(iv) L.C.M. of 2,3,6 & 12 = 12

$\sqrt{5} \to (\sqrt{5})^{12} = 5^6 = 15625$

$\sqrt[3]{6} \to (\sqrt[3]{6})^{12} = 6^4 = 1296$

$\sqrt[6]{7} \to (\sqrt[6]{7})^{12} = 7^2 = 49$

$\sqrt[12]{30} \to (\sqrt[12]{30})^{12} = 30^1 = 30$

So, $\sqrt{5}$ is largest.

(v) L.C.M. of 2 & 3 = 6

$\left(\frac{1}{2}\right)^{\frac{1}{2}} \to \left[\left(\frac{1}{2}\right)^{\frac{1}{2}}\right]^6 = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$

$\left(\frac{2}{3}\right)^{\frac{1}{3}} \to \left[\left(\frac{2}{3}\right)^{\frac{1}{3}}\right]^6 = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

So, $\left(\frac{2}{3}\right)^{\frac{1}{3}}$ is larger.

2.(i) L.C.M. of 3 & 4 = 12

$\sqrt[4]{5} \to (\sqrt[4]{5})^{12} = 5^3 = 125$

$\sqrt[3]{7} \to (\sqrt[3]{7})^{12} = 7^4 = 2401$

So, $\sqrt[4]{5}$ is smaller.

(ii) L.C.M. of 2 & 3 = 6

$\sqrt{5} \to (\sqrt{5})^6 = 5^3 = 125$

$\sqrt[3]{2} \to (\sqrt[3]{2})^6 = 2^2 = 4$

So, $\sqrt[3]{2}$ is smaller.

(iii) L.C.M. of 2 & 3 = 6

$\left(\frac{1}{3}\right)^{\frac{1}{2}} \to \left[\left(\frac{1}{3}\right)^{\frac{1}{2}}\right]^6 = \left(\frac{1}{3}\right)^3 = \frac{1}{27}$

$\left(\frac{2}{3}\right)^{\frac{1}{3}} \to \left[\left(\frac{2}{3}\right)^{\frac{1}{3}}\right]^6 = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

So, $\left(\frac{1}{3}\right)^{\frac{1}{2}}$ is smaller.

(iv) L.C.M. of 3,4 & 6 = 12

$\sqrt[3]{5} \to (\sqrt[3]{5})^{12} = 5^4 = 625$

$\sqrt[3]{6} \to (\sqrt[3]{6})^{12} = 6^4 = 1296$

$\sqrt[4]{7} \to (\sqrt[4]{7})^{12} = 7^3 = 243$

$\sqrt[6]{30} \to (\sqrt[6]{30})^{12} = 30^2 = 900$

So, $\sqrt[4]{7}$ is smallest.

(v) L.C.M of 2, 4, 10 & 20 = 20

$\sqrt[4]{5} \to (\sqrt[4]{5})^{20} = 5^5$

$\sqrt{7} \to (\sqrt{7})^{20} = 7^{10}$

$\sqrt[10]{13} \to (\sqrt[10]{13})^{20} = 13^2$

$\sqrt[20]{29} \to (\sqrt[20]{29})^{20} = 29$

So, $\sqrt[20]{29}$ is smallest.

3.(i) L.C.M. of 4,6 & 12 = 12

$\sqrt[4]{3} \to (\sqrt[4]{3})^{12} = 3^3 = 27$

$\sqrt[6]{7} \to (\sqrt[6]{7})^{12} = 7^2 = 49$

$\sqrt[12]{48} \to (\sqrt[12]{48})^{12} = 48^1 = 48$

Ascending order $\Rightarrow \sqrt[4]{3} < \sqrt[12]{48} < \sqrt[6]{7}$

(ii) L.C.M. of 2, 3 & 6 = 6

$\sqrt{5} \to (\sqrt{5})^6 = 5^3 = 125$

$\sqrt[3]{11} \to (\sqrt[3]{11})^6 = 11^2 = 121$

$2\sqrt[6]{3} = \sqrt[6]{3 \times 64} \to (\sqrt[6]{3 \times 64})^6 = 192$

Ascending order $\Rightarrow \sqrt[3]{11} < \sqrt{5} < 2\sqrt[6]{3}$

(iii) L.C.M. of 2,3 & 4 = 12

$\sqrt[4]{6} \to (\sqrt[4]{6})^{12} = 6^3 = 216$

$\sqrt{2} \to (\sqrt{2})^{12} = 2^6 = 64$

$\sqrt[3]{4} \to (\sqrt[3]{4})^{12} = 4^4 = 256$

Ascending order $\Rightarrow \sqrt{2} < \sqrt[4]{6} < \sqrt[3]{4}$

(iv) L.C.M. of 2,3 & 6 = 6

$\sqrt{5} \to (\sqrt{5})^6 = 5^3 = 125$

$\sqrt[3]{9} \to (\sqrt[3]{9})^6 = 9^2 = 81$

$\sqrt[6]{105} \to (\sqrt[6]{105})^6 = 105^1 = 105$

Ascending order $\Rightarrow \sqrt[3]{9} < \sqrt[6]{105} < \sqrt{5}$

(v) L.C.M. of 2,5,10 & 20 = 20

$\sqrt[5]{4} \rightarrow (\sqrt[5]{4})^{20} = 4^4 = 256$

$\sqrt{7} \rightarrow (\sqrt{7})^{20} = 7^{10} = 16807^2$

$\sqrt[10]{48} \rightarrow (\sqrt[10]{48})^{20} = 48^2 = 2304$

$\sqrt[20]{119} \rightarrow (\sqrt[20]{119})^{20} = 119^1 = 119$

Ascending order $\Rightarrow \sqrt[20]{119} < \sqrt[5]{4} < \sqrt[10]{48} < \sqrt{7}$

4.(i) L.C.M. of 4,6 & 12 = 12

$\sqrt[4]{3} \rightarrow (\sqrt[4]{3})^{12} = 3^3 = 27$

$\sqrt[6]{10} \rightarrow (\sqrt[6]{10})^{12} = 10^2 = 100$

$\sqrt[12]{25} \rightarrow (\sqrt[12]{25})^{12} = 25^1 = 25$

Descending order $\Rightarrow \sqrt[6]{10} > \sqrt[4]{3} > \sqrt[12]{25}$

(ii) L.C.M. of 2,3,4 & 6 = 12

$\sqrt[3]{4} \rightarrow (\sqrt[3]{4})^{12} = 4^4 = 256$

$\sqrt[4]{5} \rightarrow (\sqrt[4]{5})^{12} = 5^3 = 125$

$\sqrt{3} \rightarrow (\sqrt{3})^{12} = 3^6 = 729$

$\sqrt[6]{19} \rightarrow (\sqrt[6]{19})^{12} = 19^2 = 361$

Descending order $\Rightarrow \sqrt{3} > \sqrt[6]{19} > \sqrt[3]{4} > \sqrt[4]{5}$

(iii) L.C.M. of 3,6,9 & 18 = 18

$\sqrt[3]{2} \rightarrow (\sqrt[3]{2})^{18} = 2^6 = 64$

$\sqrt[6]{3} \rightarrow (\sqrt[6]{3})^{18} = 3^3 = 27$

$\sqrt[9]{4} \rightarrow (\sqrt[9]{4})^{18} = 4^2 = 16$

$\sqrt[18]{30} \rightarrow (\sqrt[18]{30})^{18} = 30 = 30$

Descending order $\Rightarrow \sqrt[3]{2} > \sqrt[18]{30} > \sqrt[6]{3} > \sqrt[9]{4}$

(iv) L.C.M. of 2,3,4 & 12 = 12

$\sqrt[4]{10} \rightarrow (\sqrt[4]{10})^{12} = 10^3 = 1000$

$\sqrt[3]{6} \rightarrow (\sqrt[3]{6})^{12} = 6^4 = 1296$

$\sqrt{5} \rightarrow (\sqrt{5})^{12} = 5^6 = 15625$

$\sqrt[12]{78} \rightarrow (\sqrt[12]{78})^{12} = 78^1 = 78$

Descending order $\Rightarrow \sqrt{5} > \sqrt[3]{6} > \sqrt[4]{10} > \sqrt[12]{78}$

(v) L.C.M. of 2,7,14,28 = 28

$\sqrt[7]{4} \rightarrow (\sqrt[7]{4})^{28} = 4^4 = 256$

$\sqrt[28]{17} \rightarrow (\sqrt[28]{17})^{28} = 17^1 = 17$

$\sqrt[14]{11} \rightarrow (\sqrt[14]{11})^{28} = 11^2 = 121$

$\sqrt{2} \rightarrow (\sqrt{2})^{28} = 2^{14} = 16384$

Descending order $\Rightarrow \sqrt{2} > \sqrt[7]{4} > \sqrt[14]{11} > \sqrt[28]{17}$

Prime Factors

1. $2^{11} \times 3^{12} \times 5^7$
2. $5^{12} \times 4^5 \times 7 \times 2^3$
3. $10^5 \times 5^4 \times 13^2$
4. $12^{12} \times 13^{13} \times 14^{14}$
5. $16^8 \times 19^8 \times 17^9 \times 18^2$
6. $40^2 \times 15^2 \times 17^9 \times 18^2$
7. $15^{10} \times 10^{12} \times 20^{12} \times 13^2$
8. $19^{11} \times 20^{11} \times 17^{11} \times 27^{11}$
9. $13^{12} \times 12^{18} \times 17^{15} \times 19^4 \times 7^2$
10. $17^{10} \times 18^{19} \times 18^{19} \times 15^{10} \times 10^2$
11. $45^7 \times 47^9 \times 49^2 \times 81^2$
12. $13^{12} \times 16^{12} \times 18^3 \times 9^{11}$
13. $17^{18} \times 12^{18} \times 33^{11} \times 12^8$
14. $15^{20} \times 30^{20} \times 45^{20} \times 60^9$
15. $17^{10} \times 18^{20} \times 10^5 \times 5^{10}$
16. $12^{13} \times 16^{19} \times 8^{12} \times 13^2$
17. $18^{12} \times 27^3 \times 31^9 \times 57^2$
18. $15^{12} \times 25^{12} \times 45^{12} \times 55^{12}$
19. $47^7 \times 41^7 \times 37^7 \times 14^7$
20. $10^5 \times 20^5 \times 30^5 \times 40^5$

Prime Factors (Solution)

1. $2^{11} \times 3^{12} \times 5^7$

Step-1 Convert given factors into powers of prime numbers.

$2^{11} \times 3^{12} \times 5^7$

Step-2 Add the powers of all the prime numbers.

$11 + 12 + 7 = 30$

i.e. Prime factors = 30

2. $5^{12} \times 4^5 \times 7 \times 2^3$

Step-1 Convert given factors into powers of prime numbers.

$5^{12} \times 2^{2\times5} \times 7^1 \times 2^3 = 2^{13} \times 5^{12} \times 7^1$

Step-2 Add the powers of all the prime numbers.

$13 + 12 + 1 = 26$

i.e. Prime factors = 26

3. $10^5 \times 5^4 \times 13^2$

Step-1 Convert given factors into powers of prime numbers.

$10^5 \times 5^4 \times 13^2 = (2 \times 5)^5 \times 5^4 \times 13^2$

$= 2^5 \times 5^5 \times 5^4 \times 13^2$

$= 2^5 \times 5^9 \times 13^2$

Step-2 Add the powers of all the prime numbers.

$5 + 9 + 2 = 16$

i.e. Prime factors = 16

4. $12^{12} \times 13^{13} \times 14^{14}$

Step-1 Convert given factors into powers of prime numbers.

$12^{12} \times 13^{13} \times 14^{14} = (2\times2\times3)^{12} \times 13^{13} \times (2\times7)^{14}$

$= 2^{12}\times2^{12}\times3^{12}\times13^{13} \times 2^{14}\times7^{14}$

$= 2^{38} \times 3^{12} \times 7^{14} \times 13^{13}$

Step-2 Add the powers of all the prime numbers.

$38 + 12 + 14 + 13 = 77$

i.e. Prime factors = 77

5. $16^{8} \times 19^{8} \times 17^{9} \times 18^{2}$

Step-1 Convert given factors into powers of prime numbers.

$16^{8} \times 19^{8} \times 17^{9} \times 18^{2}$

$= (2\times2\times2\times2)^{8} \times 19^{8} \times 17^{9} \times (2\times3\times3)^{2}$

$= 2^{8} \times 2^{8} \times 2^{8} \times 2^{8} \times 19^{8} \times 17^{9} \times 2^{2} \times 3^{2} \times 3^{2}$

$= 2^{34} \times 3^{4} \times 17^{9} \times 19^{8}$

Step-2 Add the powers of all the prime numbers.

$34 + 4 + 9 + 8 = 55$

i.e. Prime factors = 55

6. $40^{2} \times 15^{2} \times 17^{9} \times 18^{2}$

Step-1 Convert given factors into powers of prime numbers.

$40^{2} \times 15^{2} \times 17^{9} \times 18^{2}$

$= (2^{3} \times 5)^{2} \times (3 \times 5)^{2} \times 17^{9} \times (2 \times 3^{2})^{2}$

$= 2^{6} \times 5^{2} \times 3^{2} \times 5^{2} \times 17^{9} \times 2^{2} \times 3^{4}$

$= 2^{8} \times 3^{6} \times 5^{4} \times 17^{9}$

Step-2 Add the powers of all the prime numbers.

$8 + 6 + 4 + 9 = 27$

i.e. Prime factors = 27

7. $15^{10} \times 10^{12} \times 20^{12} \times 13^{2}$

Step-1 Convert given factors into powers of prime numbers.

$15^{10} \times 10^{12} \times 20^{12} \times 13^{2}$

$= (3 \times 5)^{10} \times (2 \times 5)^{12} \times (2^{2} \times 5)^{12} \times 13^{2}$

$= 3^{10} \times 5^{10} \times 2^{12} \times 5^{12} \times 2^{24} \times 5^{12} \times 13^{2}$

$= 2^{36} \times 3^{10} \times 5^{34} \times 13^{2}$

Step-2 Add the powers of all the prime numbers.

$36 + 10 + 34 + 2 = 82$

i.e. Prime factors = 82

8. $19^{11} \times 20^{11} \times 17^{11} \times 27^{11}$

Step-1 Convert given factors into powers of prime numbers.

$19^{11} \times 20^{11} \times 17^{11} \times 27^{11}$

$= (19)^{11} \times (2^{2} \times 5)^{11} \times (17)^{11} \times (3^{3})^{11}$

$= 19^{11} \times 2^{22} \times 5^{11} \times 17^{11} \times 3^{33}$

$= 2^{22} \times 3^{33} \times 5^{11} \times 17^{11} \times 19^{11}$

Step-2 Add the powers of all the prime numbers.

$22 + 33 + 11 + 11 + 11 = 88$

i.e. Prime factors = 88

9. $13^{12} \times 12^{18} \times 17^{15} \times 19^{4} \times 7^{2}$

Step-1 Convert given factors into powers of prime numbers.

$13^{12} \times 12^{18} \times 17^{15} \times 19^{4} \times 7^{2}$

$= 13^{12} \times (2^{2} \times 3)^{18} \times 17^{15} \times 19^{4} \times 7^{2}$

$= 13^{12} \times 2^{36} \times 3^{18} \times 17^{15} \times 19^{4} \times 7^{2}$

$= 2^{36} \times 3^{18} \times 7^{2} \times 13^{12} \times 17^{15} \times 19^{4}$

Step-2 Add the powers of all the prime numbers.

$36 + 18 + 2 + 12 + 15 + 4 = 87$

i.e. Prime factors = 87

10. $17^{10} \times 18^{19} \times 18^{19} \times 15^{10} \times 10^{2}$

Step-1 Convert given factors into powers of prime numbers.

$17^{10} \times 18^{19} \times 18^{19} \times 15^{10} \times 10^{2}$

$= 17^{10} \times 18^{38} \times 15^{10} \times 10^{2}$

$= 17^{10} \times (2 \times 3^{2})^{38} \times (3 \times 5)^{10} \times (2 \times 5)^{2}$

$= 17^{10} \times 2^{38} \times 3^{76} \times 3^{10} \times 5^{10} \times 2^{2} \times 5^{2}$

$= 2^{40} \times 3^{86} \times 5^{12} \times 17^{10}$

Step-2 Add the powers of all the prime numbers.

$40 + 86 + 12 + 10 = 148$

i.e. Prime factors = 148

11. $45^{7} \times 47^{9} \times 49^{2} \times 81^{2}$

Step-1 Convert given factors into powers of prime numbers.

$45^{7} \times 47^{9} \times 49^{2} \times 81^{2}$

$= (3^{2} \times 5)^{7} \times 47^{9} \times (7^{2})^{2} \times (3^{4})^{2}$

$= 3^{14} \times 5^{7} \times 47^{9} \times 7^{4} \times 3^{8}$

$= 3^{22} \times 5^{7} \times 7^{4} \times 47^{9}$

Step-2 Add the powers of all the prime numbers.

$22 + 7 + 4 + 9 = 42$

i.e. Prime factors = 42

12. $13^{12} \times 16^{12} \times 18^3 \times 9^{11}$

Step-1 Convert given factors into powers of prime numbers.

$13^{12} \times 16^{12} \times 18^3 \times 9^{11}$

$= 13^{12} \times (2^4)^{12} \times (2 \times 3^2)^3 \times (3^2)^{11}$

$= 13^{12} \times 2^{48} \times 2^3 \times 3^6 \times 3^{22}$

$= 2^{51} \times 3^{28} \times 13^{12}$

Step-2 Add the powers of all the prime numbers.

$51 + 28 + 12 = 91$

i.e. Prime factors = 91

13. $17^{18} \times 12^{18} \times 33^{11} \times 12^8$

Step-1 Convert given factors into powers of prime numbers.

$17^{18} \times 12^{18} \times 33^{11} \times 12^8$

$= 17^{18} \times (2^2 \times 3)^{18} \times (3\times3)^{11} \times (2^2\times3)^8$

$= 17^{18} \times 2^{36} \times 3^{18} \times 3^{11} \times 11^{11} \times 2^{16} \times 3^8$

$= 2^{52} \times 3^{37} \times 11^{11} \times 17^{18}$

Step-2 Add the powers of all the prime numbers.

$52 + 37 + 11 + 18 = 118$

i.e. Prime factors = 118

14. $15^{20} \times 30^{20} \times 45^{20} \times 60^9$

Step-1 Convert given factors into powers of prime numbers.

$15^{20} \times 30^{20} \times 45^{20} \times 60^9$

$= (3\times5)^{20} \times (2\times3\times5)^{20} \times (3^2\times5)^{20} \times (2^2\times3\times5)^9$

$= 3^{20}\times5^{20}\times2^{20}\times 3^{20}\times 5^{20} \times 3^{40}\times5^{20} \times 2^{18} \times 3^9 \times5^9$

$= 2^{38} \times 3^{89} \times 5^{69}$

Step-2 Add the powers of all the prime numbers.

$38 + 89 + 69 = 196$

i.e. Prime factors = 196

15. $17^{10} \times 18^{20} \times 10^5 \times 5^{10}$

Step-1 Convert given factors into powers of prime numbers.

$17^{10} \times 18^{20} \times 10^5 \times 5^{10}$

$= 17^{10} \times (2 \times 3^2)^{20} \times (2 \times 5)^5 \times 5^{10}$

$= 17^{10} \times 2^{20} \times 3^{40} \times 2^5 \times 5^5 \times 5^{10}$

$= 2^{25} \times 3^{40} \times 5^{15} \times 17^{10}$

Step-2 Add the powers of all the prime numbers.

$25 + 40 + 15 + 10 = 90$

i.e. Prime factors = 90

16. $12^{13} \times 16^{19} \times 8^{12} \times 13^2$

Step-1 Convert given factors into powers of prime numbers.

$12^{13} \times 16^{19} \times 8^{12} \times 13^2$

$= (2^2 \times13)^{13} \times (2^4)^{19} \times (2^3)^{12} \times (13)^2$

$= 2^{26} \times13^{13} \times 2^{76} \times 2^{36} \times 13^2$

$= 2^{138} \times13^{13} \times13^2$

Step-2 Add the powers of all the prime numbers.

$138 + 13 + 2 = 153$

i.e. Prime factors = 153

17. $18^{12} \times 27^3 \times 31^9 \times 57^2$

Step-1 Convert given factors into powers of prime numbers.

$18^{12} \times 27^3 \times 31^9 \times 57^2$

$= (2 \times3^2)^{12} \times (3^3)^3 \times 31^9 \times (3\times19)^2$

$= 2^{12} \times 3^{24} \times 3^9 \times 31^9 \times 3^2\times19^2$

$= 2^{12} \times 3^{35} \times 19^2 \times 31^9$

Step-2 Add the powers of all the prime numbers.

$12 + 35 + 2 + 9 = 58$

i.e. Prime factors = 58

18. $15^{12} \times 25^{12} \times 45^{12} \times 55^{12}$

Step-1 Convert given factors into powers of prime numbers.

$15^{12} \times 25^{12} \times 45^{12} \times 55^{12}$

$= (3\times5)^{12} \times (5^2)^{12} \times (3^2 \times 5)^{12} \times (5\times11)^{12}$

$= 3^{12} \times 5^{12} \times 5^{24} \times 3^{24} \times 5^{12} \times 5^{12} \times 11^{12}$

$= 3^{36} \times 5^{60} \times 11^{12}$

Step-2 Add the powers of all the prime numbers.

$36 + 60 + 12 = 108$

i.e. Prime factors = 108

19. $47^7 \times 41^7 \times 37^7 \times 14^7$

Step-1 Convert given factors into powers of prime numbers.

$47^7 \times 41^7 \times 37^7 \times 14^7$

$= 47^7 \times 41^7 \times 37^7 \times (2\times7)^7$

$= 2^7 \times 7^7 \times 37^7 \times 41^7$

Step-2 Add the powers of all the prime numbers.

$7 + 7 + 7 + 7 + 7 = 35$

i.e. Prime factors = 35

20. $10^5 \times 20^5 \times 30^5 \times 40^5$

Step-1 Convert given factors into powers of prime numbers.

$10^5 \times 20^5 \times 30^5 \times 40^5 = (240000)^5$

$= (2^7 \times 3^1 \times 5^4)^5$

$= 2^{35} \times 3^5 \times 5^{20}$

Step-2 Add the powers of all the prime numbers.

$35 + 5 + 20 = 60$

i.e. Prime factors = 60

Divisors

1. How many divisors are there of 30 ?
2. How many divisors are there of 170 ?
3. How many divisors are there of 37 ?
4. How many divisors are there of 1500 ?
5. How many divisors are there of 2020 ?
6. Find the total divisors of 2500.
7. Find the total divisors of 1400.
8. Find the odd divisors of 250.
9. Find the odd divisors of 750.
10. Find the even divisors of 1000.
11. Find the even divisors of 500.
12. Find the even divisors of 1200.
13. What will be the sum of the divisors of 300 ?
14. Find the sum of the divisors of 1800.
15. Find the sum of the divisors of 1500.
16. Find the product of the divisors of 100.
17. What will be the product of the divisors of 900 ?
18. Find the product of the divisors of 2500.
19. Find the product of the divisors of 2050.
20. Find the product of the divisors of 1680.

Divisors (Solution)

1. 30

Step-1 : Convert the given number into powers of prime numbers.
$30 = 2^1 \times 3^1 \times 5^1$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(1 + 1)(1 + 1)(1 + 1) = 8$
i.e. total divisors = 8

2. 170

Step-1 : Convert the given number into powers of prime numbers.
$170 = 2^1 \times 5^1 \times 17^1$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(1 + 1)(1 + 1).(1 + 1) = 8$
i.e. total divisors = 8

3. 37

Step-1 : Convert the given number into powers of prime numbers.
$37 = 37^1$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(1 + 1) = 2$
i.e. total divisors = 2

4. 1500

Step-1 : Convert the given number into powers of prime numbers.
$1500 = 2^2 \times 3^1 \times 5^3$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(2 + 1)(1 + 1)(3 + 1) = 24$
i.e. total divisors = 24

5. 2020

Step-1 : Convert the given number into powers of prime numbers.
$2020 = 2^2 \times 5^1 \times 101^1$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(2 + 1)(1 + 1)(1 + 1) = 12$
i.e. total divisors = 12

6. 2500

Step-1 : Convert the given number into powers of prime numbers.
$2500 = 2^2 \times 5^4$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(2 + 1)(4 + 1) = 15$
i.e. total divisors = 15

7. 1400

Step-1 : Convert the given number into powers of prime numbers.
$1400 = 2^3 \times 5^2 \times 7^1$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(3 + 1)(2 + 1)(1 + 1) = 24$
i.e. total divisors = 24

8. 250

Step-1 : Convert the given number into powers of prime numbers.
$250 = 2^1 \times 5^3$

Step-2 : Multiply the power of each odd prime number after adding 1 to the powers.
$(3 + 1) = 4$
i.e. total odd divisors = 4

9. 7500

Step-1 : Convert the given number into powers of prime numbers.
$750 = 2^1 \times 3^1 \times 5^3$

Step-2 : Multiply the power of each odd prime number after adding 1 to the powers.
$(1 + 1)(3 + 1) = 8$
i.e. total odd divisors = 8

10. 1000

Step-1 : Convert the given number into powers of prime numbers.
$1000 = 2^3 \times 5^3$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(3 + 1)(3 + 1) = 16$
i.e. total divisors = 8

Step-3 : Multiply the power of each odd prime number after adding 1 to the powers.
$(3 + 1) = 4$
i.e. total odd divisors = 4

Step-4 : Subtract the number of odd divisors from total number of divisors.
i.e. total even divisors = 16 – 4 = 12

11. 500

Step-1 : Convert the given number into powers of prime numbers.
$500 = 2^2 \times 5^3$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(2 + 1)(3 + 1) = 12$
i.e. total divisors = 12

Step-3 : Multiply the power of each odd prime number after adding 1 to the powers.
$(3 + 1) = 4$
i.e. total odd divisors = 4

Step-4 : Subtract the number of odd divisors from total number of divisors.
i.e. total even divisors = 12 – 4 = 8

12. 1200

Step-1 : Convert the given number into powers of prime numbers.
$1200 = 2^4 \times 3^1 \times 5^2$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(4 + 1)(1 + 1)(2 + 1) = 30$
i.e. total divisors = 30

Step-3 : Multiply the power of each odd prime number after adding 1 to the powers.
$(1 + 1)(2 + 1) = 6$
i.e. total odd divisors = 6

Step-4 : Subtract the number of odd divisors from total number of divisors.
i.e. total even divisors = 30 – 6 = 24

13. 300

Step-1 : Convert the given number into powers of prime numbers.
$300 = 2^2 \times 3^1 \times 5^2$

Step-2 : Multiply the sum of geometric progression of each prime number which is starting from 1 to the last prime number where geometric ratio is that prime number.
$(1 + 2^1 + 2^2) \times (1 + 3^1) \times (1 + 5^1 + 5^2)$

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

$= 7 \times 4 \times 31 = 868$
i.e. sum of divisors = 868

14. 1800

Step-1 : Convert the given number into powers of prime numbers.
$1800 = 2^3 \times 3^2 \times 5^2$

Step-2 : Multiply the sum of geometric progression of each prime number which is starting from 1 to the last prime number where geometric ratio is that prime number.
$(1 + 2^1 + 2^2 + 2^3) \times (1 + 3^1 + 3^2) \times (1 + 5^1 + 5^2)$

$$= \frac{2^4 - 1}{2 - 1} \times \frac{3^3 - 1}{3 - 1} \times \frac{5^3 - 1}{5 - 1} = 15 \times 13 \times 31$$

$= 6045$
i.e. sum of divisors = 6045

15. 1500

Step-1 : Convert the given number into powers of prime numbers.
$1500 = 2^2 \times 3^1 \times 5^3$

Step-2 : Multiply the sum of geometric progression of each prime number which is starting from 1 to the last prime number where geometric ratio is that prime number.

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

$= \frac{2^3 - 1}{2-1} \times \frac{3^2 - 1}{3-1} \times \frac{5^4 - 1}{5-1} = 7 \times 4 \times 156 = 4368$

i.e. sum of divisors = 4368

16. 100

Step-1 : Convert the given number into powers of prime numbers.
$100 = 2^2 \times 5^2$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(2 + 1)(2 + 1) = 9$
i.e. total divisors = 9

Step-3 : Use formula $\rightarrow (\text{Number})^{\frac{\text{Total divisors}}{2}}$

$= (100)^{\frac{9}{2}} = 10^9$

i.e. product of divisors = 10^9

17. 900

Step-1 : Convert the given number into powers of prime numbers.
$900 = 2^2 \times 3^2 \times 5^2$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(2 + 1)(2 + 1)(2 + 1) = 27$
i.e. total divisors = 27

Step-3 : Use formula $\rightarrow (\text{Number})^{\frac{\text{Total divisors}}{2}}$

$= (900)^{\frac{27}{2}} = 30^{27}$

i.e. product of divisors = 30^{27}

18. 2500

Step-1 : Convert the given number into powers of prime numbers.
$2500 = 2^2 \times 5^4$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(2 + 1)(4 + 1) = 15$
i.e. total divisors = 15

Step-3 : Use formula $\rightarrow (\text{Number})^{\frac{\text{Total divisors}}{2}}$

$= (2500)^{\frac{15}{2}} = 50^{15}$

i.e. product of divisors = 50^{15}

19. 2050

Step-1 : Convert the given number into powers of prime numbers.
$2050 = 2^1 \times 5^2 \times 4^1$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(1 + 1)(2 + 1)(1 + 1) = 12$
i.e. total divisors = 12

Step-3 : Use formula $\rightarrow (\text{Number})^{\frac{\text{Total divisors}}{2}}$

$= (2050)^{\frac{12}{2}} = (2050)^6$

i.e. product of divisors = $(2050)^6$

20. 1680

Step-1 : Convert the given number into powers of prime numbers.
$1680 = 2^4 \times 3^1 \times 5^1 \times 7^1$

Step-2 : Multiply the power of each prime number after adding 1 to the powers.
$(4 + 1)(1 + 1)(1 + 1)(1 + 1) = 40$
i.e. total divisors = 40

Step-3 : Use formula $\rightarrow (\text{Number})^{\frac{\text{Total divisors}}{2}}$

$= (1680)^{\frac{40}{2}} = (1680)^{20}$

i.e. product of divisors = $(1680)^{20}$

Division

1. If a number is divided by 60 then we get 16 as remainder. If the same number is divided by 12, what will be the remainder?
2. If a number is divided by 84 then we get 20 as remainder. If twice of the number is divided by 21, what will be the remainder?
3. If a number is divided by 65 then we get 30 as remainder. If square of the number is divided by 13, what will be the remainder?
4. If a number is divided by 96 then we get 14 as remainder. If thrice of the number is divided by 16, what will be the remainder?

5. If a number is divided by 71 then we get 37 as remainder. If the same number is divided by 29, what will be the remainder?
6. If a number is divided by 63 then we get 4 as remainder. If cube of that number is divided by 9, what will be the remainder?
7. If a number N is divided by 132 then we get 10 as remainder. If N^2 is divided by 12, what will be the remainder?
8. If a number N is divided by 179 then we get 19 as remainder. If N^3 is divided by 23, what will be the remainder?
9. If a number is divided by 5 then we get 3 as remainder. If square of this number is divided by 5, what will be the remainder?
10. If a number is divided by 17 then we get 5 as remainder. If the cube of this number is divided by 17, what will be the remainder?
11. If a number P is divided by 228 then we get 4 as remainder. If the P^4 is divided by 19, what will be the remainder?
12. If a number is divided by 293, then we get 179 as remainder. If the same number is divided by 142, what will be the remainder?

Division (Solution)

1. Let number = N
ATQ,
$N = 60Q + 16$ (Where Q is quotient)
$= 12 \times (5Q) + 12 + \boxed{4} \rightarrow$ remainder
So, when the number is divided by 12 then the remainder will be 4.

2. Let number = N
ATQ,
$N = 84Q + 20$ (Where Q is quotient)
$2N = 168Q + 40$
$= 21 \times (8Q) + 21 + \boxed{19} \rightarrow$ remainder
So, when twice of the number is divided by 21 then the remainder will be 19.

3. Let number = N
ATQ,
$N = 65Q + 30$ (Where Q is quotient)
$N^2 = (65)^2Q^2 + 900 + 2 \times 65Q \times 30$
$N^2 = 13 \times (325Q^2) + 13 \times (300Q)$
$+ 3 \times 69 + \boxed{3} \rightarrow$ remainder
So, when square of the number is divided by 13 then the remainder will be 3.

4. Let number = N
ATQ,
$N = 96Q + 14$ (Where Q is quotient)
$3N = 16 \times (18Q) + 16 \times 2 + \boxed{10} \rightarrow$ remainder
So, when thrice of the number is divided by 16 then the remainder will be 10.

5. Let number = N
ATQ,
$N = 71Q + 37$ (Where Q is quotient)
$N = 29 \times 2Q + 13Q + 29 + 8$
$= 29 \times 2Q + 29 + \boxed{13Q + 8} \rightarrow$ remainder
So, data is incomplete if we want to get the remainder.

6. Let number = N
ATQ,
$N = 63Q + 4$ (Where Q is quotient)
$N^3 = (63)^3 Q^3 + 3 \times 63Q \times 4(63Q + 4) + 64$
$= 9[3 \times (21)^3Q^3 + 81Q(63Q + 4)]$
$+ 9 \times 7 + \boxed{1} \rightarrow$ remainder
So, when cube of the number is divided by 9 then the remainder will be 1.

7. Let number = N
ATQ,
$N = 132Q + 10$ (Where Q is quotient)
$N^2 = (132Q^2) + 2 \times 132Q \times 10 + 100$
$= (132Q^2) + 12 \times (2 \times 11Q \times 10)$
$\times 12 \times 8 + \boxed{4} \rightarrow$ remainder
So, when square of the number is divided by 12 then the remainder will be 4.

8. Let number = N
ATQ,
$N = 179Q + 19$ (Where Q is quotient)
179 is not a multiple of 23, so remainder cannot be calculated.

9. Let number = N
ATQ,
$N = 5Q + 3$ (Where Q is quotient)
$N^2 = 5Q^2 + 2 \times 5Q \times 3 + 9$
$= 5 \times 5Q^2 + 5 \times 6Q + 5 + \boxed{4} \rightarrow$ remainder
So, when the square of the number is divided by 5 then the remainder will be 4.

10. Let number = N
ATQ,
$N = 17Q + 5$ (Where Q is quotient)
$N^3 = (17Q)^3 + 3 \times 17Q \times 5(17Q + 5) + 125$
$= 17(289Q^3) + 17 \times 15Q(17Q + 5) + 17 \times 7 + \boxed{6} \rightarrow$ remainder
So, when the cube of the number is divided by 17 then the remainder will be 6.

11. Given number = P
ATQ,
$P = 228Q + 4$ (Where Q is quotient)
$= 19 \times 12Q + 4$
So, when P^4 will be divided by 19, it will give the same remainder as when 4^4 is divided by 19.
$4^4 = 256 = 19 \times 13 + \boxed{9} \rightarrow$ remainder
So, when P^4 will be divided by 19 then remainder will be 9.

12. Let number = N
ATQ,
$N = 293Q + 179$ (Where Q is quotient)
$= 142 \times 2Q + 9Q + 142 + 37$
$= 142 \times 2Q + 142 + \boxed{9Q + 37} \rightarrow$ remainder
So, data is incomplete if we want to get the remainder.

Successive Division

1. A number on being successively divided by 12 and 15 leaves remainder 4 and 6 respectively. Find the remainder when the same number is divided by 180.
2. A number on being successively divided by 5 and 7 leaves remainder 3 and 6 respectively. Find the remainder when the same number is divided by 35.
3. A number on being successively divided by 10 and 11 leaves remainder 5 and 7 respectively. Find the remainder when the same number is divided by 110.
4. A number is successively divided by 7,5 and 4 then remainder are 1,4 and 2 respectively. If the same number is successively divided by 4,5 and 7 then find the remainders.
5. If a number is successively divided by 11,7 and 9 then remainder are 1,4 and 8 respectively. If the same number is successively divided by 5,6 and 7. Then find the remainders.

Successive Division (Solution)

1.

12	x	4
15	y	6
×	1	+

In this type of question x will always be the Number.
$y = 15 \times 1 + 6 = 21$
$x = 12 \times 21 + 4 = 256$
Now, $256 \div 180$
↓
Remainder = 76

2.

5	x	3
7	y	6
	1	

$y = 7 \times 1 + 6 = 13$
$x = 5 \times 13 + 3 = 68$
Now, $68 \div 35$
↓
Remainder = 33

3.

10	x	5
11	y	7
	1	

$y = 11 \times 1 + 7 = 18$
$x = 10 \times 18 + 5 = 185$
$185 \div 110$
↓
Remainder = 75

4.

7	x	1
5	y	4
4	z	2
	1	

$z = 4 \times 1 + 2 = 6$
$y = 5 \times 6 + 4 = 34$
$x = 7 \times 34 + 1 = 239$
Now, 239 divided successively by 4,5,7

$239 \div 4$	$59 \div 5$	$11 \div 7$
↓	↓	↓
quotient = 59	quotient = 11	Remainder = 4
↓	↓	
Remainder = 3	Remainder = 4	

Remainder = (3,4,4)

5.

11	x	1
7	y	4
9	z	8
	1	

$z = 9 \times 1 + 8 = 17$
$y = 7 \times 17 + 4 = 123$
$x = 11 \times 123 + 1 = 1354$

$1354 \div 5$	$270 \div 6$	$45 \div 7$
↓	↓	↓
quotient = 270	quotient = 45	Remainder = 3
↓	↓	
Remainder = 4	Remainder = 0	

Remainder = (4,0,3)

Counting of Zeroes

Find the number zeroes in the products of the questions given below.

1. $25 \times 75 \times 95 \times 135 \times 37 \times 93 \times 64$.
2. $1 \times 2 \times 3 \times 4 \times 5 \times \ldots\ldots\ldots\ldots \times 100$.
3. $2 \times 4 \times 6 \times 8 \times 10 \times \ldots\ldots\ldots\ldots \times 200$.
4. $1 \times 2 \times 3 \times 4 \times 5 \times \ldots\ldots\ldots\ldots \times 273$.
5. $10 \times 20 \times 30 \times 40 \times \ldots\ldots\ldots\ldots \times 1000$.
6. $3 \times 6 \times 9 \times 12 \times \ldots\ldots\ldots\ldots \times 600$
7. $7 \times 14 \times 21 \times 28 \times \ldots\ldots\ldots\ldots \times 2100$
8. $100 \times 200 \times 300 \times 400 \times \ldots\ldots\ldots\ldots \times 5000$.
9. $5 \times 10 \times 15 \times 20 \times \ldots\ldots\ldots\ldots \times 500$.
10. $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times \ldots\ldots\ldots\ldots \times 378 \times 379$.
11. $222^{333} \times 555^{666}$
12. $27! \times 397! \times 435!$
13. $876! \times 3257! \times 783!$
14. $44^{56} \times 22^{38} \times 55^{190} \times 35^{7}$
15. $312^{312} \times 715^{311}$

Counting of Zeroes (Solution)

1. $25 \times 75 \times 95 \times 135 \times 37 \times 93 \times 64$

To find the zeros at the end of the product.

Step - 1 Find the power of 2 in the given equation.

25 ×	75 ×	95 ×	135 ×	37 ×	93 ×	64
↓	↓	↓	↓	↓	↓	↓
$\underbrace{2^0}_{\text{since we have no 2 in 25 i.e. } 5\times5}$	2^0	2^0	2^0	2^0	2^0	2^6

Step - 2 Add the power of 2.
$0 + 0 + 0 + 0 + 0 + 0 + 6 = 6$

Step - 3 Find the power of 5 in given equation.

25 ×	75 ×	95 ×	135 ×	37 ×	93 ×	64
↓	↓	↓	↓	↓	↓	↓
5^2	5^2	5^1	5^1	5^0	5^0	5^0

Step - 4 Add the power of 5.
$2 + 2 + 1 + 1 + 0 + 0 + 0 = 6$

Step - 5 Number of zeros = Least number from step 2 and step 4.
Number of zeroes in equation = 6.

2. $1 \times 2 \times 3 \times 4 \ldots\ldots\ldots \times 99 \times 100 = 1100$

In case of factorial the following steps follow.

Step - 1 Divide the factorial number term by 5.
$$\frac{100}{5} = 20$$

Step - 2 Repeat step 1 till Quotient comes less than 5.
$$\frac{20}{5} = 4$$

Step - 3 Add all quotients $20 + 4 = 24$

Step - 4 Number of zeros = Sum of quotients.
= 24

3. $2 \times 4 \times 6 \times \ldots\ldots\ldots \times 198 \times 200$
$= 2^{100} \times (1 \times 2 \times 3 \times \ldots\ldots \times 99 \times 100)$
$= 2^{100} \times \underline{|100}$

Number of zeroes in $2^{100} \times \underline{|100}$
= Number of zeroes in $\underline{|100}$
= 24.
[from question number 2]

4. $1 \times 2 \times 3 \times \ldots\ldots \times 272 \times 273 = \underline{|273}$

Step - 1 Quot. of $\frac{273}{5}$ is 54.

Step - 2 Quot. of $\frac{54}{5}$ is 10.

Step - 3 Quot. of 10 is 2.

Step - 4 Number of zeroes = Sum of quotients
= 54 + 10 + 2
= 66

5. $10 \times 20 \times 30 \times \ldots\ldots\ldots\ldots \times 990 \times 1000$
$= 10^{100} \times (1 \times 2 \times 3 \times \ldots\ldots\ldots 99 \times 100)$
$= 10^{100} \times \underline{|100}$

Number of zeroes in $10^{100} \times \underline{|100}$

$= \underbrace{100}_{\text{Power of 10}} + \underbrace{24}_{\text{Number of zeroes in } \underline{|100}}$

= 124

6. $3 \times 6 \times 9 \times \ldots\ldots\ldots\ldots \times 597 \times 600$
$= 3^{200} \times (1 \times 2 \times 3 \times \ldots\ldots \times 199 \times 200)$
$= 3^{200}\ \underline{|200}$

Number of zeroes in $3^{200} \times \underline{|200}$

$= \text{Q.of}\left(\frac{200}{5} i.e. 40\right)$

$+ \text{Q. of}\left(\frac{40}{5} i.e. 5\right)$

$+ \text{Q. of}\left(\frac{8}{5} i.e. 1\right) = 40 + 8 + 1$
= 49

7. $7 \times 14 \times 21 \times 9 \ldots\ldots\ldots 2093 \times 2100$
$= 7^{300} \times (1 \times 2 \times 3 \times \ldots\ldots \times 299 \times 300)$
$= 7^{300} \times \underline{|300}$

Number of zeroes in $7^{300} \times \underline{|300}$
= Number of zeroes in $\underline{|300}$

$= \text{Quot. of}\left(\frac{300}{5} i.e. 60\right) + \text{Quot. of}\left(\frac{60}{5} i.e. 12\right)$

$+ \text{Quot. of}\left(\frac{12}{5} i.e. 2\right)$

= 60 + 12 + 2 = 74

8. $100 \times 200 \times 300 \times \ldots\ldots\ldots 4900 \times 5000$
$= 100^{50} \times (1 \times 2 \times 3 \times \ldots\ldots \times 49 \times 50)$
$= 10^{100} \times \underline{|50}$

Number of zeroes in $10^{100} \times \underline{|50}$

$= \underbrace{100}_{\text{power of 10}} + \text{Number of zeroes in } \underline{|50}$

$= 100 + \text{Quot. of}\left(\frac{50}{5} i.e. 10\right)$

$+ \text{Quot. of}\left(\frac{10}{5} i.e. 2\right)$

= 100 + 10 + 2 = 112

9. $5 \times 10 \times 15 \times \ldots\ldots\ldots\ldots \times 495 \times 500$
$= 5^{100} \times (1 \times 2 \times 3 \times \ldots\ldots\ldots \times 99 \times 100)$

Step - 1 Power of 2 in given number

$= \text{Quot. of}\left(\frac{100}{2} i.e. 50\right) + \text{Quot. of}\left(\frac{50}{2} i.e. 25\right)$

$+ \text{Quot. of}\left(\frac{25}{2} i.e. 12\right) + \text{Quot. of}\left(\frac{12}{2} i.e. 6\right)$

$+ \text{Quot. of}\left(\frac{6}{2} i.e. 3\right) + \text{Quot. of}\left(\frac{3}{2} i.e. 1\right)$

= 50 + 25 + 12 + 6 + 3 + 1 = 97

Step - 2 Power of 5 in given number

$= 100 + \text{Quot. of}\left(\frac{100}{5} i.e. 20\right)$

$+ \text{Quot. of} \left(\frac{20}{5} \text{ i.e. } 4\right)$

$= 100 + 20 + 4 = 124$

Step - 3 Number of zeroes = Least number from step 1 and step 2 = 97

10. $1 \times 2 \times 3 \times \ldots\ldots \times 378 \times 379 = \lfloor 379$

Number of zeroes in $\lfloor 379$

$= \text{Quot. of} \left(\frac{379}{5} \text{ i.e. } 75\right) + \text{Quot. of} \left(\frac{75}{5} \text{ i.e. } 15\right)$

$+ \text{Quot. of} \left(\frac{15}{5} \text{ i.e. } 3\right)$

$= 75 + 15 + 3 = 93$

11. $222^{333} \times 555^{666} = 2^{333} \times 111^{333} \times 5^{666} \times 111^{666}$

$= 2^{333} \times 5^{666} \times 111^{999}$

So, number of zeroes in $222^{333} \times 555^{666}$
= Least power of 2 or 5 = 333

12. Number of zeroes in $27! \times 397! \times 435!$

$= \text{Quot. of} \left(\frac{27}{5} \text{ i.e. } 5\right) + \text{Quot. of} \left(\frac{5}{5} \text{ i.e. } 1\right)$

$+ \text{Quot. of} \left(\frac{397}{5} \text{ i.e. } 79\right) + \text{Quot. of} \left(\frac{79}{5} \text{ i.e. } 15\right)$

$+ \text{Quot. of} \left(\frac{15}{5} \text{ i.e. } 3\right) + \text{Quot. of} \left(\frac{435}{5} \text{ i.e. } 87\right)$

$+ \text{Quot. of} \left(\frac{87}{5} \text{ i.e. } 17\right) + \text{Quot. of} \left(\frac{17}{5} \text{ i.e. } 3\right)$

$= 5 + 1 + 79 + 15 + 3 + 87 + 17 + 3$
$= 210$

13. Number of zeroes in $876! + 3257! + 783!$

$= + \text{Q. of} \left(\frac{876}{5} \text{ i.e. } 175\right) + \text{Q. of} \left(\frac{175}{5} \text{ i.e. } 35\right) + \text{Q. of} \left(\frac{35}{5} \text{ i.e. } 7\right) +$

$\text{Q.of} \left(\frac{7}{5} \text{ i.e. } 1\right)$

$+ \text{Q. of} \left(\frac{3257}{5} \text{ i.e. } 651\right) + \text{Q. of} \left(\frac{651}{5} \text{ i.e. } 130\right)$

$+ \text{Q.of} \left(\frac{130}{5} \text{ i.e. } 26\right) + \text{Q. of} \left(\frac{26}{5} \text{ i.e. } 5\right)$

$+ \text{Q. of} \left(\frac{5}{5} \text{ i.e. } 1\right) + \text{Q. of} \left(\frac{783}{5} \text{ i.e. } 156\right)$

$+ \text{Q. of} \left(\frac{156}{5} \text{ i.e. } 31\right) + \text{Q. of} \left(\frac{31}{5} \text{ i.e. } 6\right)$

$+ \text{Q. of} \left(\frac{6}{5} \text{ i.e. } 1\right)$

$= \underbrace{175 + 35 + 7 + 1}_{\text{zeroes of } 876!} + \underbrace{651 + 130 + 26 + 5 + 1}_{\text{zeroes of } 3257!}$

$+ \underbrace{156 + 31 + 6 + 1}_{\text{zeroes of } 783!}$

$= 218 + 813 + 194 = 1225$

14. $44^{56} \times 22^{38} \times 55^{190} \times 35^{7}$

$= (2^2)^{56} \times (11)^{56} \times 2^{38} \times 11^{38} \times 5^{190} \times 11^{190} \times 5^7 \times 7^7$

$= 2^{112+38} \times 5^{190+7} \times 7^7 \times 11^{56+38}$

$= 2^{150} \times 5^{197} \times 7^7 \times 11^{94}$

Number of zeroes in $44^{56} \times 22^{38} \times 55^{190} \times 35^7$
= Least power of 2 or 5
= 150

15. $312^{312} \times 715^{311} = (2 \times 2 \times 2 \times 3 \times 13)^{312} \times (5 \times 11 \times 13)^{311}$

$= 2^{3 \times 312} \times 3^{312} \times 5^{311} \times 11^{311} \times 13^{312+311}$

$= 2^{936} \times 3^{312} \times 5^{311} \times 11^{311} \times 3^{623}$

Number of zeroes in $312^{312} \times 715^{311}$
= Least power of 2 or 5 = 311