



## Number System

- **Classification of Numbers** (संख्याओं का वर्गीकरण)
- **Unit Digit** (इकाई का अंक)
- **Factors** (गुणखंड)
- **Number of Zero** (शून्यों की संख्या)
- **Rules of Divisibility** (विभाज्यता के नियम)
- **Remender Theorom** (शेषफल परिमेय)



# Foundation Batch

# MATHS



## Number System factors (गुणनखंड)

Part- 03

LIVE

27-02-2024

07:00PM







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

Find the number of prime factors  
in the product of  $(30)^5 \times (24)^5$ .

$$2^5 \times 3^5 \times 5^5 \times 2^{15} \times 3^5$$

$$2^{20} \times 3^{10} \times 5^5$$

$$20 + 10 + 5$$

$$35$$

$(30)^5 \times (24)^5$  के गुणनफल में अभाज्य  
गुणनखंडों की संख्या ज्ञात कीजिए।

✓ 1. 35

2. 45

3. 10

4. 30

$$8 \times 3$$

$$\begin{array}{r}
 5 \overline{) 303020} \\
 \underline{15} \phantom{00} \\
 15 \phantom{00} \\
 \underline{10} \phantom{00} \\
 50 \phantom{00} \\
 \underline{40} \phantom{00} \\
 100 \phantom{00} \\
 \underline{100} \phantom{00} \\
 0
 \end{array}$$

$$2 \times 3$$

$$2 + 3 = 5$$

$$\begin{array}{r}
 4 \overline{) 36} \\
 \underline{32} \phantom{00} \\
 40 \phantom{00} \\
 \underline{36} \phantom{00} \\
 4
 \end{array}$$

$$2^6 \times 3^4 \times 5^2$$

factor  $\rightarrow$  30 के multiple.

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

$$\downarrow \downarrow$$
$$6 \times 4 \times 2 = \textcircled{48}$$

Ans

सम गुणखंड  
even factor

$$\textcircled{2} \times 3^3 \times 5^1$$

$$\textcircled{2} \times (2^1 \times 3^3 \times 5^1)$$





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$$\begin{array}{l}
 120 \\
 \swarrow \searrow \\
 12 \times 10 \\
 \downarrow \quad \downarrow \\
 4 \times 3 \quad 2 \times 5 \\
 \downarrow \\
 2^2 \times 3
 \end{array}$$

$$= 2^3 \times 3^1 \times 5^1$$

27. How many factors of the number  $2^8 \times 3^6 \times 5^4 \times 10^5$  are multiples of 120?

संख्या  $2^8 \times 3^6 \times 5^4 \times 10^5$  के कितने गुणखंड 120 के गुणज हैं?

- (a) 540      (b) 660  
(c) 594      (d) 792

$$\begin{array}{l}
 2^3 \times 3^1 \times 5^1 \\
 (2^5 \times 3^5 \times 5^3 \times 2^5 \times 5^5) \\
 (2^{10} \times 3^5 \times 5^8) \\
 11 \times 6 \times 9 \\
 66 \times 9 \\
 594
 \end{array}$$

$$2^5 \times 5^5$$





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$$a^2 = \text{पूर्ण वर्ग}$$

28. How many factors of  $2^5 \times 3^6 \times 5^2$

are perfect squares?

$$\cancel{2} \times (2^2)^2 \times (3^2)^3 \times (5^2)^1$$

$2^5 \times 3^6 \times 5^2$  के कितने गुणखंड पूर्ण वर्ग हैं?

Total factors  
कुल गुणखंड

$$\rightarrow (2+1) \times (3+1) \times (1+1)$$

(a) 18  
(b) 24  
(c) 36  
(d) 8

$$3 \times 4 \times 2$$

(24)

II<sup>nd</sup> method

$$\frac{\text{Power}}{2} = \text{भागफल (Q) + 1}$$

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

$$\frac{6}{2} (3+1) = 4$$

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

(24)

$$2^{\textcircled{4}} \times 3^{\textcircled{2}} \times 7^5$$

factors  $\rightarrow$  200 900

$$\frac{0}{1} (4+1) = 5$$

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

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

$$\textcircled{60}$$



$$a^3 = \text{पूर्ण घन}$$

$$2^{11} \times 3^{17} \times 5^6$$

factor  $\rightarrow$  पूर्ण घन (Perfect cube)

$$\frac{\text{Power}}{3} \Rightarrow (\text{भागफल } Q+1)$$

$$\frac{11}{3} = (3+1) = 4$$

$$\frac{17}{3} (5+1) = 6$$

$$\frac{6}{3} (2+1) = \frac{3}{\textcircled{72}}$$



$$(9)^9 = (3^2)^9$$

$$3^{18}$$

$$\frac{18}{3} = (6+1) \\ = 7$$

29. If  $N = 9^9$ , then  $N$  is the divisible by how many positive perfect cubes ?

यदि  $N = 9^9$  है, तो  $N$  कितने धनात्मक पूर्ण घनों से विभाज्य है?

(a) 6

~~(c) 4~~

~~(b) 7~~

(d) 5





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$$a^2 \times a^3 = a^5$$

30. Find the number of factors of  $9^7 \times$

$(3^2)^7 \times (2^2 \times 3)^{10} \times 7^9 \times (2^2 \times 5)^7 \times 12^{10} \times 7^9 \times 20^7 \times 25^9$  which are perfect

square and perfect cube both?

$= 3^{14} \times 2^{20} \times 3^{10} \times 7^9 \times 2^{14} \times 5^7 \times 5^{18} \times 9^7 \times 12^{10} \times 7^9 \times 20^7 \times 25^9$  के गुणखण्डों

की कुल संख्या ज्ञात कीजिये जो पूर्ण वर्ग और पूर्ण घन दोनों हैं ?

$$2^{34} \times 3^{24} \times 5^{25} \times 7^9$$

$$\frac{34}{6}(5+1) \quad \frac{9}{6}(1+1)$$

$$\frac{24}{6}(4+1)$$

$$\frac{25}{6}(4+1)$$

$$6 \times 5 \times 5 \times 2 = 300$$

(a) 150 (b) 60

(c) 120 (d) 300

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





$$(N) \Rightarrow a^7$$

8 गुणनखंड

$$\begin{array}{c} \Downarrow \\ \textcircled{2} \times \textcircled{2} \times \textcircled{2} \\ a^1 \quad b^2 \quad c^3 \end{array}$$

$$\Rightarrow \begin{array}{c} a^1 \times b^1 \times c^1 \\ 2^1 \times 3^1 \times 5^1 \end{array}$$

$$2 \times 3 \times 5 = \textcircled{30}$$

31. If a number  $N$  has 8 factors then find the minimum value of  $N$ ?

यदि किसी संख्या  $N$  के 8 गुणनखंड हैं तो  $N$  का न्यूनतम मान ज्ञात कीजिए?

(a) 15  $\rightarrow 3^1 \times 5^1 = 2 \times 2 = \textcircled{4}$

(b) 45  $\Rightarrow 3^2 \times 5^1 = 3 \times 2 = 6$

~~(c) 30~~  $= 2^1 \times 3^1 \times 5^1 = 2 \times 2 \times 2 = 8$

(d) 55  $\Rightarrow 5^1 \times 11^1 = 2 \times 2 = 4$





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UPSC  
CSAT

32. Five numbers P, Q, R, S and T have 40, 15, 3, 28 and 34 number of factors respectively. Which of these could be perfect cube ?

पाँच संख्या P, Q, R, S और T के गुणनखंडों की संख्या क्रमशः 40, 15, 3, 28 और 34 हैं। इनमें से कौन सा एक पूर्ण घन हो सकता है ?

- (a) Only P, Q and R (b) Only Q and R  
 (c) Only P, S and T (d) Only P and S

$P \rightarrow 40$   
 $40 + 1 = 40$   
 $40 - 39 = 1$

$Q \rightarrow 15$   
 $15 - 1 = 14$

$R \rightarrow 3$   
 $3 - 1 = 2$

$S \rightarrow 28$   
 $28 - 1 = 27$

$T \rightarrow 34$   
 $34 - 1 = 33$

$P^{39}$

$Q^{14}$

$R^2$

$S^{27}$

$T^{33}$

P S T







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## MATHS



$$4^{11} + 4^{12} + 4^{13} + 4^{14}$$

$$4^{11} [1 + 4 + 4^2 + 4^3]$$

$$(2^2)^{11} [1 + 4 + 16 + 64]$$

$$2^{22} \times 85$$

$$5 \times 17$$

$$2^{22} \times 5^1 \times 17^1$$

$$(22+1) \times (1+1) \times (1+1)$$

$$23 \times 2 \times 2 = 92$$

33. If  $N = 4^{11} + 4^{12} + 4^{13} + 4^{14}$ , then how many positive factors of  $N$  are there?

यदि  $N = 4^{11} + 4^{12} + 4^{13} + 4^{14}$ , तो  $N$  के कितने सकारात्मक गुणखंड हैं?

(a) 92

(b) 48

(c) 50

(d) 51



$5^{10} [5^3 + 5^2 + 5^1 + 1]$  34. Find the total number of factors of  $5^{13} + 5^{12} + 5^{11} + 5^{10}$ .

$5^{10} [125 + 25 + 5 + 1]$  गुणखंडों की कुल संख्या ज्ञात कीजिये।

$$5^{10} \times 156$$

$$12 \times 13$$

$$\downarrow$$

$$4 \times 3$$

$$\downarrow$$

$$2^2$$

$$2^2 \times 3^1 \times 5^{10} \times 13^1$$

$$3 \times 2 \times 11 \times 2$$

$$= 132$$

✓ (a) 132

(b) 143

(c) 46

(d) 20

$$\begin{array}{r} 2 \overline{) 156} \\ \underline{78} \phantom{0} \\ 78 \phantom{0} \\ \underline{78} \phantom{0} \\ 0 \end{array}$$

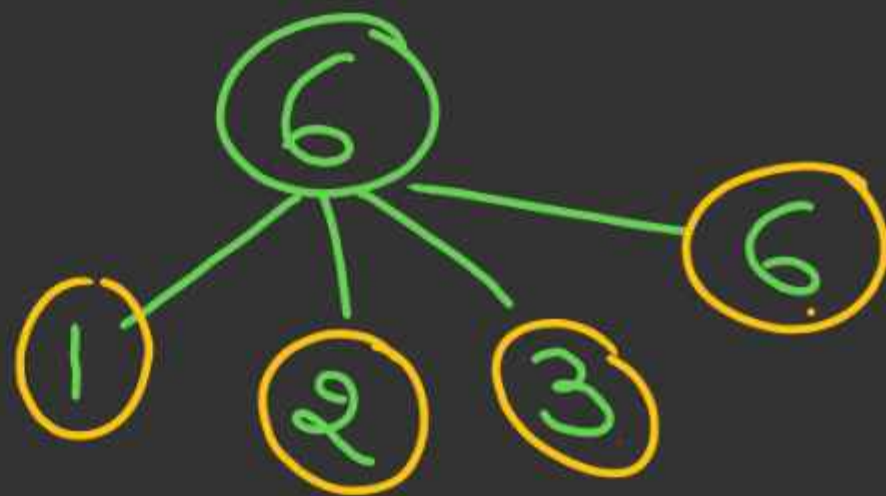
$$2^2 \times 3^1 \times 13^1$$



$$\begin{array}{c}
 6 \\
 \downarrow \\
 2^1 \times 3^1 \\
 \downarrow \quad \downarrow \\
 (2^0 + 2^1) \quad (3^0 + 3^1)
 \end{array}$$

$$\begin{aligned}
 &1 + 3 + 2 + 6 \\
 &= \underline{\underline{12}}
 \end{aligned}$$

Sum of factors  
गुणनखंडों का योग



सभी का योग = 12  
 सम का योग = 8  
 विषम का योग = 4

$$\begin{array}{c}
 \boxed{36} \\
 \swarrow \quad \searrow \\
 4 \quad \times \quad 9 \\
 2^2 \quad \times \quad 3^2 \\
 \times \\
 (2^0 + 2^1 + 2^2) \times (3^0 + 3^1 + 3^2) \\
 \times \\
 (1 + 2 + 4) \times (1 + 3 + 9)
 \end{array}$$

$$\boxed{1, 3, 9 \mid 2, 6, 18, 4, 12, 36}$$

↓  
सम गुणजों का योग







$$\begin{array}{r} 2 \overline{) 56} \\ \underline{28} \\ 28 \\ \underline{28} \\ 0 \end{array}$$

$$2^3 \times 7^1$$

37. What is the sum of all the factors of the number 56?

संख्या 56 के सभी गुणनखंडों का योगफल कितना है?

① सभी गुणनखंडों का योग  
Sum of all factors

$$(2^0 + 2^1 + 2^2 + 2^3) \times (7^0 + 7^1)$$

$$(1 + 2 + 4 + 8) \times (1 + 7)$$

$$15 \times 8 = 120$$

1. 64

2. 120

3. 63

4. उपर्युक्त में से एक से अधिक

$$8 \times 7$$

$$2^3 \times 7$$



$$\begin{array}{c} 56 \\ \downarrow \\ 2^3 \times 7^1 \end{array}$$

② Sum of even factors  
सम गुणखंडों का योग

$$(2^0 + 2^1 + 2^2 + 2^3) \times (7^0 + 7^1)$$

$$(2 + 4 + 8) \times (1 + 7)$$

$$14 \times 8 = 112$$

✓

2 है उसकी 56  
 $\swarrow \searrow$   
 $2^3 \times 7^1$

③ Sum of odd factors  
 विषम गुणकों का योग .

$$(7^0 + 7^1) = \underbrace{1 + 7} = \underline{8}$$





$$\begin{array}{l}
 324 \times 10 \\
 \downarrow \quad \swarrow \searrow \\
 (18)^2 \quad 2 \times 5 \\
 \swarrow \searrow \\
 (2 \times 3^2)^2 \\
 2^2 \times 3^4 \times 2 \times 5 \\
 \boxed{2^3 \times 3^4 \times 5^1}
 \end{array}$$

38. Find the sum of factors of 3240

3240 के गुणनखण्डों का योग ज्ञात कीजिए

1. 10890

2. 11000

3. 10800

$$\begin{array}{r}
 2 \overline{) 3240} \\
 \hline
 \end{array}$$

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

$$(1 + 2 + 4 + 8) (1 + 3 + 9 + 27 + 81) (1 + 5)$$

$$15 \times 121 \times 6 \Rightarrow 121 \times 90 = \underline{10890}$$

$$3240 \rightarrow 2^3 \times 3^4 \times 5^1$$

Q → सम गुणनखंडों का योग

Sum of even factors

$$\cancel{(2^0 + 2^1 + 2^2 + 2^3)} \times \underbrace{(3^0 + 3^1 + 3^2 + 3^3 + 3^4)}_{\downarrow 121} (5^0 + 5^1) \downarrow 6$$

$$14 \times 121 \times 6$$

$$1694 \times 6$$

$$\underline{10164}$$



$$3240 \rightarrow 2^3 \times 3^4 \times 5^1$$

Q  $\rightarrow$  विषम गुणनखंडों का योग  
Sum of odd factors

2<sup>1</sup> है दुखनी

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

$$121 \times 6$$

$$= 726$$

