General Aptitude

Q. In a book sum of all the page no. is 10,000 without having a page sheet. Find the missing page no.

(a) 76 & 77
(b) 9, 10
(c) 24 & 15
(d) NOT

Sol →

(a) $\frac{n(n+1)}{2} = 10000 + 76 + 77$

$n^2 + n = 20306$

$n^2 + 143n - 142n - 20306 = 0$

$\Rightarrow n(n+143) - 142(n+143) = 0$

$n = 142$, $n = -143$

Since n comes as whole no.
So, it is true ans.

So, missing page is 76 & 77.

Q. How many pair of possible integers (x, y) exists such that $HCF(x, y) + LCM(x, y) = 91$

Sol →

$x = ha$, $y = hb$.

$hcf = h$, $LCM = hab$

$h + hab = 91$

$h(1 + ab) = 91 \begin{cases} 7 \times 13 \\ 1 \times 91 \end{cases}$

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for $h = 1$, $(1+ab) = 91$
$ab = 90$

1	90
2	45
5	18
9	10

for $h = 7$, $(1+ab) = 13$
$ab = 12$

1	12
3	4

for $h = 13$ $(1+ab) = 7$
$ab = 6$

1	6
2	3

$\Rightarrow$ 8 pairs.

Q How many pairs of integers (x,y) exist such that product of x and y and HCF of $(x,y) = 1080$

Sol $\rightarrow$ $x = ha$ $y = hb$

a/q. $ha \cdot hb \cdot h = 1080$
$h^3 ab = 1080$
$h^3 ab = 2^3 3^3 \times 5$

$h = 1$:- $ab = 1080$

1	1080
8	135
$2^3 \times 3^3$	5
40	27

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$h = 2 : \quad ab = 3^3 \times 5$

1	135
27	5

$h = 3 \quad ab = 2^3 \times 5$

1	40
5	8

$h = 6 \quad ab = 5$

1	5

$\Rightarrow$ 9 pair Ans

Q. aabb is a perfect square. find value of a − b.

$\Rightarrow$ aabb unique feature → 11 ka multiple hoga

$aabb = 11 \times 11 \times n^2$
$aabb = 121 \times n^2$
$7744 = 121 \times 64.$
$7 - 4 = 3$ Ans

Q. N → 10800
find No. of (i) Prime factor (ii) even factor (iii) odd factor (iv) factor that are perfect square

$\Rightarrow$ (i) 3 $\quad (2^4 \times 3^3 \times 5^2).$
(ii) $p \times (q+1)(r+1) = 4 \times 4 \times 3 = 48$
(iii) $(q+1)(r+1) = 4 \times 3 = 12$
(iv) $\left[\left[\frac{p}{2}\right]+1\right] \left[\left[\frac{q}{2}\right]+1\right] \left[\left[\frac{r}{2}\right]+1\right] = 3 \times 2 \times 2 = 12$

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Q. $N = 55^5 + 17^5 - 72^5$
Which of the following is true.

(a) N is divisible by both 7 & 13
(b) N is divisible by both 3 & 17
(c) N is divisible by 17 but not 3
(d) N is divisible by 11 but not 17.

$\Rightarrow$ For 3:-

$$(54+1)^5 + (15+2)^5 - (72+0)^5$$

$$= \frac{(1)^5 + 2^5 - 0^5}{3} = \frac{33}{3} = 11$$

divisible by 3.

For 17:-

$$(51+4)^5 + (17)^5 - (68+4)^5$$

$$= \frac{(4)^5 + 0^5 - 4^5}{17}$$

$$= 0 \leftarrow \text{divisible by } 17$$

$\Rightarrow$ (b) Ans

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Unit - Digits

Q. 1) $(413)^{259} \times (727)^{796} + (429)^{430} \times (208)^{471}$

$\Rightarrow 7 \times 1 + 1 \times 2$

$\Rightarrow 9$ Ans

2) $(412)^{256} * (724)^{723} + (535)^{203} + (101)^{110}$

$\Rightarrow 6 * 4 + 5 + 1$

$= 30$

$= 0$ Ans

3) $(0!)^2 + (2!)^2 + (4!)^2 + \cdots (1096!)^2$

$\Rightarrow 1 + 4 + 6 + 0 + \cdots$

$= 1$ Ans

4) $0! \times 1! \times 2! \times 3! \times \cdots 723!$

$\Rightarrow 1 \times 1 \times 2 \times 6 \times 4 \times 0 \times 0 \times 0 \cdots$

$= 0$ Ans

5) $\cancel{0!+} 1! + 2! + 3! + 4! + \cdots 119!$

$\Rightarrow 1 + 2 + 6 + 4 + 0 + \cdots$

$= 3$ Ans

Rules for The Unit digit

$2^1 = 2$	$3^1 = 3$	$7^1 = 7$	$8^1 = 8$
$2^2 = 4$	$3^2 = 9$	$7^2 = 9$	$8^2 = 4$
$2^3 = 8$	$3^3 = 7$	$7^3 = 3$	$8^3 = 2$
$2^4 = 6$	$3^4 = 1$	$7^4 = 1$	$8^3 = 6$
$2^5 = 2$	$3^5 = 3$	$7^5 = 7$	$8^5 = 8$

Cycle repeat after 4.
So, divide exponent
by 4 and check for the remainder.

$4^1 = 4$	$9^1 = 9$
$4^2 = \cancel{1}6$	$9^2 = 1$
$4^3 = 4$	$9^3 = 9$

Cycle repeat after 2. So, divide exponent
by 2 and check for remainder.

$5^{any} = 5$

$6^{any} = 6$

$0^{any} = 0$

$1^{any} = 1$

Trailing Zero :-

① $4096!$

$\Rightarrow 1021$

5	4096
5	819
5	163
5	32
5	6
5	1
	0

$\Rightarrow 819 + 163 + 32 + 6 + 1 = \underline{\underline{1021}}$

② $209!$

$\Rightarrow 50$

5	209
5	41
5	8
5	1
	0

$\Rightarrow 41 + 8 + 1 = 50$

③ $(30)^{111} \times (75)^{222} \times (24)^{333}$

$\Rightarrow (3 \times 10)^{111} \times (5^2 \times 3)^{222} \times (2^3 \times 3)^{333}$

$= 10^{111} \times \underbrace{5^{444} \times 2^{999}}$

$\min(444, 999) = 444$

$= 111 + 444$

$= 555$ Ans

Q. find the largest exponent of

(a) 15 in 509!

$15 = 3 \times 5$

$$\begin{array}{r|l} 5 & 509 \\ \hline 5 & 101 \\ \hline 5 & 20 \\ \hline 5 & 4 \\ \hline & 0 \end{array}$$

$\Rightarrow 125$ Ans

(b) 42 in 209!

$42 = 2 \times 3 \times 7$

$$\begin{array}{r|l} 7 & 209 \\ \hline 7 & 29 \\ \hline 7 & 4 \\ \hline & 0 \end{array}$$

$\Rightarrow 33$ Ans

Remainders :-

Q. $\dfrac{1954 \times 1955 \times 1956}{19}$

$$\Rightarrow \frac{(1900+54)(1900+55)(1900+56)}{19}$$

$$= \frac{-3 \times -2 \times -1}{19} = -6 \Rightarrow -6+19$$

$= 13$ Ans

Q. $\frac{3^{4137}}{2}$

$= (1)^{4137} = 1$ Ans

Q. $\frac{2^{4137}}{3}$

$= (-1)^{4137}$
$= -1$
$= -1 + 3$
$= 2$ Ans

Q. $\frac{2^{4137}}{7} = \frac{(2^3)^{1379}}{7}$

$= (1)^{1379} = 1$ Ans

Q. $\frac{7^{21} + 7^{22} + 7^{23} + 7^{24}}{25}$

$\frac{7^{21}(1 + 7 + 49 + 343)}{25}$

$= \frac{7^{21} \times 400}{25} = 0$ Ans

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Q. $\dfrac{2^{261} + 3^{283}}{11}$

$= \dfrac{(2^5)^{52} \cdot 2 + (3^5)^{56} \cdot 3^3}{11}$

$= \dfrac{(-1)^{52} \cdot 2 + (1)^{56} \cdot 3^3}{11}$

$= \dfrac{2 + 3^3}{11} = \dfrac{29}{11} = 7$ Ans

Q. $\dfrac{10^{10} + 10^{100} + 10^{1000} + \cdots 10^{10000000000}}{7}$

$\dfrac{(10^3)^3 \cdot 10 + (10^3)^{33} \cdot 10 + \cdots (10^3)^{333333333} \cdot 10}{7}$

$= (-1)(-4) + (-1)(-4) \cdots (-1)(-4)$

$= \dfrac{40}{7}$

$\Rightarrow 5$ Ans

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Q. $\frac{1800}{500}$ → (a) 3 (b) 30 (c) 300

Which one is right?

⇓

300 Ans

⇓

$\frac{300 \times 18}{100 \times 5}$

⇓

$\frac{c}{c} \times \frac{18}{5}$

c x Remainder (18/5) ←

100×3

$= 300$ Ans

Q. $\frac{2^{199}}{96}$

$\Rightarrow \frac{2^{199}}{2^5 \cdot 3} = \frac{2^{194}}{3} = (-1)^{194}$

$= 1$

$R \times C \Rightarrow 1 \times 2^5$

$= 32$ Ans

Q. $\frac{3^{273}}{135} \Rightarrow \frac{3^{273}}{3^3 \cdot 5} = \frac{3^{270}}{5}$

$\Rightarrow \frac{(3^2)^{135}}{5} = (-1)^{135} = -1 = -1+5 = 4$

Faith is the bird that feels the light when the dawn is still dark. "—Rabindranath Tagore

$\Rightarrow 4 \times 3^3 = 108$ Ans

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Q. $\frac{2^{199}}{97}$

Fermat's Theorem :-

$\frac{a^{p-1}}{p} \Rightarrow$ Rem = 1 (always)

a, p → co-primes.
p → prime no.

Rule to solve this type of Question

$\Rightarrow \frac{2^{199}}{97} = \frac{(2^{97-1})^2 \cdot 2^7}{97}$

$= 1 \cdot 2^7$

$= \frac{128}{97} = 31$ Ans

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Q $\dfrac{(26)^{87}}{29}$

$\dfrac{\left[(26)^{29-1}\right]^{3} \cdot 26^{3}}{29}$

$= \dfrac{1 \cdot (26)^{3}}{29}$

$\Rightarrow -3 \times -3 \times -3$

$= -27 + 29$

$= 2$ **Ans**

Q. Find the remainder of $\dfrac{5^{2p}}{13}$

when $p = (1!)^2 + (2!)^2 + (3!)^2 + \cdots (913!)^2 \cdots$

$\Rightarrow \dfrac{(5^2)^p}{13} = (-1)^p$

$= (-1)^{odd} = -1$

$= -1 + 13$

$= 12$ **Ans**

by checking unit digit of $(1!)^2 + (2!)^2 + (3!)^2 \cdots$

$\Rightarrow$ odd + even

$=$ odd

"Faith is the bird that feels the light when the dawn is still dark." —Rabindranath Tagor

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Question to Practise :-

Q1. Find the greatest no. which when divides 259 and 465 leaves remainder 4 and 6 respectively.

Q2. Find the least no which when divided by 6, 14, 18 and 22 leaves remainder 4 in each case.

Q3. Find the least no. which when divided by 8, 12, 20 & 36 leaves remainder 6, 10, 18, and 34 respectively.

Q4. Find the greatest no. which when divides 41 71 and 91 leaves the same remainder in each case.

1) $\Rightarrow$ $259 - 4$ & $465 - 6$

$= 255$ & 459

$HCF(255, 459) = 51$

$\Rightarrow 51$ Ans

2) $LCM(6, 14, 18, 22) = 1386$

$\Rightarrow 1386 + 4 = 1390$ Ans