left(z\sqrt{\left(y\sqrt{\left(x\sqrt{a^m} \right)^n} \right)^o} \right)^p$

Ans $= \boxed{a^{\frac{m \times n \times o \times p}{x \times y \times z}}}$

(58) $\sqrt[3]{\left(\sqrt{5^4}\right)^6} \times \sqrt{\left(\sqrt[6]{5^8}\right)^3}$

$\Rightarrow 5^{\frac{4 \times 6}{2 \times 3}} \times 5^{\frac{8 \times 3}{6 \times 2}}$

$\Rightarrow 5^4 \times 5^2$

$\Rightarrow 5^6$

(#) $\sqrt{a+\sqrt{a+\sqrt{a+\ldots\ldots\infty}}}$

$= \frac{1+\sqrt{1+4a}}{2}$

अगर a के दो factors के बीच का diff 1 हो तो बड़ा factor Ans होगा।

(#) $\sqrt{a-\sqrt{a-\sqrt{a-\ldots\ldots\infty}}}$

$= \frac{-1+\sqrt{1+4a}}{2}$

छोटे वाला factor Ans होगा।

(59) $x = \sqrt{7+\sqrt{7+\sqrt{7+\ldots\infty}}}$

$x = \frac{1+\sqrt{29}}{2}$ Ans.

Range $= \frac{1+\sqrt{25}}{2}$ $\quad$ $\frac{1+\sqrt{36}}{2}$

$= 3$ $\quad$ $= 3.5$

$3 < x < 3.5$ Ans.

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(60) $\sqrt{12+\sqrt{12+\sqrt{12+\ldots\infty}}}$

3 ^ 4

Ans = 4.

(61) $x = \sqrt{8-\sqrt{8-\sqrt{8-\ldots\infty}}}$

$x = \frac{-1+\sqrt{33}}{2}$

$2 < x < 2.5$

---

(62) $x = \sqrt{2 \times \sqrt[3]{4 \times \sqrt{2 \times \sqrt[3]{4 \times \sqrt{2 \times \sqrt[3]{4 \times \ldots \ldots \infty}}}}}}$

square

$x^2 = 2 \times \sqrt[3]{4 \times x}$

cube

$x^6 = 8 \times 4x$

$x^5 = 32$

$x^5 = 2^5$

$x = 2$ Ans

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(63) Factor of $(x^{29} - x^{26} - x^{23} + 1) = ?$

A) $(x-1)$ but not $(x+1)$

B) $(x+1)$ but not $(x-1)$

C) both

D) Neither $(x+1)$ nor $(x-1)$

$x+1 = 0$
$x = -1$
Put $x = -1$
$\Rightarrow 0$

$x-1 = 0$
$x = 1$
Put $x = 1$
$\Rightarrow 0$

$(x+1)$ & $(x-1)$ both are fact

---

(64) if $(x-2)$ is a factor of $(x^2 + kx + 4)$. Then $k = ?$

$x - 2 = 0$
$x = 2$ $\Rightarrow$ $4 + 2k + 4 = 0$.

$2k = -8$

$\boxed{k = -4}$

---

(65) if $(x+1)$ and $(x-1)$ are factor of $(ax^3 + bx^2 + 3x + 5)$. Find a,

$x - 1 = 0$
$x = 1$
$\Rightarrow a + b = -8$

$x + 1 = 0$
$x = -1$
$\Rightarrow -a + b = -2$

$\boxed{a = -3}$
$\boxed{b = -5}$

(66) $\frac{x^2-7x+15}{x-3}$. find R

$x=3 \Rightarrow 9-21+15 \Rightarrow 3$ Ans

(67) $\frac{x^{11}+1}{x+1} \Rightarrow x+1=0$

$x=-1$

$-1+1 \Rightarrow 0 = R$

---

(68) $\frac{x^{40}+3}{x^4+1} \Rightarrow x^4+1=0$

$x^4=-1$

$(x^4)^{10}+3 \Rightarrow (-1)^{10}+3 \Rightarrow 4=R.$

---

(69) $\frac{x^{51}+51}{x+1} \Rightarrow x=-1$

$(-1)^{51}+51 \Rightarrow 50=R$

(70) $\frac{x^{51}+a}{x+1}$, $R=50$. find a

$x+1=0 \Rightarrow (-1)^{51}+a=50$

$x=-1$

$-1+a=50$

$\boxed{a=51}$

---

(71) $a^4+a^2b^2+b^4=8$ $\quad ab=?$

$\boxed{(a+b)^2=a^2+b^2+2ab}$

$a^2+b^2+ab=4$

$a^4+b^4=8-a^2b^2$

$a^2+b^2=4-ab$

Squaring

$a^4+b^4+2a^2b^2=16+a^2b^2-8ab$

$8-a^2b^2+2a^2b^2=16+a^2b^2-8ab$

$\boxed{ab=1}$

(72) If $x^2+2 = 2x$

$x^4 - x^3 + x^2 + 2 = ?$

$x^2+2 = 2x$

squaring

$x^4 + 4 + 4x^2 = 4x^2$

$\boxed{x^4 = -4}$

Now $x^2+2 = 2x$

$x^2 = 2x-2$

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

$\therefore -4 - x^3 + x^2 + 2$

$\Rightarrow -x^3 + x^2 - 2$

$\Rightarrow -x^2(x-1) - 2$

Now $-x^2\left(\frac{x^2}{2}\right) - 2$

$\Rightarrow \frac{-x^4}{2} - 2$

$\frac{4}{2} - 2$

$\Rightarrow 2 - 2 = 0$ Ans.

---

(73) $x^4 + y^4 = 19$ | $x+y = 1$ | $x^2y^2 - 2xy = ?$

$x^2+y^2+2xy = 1$

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

square again

$\Rightarrow x^4+y^4+2x^2y^2 = 1 + 4x^2y^2 - 4xy$

$\Rightarrow 19 - 2x^2y^2 - 1 = -4xy$

$\Rightarrow 18 - 2x^2y^2 + 4xy$

$\Rightarrow 9 - x^2y^2 + 2xy = 0$

$\Rightarrow -x^2y^2 + 2xy = -9$

$\Rightarrow x^2y^2 - 2xy = 9$ Ans

---

1) $a^4 + a^2b^2 + b^4 = 12$ | $a^2+ab+b^2 = 4$ | $ab = ?$

$a^2+b^2 = 4-ab$

square

$a^4+b^4+2a^2b^2 = 16 + a^2b^2 - 8ab$

$12 - a^2b^2 + 2a^2b^2 = 16 + a^2b^2 - 8ab$

$\Rightarrow -4 = -8ab$

$\boxed{ab = \frac{1}{2}}$

OR $a^4 + a^2b^2 + b^4 = 12$

$a^4 + a^2b^2 + b^4 + a^2b^2 - a^2b^2 = 12$

$a^4 + 2a^2b^2 + b^4 - a^2b^2 = 12$

$(a^2+b^2)^2 - (ab)^2 = 12$

$(a^2+b^2-ab)(a^2+b^2+ab) = 12$

$(4-ab-ab)(4) = 12$

$(4-2ab)(4) = 12$

$16 - 8ab = 12$

$\boxed{ab = \frac{1}{2}}$

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(75) $x = a^2+b^2$ | $y = ab\sqrt{2}$ | $\frac{a^4+b^4}{a^2 - ab\sqrt{2} + b^2} = ?$

$x = a^2+b^2$ | $y = ab\sqrt{2}$

$x^2 = a^4+b^4+2a^2b^2$ | $y^2 = 2a^2b^2$

$x^2 = a^4+b^4+y^2$

$\therefore x^2 - y^2 = a^4+b^4$

$\therefore \frac{(x+y)(x-y)}{x-y} \Rightarrow \boxed{x+y}$ Ans

---

(#) $x + \frac{1}{x} = 13$

$x^2 + \frac{1}{x^2} = 13^2 - 2 = 167$

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

$x^2 + \frac{1}{x^2} = 7$

$x^4 + \frac{1}{x^4} = 47$

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

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

(76) if $\sqrt{x} + \frac{1}{\sqrt{x}} = 1$

square

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

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

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

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

$\therefore x^{512} + \frac{1}{x^{512}} = -1$ Ans

$x^{40} + \frac{1}{x^{40}} = ?$

$x^{512} + \frac{1}{x^{512}} = ?$

(#) $x - \frac{1}{x} = 13$

$x^2 + \frac{1}{x^2} - 2 \cdot x \cdot \frac{1}{x} = 169$

$x^2 + \frac{1}{x^2} = 169 + 2$

(*) $x - \frac{1}{x} = 3$

$x^2 + \frac{1}{x^2} = 11$

$x^4 + \frac{1}{x^4} = 11^2 - 2 = 119$

(*) $x - \frac{1}{x} = 5$

$x^2 + \frac{1}{x^2} = 27$

$x^4 + \frac{1}{x^4} = 727$

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

(#) $x + \frac{1}{x} = 1$

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

$x^3 + \frac{1}{x} = -x$

$x^3 + \frac{1}{x} + x = 0$

$x^3 + 1 = 0$

$x^3 = -1$

if $x + \frac{1}{x} = 1$	or $x^2 - x + 1 = 0$
$x^3 + 1 = 0$	$\therefore x^3 + 1 = 0$
$x^3 = -1$	$x^3 = -1$

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

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

(Ans) if $x+\frac{1}{x}=-1$

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

$\left(x^3+\frac{1}{x}\right)=-x$

$x^3+\frac{1}{x}+x=0$

$x^3-1=0$

$x^3=1$

> if $x+\frac{1}{x}=-1$
> or
> $x^2+x+1=0$
> then $x^3=1$
> $x^3-1=0$

---

(77) if $x^2+x+1=0$ | find $x^3+1=?$

$\therefore x^3=1$ $\quad 1+1=2$ Ans.

(78) if $\sqrt{x}+\frac{1}{\sqrt{x}}=1$ | $x^{40}+\frac{1}{x^{40}}=?$

$x+\frac{1}{x}=-1$ $\quad \Rightarrow x\cdot x^{39}+\frac{1}{x\cdot x^{39}}$

$\therefore x^3=1$

$(x^3)^{13}=(1)^{13}$ $\quad \Rightarrow x+\frac{1}{x}$

$x^{39}=1$ $\quad \Rightarrow -1$ Ans.

---

(79) if $x+\frac{1}{x}=1$ | $x^{17}+\frac{1}{x^{17}}=?$

$\boxed{x^3=-1}$

$x^{18}=1$

$\frac{x\cdot x^{17}}{x}+\frac{1}{\frac{x\cdot x^{17}}{x}}$

$\frac{x^{18}}{x}+\frac{x}{x^{18}}$

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

$=1$ Ans

(80) $x+\frac{1}{x}=1$ | $x^{16}+x^{13}=?$ → Power diff 3 then Ans 0

$x^3=-1$ ⇒ $x^3 \cdot x^{13}+x^{13}$

⇒ $-x^{13}+x^{13}$

0

(81) if $x+\frac{1}{x}=1$ | $x^{91}+x^{96}+x^{89}+x^{88}+x^{87}+x^{86}$

$x^3=-1$

$= 0$

$$x^3+\frac{1}{x^3}=\left(x+\frac{1}{x}\right)^3-3\left(x+\frac{1}{x}\right)$$

$$x^3-\frac{1}{x^3}=\left(x-\frac{1}{x}\right)^3+3\left(x-\frac{1}{x}\right)$$

(##) if $x+\frac{1}{x}=3, 4, 5, 6, 10$

$x^3+\frac{1}{x^3}=18, 52, 110, 198, 970$

(#) if $x-\frac{1}{x}=10, 6, 5, 4, 3, 2$

$x^3-\frac{1}{x^3}=1030, 234, 140, 76, 36, 14$

---

(82) if $a-b+5=0$ | $(x-a)(x-b)=1$ | $(x-a)^3-\frac{1}{(x-a)^3}=?$

$-b=-a-5$

$m(x-a-5)=1$

$m(m-5)=1$

$m-5=\frac{1}{m}$

$m-\frac{1}{m}=5$

$x-a=m$

$m^3-\frac{1}{m^3}=?$

$=140$

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(33) if $x^2+x=5$ | $(x+3)^3+\frac{1}{(x+3)^3}=?$

$x+3=m$ | $x=m-3$

$(m-3)^2+(m-3)=5$

$m^2+9-6m+m-3=5$

$m^2-5m=-1$

$m(m-5)=-1$

$(m-5)=-\frac{1}{m}$

$m+\frac{1}{m}=5$

$\Rightarrow m^3+\frac{1}{m^3}$

$\therefore m^3+\frac{1}{m^3}=125-15=110$

(34) if $x(x-3)=-1$ | $x^3(x^3-18)=?$

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

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

$\therefore x^3+\frac{1}{x^3}=18$

$x^3\cdot x^3+\frac{1}{x^3}\cdot x^3=18\cdot x^3$

$x^6+1=18x^3$

$x^6-18x^3=-1$

$x^3(x^3-18)=-1$ **Ans**

(35) if $x-\frac{1}{x}=3$ | $x^7-\frac{1}{x^7}=?$

$x^2+\frac{1}{x^2}=11$

$x^4+\frac{1}{x^4}=119$

$x^3-\frac{1}{x^3}=36$

$\left(x^4+\frac{1}{x^4}\right)\left(x^3-\frac{1}{x^3}\right)=119\times36$

$x^7-\frac{1}{x^7}-\left(x-\frac{1}{x}\right)=119\times36$

$x^7-\frac{1}{x^7}=119\times36+3$

| 9×6 $=5\,(4)$ $+3$ $=7$ unit p'

(86) if $x+\frac{1}{x}=3$ | $x^7+\frac{1}{x^7}=?$

$x^4+\frac{1}{x^4}=47$

$x^3+\frac{1}{x^3}=18$

$\left(x^4+\frac{1}{x^4}\right)\left(x^3+\frac{1}{x^3}\right)=47\times18$

$x^7+\frac{1}{x^7}+\left(x+\frac{1}{x}\right)=47\times18$

$x^7+\frac{1}{x^7}=47\times18-3$

$8\times7=56$

-3

③ - unit digit 3 वाला Ans होगा।

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(87) $x+\frac{1}{x}=4$ | $x^5+\frac{1}{x^5}=?$

$x^2+\frac{1}{x^2}=14$

$x^3+\frac{1}{x^3}=52$

$\left(x^2+\frac{1}{x^2}\right)\left(x^3+\frac{1}{x^3}\right)=14\times52$

$\left(x^5+\frac{1}{x^5}\right)=14\times52-4$

---

(88) $x+\frac{1}{x}=5$ | $x^5+\frac{1}{x^5}=?$

$x^5+\frac{1}{x^5}=23\times110-5$ Ans.

(卌) if $x+\frac{1}{x}=\sqrt{3}$

Then $x^3+\frac{1}{x^3}=0$

$x^6+1=0$

$x^6=-1$

(89) if $x+\frac{1}{x}=\sqrt{3}$

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

OR

$x^4 \cdot x^{96}+\frac{1}{x^4 \cdot x^{96}}$

$(x^6)^{16}=(-1)^{16}=1$

$\therefore x^4+\frac{1}{x^4}$

Now: if $x+\frac{1}{x}=\sqrt{3}$

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

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

$x^{100}+\frac{1}{x^{100}}=?$

$\frac{x^2 \cdot x^{100}}{x^2}+\frac{1 \cdot x^2}{x^{100} \cdot x^2}$

$\frac{x^{102}}{x^2}+\frac{x^2}{x^{102}}$

$(x^6)^{17}=(-1)^{17}=-1$

$\therefore x^{102}=-1$

$\therefore -\frac{1}{x^2}-x^2$

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

$\Rightarrow -1$ Ans

(90) if $x+\frac{1}{x}=\sqrt{3}$

$x^3+\frac{1}{x^3}=0$

$x^{33}+\frac{1}{x^{33}}=?$

$x^3 \cdot x^{30}+\frac{1}{x^3 \cdot x^{30}}$

$-x^3-\frac{1}{x^3}$

$\Rightarrow -\left(x^3+\frac{1}{x^3}\right)$

$=0$ Ans.

(91) if $x+\frac{1}{x}=\sqrt{3}$

$x^6=-1$

$x^{93}+x^{91}+x^{87}+x^{85}+x^{83}+x^{89}$

(0, 0, power diff 6)

$= 0$ Ans

$x^{16}+x^{10}$

$x^6 \cdot x^{10}+x^{10}$

$-x^{10}+x^{10}$

$=0$

(92) if $a^2+a+1=0$ | then $a^5+a^4+1=?$

$a^3=1$

$a^2 \cdot a^3 + a \cdot a^3 + 1$

$= a^2+a+1$

$= 0$ Ans.

(#)

(1) if $\begin{bmatrix} x+\frac{1}{x}=1 \\ x^2-x+1=0 \end{bmatrix}$ then $x^3=-1$

(2) if $\begin{bmatrix} x+\frac{1}{x}=-1 \\ x^2+x+1=0 \end{bmatrix}$ then $x^3=1$

(3) if $\begin{bmatrix} x+\frac{1}{x}=\sqrt{3} \\ x^2-\sqrt{3}x+1=0 \end{bmatrix}$ then $x^6=-1$

---

(93) $x^2+\frac{1}{x^2}=13$ | $x+\frac{1}{x}=?$

$x^2+\frac{1}{x^2}+2\times x\times\frac{1}{x}=13+2$

$\left(x+\frac{1}{x}\right)^2=13+2$

$x+\frac{1}{x}=\sqrt{15}$

if $x^2+\frac{1}{x^2}=a$

then $x+\frac{1}{x}=\sqrt{a+2}$

if $x^2+\frac{1}{x^2}=a$

then $x-\frac{1}{x}=\sqrt{a-2}$

(94) $x^4 + \frac{1}{x^4} = 98$

$x^2 + \frac{1}{x^2} = \sqrt{98+2} = 10$

$x - \frac{1}{x} = \sqrt{10-2} = \sqrt{8}$

$x + \frac{1}{x} = \sqrt{10+2} = \sqrt{12}$

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(95) $x^4 + \frac{1}{x^4} = 322$

$x^2 + \frac{1}{x^2} = \sqrt{322+2} = 18$

$x + \frac{1}{x} = \sqrt{18+2} = \sqrt{20}$

$x - \frac{1}{x} = \sqrt{18-2} = 4$

---

(96) $x + \frac{1}{x} = 3$ | $x^2 - \frac{1}{x^2} = ?$

$x^2 + \frac{1}{x^2} = 7$

$x^4 + \frac{1}{x^4} = 47$

$x^2 - \frac{1}{x^2} = \sqrt{47+2} = \sqrt{45} = 3\sqrt{5}$

OR $x^2 - \frac{1}{x^2}$

$\Rightarrow \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right)$

$x^2 + \frac{1}{x^2} = 7$

$\because x - \frac{1}{x} = \sqrt{7-2} = \sqrt{5}$

$\Rightarrow 3\sqrt{5}$ Ans

---

(97) $x + \frac{1}{x} = 4$ | $x^4 - \frac{1}{x^4} = ?$

$x^2 + \frac{1}{x^2} = 14$

$x^4 + \frac{1}{x^4} = 194$

$x^2 - \frac{1}{x^2} = \sqrt{192}$

$= 8\sqrt{3}$

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

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

$14 \times 8\sqrt{3}$

$112\sqrt{3}$ Ans

(98) if $x + \frac{1}{x} = 3$ | $x - \frac{1}{x} = ?$

$x^2 + \frac{1}{x^2} = 7$

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

---

(99) if $x - \frac{1}{x} = 1$ | $x = ?$ $\sqrt{x} = ?$

$x^2 + \frac{1}{x^2} = 3$

$x + \frac{1}{x} = \sqrt{5}$

$x - \frac{1}{x} = 1$

$x + \frac{1}{x} = \sqrt{5}$

$2x = \sqrt{5} + 1$

$x = \frac{\sqrt{5}+1}{2}$ Ans

$\sqrt{x} = \sqrt{\frac{\sqrt{5}+1}{2}}$ Ans

---

(100) $x4 + \frac{1}{x4} = 23$ | $x^3 - \frac{1}{x^3} = ?$

$x^2 + \frac{1}{x^2} = 5$

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

$x^3 - \frac{1}{x^3} = \left(x - \frac{1}{x}\right)^3 + 3\left(x - \frac{1}{x}\right)$

$\Rightarrow 3\sqrt{3} + 3\sqrt{3}$

$\Rightarrow 6\sqrt{3}$ Ans

---

(101) $x4 + \frac{1}{x4} = 322$ | $x^3 + \frac{1}{x^3} = ?$

$x^2 + \frac{1}{x^2} = 18$

$x + \frac{1}{x} = \sqrt{20}$

$x3 + \frac{1}{x3} = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right)$

$\Rightarrow 20\sqrt{20} - 3\sqrt{20}$

$\Rightarrow 17\sqrt{20}$ Ans

if $x^2+y^2+z^2=0$
then $x+y+z=0$

(102) $(a-2)^2+(b-5)^2+(c+1)^2=0$ | $\sqrt{a+b+c}=?$

$a-2=0$ | $b-5=0$ | $c+1=0$

$a=2$ | $b=5$ | $c=-1$

$\sqrt{a+b+c}=\sqrt{2+5-1}=\sqrt{6}$ Ans

---

(103) $a^2+b^2+c^2=2(a-b+c)-3$ | $a+b+c=?$

$a^2+b^2+c^2=2a-2b+2c-1-1-1$

$a^2+1-2a+b^2+1+2b+c^2+1-2c=0$

$(a-1)^2+(b+1)^2+(c-1)^2=0$

$a-1=0$ | $b+1=0$ | $c-1=0$

$a=1$ | $b=-1$ | $c=1$

$a+b+c=1-1+1=1$ Ans

---

(104) $a^2+b^2+c^2=2(a+2b-2c)-9$ | $a+b+c=?$

$a^2+b^2+c^2=2a+4b-4c-9$

$a^2+1-2a+b^2+4-4b+c^2+4+4c=-9+1+4+4$

$(a-1)^2+(b-2)^2+(c+2)^2=0$

$a=1$ $b=2$ $c=-2$

$a+b+c=1+2-2=1$ Ans

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(105) $\left(1-\frac{1}{n+1}\right)+\left(1-\frac{2}{n+1}\right)+\left(1-\frac{3}{n+1}\right)+\cdots\cdots+\left(1-\frac{n}{n+1}\right)$

$\Rightarrow n-\frac{1}{n+1}-\frac{2}{n+1}-\frac{3}{n+1}-\cdots\cdots-\frac{n}{n+1}$

$\Rightarrow n-\left[\frac{1}{n+1}+\frac{2}{n+1}+\frac{3}{n+1}\cdots\cdots+\frac{n}{n+1}\right]$

$1+1+1+1+\cdots\cdots n$
$= 1\times n = n$

$\Rightarrow n-\left[\frac{1+2+3+\cdots\cdots n}{n+1}\right]$

$1+2+3\cdots\cdots n=\frac{n(n+1)}{2}$

$\Rightarrow n-\frac{n(n+1)}{2(n+1)}$

$\Rightarrow n-\frac{n}{2}=\frac{n}{2}$

---

(106) $\frac{3}{4}\left(1+\frac{1}{3}\right)\left(1+\frac{2}{3}\right)\left(1-\frac{2}{5}\right)\left(1+\frac{6}{7}\right)\left(1-\frac{12}{13}\right)$

$\frac{3}{4}\times\frac{4}{3}\times\frac{5}{3}\times\frac{3}{5}\times\frac{13}{7}\times\frac{1}{13}=\frac{1}{7}$

(107) $\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\cdots\cdots\left(1-\frac{1}{n}\right)$

$\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}\times\cdots\times\frac{n-1}{n}\Rightarrow\frac{1}{n}$

(108) $\left(2-\frac{1}{3}\right)\left(2-\frac{3}{5}\right)\left(2-\frac{5}{7}\right)\left(2-\frac{7}{9}\right)\cdots\cdots\left(2-\frac{999}{1001}\right)$

$\frac{5}{3}\times\frac{7}{5}\times\frac{9}{7}\times\frac{11}{9}\times\cdots\times\frac{1001}{999}\times\frac{1003}{1001}$

$\Rightarrow\frac{1003}{3}$

---

(109) $\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)\ldots\ldots\left(1-\frac{1}{85^2}\right)$

$\Rightarrow \left(\frac{2^2-1}{2^2}\right)\left(\frac{3^2-1}{3^2}\right)\left(\frac{4^2-1}{4^2}\right)\ldots\ldots\left(\frac{85^2-1}{85^2}\right)$ | $a^2-b^2=(a+b)(a-b)$

$\Rightarrow \frac{1\times 3}{2\times 2}\times\frac{2\times 4}{3\times 3}\times\frac{3\times 5}{4\times 4}\times\frac{4\times 6}{5\times 5}\times\ldots\ldots\times\frac{84\times 86}{85\times 85}$

$\Rightarrow \frac{1}{2}\times\frac{86}{85} \Rightarrow \frac{43}{85}$

---

(110) $\frac{1}{2}+\frac{1}{3}-\frac{1}{4}-\frac{1}{2}-\frac{1}{3}+\frac{1}{4}+\frac{1}{2}+\frac{1}{3}-\frac{1}{4}\ldots\ldots$ 34 term

6 terms | 6 terms

0 | 0

5 complete group = 0. (upto 30 terms)

$\Rightarrow \frac{1}{2}+\frac{1}{3}-\frac{1}{4}-\frac{1}{2}$

$\Rightarrow \frac{1}{12}$ Ans.

---

(111) $\frac{1}{\sqrt{3}+\sqrt{4}}+\frac{1}{\sqrt{4}+\sqrt{5}}+\ldots\ldots+\frac{1}{\sqrt{99}+\sqrt{100}}$

$\Rightarrow \frac{1}{\sqrt{4}+\sqrt{3}}+\frac{1}{\sqrt{5}+\sqrt{4}}+\ldots\ldots\frac{1}{\sqrt{100}+\sqrt{99}}$

बड़ी term आगे लिखते हैं।

$\Rightarrow \sqrt{4}-\sqrt{3}+\sqrt{5}-\sqrt{4}+\sqrt{6}-\sqrt{5}+\sqrt{7}-\sqrt{6}+\ldots\ldots+\sqrt{100}-\sqrt{99}$

$\Rightarrow -\sqrt{3}+\sqrt{100}$

$\Rightarrow 10-\sqrt{3}$ Ans

* पहले वाला no. बच रहा है।

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(112) $1^2-2^2+3^2-4^2+5^2-6^2+\ldots\ldots+99^2-100^2$

$\Rightarrow (-1\times 3)+(-1\times 7)+(-1\times 11)+\ldots\ldots+(-1\times 199)$

$\Rightarrow -3-7-11-15-\ldots\ldots-199$

$\Rightarrow -[3+7+11+15+\ldots\ldots+199]$

AP series

$S_n = \frac{n}{2}[1^{st}\text{ term} + \text{last term}]$

$= \frac{n}{2}[2a+(n-1)d]$

$n = 50$

$\Rightarrow S_n = -\frac{50}{2}(3+199)$

$= -\frac{50}{2} \times \frac{101}{202} = -5050$ Ans

---

(113) $\frac{3}{4} + \frac{5}{36} + \frac{7}{144} + \cdots\cdots + \frac{19}{8100}$

1×4 $\quad 4\times9$ $\quad 9\times16$ $\quad 81\times100$

$\frac{1}{1} - \frac{1}{4} + \frac{1}{4} - \frac{1}{9} + \frac{1}{9} - \frac{1}{16} + / - / \cdot + \frac{1}{81} - \frac{1}{100}$

$1 - \frac{1}{100} = \frac{99}{100}$

अगर ऊपर वाले no. diff हैं तो इस Type में हो जायेगा। same हैं तो कुछ calculations कर पड़ सकती हैं- (115, 116)

(114) $\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \cdots\cdots + \frac{1}{132}$

1×2 $\quad 2\times3$ $\quad 3\times4$ $\quad 4\times5$ $\quad 11\times12$

$\frac{1}{1} - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \frac{1}{4} - \frac{1}{5} + / - / \cdot \cdot \frac{1}{11} - \frac{1}{12}$

$1 - \frac{1}{12} = \frac{11}{12}$

---

(115) $\frac{1}{10} + \frac{1}{40} + \frac{1}{88} + \cdots\cdots + \frac{1}{598}$

2×5 $\quad 5\times8$ $\quad 8\times11$ $\quad 23\times26$

Multiply & divide by 3.

$\frac{1}{3}\left[\frac{3}{10} + \frac{3}{40} + \frac{3}{88} + \cdots\cdots \frac{3}{598}\right]$

$\frac{1}{3}\left[\frac{1}{2} - \frac{1}{5} + \frac{1}{5} - \frac{1}{8} + \frac{1}{8} - \frac{1}{11} + \cdots + \frac{1}{23} - \frac{1}{26}\right]$

$\frac{1}{3}\left[\frac{1}{2} - \frac{1}{26}\right] = \frac{2}{13}$ Ans

(OR) $\frac{1}{\text{diff b/w terms}}\left[\frac{1}{\text{first term}} - \frac{1}{\text{last term}}\right]$

$\frac{1}{3}\left(\frac{1}{2} - \frac{1}{26}\right)$

$= \frac{2}{13}$ Ans

(116) $\frac{1}{5}+\frac{1}{45}+\frac{1}{117}+\cdots\cdots+\frac{1}{3965}$

$1\times5 \quad 5\times9 \quad 9\times13 \qquad 61 \quad 65$

$\Rightarrow \frac{1}{4}\left[1-\frac{1}{65}\right]$

$\Rightarrow \frac{1}{4}\times\frac{64}{65}^{16} = \frac{16}{65}$ Ans

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(117) $\frac{1}{2+\frac{1}{1+\frac{1}{8}}}$

$\Rightarrow \frac{1}{2+\frac{1}{\frac{9}{8}}} \Rightarrow \frac{1}{2+\frac{8}{9}} \Rightarrow \frac{1}{\frac{26}{9}} \Rightarrow \frac{9}{26}$ Ans

(118) $\frac{1}{3+\frac{1}{1+\frac{1}{2+\frac{1}{4}}}} \Rightarrow \frac{1}{3+\frac{1}{1+\frac{1}{\frac{9}{4}}}} \Rightarrow \frac{1}{3+\frac{1}{1+\frac{4}{9}}} \Rightarrow \frac{1}{3+\frac{1}{\frac{13}{9}}}$

$\Rightarrow \frac{1}{3+\frac{9}{13}} \Rightarrow \frac{1}{\frac{48}{13}} \Rightarrow \frac{13}{48}$ Ans

(119) $\frac{2}{2+\frac{2}{3+\frac{2}{3+\frac{2}{3}}}}\times0.39 \Rightarrow \frac{2}{2+\frac{2}{3+\frac{2}{\frac{11}{3}}}}\times0.39$

$\Rightarrow \frac{2}{2+\frac{2}{3+\frac{6}{11}}}\times0.39 \Rightarrow \frac{2}{2+\frac{2}{\frac{39}{11}}}\times0.39$

$\Rightarrow \frac{2}{2+\frac{22}{39}\times\frac{39}{50}} \Rightarrow \frac{2}{2+\frac{11}{50}} \Rightarrow \frac{2}{\frac{100+11}{50}} \Rightarrow \frac{100}{111}$ Ans

(120) $\dfrac{1}{a+\dfrac{1}{b+\dfrac{1}{c+\frac{1}{d}}}} = \dfrac{17}{60}$ $(a+b+c+d) = ?$

$\Rightarrow \dfrac{1}{\frac{60}{17}} \Rightarrow \dfrac{1}{3+\frac{9}{17}} \Rightarrow \dfrac{1}{3+\dfrac{1}{\frac{17}{9}}}$

$\Rightarrow \dfrac{1}{3+\dfrac{1}{1+\frac{8}{9}}} \Rightarrow \dfrac{1}{3+\dfrac{1}{1+\dfrac{1}{\frac{9}{8}}}}$

$\Rightarrow \dfrac{1}{3+\dfrac{1}{1+\dfrac{1}{1+\frac{1}{8}}}}$ $\Rightarrow 3+1+1+8 = 13$ Ans

a b c d

---

(121) $\dfrac{1}{a+\dfrac{1}{b+\frac{1}{c}}} = \dfrac{9}{26}$

$\Rightarrow \dfrac{1}{\frac{26}{9}} \Rightarrow \dfrac{1}{2+\frac{8}{9}} \Rightarrow \dfrac{1}{2+\dfrac{1}{\frac{9}{8}}} \Rightarrow \dfrac{1}{2+\dfrac{1}{1+\frac{1}{8}}}$

a b c

$a = 2$
$b = 1$
$c = 8$

अगर यहाँ पे $\frac{1}{8}$ की जगह $\frac{1}{\frac{8}{3}}$ आता तो

$c = \left(\frac{8}{3}\right)$ होता

(122) $(x+y-z-1)^2 + (z+x-y-2)^2 + (z+y-x-4)^2 = 0$ | $x+y+z=?$

$x+y-z-1=0$ | $z+x-y=2$ | $z+y-x=4$

$x+y-z=1$

Add

$\boxed{x+y+z=7}$ Ans

(123) $5x^2 + 4xy + y^2 + 2x + 1 = 0$ | Find x, y.

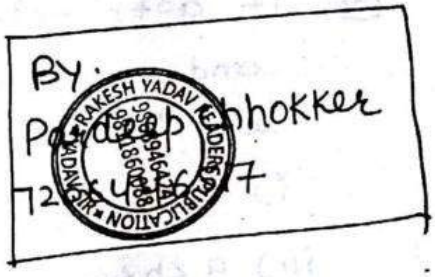
$x^2+2x+1 + 4x^2+y^2+4xy = 0$

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

$x+1=0$ | $2x+y=0$

$\boxed{x=-1}$ | $-2+y=0$

$\boxed{y=2}$



CLASS 40

(124) if $a=999$, $b=997$, $c=995$ $\quad a^2+b^2+c^2-ab-bc-ca = ?$

$\boxed{a^2+b^2+c^2-ab-bc-ca = \frac{1}{2}[(a-b)^2+(b-c)^2+(c-}$

$\frac{1}{2}[(2)^2 + (2)^2 + (-4)^2]$

$\frac{1}{2} \times 24 = 12$ Ans

(125) if $a=99$, $b=97$, $c=95$

$\boxed{a^3+b^3+c^3-3abc = \frac{1}{2}(a+b+c)[(a-b)^2+(b-c)^2+(c-a)^2]}$

$a^3+b^3+c^3-3abc = \frac{1}{2} \times 291 [4+4+16]$

$= \frac{1}{2} \times 291 \times \overset{12}{\cancel{24}} = 291 \times 12$ Ans $= 3492$

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

$a^3+b^3+c^3-3abc = 0$ if

① $a+b+c = 0$
$\therefore a \neq b \neq c$

② $a^2+b^2+c^2-ab-bc-ca = 0$
$\therefore a = b = c$

(126) if $a^3+b^3+c^3-3abc = 0$
and $a+b+c \neq 0$
w/c is true
i) $a > b > c$ ii) $b < a > c$
iii) $a < b < c$ ~~iv)~~ $a = b = c$

---

(127) if $a^3+b^3+c^3 = 3abc$
and $a+b+c \neq 0$, $a, b, c \in N$
find $a+b+c$
A) 2 B) 4 ~~C)~~ 6 D) 8

$a = b = c$
2 2 2

---

(128) $\left(\frac{a+b}{c} + \frac{b+c}{a} + \frac{c+a}{b}\right)\left(\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}\right) = ?$

if $a^2+b^2+c^2 = ab+bc+$

$\therefore$ $a = b = c$

put $a = b = c = 1$

$3 \times \frac{3}{2} = 9$ Ans

---

if $a+b+c=0$

then $a^3+b^3+c^3 = 3abc$

(#) if $a+b-c=0$

$a^3+b^3-c^3 = -3abc$

$\Rightarrow$ $a+b+(-c)=0$

$a^3+b^3+(-c)^3 = 3ab(-c)$

$= -3abc$

---

(129) if $a^2+b^2=c^2$

$a^2+b^2+(-c^2)=0$

$x+y+z=0$

$x^3+y^3+z^3 = 3xyz$

$a^6+b^6-c^6 = 3\times a^2\times b^2(-c^2)$

$= -3a^2b^2c^2$

$\frac{a^6+b^6-c^6}{a^2b^2c^2}$

$\Rightarrow \frac{-3a^2b^2c^2}{a^2b^2c^2}$

$\Rightarrow -3$ Ans

---

(130) A) $a^3+b^3+c^3 = 3abc$

B) $a+b+c = 3abc$

C) $(a+b-c)^3+27abc=0$

D) $(a+b+c)^3-27abc=0$

$a^{\frac{1}{3}}+b^{\frac{1}{3}} = c^{\frac{1}{3}}$

$a^{\frac{1}{3}}+b^{\frac{1}{3}}+(-c^{\frac{1}{3}})=0$

$x+y+z=0$

$\therefore x^3+y^3+z^3 = 3xyz$

$a+b-c = 3a^{\frac{1}{3}}b^{\frac{1}{3}}(-c^{\frac{1}{3}})$

cube

$(a+b-c)^3 = -27abc$

$(a+b-c)^3+27abc=0$ Ans

(131) $a = 1.21$
$b = 2.23$
$c = 3.44$

$a^3+b^3-c^3+3abc = ?$

$a+b-c = 0$

$\therefore a^3+b^3-c^3+3abc = 0$

---

(132) $a = 1.21$
$b = 2.23$
$c = -3.44$

$a^3+b^3+c^3+3abc = ?$

$a+b+c = 0$

$\therefore a^3+b^3+c^3 = 3abc$

$\therefore 3abc + 3abc = 6abc$

---

(133) $$\frac{(x^2-y^2)^3 + (y^2-z^2)^3 + (z^2-x^2)^3}{(x-y)^3 + (y-z)^3 + (z-x)^3} = ?$$

$(x^2-y^2)^3 + (y^2-z^2)^3 + (z^2-x^2)^3$
$\quad a \qquad\quad b \qquad\quad c$

$a = x^2-y^2$
$b = y^2-z^2$
$c = z^2-x^2$
$a+b+c = 0$

$\therefore (x^2-y^2)^3 + (y^2-z^2)^3 + (z^2-x^2)^3$
$= 3(x^2-y^2)(y^2-z^2)(z^2-x^2)$
$= 3(x-y)(x+y)(y-z)(y+z)(z-x)(z+x)$

Now, $(x-y)^3 + (y-z)^3 + (z-x)^3$
$\quad a \qquad\quad b \qquad\quad c$

$\therefore a+b+c = 0$

$\therefore (x-y)^3 + (y-z)^3 + (z-x)^3 = 3(x-y)(y-z)(z-x)$

$\Rightarrow \dfrac{3(x-y)(x+y)(y-z)(y+z)(z-x)(z+x)}{3(x-y)(y-z)(z-x)}$

$\Rightarrow (x+y)(y+z)(z+x)$ Ans

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(134) if $x+y+z = 2s$ | $(s-x)^3 + (s-y)^3 + 3(s-x)(s-y)z = ?$
a b 3 a b (a+b)

$z = 2s - x - y$

$z = \underbrace{s-x}_{a} + \underbrace{s-y}_{b}$ $\Rightarrow (s-x+s-y)^3$

$\Rightarrow (2s-x-y)^3$

$\Rightarrow z^3$ Ans

$\boxed{(a+b)^3 = a^3+b^3+3ab(a+b)}$

OR $a+b+c = 0$ | $a^3+b^3+c^3-3abc = 0$

$(s-x)+(s-y)+(-z) = 0$ | $(s-x)^3+(s-y)^3-z^3-3(s-x)(s-y)(-z) = 0$

$2s-x-y-z$ | $(s-x)^3+(s-y)^3+3(s-x)(s-y)z = z^3$

$2s-(x+y+z)$

$= 2s$

OR put $s = 0$

$x+y+z = 0$ | $-x^3-y^3+3xyz = ?$

$\therefore x^3+y^3+z^3-3xyz = 0$

$\therefore -x^3-y^3+3xyz = z^3$ Ans.

(135) $a=25$
$b=27$
$c=24$ | $\dfrac{a^3+b^3+c^3-3abc}{(a-b)^2+(b-c)^2+(c-a)^2} = ?$

$\Rightarrow \dfrac{\frac{1}{2}(a+b+c)\left[(a-b)^2+(b-c)^2+(c-a)^2\right]}{\left((a-b)^2+(b-c)^2+(c-a)^2\right]}$

$\Rightarrow \frac{1}{2}(a+b+c) \Rightarrow \frac{1}{2}(25+27+24)$

$\Rightarrow \frac{1}{2} \times 76 \Rightarrow 38$ Ans

& $\dfrac{a^3+b^3+c^3-3abc}{a^2+b^2+c^2-ab-bc-ca} = \dfrac{(a+b+c)(a^2+b^2+c^2-ab-bc-ca)}{(a^2+b^2+c^2-ab-bc-ca)}$

$\Rightarrow a+b+c \Rightarrow 76$ Ans.

---

(136) $\dfrac{1}{x+1} + \dfrac{2}{x+2} + \dfrac{3}{x+3} + \cdots\cdots + \dfrac{1005}{x+1005} = 1200$

$\dfrac{x}{x+1} + \dfrac{x}{x+2} + \cdots\cdots + \dfrac{x}{x+1005} = ?$

$\Rightarrow \dfrac{1}{x+1} - 1 + \dfrac{2}{x+2} - 1 + \cdots\cdots \dfrac{1005}{x+1005} - 1 = 1200 - 1005$

$\Rightarrow \dfrac{-x}{x+1} + \dfrac{-x}{x+2} + \cdots\cdots + \dfrac{-x}{x+1005} = 195$ do directly.

$\Rightarrow \dfrac{x}{x+1} + \dfrac{x}{x+2} + \cdots\cdots + \dfrac{x}{x+1005} = -195$

इस Type में या तो +1 Add होगा या -1 होगा

---

(137) $\dfrac{a}{x-a} + \dfrac{b}{y-b} + \dfrac{c}{z-c} = 2$

$\dfrac{x}{x-a} + \dfrac{y}{y-b} + \dfrac{z}{z-c} = ?$

Add +1 $\therefore 2+3 = 5$ Ans

---

(138) $\dfrac{a^2-bc}{a^2+bc} + \dfrac{b^2-ac}{b^2+ac} + \dfrac{c^2-ab}{c^2+ab} = 1$ | $\dfrac{a^2}{a^2+bc} + \dfrac{b^2}{b^2+ca} + \dfrac{c^2}{c^2+ab} =$

$\dfrac{a^2-bc}{a^2+bc} + 1$ $= 1+3 = 4$

$\Rightarrow \dfrac{2a^2}{a^2+bc}$ $\Rightarrow \dfrac{4}{2} \Rightarrow 2$ Ans

(139) $x+y+z = 10$

$x^2+y^2+z^2 = 30$

$x+y+z = 10$

square

$x^2+y^2+z^2+2(xy+yz+zx) = 100$

$\therefore xy+yz+zx = 100-30 = \frac{70}{2} = 35$

$x^3+y^3+z^3-3xyz = ?$

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

$\Rightarrow 10(30-35) = -50$ Ans.

---

(140) $x+y+z = 15$

$x^2+y^2+z^2 = 83$

$xy+yz+zx = \frac{225-83}{2}$

$= 71$

$x^3+y^3+z^3-3xyz = ?$

$\rightarrow 15(83-71)$

$\rightarrow 15\times 12$

$\rightarrow 180$ Ans

---

(141) $a+b+c = 6$

$a^2+b^2+c^2 = 16$

$ab+bc+ca = \frac{36-16}{2}$

$= 10$

$x^3+y^3+z^3-3xyz = ?$

$a^3+b^3+c^3 = 40$

$abc = ?$

$\Rightarrow 40-3abc = 6(16-10)$

$\Rightarrow -3abc = -4$

$\Rightarrow abc = \frac{4}{3}$

---

(142) $x+y+z = 8$

$xy+yz+zx = 24$

$x^2+y^2+z^2 = 16$

$x^3+y^3+z^3-3xyz = ?$

$\Rightarrow 8(16-24)$

$= 8(-8) = -64$ Ans

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(150) if $x-\frac{1}{x}=1$ | $\frac{1x}{x^2-\sqrt{x}+1}$ = ?

$x^2+\frac{1}{x^2}=3$

$x+\frac{1}{x}=\sqrt{5}$

$x-\frac{1}{x}=1$

$x=\frac{\sqrt{5}+1}{2}$

$\sqrt{x}=\sqrt{\frac{\sqrt{5}+1}{2}}$

$\frac{1}{\sqrt{x}}=\frac{\sqrt{2}}{\sqrt{\sqrt{5}+1}}$

divide by x

$\rightarrow \frac{1}{x+\frac{1}{x}-\frac{1}{\sqrt{x}}}$

$\rightarrow \frac{1}{\sqrt{5}-\frac{1}{\sqrt{x}}}$

$\rightarrow \frac{1}{\sqrt{5}-\frac{\sqrt{2}}{\sqrt{\sqrt{5}+1}}}$ Ans

---

(151) if $x\left(3-\frac{2}{x}\right)=\frac{3}{x}$ | $x^2+\frac{1}{x^2}$ = ?

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

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

Divide by 3

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

$x-\frac{1}{x}=\frac{2}{3}$

$x^2+\frac{1}{x^2}=\frac{4}{9}+2=\frac{22}{9}$ Ans.

---

(152) $3a+\frac{1}{5a}=6$ | $25a^2+\frac{1}{9a^2}$ = ?

multiply by $\frac{5}{3}$ (to get coff of a-s)

$\frac{5}{3}\times 3a+\frac{1}{5a}\times\frac{5}{3}=6\times\frac{5}{3}$

$5a+\frac{1}{3a}=10$

$25a^2+\frac{1}{9a^2}+2\times 5a\times\frac{1}{3a}=100$

$25a^2+\frac{1}{9a^2}=100-\frac{10}{3}$

$=\frac{290}{3}$ Ans

(153) $a + \frac{1}{64a} = \frac{3}{2}$ | $64a^2 + \frac{1}{64a^2} = ?$ $64a^2 = (8a)$

multiply by 8 (to get coff of $a = 8$)

$8a + \frac{1}{8a} = 12$

$64a^2 + \frac{1}{64a^2} + 2 \cdot 8a \cdot \frac{1}{8a} = 144$

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$64a^2 + \frac{1}{64a^2} = 144 - 2 = 142$ Ans

---

(154) $4b^2 + \frac{1}{b^2} = 2$ | $8b^3 + \frac{1}{b^3} = ?$

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

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

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

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

$2b + \frac{1}{b} = \sqrt{6}$ | $8b^3 + \frac{1}{b^3} = \left(2b + \frac{1}{b}\right)^3 - 3 \times 2b \times \frac{1}{b}\left(2b + \frac{1}{b}\right)$

$\Rightarrow 6\sqrt{6} - 6\sqrt{6} \Rightarrow 0$ Ans

---

(155) $3x + \frac{1}{2x} = 5$ | $8x^3 + \frac{1}{27x^3} = ?$

$3x \times \frac{2}{3} + \frac{1}{2x \times \frac{3}{2}} = 5 \times \frac{2}{3}$ | $8x^3 + \frac{1}{27x^3} = \left(2x + \frac{1}{3x}\right)^3 - 3 \times 2x \times \frac{1}{3x}\left(2x + \frac{1}{3x}\right)$

$2x + \frac{1}{3x} = \frac{10}{3}$

$= \frac{1000}{27} - 2 \times \frac{10}{3}$

$= \frac{1000}{27} - \frac{20}{3}$

$= \frac{1000 - 180}{27} = \frac{820}{27}$ Ans

(156) $\left(2x-\frac{3}{x}\right)=5$

$4x^2+\frac{9}{x^2}-2\times 2x\times\frac{3}{x}=25$

$4x^2+\frac{9}{x^2}=37$

$\left(2x+\frac{3}{x}\right)^2-2\cdot 2x\cdot\frac{3}{x}=37$

$\left(2x+\frac{3}{x}\right)^2=37+12=49$

$\left(2x+\frac{3}{x}\right)=7$

$4x^2-\frac{9}{x^2}=?$

$\rightarrow (2x)^2-\left(\frac{3}{x}\right)^2$

$\rightarrow \left(2x-\frac{3}{x}\right)\left(2x+\frac{3}{x}\right)$

$\rightarrow 5\times 7$

$\rightarrow 35$ Ans

(OR) put $x=3$

$36-1=35$ Ans

---

if $a+\frac{1}{a}=2$

$\Rightarrow a=1$

---

(157) if $a+\frac{1}{a}=2$

$a^{112}-\frac{1}{a^3}=?$

$1-1=0$ Ans.

---

(158) $m+\frac{1}{m-2}=4$

$(m-2)+\frac{1}{m-2}=4-2$

$(m-2)+\frac{1}{(m-2)}=2$

$\therefore m-2=1$

$m=3$

i) $(m-2)^{10}+\frac{1}{(m-2)^{10}}=?$

ii) $m^3+m^2+m-1=?$

$27+9+3-1=38$ Ans

i) $1+1=2$ Ans

(159) $m+\frac{1}{m+2}=0$

$(m+2)+\frac{1}{(m+2)}=0+2$

$\therefore m+2=1$

$m=-1$

i) $(m+2)^{10}+\frac{1}{(m+2)^{10}}=?$

$1+1=2$ Ans

ii) $m^3+m^2+m-1=?$

$-1+1-1-1=-2$ Ans

if $x+\frac{1}{x} = -2$

$\Rightarrow x = -1$

(60) if $m+\frac{1}{m-2} = 0$

$(m-2)+\frac{1}{(m-2)} = 0-2 = -2$

$\therefore m-2 = -1$

$m = 1$

$m^5+m^4+m^3+m^2+m+1 = ?$

$\Rightarrow 1+1+1+1+1+1$

$\Rightarrow 6$ Ans

componendo - dividendo

(1) Applicable only when fraction is equivalent to something

Doesn't applicable on single fraction.

$\frac{a}{b}$

(2) $\frac{a}{b} = \frac{5}{1}$

$\frac{a+b}{a-b} = \frac{5+1}{5-1}$

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

Apply again

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

$\frac{2a}{2b} = \frac{5}{1}$

$\frac{a}{b} = \frac{5}{1}$ (same form obtained)

∵ अगर पहले से apply किया हुआ है तो बस fraction लिखो और दूसरी side apply करो।

(161) $\frac{2x-y}{x+2y} = \frac{1}{2}$ | $\frac{3x-y}{3x+y} = ?$

$4x-2y = x+2y$

$3x = 4y$

$\frac{3x}{y} = \frac{4}{1}$

$\frac{3x+y}{3x-y} = \frac{5}{3}$

$\therefore \frac{3x-y}{3x+y} = \frac{3}{5}$

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CLASS 42

(162) $a+b = 1$

$c+d = 1$

$a-b = \frac{d}{c}$

$c^2-d^2 = ?$

$\frac{a+b}{a-b} = \frac{1}{d/c}$

$\frac{a+b}{a-b} = \frac{c}{d}$

$\frac{a}{b} = \frac{c+d}{c-d}$

$\frac{a}{b} = \frac{1}{c-d}$

$c-d = \frac{b}{a}$

$c^2-d^2 = (c+d)(c-d)$

$= (1)(\frac{b}{a})$

$= \frac{b}{a}$ Ans

(163) $x = \frac{2ab}{b^2+1}$, $b>1$ | $\frac{\sqrt{a+x}-\sqrt{a-x}}{\sqrt{a+x}+\sqrt{a-x}} = ?$

$\frac{x}{a} = \frac{2ab}{(b^2+1)a}$

$\frac{x}{a} = \frac{2b}{b^2+1}$

$\frac{a}{x} = \frac{b^2+1}{2b}$

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

$\frac{a+x}{a-x} = \frac{(b+1)^2}{(b-1)^2}$

$\Rightarrow \frac{\sqrt{a+x}}{\sqrt{a-x}} = \frac{b+1}{b-1}$

$\Rightarrow \frac{\sqrt{a+x}+\sqrt{a-x}}{\sqrt{a+x}-\sqrt{a-x}} = \frac{b}{1}$

$\Rightarrow \frac{\sqrt{a+x}-\sqrt{a-x}}{\sqrt{a+x}+\sqrt{a-x}} = \frac{1}{b}$ Ans

can also be solved by rationalisation

(164) $\frac{x^3+3x}{3x^2+1} = \frac{189}{61}$. find value of x

$\frac{x^3+3x+3x^2+1}{x^3+3x-3x^2-1} = \frac{189+61}{189-61}$

$\frac{(x+1)^3}{(x-1)^3} = \frac{250}{128} = \frac{125}{64}$

$\Rightarrow \frac{(x+1)^3}{(x-1)^3} = \frac{(5)^3}{(4)^3}$

cube root

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

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

$x = 9$ Ans

$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

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

(165) $(a+b) : \sqrt{ab} = 4:1$, $a>b$ | $a:b = ?$

$\frac{a+b}{\sqrt{ab}\times 2} = \frac{4}{1\times 2}$

$\frac{a+b}{2\sqrt{ab}} = \frac{2}{1}$

$\Rightarrow \frac{a+b+2\sqrt{ab}}{a+b-2\sqrt{ab}} = \frac{2+1}{2-1}$

$\Rightarrow \frac{(\sqrt{a}+\sqrt{b})^2}{(\sqrt{a}-\sqrt{b})^2} = \frac{3}{1}$

$\Rightarrow \frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}} = \frac{\sqrt{3}}{1}$

$\Rightarrow \frac{\sqrt{a}}{\sqrt{b}} = \frac{\sqrt{3}+1}{\sqrt{3}-1}$

$\Rightarrow \frac{a}{b} = \frac{4+2\sqrt{3}}{4-2\sqrt{3}} = \frac{2(2+\sqrt{3})}{2(2-\sqrt{3})}$

$\Rightarrow \frac{a}{b} = \frac{2+\sqrt{3}}{2-\sqrt{3}}$ Ans:

OR $a+b = 4$

$a + \frac{1}{a} = 4$

$a^2 - 4a + 1 = 0$

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

$= \frac{4 \pm \sqrt{16-4\times 1\times 1}}{2\times 1}$

$\sqrt{ab} = 1$

$ab = 1$

$b = \frac{1}{a}$

$\Rightarrow \frac{4 \pm 2\sqrt{3}}{2}$

$a = 2+\sqrt{3}, 2-\sqrt{3}$

$b = \frac{1}{a} = 2-2\sqrt{3}, 2+\sqrt{3}$

$\therefore a > b$

$a = 2+\sqrt{3}$

$b = 2-\sqrt{3}$

$\frac{a}{b} = \frac{2+\sqrt{3}}{2-\sqrt{3}}$

(166) $x = \dfrac{\sqrt{m+3n} + \sqrt{m-3n}}{\sqrt{m+3n} - \sqrt{m-3n}}$ | $3nx^2 + 3n = ?$

$\dfrac{x+1}{x-1} = \dfrac{\sqrt{m+3n}}{\sqrt{m-3n}}$ | $\dfrac{(x^2+1)+2x}{(x^2+1)-2x} = \dfrac{m+3n}{m-3n}$

$\dfrac{(x+1)^2}{(x-1)^2} = \dfrac{m+3n}{m-3n}$ | $\Rightarrow \dfrac{x^2+1}{2x} = \dfrac{m}{3n}$

$\Rightarrow 3nx^2 + 3n = 2mx$ Ans

(#) $(2+\sqrt{3})^2 = 4+3+2\cdot 2\sqrt{3}$

$= 7 + 4\sqrt{3}$

$7 \rightarrow a^2+b^2$; $4\sqrt{3} \rightarrow 2ab$

---

(167) $x = 7 + 4\sqrt{3}$ find $\sqrt{x}$

$7 \rightarrow 4+3 \rightarrow (2)^2 + (\sqrt{3})^2$; $4\sqrt{3} \rightarrow 2\cdot 2\sqrt{3} \rightarrow 2ab$

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

$\sqrt{x} = 2+\sqrt{3}$ Ans.

---

(168) $x = 13 - 4\sqrt{3}$. find $\sqrt{x}$

$13 \rightarrow 12+1$; $4\sqrt{3} \rightarrow 2\cdot 2\sqrt{3} \rightarrow ab \rightarrow 2\sqrt{3}\times 1,\ 12\times 1$

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

$\sqrt{x} = 2\sqrt{3}-1$ Ans

---

(169) $x = 76 + 10\sqrt{3}$. find $\sqrt{x}$

$= 76 + 2 \cdot 5\sqrt{3}$

$(5\sqrt{3})^2 + (1)^2 \quad ab$

$75 + 1 \quad 5\sqrt{3} \times 1$

$x = (5\sqrt{3}+1)^2$

$\sqrt{x} = 5\sqrt{3}+1$ Ans

---

(170) $x = 33 - 4\sqrt{35}$. find $\sqrt{x}$

$= 33 - 2 \cdot 2\sqrt{35}$

$a^2+b^2 \quad ab$

$28+5 \quad 2\sqrt{7} \quad \sqrt{5}$

$x = (2\sqrt{7} - \sqrt{5})^2$

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

---

(171) $x = 139 - 80\sqrt{3}$. find $\sqrt{x}$

$= 139 - 2 \cdot 40\sqrt{3}$

$a^2+b^2 \quad ab$

$64+75 \quad 8 \times 5\sqrt{3}$

$x = (5\sqrt{3} - 8)^2$

$\sqrt{x} = 5\sqrt{3} - 8$ Ans

(*) बड़ा no. पहले । जिसका sq. बड़ा है वह no. बड़ा है

---

(172) $x = 52 + 30\sqrt{3}$. find $\sqrt{x}$

$= 52 + 2 \cdot 15\sqrt{3}$

$a^2+b^2 \quad ab$

$25+27 \quad 5 \times 3\sqrt{3}$

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

$\sqrt{x} = 3\sqrt{3} + 5$

---

(173) $x = 8 - 4\sqrt{3}$. find $\sqrt{x}$

$= 8 - 2 \cdot 2\sqrt{3}$

$2\sqrt{3} = \sqrt{4 \times 3} = \sqrt{12}$

$x \Rightarrow 8 - 2 \cdot \sqrt{12}$

$a \quad b$

$\sqrt{6} \quad \sqrt{2}$

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

$\sqrt{x} = (\sqrt{6} - \sqrt{2})$ Ans

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(174) $\sqrt{-\sqrt{3}+\sqrt{3+8\sqrt{7+4\sqrt{3}}}}$

$\Rightarrow \sqrt{-\sqrt{3}+\sqrt{3+8(2+\sqrt{3})}}$

$\Rightarrow \sqrt{-\sqrt{3}+\sqrt{19+8\sqrt{3}}}$

a^2+b^2 : $16+3$; $2 \cdot 4\sqrt{3}$: ab : $4\ \sqrt{3}$

$\sqrt{-\sqrt{3}+4+\sqrt{3}}$

$= 2$ Ans

---

(175) $x = 38+5\sqrt{3}$. find $\sqrt{x}$

$= \frac{38\times2+2\times5\sqrt{3}}{2}$

$= \frac{76+2\cdot5\sqrt{3}}{2}$

$x = \frac{(5\sqrt{3}+1)^2}{2}$

$\sqrt{x} = \frac{5\sqrt{3}+1}{\sqrt{2}}$ Ans

---

(176) $x = 26+15\sqrt{3}$. find $\sqrt{x}$

$x = \frac{52+2\cdot15\sqrt{3}}{2}$

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

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

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(177) $x = \dfrac{\sqrt[3]{m+1} + \sqrt[3]{m-1}}{\sqrt[3]{m+1} - \sqrt[3]{m-1}}$ | $x^3 - 3mx^2 + 3x - m = ?$

$\Rightarrow \dfrac{x+1}{x-1} = \dfrac{\sqrt[3]{m+1}}{\sqrt[3]{m-1}}$

$\dfrac{(x+1)^3}{(x-1)^3} = \dfrac{m+1}{m-1}$

$\Rightarrow \dfrac{x^3+3x+1+3x^2}{x^3+3x-1-3x^2} = \dfrac{m+1}{m-1}$

$\Rightarrow \dfrac{(x^3+3x)+(1+3x^2)}{(x^3+3x)-(1+3x^2)} = \dfrac{m+1}{m-1}$

$\Rightarrow \dfrac{x^3+3x}{1+3x^2} = \dfrac{m}{1}$

$\Rightarrow x^3+3x = m + 3mx^2$

$\Rightarrow x^3 - 3mx^2 + 3x - m = 0$

(178) if $x = \dfrac{4ab}{a+b}$ | $\dfrac{x+2a}{x-2a} + \dfrac{x+2b}{x-2b}$

divide by 2a

$\Rightarrow \dfrac{x}{2a} = \dfrac{2b}{a+b}$

$\dfrac{x+2a}{x-2a} = \dfrac{2b+a+b}{2b-a-b}$

$\Rightarrow \dfrac{x+2a}{x-2a} = \dfrac{3b+a}{b-a}$

Now divide by 2b

$\Rightarrow \dfrac{x}{2b} = \dfrac{2a}{a+b}$

$\Rightarrow \dfrac{x+2b}{x-2b} = \dfrac{3a+b}{a-b}$

$= -\dfrac{3a+b}{b-a}$

$\Rightarrow \dfrac{3b+a}{b-a} - \dfrac{3a+b}{b-a}$

$\Rightarrow \dfrac{3b+a-3a-b}{b-a} \Rightarrow \dfrac{2(b-a)}{b-a} = 2$

(*) $x = \dfrac{4ab}{a+b}$ | $\dfrac{x+2a}{x-2a} + \dfrac{x+2b}{x-2b}$

If $2 \cdot \dfrac{2ab}{a+b}$ $\dfrac{x+2a}{x-2a} + \dfrac{x+2b}{x-2b}$

$\dfrac{2ab}{2a} = b$

$\dfrac{2ab}{2b} = a$

> नीचे वाली term बचनी चाहिए।

इसका Ans टोगा 2 होगा।

(179) if $x = \frac{4\sqrt{15}}{\sqrt{5}+\sqrt{3}}$ | $\frac{x+\sqrt{12}}{x-\sqrt{12}} + \frac{x+\sqrt{20}}{x-\sqrt{20}}$ ⇒ यहाँ पे compenendo e dividendo देना चाहिए or ⊕ का

factor वाला 2 होना चाहिए |

$\Rightarrow \frac{2 \cdot 2\sqrt{15}}{\sqrt{5}+\sqrt{3}} \Rightarrow \frac{2\sqrt{60}}{\sqrt{5}+\sqrt{3}}$

$\frac{\sqrt{60}}{\sqrt{12}} = \sqrt{5}$ > नीचे वाले part.

$\frac{\sqrt{60}}{\sqrt{20}} = \sqrt{3}$

Ans = 2

---

(180) if $x = \frac{\sqrt{3}}{2}$ | $\sqrt{1+x} = ?$

$1+x = 1+\frac{\sqrt{3}}{2}$

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

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

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

$4 + \frac{2\sqrt{3}}{ab}$

a^2+b^2

$(\sqrt{3})^2 + (1)^2 \quad \sqrt{3} \quad 1$

$3 + 1$

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

$\frac{\sqrt{3}+1}{2} = \sqrt{1+x}$

---

if $x = \frac{\sqrt{3}}{2}$

Then $\sqrt{1+x} = \frac{\sqrt{3}+1}{2}$

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

(181) if $x = \frac{\sqrt{3}}{2}$ | $\frac{\sqrt{1+x}}{1+\sqrt{1+x}} + \frac{\sqrt{1-x}}{1-\sqrt{1-x}} = ?$

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

$$\frac{\sqrt{3}+1}{3+\sqrt{3}} + \frac{\sqrt{3}-1}{3-\sqrt{3}}$$

$$\frac{\cancel{\sqrt{3}+1}}{\sqrt{3}(\cancel{\sqrt{3}+1})} + \frac{\cancel{\sqrt{3}-1}}{\sqrt{3}(\cancel{\sqrt{3}-1})}$$

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

---

(182) if $x = \frac{\sqrt{3}}{2}$ | $\frac{1+x}{1+\sqrt{1+x}} + \frac{1-x}{1-\sqrt{1-x}} = ?$

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

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

$$\Rightarrow \frac{6-2\cancel{\sqrt{3}}+3\cancel{\sqrt{3}}-3+6-3\cancel{\sqrt{3}}+2\cancel{\sqrt{3}}-3}{(3+\sqrt{3})(3-\sqrt{3})}$$

$$\Rightarrow \frac{12-6}{6} = \frac{6}{6} = 1 \quad \underline{\text{Ans}}$$

---

(183) if $x = \frac{2\sqrt{10}}{7}$ | $\frac{\sqrt{1+x}+\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}} = ?$

$1+x = \frac{7+2\sqrt{10}}{7}$

$= \left(\frac{\sqrt{5}+\sqrt{2}}{\sqrt{7}}\right)^2$

$\sqrt{1+x} = \frac{\sqrt{5}+\sqrt{2}}{\sqrt{7}}$

$$\frac{\sqrt{5}+\cancel{\sqrt{2}}+\sqrt{5}-\cancel{\sqrt{2}}}{\cancel{\sqrt{5}}+\sqrt{2}-\cancel{\sqrt{5}}+\sqrt{2}} = \frac{\cancel{2}\sqrt{5}}{\cancel{2}\sqrt{2}} = \frac{\sqrt{5}}{\sqrt{2}} \quad \underline{\text{Ans}}$$

(OR) $\dfrac{\sqrt{1+x}+\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}} = \dfrac{m}{1}$

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

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

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

(OR) By rationalization

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

Rationalize

$$\frac{1+x+1-x+2\sqrt{1-x^2}}{1+x-1+x}$$

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

$$x = \frac{2\sqrt{10}}{7}$$

$$1-x^2 = 1-\frac{40}{49}$$

$$= \frac{9}{49}$$

$$\sqrt{1-x^2} = \frac{3}{7}$$

$$= \frac{2+2\times\frac{3}{7}}{2\times 2\sqrt{10}} = \frac{5}{\sqrt{10}} = \frac{\sqrt{5}}{\sqrt{2}}$$ Ans

(5) $x = \frac{\sqrt{3}}{2}$ | $\sqrt{1+x} - \sqrt{1-x}$

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

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

Geometric Progression (GP)

a_1 a_2 a_3
4, 8, 16, 32, 64

$\frac{4}{8} = \frac{1}{2}$, $\frac{8}{16} = \frac{1}{2}$, $\frac{16}{32} = \frac{1}{2}$ $\frac{8}{4} = 2$, $\frac{16}{8} = 2$

ratio of two terms will be same.

common ratio (r) $= \frac{a_2}{a_1}$

$T_n = ar^{n-1}$

$S_n = \frac{a(r^n-1)}{r-1}$, $r>1$

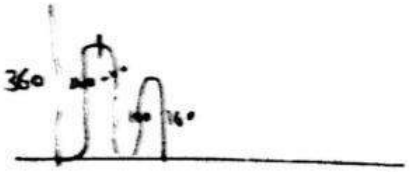
$S_n = \frac{a(1-r^n)}{(1-r)}$, $r<1$

$S_\infty = \frac{a}{1-r}$, $r<1$

(35) If a ball is thrown from a height of 360 m. It bounce 2/3 times of its every last bounce. Calculate the total distance covered by the ball till it stops.

$600 + 400 + \dots \infty$

$S_\infty = \frac{600}{1-\frac{2}{3}} = 1800$ m



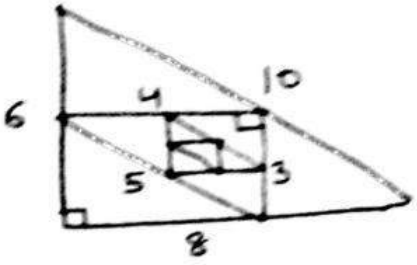
$360 + 240 = 600$ (1st bounce)
$240 + 160 = 400$ (2nd bounce)
$160 + 160 \times \frac{2}{3}$ like this

(186) If a ball is thrown from a height of 900 m, it rebounds $\frac{4}{5}$ times of its last height. Find the total distance covered by the ball till it stops.

$S_\infty = 900 + 720 \ldots\ldots \infty$

$S_\infty = \frac{900}{1-\frac{4}{5}} =$ 4500 m.

(187) The side of a $\triangle$ is 6, 8, 10 cm. If a $\triangle$ is formed by joining the mid points of all the sides of that $\triangle$ and in the same process infinite no. of $\triangle$s are formed. Find the sum of area of infinite $\triangle$s.



$24 + 6 + \ldots\ldots \infty$

$r = \frac{6}{24} = \frac{1}{4}$

$S_\infty = \frac{24}{1-\frac{1}{4}} = \frac{24 \times 4}{3}^{8}$

$= 32 \text{ cm}^2$

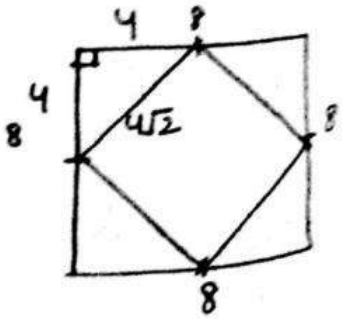
$\frac{1}{2} \times 6 \times 8 = 24$

$\frac{1}{2} \times 3 \times 4 = 6$

(188) The side of a square is 8 cm. A square is formed by joining the mid points of all sides and so on infinite no. of squares are formed.

$64 + 32 \ldots\ldots$

$S_\infty = \frac{64}{1-\frac{1}{2}} = 128 \text{ cm}^2$



(189) $(25)^{1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\cdots\infty}$

$S_\infty = \frac{1}{1-\frac{1}{2}} = 2$

$(25)^2 = 625$

ARITHMETICAL PROGRESSIONS

4, 8, 12, 16, 20. . .

common diff (d) = $a_2 - a_1$

$T_n = a + (n-1)d$

$S_n = \frac{n}{2}\left[1\text{st term} + \text{last term}\right]$

$S_n = \frac{n}{2}\left[2a + (n-1)d\right]$

$n = \frac{\text{last term} - \text{first term}}{d} + 1$

(190) find the sum of all the 3 digit no w/c are exactly divisible by 12

$108 + 120 + 132 + \cdots\cdots + 996$

$n = \frac{996 - 108}{12} + 1$

$\Rightarrow \frac{888}{12} + 1 \Rightarrow 74 + 1 \Rightarrow 75$

$S_n = \frac{75}{2}\left[108 + 996\right] \Rightarrow \frac{75}{2} \times 1104^{552}$

$\Rightarrow 75 \times 552$ Ans

(191) find the total no. of terms b/w 100 and 300 w/c are exactly divisible by 4 or 6

Number of terms divisible by 4

$$n_4 = \frac{296-104}{4} + 1 = 49$$

No. of terms divisible by 6

102, 108, ---- 294

$$n_6 = \frac{294-102}{6} + 1 = 33$$

No. of terms divisible by 12

108, 120, ---- 288

$$n_{12} = \frac{288-108}{12} + 1 = 16$$

No. of terms divide by 4 and 6 = 16 Ans

(LCM of 4&6 = 12)

∴ No. of terms b/w 100 and 300 that are divisible by 4 or 6 ⇒ 49+33−16 = 66

CLASS 44

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(192) if the sum of 1st 11 terms of an A.P is equal to the sum of 1st 19 terms of that AP. find the sum of first 30 terms of that A.P.

$S_{11} = S_{19}$

$$\frac{11}{2}[2a+10d] = \frac{19}{2}[2a+18d]$$

$$22a + 110d = 38a + 18\times 19 d$$

$$\boxed{2a = -29d}$$

$$S_{30} = \frac{30}{2}[2a+(30-1)d]$$

$$= 15[-29d + 29d]$$

$$= 0 \quad \text{Ans}$$

(193) Find the total no terms b/w 100 and 300 w/c are exactly divided by 4.

104, 108, ----- 296

$$n = \frac{296-104}{4} + 1 = 49$$

---

(194) If the Avg of n numbers is a. if 2 is added in 1st term, 4 is added in 2nd terms, 8 is added in 3rd term and in the same way he added in every term. find the new Avg.

$$\underset{+2}{-}, \underset{+4}{-}, \underset{+8}{-}, -, -, -$$

$$Avg = \frac{sum}{n} = a$$

$$sum = na$$

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

$$\text{New Avg} = \frac{na + 2(2^n-1)}{n}$$

$$= a + \frac{2(2^n-1)}{n} \quad \underline{\text{Ans}}$$

---

(195) $999\frac{57}{99} \times 99$

$$\left[999 + \frac{57}{99}\right] \times 99$$

$$99000 - 42$$

$$98958$$

Ans.

57 की जगह 99 मान लें

$999+1 = 1000$

$1000 \times 99 = 99000$

$99-57 = 42$

$$9\frac{5}{9} \times 9$$

$$\left(9 + \frac{5}{9}\right) \times 9$$

अगर 5 की जगह 9 मान लें

$10 \times 9 = 90$

$90-4 = 86$ Ans

(195) $9\frac{9998}{9999} \times 9999$

$\left(9+\frac{9998}{9999}\right) \times 9999$

99990
-1
99989

9998 की जगह 9999 मान लो। बाद में 1 घटा दो

---

[196] $\frac{1}{5} + 99999\frac{44}{45} \times 9$

इस Pattern में $\frac{44}{45}$ > यहाँ 1 का diff. होगा.

$\frac{44}{45} \times 9$ (×5) → ये यहाँ 5 पे कट रहा है तो starting में $\frac{1}{5}$ Add होगा.

इसका Ans. → जितने 9 end में हैं वो लिख लो और जितने 9 fraction से पहले हैं उतनी zero लिख लो।

∴ 900000 Ans

---

(197) $\frac{1}{5} + 999\frac{44}{45} \times 9$

9000 Ans

(198) $99\frac{1}{7} + 99\frac{2}{7} + 99\frac{3}{7} + \cdots + 99\frac{6}{7}$

$99+\frac{1}{7} + 99+\frac{2}{7} + 99+\frac{3}{7} + \cdots 99+\frac{6}{7}$

$99\times6 + \frac{1}{7} + \frac{2}{7} + \cdots \frac{6}{7}$

$594 + \frac{1+2+3+\cdots 6}{7}$

$594 + \frac{21}{7}$

$594+3 = 597$ Ans

(199) $9\frac{1}{3} + 99\frac{1}{3} + 999\frac{1}{3} + \cdots\cdots 999999\frac{1}{3}$

$9+\frac{1}{3} + 99+\frac{1}{3} + 999+\frac{1}{3} + \cdots\cdots 999999+\frac{1}{3}$

$(9+99+999+9999+99999+999999)+\left(\frac{1}{3}+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}\right)$

$1111104+2 = 1111106$ Ans

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(200) $4+44+444+\cdots\cdots+100$ terms

$4[1+11+111+\cdots\cdots 100\text{ tem}]$

$4\times\frac{9}{9}[1+11+111+\cdots\cdots 100\text{ tem}]$

$\frac{4}{9}[9+99+999+\cdots\cdots 100\text{ tem}]$

$\frac{4}{9}[10^1-1+10^2-1+10^3-1+\cdots\cdots 10^{100}-1]$

$\frac{4}{9}\left[\underset{\text{GP}}{\frac{10(10^{100}-1)}{10-1}} - 100\right]$

$\Rightarrow \frac{4}{9}\left[\frac{10(10^{100}-1)-900}{9}\right]$

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Number of zeros

(201) $1\times2\times3\times4\times\cdots\cdots 10$

* 3 appears how much time.

$\frac{10}{3} = 3$ ← जब तक divide करो तब तक 3 से छोटा ना हो

$\frac{3}{3} = \frac{1}{4 \text{ times}}$

(202) $1\times2\times3\times4\times\cdots\cdots 1200$

5 appears how many times

$\frac{1200}{5} = 240$

$\frac{240}{5} = 48$

$\frac{48}{5} = 9$

$9 = \frac{1}{\cdots}$ ans

(203) $192 \times 65 \times 1250 \times 750 \times 55 \times 37 \times 39 \times 36$. 2^2

$2^6 \times 5^1 \times 5^4 \times 2^1 \times 5^3 \times 2^1 \times 5^1$

$2 \rightarrow$ 10 times

$5 \rightarrow$ 9 times

(2×5) pair = 9 pairs.

So. no. of zero's is 9 in this multiplication.

Find no. of zero

2×5

$= 10$

0 appears when 2 and 5 is multiplied

---

(204) $1 \times 3 \times 5 \times 7 \times 9 \times \cdots\cdots 87$

no. of zeros = 0 (2 नहीं है multiply में)

(205) $1 \times 3 \times 5 \times 7 \times 9 \times \cdots\cdots 87 \times 256$

2^8

$5 \rightarrow$ 11 times

$2 \rightarrow$ 8 times

(2×5) pair $\rightarrow$ 8 pairs

So. no. of zero's = 8

5 – 1 | 75 → 2

15 – 1 | 85 → 1

25 – 2 | 11

35 – 1

45 – 1

55 – 1

65 – 1

---

(206) $5 \times 10 \times 15 \times \cdots\cdots 45$

$5 \rightarrow$ 10 times

$2 \rightarrow$ 7 times

No. of zero's = 7 Ans

---

(207) $1 \times 2 \times 3 \times \cdots\cdots \times \frac{100}{5} = 20$

$\frac{20}{5} = \frac{4}{24}$

$5 \rightarrow$ 24 times

no of zeros = 24

$2 \rightarrow 5$ से more than ही होंगे। हर दूसरी term में 5 है। So, 5 देखेंगे बस।

(208) $1 \times 2 \times \cdots \frac{1000}{5} = 200$

$\frac{200}{5} = 40$

$\frac{40}{5} = 8$

$\frac{8}{5} = 1$

$\underline{249}$

No of zeros $= 249$

---

(209) $513 \times 514 \times \cdots \cdots 1048$

$1 \times 2 \times 3 \times 4 \cdots \times 512 \times 513 \times 514 \times \cdots \frac{1048}{5} = 209$

$\frac{209}{5} = 41$

$\frac{41}{5} = 8$

$\frac{8}{5} = 1$

$\underline{259}$

$\frac{512}{5} = 102$

$\frac{102}{5} = 20$

$\frac{20}{5} = 4$

$\underline{126}$

No° of 5 → $259 - 126 = 133$

No° of zero's $= 133$ Ans

---

(210) $10 \times 20 \times 30 \times \cdots \times 1000$

→ $10 \times 1 \times 10 \times 2 \times 10 \times 3 \times \cdots \times 10 \times 100$

→ $10^{100} \times 1 \times 2 \times 3 \times 4 \times \cdots \times \frac{100}{5} = 20$

$\frac{20}{5} = 4$

$\underline{24}$

$100 + 24$

$= 124$ → No° of zero's.

(211) $1^{20} \times 2^{20} \times 3^{20} \times \text{----} \times 38^{20}$

$1 \times 2 \times 3 \times 4 \times \text{——} \quad \frac{38}{5} = 7$

$\frac{7}{5} = 1$

8 times ⇒ 5

$5^{20} \rightarrow 5 \rightarrow 20$ times

5— 20
10— 20
15— 20
20— 20
25— 40
30— 20
35— 20
160

No. of zero = 168

2 is very frequent so बस 5 देखो

---

(212) $1^2 \times 2^3 \times 3^4 \times 4^5 \times \text{-----} \times 28^{29}$

5^6 — 6

10^{11} — 11

15^{16} — 16

20^{21} — 21

25^{26} — 52

106

5 appears 106 times

No. of zero = 106

---

(213) $a = 1^3$, $b = 2^4$, $c = 3^5$ .... $z = 26^{28}$

$a \times b \times c \times \text{---} \times z$

$1^3 \times 2^4 \times 3^5 \times 4^6 \times \text{——} \quad 26^{28}$

$5^7 \rightarrow 7$

$10^{12} \rightarrow 12$

$15^{17} \rightarrow 17$

$20^{22} \rightarrow 22$

$25^{27} \rightarrow 54$

112

No. of zeros = 112

CLASS
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(214) $x(x+a)(x+2a)(x+3a) + ?$ What should be ---- so that it becomes perfect square.

A) a^4 C) $16a^3$

B) $2a^2$ D) $9a^4$

put $x=1, a=1$

$1 \times 2 \times 3 \times 4 = 24 + (1)$ ↓ a^4

OR

$x=1, a=2$

$1 \times 3 \times 5 \times 7 = 105 + (16)$ ↓ a^4

its an identity. All value must be satisfied. Place any value of x & a.

अगर एक और option में a^2 हो तो $a=1$ दोनों option (a^4, a^2) में 1 result देगा। so. option देख कर value put करें।

इस case में $a=2$ रख दो।

---

(215) if $a+b+c=0$

$$\frac{1}{a^2+b^2-c^2} + \frac{1}{b^2+c^2-a^2} + \frac{1}{a^2+c^2-b^2} = ?$$

$a+b = -c$

$a^2+b^2+2ab = c^2$

$a^2+b^2-c^2 = -2ab$

$$\therefore \frac{1}{-2ab} + \frac{1}{-2bc} + \frac{1}{-2ac} \Rightarrow \frac{a+b+c}{-2abc} = 0$$

(OR) value putting

put $a=1, b=1, c=-2$

$$\frac{1}{-2} + \frac{1}{4} + \frac{1}{4}$$

$$\frac{-2+1+1}{} = 0$$

Keep in mind while putting values - denominator में zero नहीं बनना चाहिए। ∞ हो जायेगा।

(216) if $pq+qr+rp=0$ | $\frac{p^2}{p^2-qr}+\frac{\nu}{q^2-rp}+\frac{\square}{r^2-pq}$

$pq+rp=-qr$

$pq+qr=-rp$

$qr+rp=-pq$

$\frac{p^2}{p^2+pq+rp}+\frac{q^2}{q^2+pq+qr}+\frac{r^2}{r^2+qr+rp}$

$\frac{p}{p+q+r}+\frac{q}{p+q+r}+\frac{r}{p+q+r}$

$\frac{p+q+r}{p+q+r}=$ (1) Ans

value putting.

$p=1$

$q=-2$

$r=-2$

ऐसे case में दो value +ve/-ve की same रखनी है।

दो value same रखनी है या +ve की या -ve की.

$\frac{1}{1-4}+\frac{4}{4+2}+\frac{4}{4+2}$

$-\frac{1}{3}+\frac{4}{3}=\frac{-1+4}{3}=\frac{3}{3}=$ (1) Ans

---

(217) if $\frac{x-a^2}{b+c}+\frac{x-b^2}{c+a}+\frac{x-c^2}{a+b}=4(a+b+c)$ | find x

A) $(a+b+c)^2$

C) $(a^2+b^2+c^2-ab-bc-ca)$

B) $(a^2+b^2+c^2)$

D) $(ab+bc+ca)$

$\frac{b^2+c^2}{b+c}$ (square कभी खत्म नहीं होगा)

× option B → not satisfied

option A → $\frac{(a+b+c)^2-a^2}{b+c}$

$\Rightarrow \frac{(a+b+c-a)(a+b+c+a)}{b+c} \Rightarrow 2a+b+c$

⇒ similarly $(2a+b+c)+(a+2b+c)+(a+b+2c)$

$= 4(a+b+c)$ satisfied

OR put values of a, b, c (any values)

$a = b = c = 1$

$$\frac{x-1}{2} + \frac{x-1}{2} + \frac{x-1}{2} = 12$$

$$x = 9$$

Now check w/c option gives 9 by putting values of a, b, c

✓ **option A** $(a+b+c)^2 \Rightarrow (1+1+1)^2 = 9$ ✓

---

(218) if $x + \frac{1}{y} = 1$ and $y + \frac{1}{z} = 1$ | $z + \frac{1}{x} = ?$

$x = 1 - \frac{1}{y}$

$x = \frac{y-1}{y}$

$\frac{1}{x} = \frac{y}{y-1}$

$\frac{1}{z} = \frac{1-y}{1}$

$z = \frac{1}{1-y}$

$\frac{1}{1-y} + \frac{y}{y-1}$

$\Rightarrow \frac{1}{1-y} - \frac{y}{1-y}$

$\frac{1-y}{1-y} = 1$ Ans.

OR

$x = \frac{1}{2}$

$y = 2$

$z = -1$

$-1 + 2 = 1$ Ans

---

(219) $\frac{a}{b} = \frac{4\times3}{5\times3}$, $\frac{b}{c} = \frac{15}{16}$ | $\frac{27c^2 - 7a^2}{36c^2 + 18a^2} = ?$

$\frac{a}{b} = \frac{12}{15}$, $\frac{b}{c} = \frac{15}{16}$

a : b : c

12 : 15 : 16

$\therefore \frac{a}{c} = \frac{12}{16} \frac{3}{4}$

$\frac{a}{c} = \frac{3}{4}$ | $\frac{c}{a} = \frac{4}{3}$

$\frac{27\frac{c^2}{a^2} - 7\frac{a^2}{a^2}}{36\frac{c^2}{a^2} + 18\frac{a^2}{a^2}}$

अगर c^2 से divid करें तो fraction बनेगा।

$\frac{48-7}{64+18} = \frac{41}{82} = \frac{1}{2}$

Ans

(220) if $p \cdot q \cdot r = 1$ | $\frac{1}{1+p+q^{-1}} + \frac{1}{1+r+p^{-1}} + \frac{1}{1+q+r^{-1}}$

$\Rightarrow \frac{q}{q+pq+1} + \frac{1}{1+\frac{1}{pq}+\frac{1}{p}} + \frac{1}{1+q+pq}$

$\downarrow$

$\frac{pq+1+q}{pq}$

$\downarrow$

$\Rightarrow \frac{q}{q+pq+1} + \frac{pq}{pq+1+q} + \frac{1}{1+q+pq}$

$\Rightarrow \frac{q+pq+1}{1+q+pq} = (1)$ Ans

OR

Put $p=q=r=1$

$\Rightarrow \frac{1}{3}+\frac{1}{3}+\frac{1}{3} = \frac{3}{3} = (1)$ Ans

---

(221) if $a+b+c=2s$ (2, 2, 2, 3) | $\frac{(s-a)^2+(s-b)^2+(s-c)^2+s^2}{a^2+b^2+c^2} = ?$

$\frac{12}{12} = (1)$ Ans.

---

(222) if $\frac{x-a^2}{b^2+c^2} + \frac{x-b^2}{c^2+a^2} + \frac{x-c^2}{b^2+a^2} = 3$ | find x

A) $a^2+b^2+c^2$

B) $(a+b+c)^2$

C) $(a^2+b^2+c^2-ab-bc-ca)$

D) $ab+bc+ca$

option A gives 3

Put $a=b=c=1$

$\frac{x-1}{2} + \frac{x-1}{2} + \frac{x-1}{2} = 3$

$\frac{x-1+x-1+x-1}{2} = 3$

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

$x = 3$

(223) if $xy+yz+zx=0$ | $\frac{1}{x^2-yz}+\frac{1}{y^2-zx}+\frac{1}{z^2-xy}$

(224) if $\frac{a}{b+c}+\frac{b}{c+a}+\frac{c}{a+b}=1$ | $\frac{a^2}{b+c}+\frac{b^2}{c+a}+\frac{c^2}{a+b}=?$

$$\left(\frac{a}{b+c}+\frac{b}{c+a}+\frac{c}{a+b}\right)(a+b+c)=1(a+b+c)$$

$$\Rightarrow \frac{a^2+a(b+c)}{b+c}+\frac{b^2+b(a+c)}{(c+a)}+\frac{c^2+c(a+b)}{a+b}=a+b+c$$

$$\Rightarrow \frac{a^2}{b+c}+a+\frac{b^2}{c+a}+b+\frac{c^2}{a+b}+c=a+b+c$$

$$\Rightarrow \frac{a^2}{b+c}+\frac{b^2}{c+a}+\frac{c^2}{a+b}=0 \quad \text{Ans.}$$

OR $\frac{a}{b+c}+\frac{b}{c+a}+\frac{c}{a+b}=1$ — wrong method but Ans आ जायेगा।

$\downarrow \frac{1}{3}$ $\downarrow \frac{1}{3}$ $\downarrow \frac{1}{3}$

$\frac{a}{b+c}=\frac{1}{3}$

$b+c=3a$

$\therefore c+a=3b$

$\therefore a+b=3c$

$2(a+b+c)=3(a+b+c)$

$\therefore a+b+c=0$

$b+c=-a$

$\frac{a^2}{b+c}+\frac{b^2}{c+a}+\frac{c^2}{a+b}$

$\frac{a^2}{-a}+\frac{b^2}{-b}+\frac{c^2}{-c}$

$-a-b-c$

$-(a+b+c)$

$=0$ Ans

OR (Short the ques.)

$\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b} = 1$ | $\frac{a^2}{b+c} + \frac{b^2}{c+a} + \frac{c^2}{a+b} = ?$

$a = 0$

$b = 1$ ($b=0$ में एक part ∞ हो जायेगा)

$\frac{1}{c} + c = 1$

$\frac{1+c^2}{c} = 1$

$1 + c^2 = c$

$\frac{1}{c} + c^2$

$\frac{1}{c} + c, -1$

$1 - 1 = 0$

---

(225) if $\frac{b-c}{a} + \frac{a+c}{b} + \frac{a-b}{c} = 1$ | $a-b+c \neq 0$

$b = 1$

$c = 1$

$\therefore \frac{a+1}{1} + \frac{a-1}{1} = 1$

$a + 1 + a - 1 = 1$

$\boxed{a = \frac{1}{2}}$

$b = 1$

$c = 1$

A) $\frac{1}{b} = \frac{1}{a} - \frac{1}{c}$

B) $\frac{1}{b} = \frac{1}{a} + \frac{1}{c}$

C) $\frac{1}{c} = \frac{1}{a} + \frac{1}{b}$

D) None of these.

(226) if $a+\frac{1}{a} = -1$ | $(1-a+a^2)(1+a-a^2) = ?$

$a^2+a+1 = 0$

$a^2+1 = -a$

$a+1 = -a^2$

$a^3 = 1$

$-2a \times -2a^2$

$\Rightarrow 4a^3$

$\Rightarrow 4 \times 1 = 4.$

(#)

ax^2+bx+c

$a = +ve$

Min. value $= \frac{4ac-b^2}{4a}$

Max. value $= \infty$

(#)

ax^2+bx+c

$a = -ve$

Max. value $= \frac{4ac-b^2}{4a}$

Min value $= -\infty$

(227) find min. value of $(x-9)(x-2)$

$x^2-11x+18$

Min value $= \frac{4 \times 1 \times 18 - 121}{4} = \frac{-49}{4}$

(228) $a_1, a_2, a_3 \ldots\ldots$ are the terms of A.P series.
if $a_1+a_5+a_{10}+a_{15}+a_{20}+a_{24} = 225$. find the sum of 1st 24 terms of this series.

[$\because T_n = a+(n-1)d$]

$a+a+4d+a+9d+a+14d+a+19d+a+23d = 225$

$6a+69d = 225$

$(2a+23d) = 75$

$S_{24} = \frac{24}{2}[2a+23d] = 12 \times 75 = 900$ Ans.