Trailing Zeros

30-11-18

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9$

এখানে আমাদেরকে দেখতে হবে 2 multiplication

এ 2 কতবার আসছে।

2 → 1 7 times 2

4 → 2

6 → 1

8 → 3

আমাকে যদি বলা হয় 1 to 9 এর multiplication

এ 2 কতবার আসছে, তাহলে —

$\frac{9}{2} = 4$ $\frac{4}{2} = 2$ $\frac{2}{2} = 1$

divide until one comes,

$4+2+1 = 7$ → single time 2

2 → 1 → double time 2

4 → 1+1

6 → 1

8 → 1+1+1 → triple time 2

* $1 \times 2 \times 3 \times \dots \times 25$ how many 3 ?

$\frac{25}{3} = 8$ $\frac{8}{3} = 2$ [End]

$3 \rightarrow 8+2 = 10$ times

$1 \times 2 \times 3 \times \ldots \times 47$ how many 5's?

$\frac{47}{5} = 9 \quad \frac{9}{5} = 2$

$9 + 2 = 11$ times.

trailing zeros → number of zeros in the last of the multiplications.

$25 \times 4 = 100$

$5 \times 2 = 0 \rightarrow 1$ zero

$5 \times 4 = 0 \rightarrow 1$ zero

but $5 \times 2 \times 2 = 40 \rightarrow 1$ zero

So one zero will be made if there exists one 5×2.

⇒ $27 \times 39 \times 53 \times 99$ how many zeros in the last?

= no zeros

⇒ $27 \times 39 \times 53 \times 99 \times 24 = ?$ no zero

2^3

$65 \times 27 \times 39 \times 53 \times 99 \times 24 \times 35$

13×5 $\quad 2^3 \times 3 \quad 5 \times 7$

$5 \rightarrow 2$ times $\quad 2 \rightarrow 3$ times.

So 2 pair of 5×2 possible

So there will be 2 zeros in the last.

$65 \times 1250 \times 128 \times 39 \times 73 \times 56$

$5^1 \times 13 \quad 5^4 \times 2 \quad 27 \quad 13 \times 3 \quad 2^3 \times 7$

$2 \rightarrow 11$ times

$5 \rightarrow 5$ times

5 zeros

Regular series

$1 \times 2 \times 3 \times 4 \times \ldots \times 53$

$\frac{53}{2} = 26$

$\frac{26}{2} = 13$

$\frac{13}{2} = 6$

$\frac{6}{2} = 3$

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

40

$\frac{53}{5} = 10$

$\frac{10}{5} = 2$

12 times

50 - 12 zeros

Let's take which should be counted first

$1 \times 2 \times 3 \times \_\_\_ \_\_\_ \times 1000$

here 2 exists many times, so we have to count 5 first.

$\frac{1000}{5} = 200$ $\quad \frac{200}{40} = 8$ $\quad \frac{8}{5} = 1$

$5 \rightarrow 249$ times,

$1 \times 2 \times 3 \times \_\_\_ \times 500$

this kind of regular series we have to count 5.

$\therefore$ So how many 2520s in $\lfloor 1000 = ?$

Answer is 240

$\lfloor 500$

$\lfloor 1000$

(5) $317 \times 318 \times 319 \times \_\_\_ \_\_\_ \times 1207 = ?$

here it is not from one.

we have to add like this.

$1 \times 2 \times \_\_\_ \_\_\_ \times 316 \times 317 \times 318 \times 319 \times \_\_\_ \times 1207$

$\frac{316}{5} = 63$

$\frac{63}{5} = 12$

$\frac{12}{5} = 2$

77

$\frac{1207}{5} = 241$

$\frac{241}{5} = 48$

$\frac{48}{5} = 9$

$\frac{9}{5} = 1$

299 pairs.

Ans: $299 - 77 = 222$

$L15 = \frac{15}{5} = 3$ zeros

$L40 = \frac{40}{5} = 8$

$\frac{8}{5} = 1$ zero

$L67 = \frac{67}{5} = 13$

$\frac{13}{5} = 2$ zeros

15 zeros

Q $10^{50} \times 10^{50} = ?$

(a) $(a^m \times a^n = a^{m+n})$

$\therefore 10^{50} \times 10^{50} = 10^{100}$

100 zeros.

Here $10^1 = 0$

$10^2 = 100$

$10^3 = 1000$

that means the power of 10 is equal to the number of trailing zeros.

Q $10^{51} \times 10^2 = 10^{53}$

Ans: 53 trailing zeros.

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Q $10^3 \times (1000)^5 = 10^3 \times (10^3)^5 = 10^3 \times 10^{15}$

$= 10^{18}$ = 18 zeros.

Q 1000 + 100

$= 10^3 + 10^2$

$= 10^2 [10^1 + 1]$ $= 10^2 \times 11 = 1100$ (2 zeros)

→ no values of this power.

So, $10^3 + 10^2$

So we will take the least power of 10

Answer 2.

Q: $10^{64} + 10^{30} = 10^{30}[10^{34} + 1]$

→ Ans: 30.

** So lesser power is the answer.

Q $(10000)^{60} + (10000)^{50}$

$= (10^4)^{60} + (10^4)^{50} = 10^{240} + 10^{150}$

Ans: 150 zeros.

Q $L40 \times L73 = ?$

$L40 = \frac{40}{5} = 8$

$= \frac{8}{5} = 1$

0 zeros.

$L73 = \frac{73}{5}$

$= 14$

$\frac{14}{5} = 2$

16 zeros.

→ $L40 \times L73$

$= 10^9 \times 10^{16}$

$= 10^{25}$

Ans. 25 zeros

WOW

Q: $10 \times 20 \times 30 \times \_\_\_ \times 12000 = ?$

10^1 ~~$10^1 \times 2$~~

$10^1 \times 1$ $\quad 10^1 \times 2$ $\quad 10^1 \times 3$ $\quad 10^1 \times 120$

here 10 is 120 times

$= 10^{120} \times 1 \times 2 \times 3 \times \_\_\_ \times 120$

$\downarrow$

120 zero

$\frac{120}{5} = 24$

$\frac{24}{5} = 4$

28 zero

$\therefore$ Total zeros $= 120 + 28$

$= 148$ zeros

WOW ☺

here suppose.

$10 \times 10 \times 10 = 1000$

$10^1[1 \times 1 \times 1]$

$= 10^1 \times 1$

$= 10$

$= 10$ zeros

wrong

$10 + 10 + 10 = 30$

$10^1[1 + 1 + 1] = 30$

Ans 10 zeros

so we can take common in case of plus.

multiplication

→ add the powers.

Q. $10 \times 20 \times 30 \times \dots \times 940$

$10^{94} \times 1 \times 2 \times 3 \times \dots \times 94$

$\frac{94}{5} = 18$

$\frac{18}{5} = 3$

$94 + 21$

Ans: $= 115$

$1 \times 2 \times 3 \times \dots \times 28^{28} = ?$

So we have to count 5 or 2 in a regular series. And there is 2's more than 5 in a regular series.

So we have to count 5 here

5 exists in 5, 10, 15, 20, 25 — according to question.

5, 10, 15, 20, 25 — less than 28

∴ 5, 10, 15, 20, 25 → according to question

~~5 + 10 + 15 + 20 + 25~~

5 times

P.T.O.

$5^5 \rightarrow 5$

$(5\times2)^{10} \leftarrow 10^{10} \rightarrow 10$

$(5\times3)^{15} \leftarrow 15^{15} \rightarrow 15$

$(5\times4)^{20} \leftarrow 20^{20} \rightarrow 20$

$(52)^{25} \leftarrow 25^{25} \rightarrow 50$

100 times. Ans. 100 zeros.

Q. if $a = 1^2, b = 2^3, c = 3^4, d = 4^5, \ldots Z = 26^{27}$

Find the number of trailing zeros

in $a \times b \times c \times \ldots \times Z$

$\Rightarrow 1^2 \times 2^3 \times 3^4 \times \ldots \times 26^{27}$

→ regular 5 will comes in 5, 10, 15, 20, 25

for this question power is incremented by one.

∴ P.T.O.

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Q: $L1 \times L2 \times L3 \times L4 \times \ldots \times L28$

We have to consider from

5 L^5

$L5 \times L6 \times L7 \times L8 \times L9 = 5$ zero

$L10 \times L11 \times L12 \times L13 = 10$ n

$L15^3 \quad L19 = 15$ zeros

$L20^4 \times \ldots \times L24 = 20$ n

$L25^6 \times \ldots \times L28^6 = 24$ n.

74 zero.

here,

$L5 \times L6$

$\frac{5}{5} \quad \frac{6}{5} = 1$

$1 + 1$

$\therefore$ 2 zeros

$L4 =$ no zero

$\frac{25}{5} = 5$

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

6

Q: $(3^{123} - 3^{122} - 3^{121}) \times (2^{121} - 2^{120} - 2^{119})$

$= 3^{121}[3^2 - 3^1 - 1] \times 2^{119}[2^2 - 2^1 - 1]$

$= 3^{121} \times 2^{119} \times 5 \times 1$

$= 1$ zero (Ans)

The end
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