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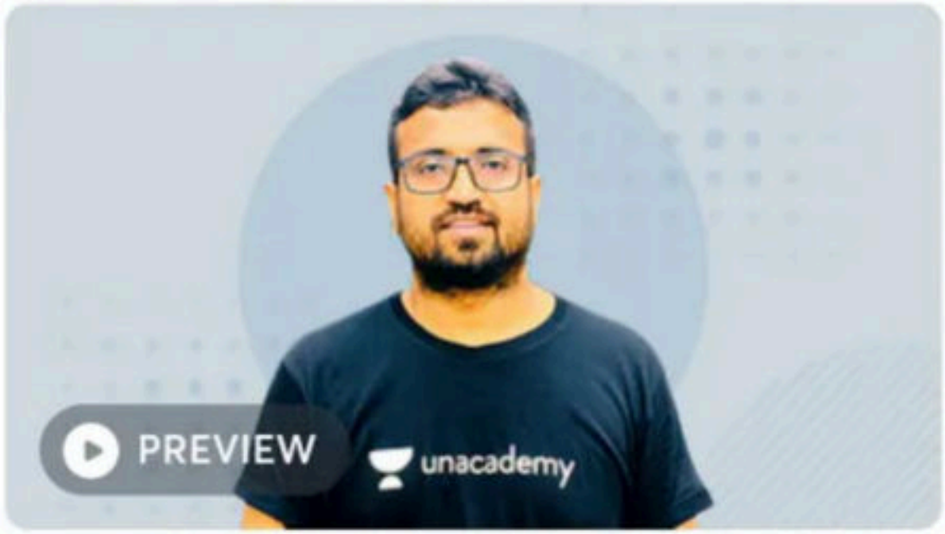
Number System - Part V

Complete Course on General Aptitude - GATE & ESE, 2024 & 2025

Saurabh Thakur • Lesson 7 • May 14, 2023



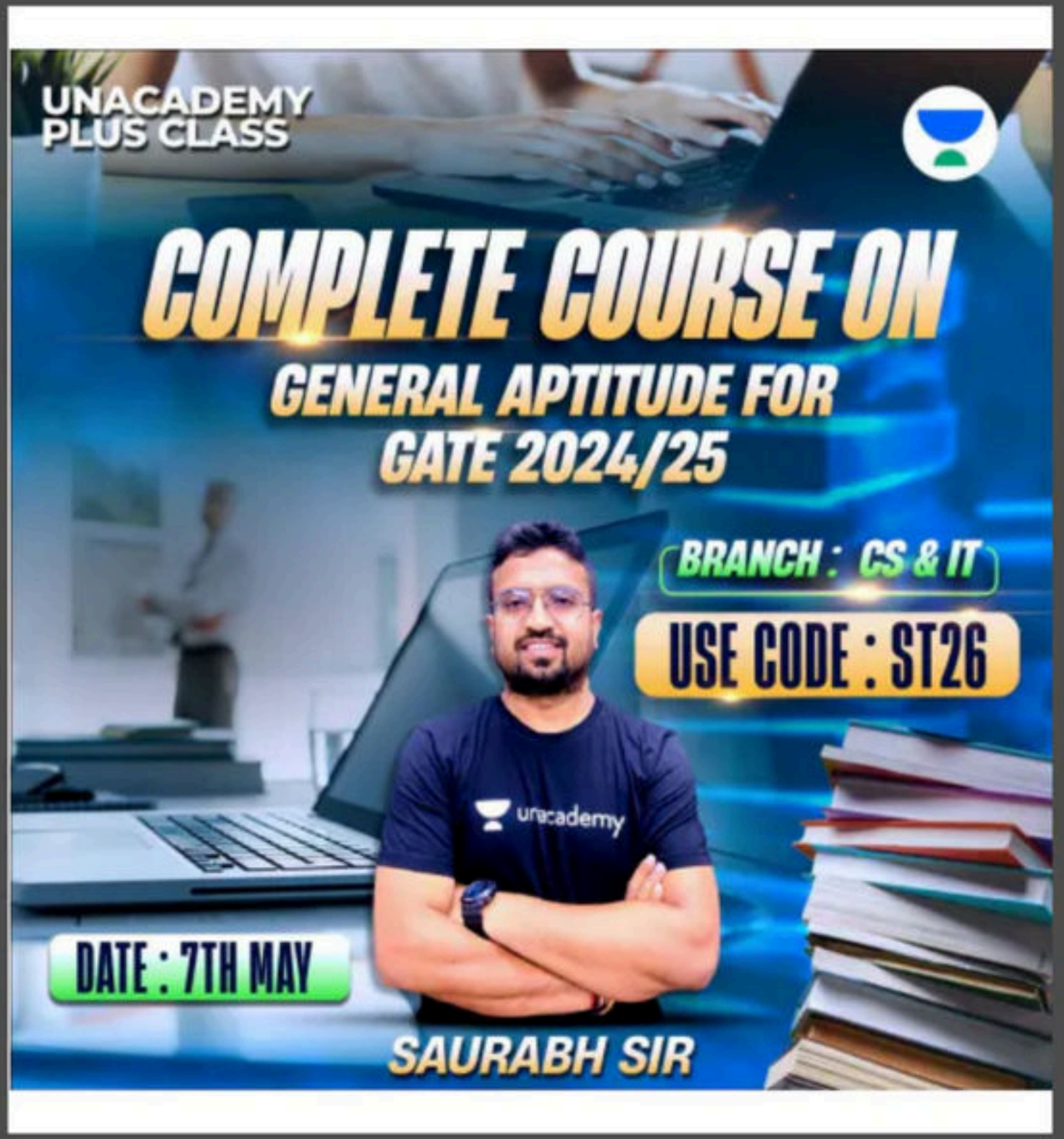
HINDI GA,GS AND MATHEMATICS

Complete Course on General Aptitude - GATE & ESE, 2024 & 2025

Saurabh Thakur

Starts on May 7, 2:15 PM

May 7 - Aug 13 • 15 weeks

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NUMBER SYSTEM...

Factorisation

$12 = 2^2 \times 3$.

$N = a^p \times b^q \times c^r$

1 x 12
2 x 6
3 x 4

Number of factors —

$n = 06$

$n = (p+1) \times (q+1) \times (r+1)$

$= (2+1)(1+1) = 06.$

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factors = Divisors

Factorisation

$12 = 2^2 \times 3$

$N = a^p \times b^q \times c^r$

Number of factors

$n = (2+1) \times (1+1) \times (1+1)$

$= (2+1)(1+1) = 06$

$n = 06$

$12 = 2^2 \times 3^1$

$n_{odd} = (1+1) = 2$

$n_{even} = 6 - 2 = 04$

n_{odd}

(odd factors)

02

n_{even}

(even factors)

04

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

$n = 4 \times 3 \times 5 = 60$

$n_{odd} = 3 \times 5 = 15$

$n_{odd} + n_{even} = n$

$n_{even} = n - n_{odd}$

$60 - 15 = 45$

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$$\frac{2^{2} \times 3^{2} \times 5^{2} \times 7^{3} \times 11^{4}}{\quad}$$

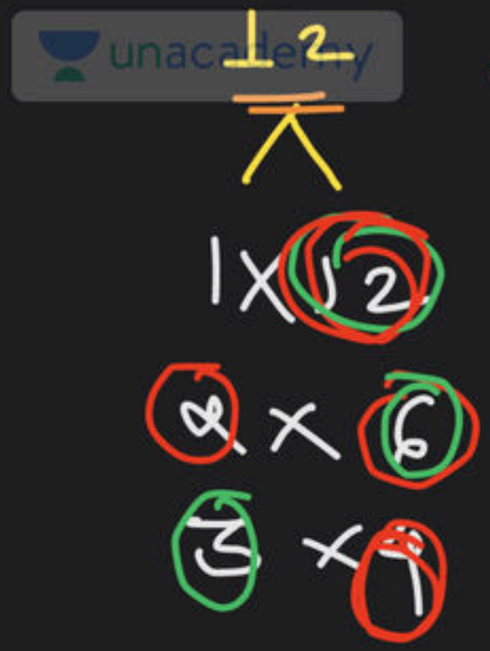
$\eta = 3 \times 3 \times 3 \times 4 \times 5$

$= 540$

$\eta_{odd} = 3 \times 3 \times 4 \times 5$

$= 180$

$\eta_{even} = 540 - 180 = 360$



Factors

÷ 2	2, 4, 6, 12	04
÷ 3	3, 6, 12	03
÷ 4	4, 12	02
÷ 6	6, 12	02
÷ 12	12	1

$12 = 2^2 \times 3$

÷2	2, 4, 6, 12	04
÷3	3, 6, 12	03
÷4	4, 12	02
÷6	6, 12	02
÷12	12	1

(2^2) (2×3) $(2^2 \times 3)$

÷2	$2^1 \times 3^1$	$2 \times 2 = 04$
÷3	2^2	03
÷4	3^1	02
÷6	2^1	02
÷12	$2^0 \times 3^0$	01

n

$12 = 2^2 \times 3$

$12 = 2^2 \times 3$

		n
$\div 2$	$2^1 \times 3^1$	$2 \times 2 = 04$
$\div 3$	2^2	03
$\div 4$ (2^2)	3^1	02
$\div 6$ (2×3)	2^1	02
$\div 12$ $(2^2 \times 3)$	$2^0 \times 3^0$	01

$\frac{N}{4}$

2^2

$2^2 \times 3^0 = 4$

$\times 3^1 = 12$

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$$\frac{2^{2} \times 3^{5^{-1}} \times 5^{-9}}{\quad}$$

$$\frac{2^{5}}{3} \boxed{243} \left(3^{5}\right) \Rightarrow 3 \times 10 \Rightarrow 30$$

$$\frac{\left(3^{5}\right) \times \quad}{243} \qquad \div 100 \qquad \left(2^{2} \times 5^{-2}\right)$$

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

$$6 \times 8 = 48$$

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$q4 = x^3 \times 3 \cdot n$

Num

$\Rightarrow x^{2 \times 3^1} \Rightarrow 3 \times 2 = 06$

$\frac{1}{0}\boxed{3} \Rightarrow x^3 \Rightarrow 04$

$\frac{1}{0}\underline{f(9 \times 3)} \Rightarrow x^2 \Rightarrow 03.$

$\frac{1}{0}(B)(x^2) \Rightarrow 3^1 \Rightarrow 02$

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

$\div 10 \cdot (2^2 \times 5^{-2})$

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

(1) $= 4 \times 5^{-} \times 5 \Rightarrow 16$

$4 \times 3/4 = 30$

Newton

(2) $\Rightarrow 2^2 \times 3^4 \times 5^4 \Rightarrow 3 \times 5 \times 5 = 75$

(3) $2^3 \times 5^2$ $(5^2) \Rightarrow 2^3 \times 3^4 \times 5^{-2} \rightarrow 8 \times 9 \times 7 = 60$

(4) (34) $\Rightarrow 2^3 \times 5^4 \Rightarrow 4 \times 5 = 20$

$P_n = (N)^{n/2}$

* $196 = 14^2 = 2^2 \times 7^2$

$n = 3 \times 3 = 09 \Rightarrow P_n = 196^{9/2} = 14^{2 \times 9/2} = 14^9$

* $256 = 2^8$ $n = (8+1) = 9$

$n = 2$ → $P_n =$

$P_n = (256)^{9/2} = 16^9$

$P_n =$

* $800 = n = ?$ → $2^5 \times 5^2 \Rightarrow n = 6 \times 3 = 18$

$(800)^9$

90

$n = 2 \times 3 \times 2 = \boxed{12}$

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

$n_{odd} = 3 \times 2 = \boxed{6}$

$(\div 2)$ $n_{even} \Rightarrow 3^{2} \times 5^{1} \Rightarrow 3 \times 2 = 6$

$P_n = (x)^{n/2} = 90^{6}$

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1 2

1×1×2

2×3×4

3×4×1

Sum = S_n

$N = a^{p} \times b^{q} \times c^{r}$

28

$R = 2^3 \times 3!$

$S_n = \dfrac{(a^{p+1}-1)(b^{q+1}-1)(c^{r+1}-1)}{(a-1)(b-1)(c-1)}$

$= \dfrac{(2^3-1)(3^2-1)}{(2-1)(3-1)} = \dfrac{7 \cdot 8}{1 \cdot 2}$

28

$$a_4 = a^3 \times 3$$

$$S_n = \frac{(a^4 - 1)(3^2 - 1)}{(a-1)(3-1)} = \frac{15 \times 8}{1 \cdot 2}$$

$$= 60$$

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TEST

n_o Nodd, Neven, P_n, S_n

$P_n = 60^{5}$

$S_n = \frac{4 \cdot 6 \cdot 24}{1 \cdot 2 \cdot 4}$

16B.

① $60 = 2^2 \times 3 \times 5$

3.2.2 = 12

Nodd = 4

Neven = 8

② 288 $= 2^5 \times 3^2$

n = 18

Nodd = 3

Neven = 15

P_n = 288

$S_n = \frac{3 \times 2 \times 6}{1 \cdot 2}$

= 18/9

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$60 = 2^2 \times 3 \times 5$

Num

2	$2^1 \times 3^1 \times 5^1 \Rightarrow 2^3 = 08$	
3	$\Rightarrow 2^2 \times 5 \Rightarrow 3 \times 2 = 06$	
5	$\Rightarrow 2^2 \times 3^1 \Rightarrow 3 \times 2 = 06$	
10	$(2 \times 5) \Rightarrow 2^0 \times 3^0 \Rightarrow 04$	
15	(3×5) $2^2 \Rightarrow 03$	
20	$(2^2 \times 5)$ $3^1 \Rightarrow 02$	

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$2^{1} \times 3^{2} \times 5^{4} \times 7^{3}$

① $n = 2 \times 3 \times 5 \times 4 = 120$

② Model $\Rightarrow 3^{2} \times 5^{4} \times 7^{3} \Rightarrow 3 \times 5 \times 4 = 60$

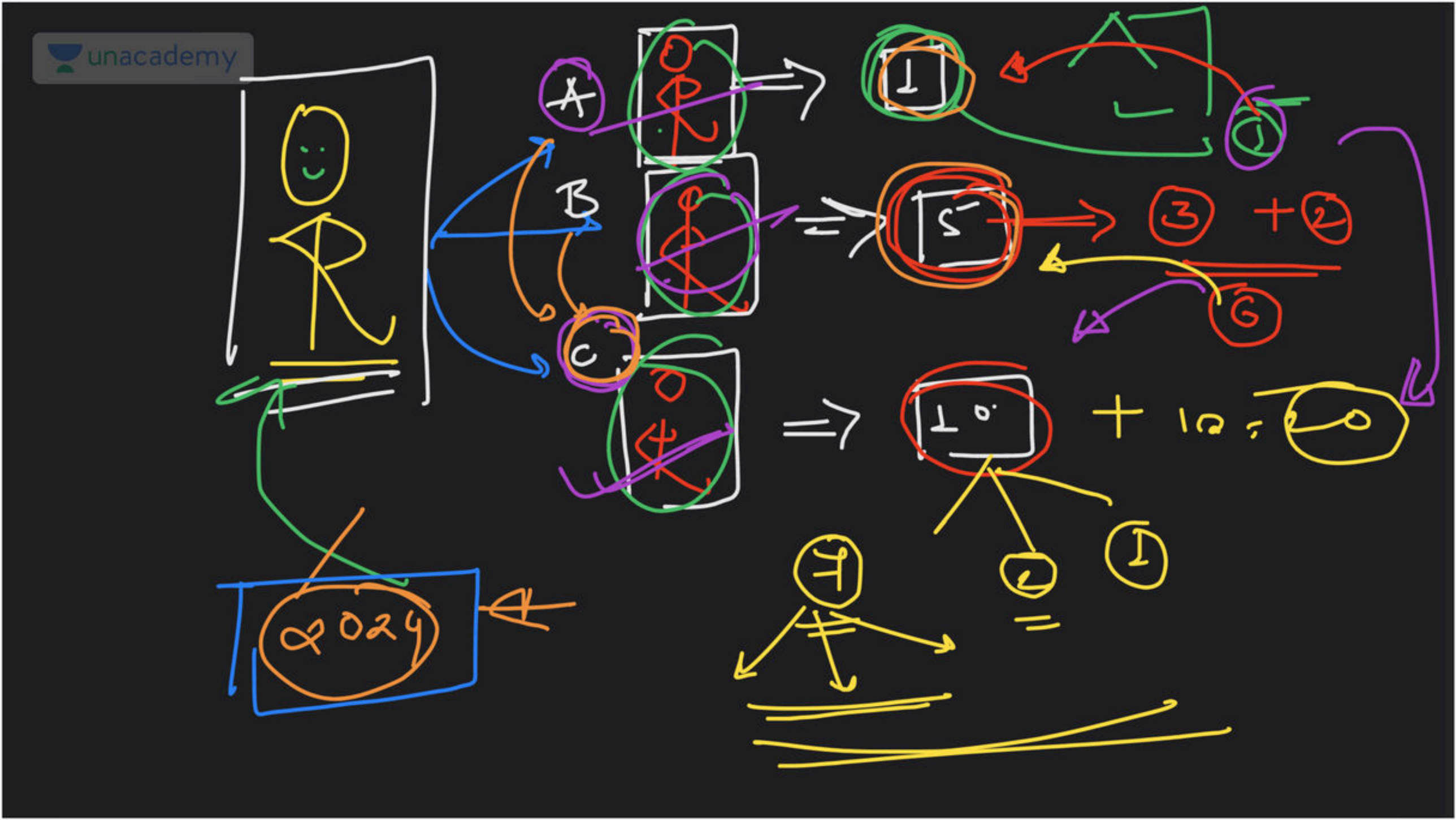
③ $\div 2$ — even $\Rightarrow 3^{2} \times 5^{4} \times 3^{3} \Rightarrow 3 \times 5 \times 4 = 60$

④ $\frac{1}{5}$ of $625 \div 54$

$2^{1} \times 3^{2} \times 7^{3} \Rightarrow 2 \times 3 \times 4 = 24$

⑤ $\div 343 \Rightarrow 7^{3}$

$\frac{2^{1} \times 3^{2} \times 5^{4}}{2 \times 3 \times 5} = 36$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A
B
C
1
5
3
+2
6
10
+10
0
1
2024


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01

100!,150!, 250!


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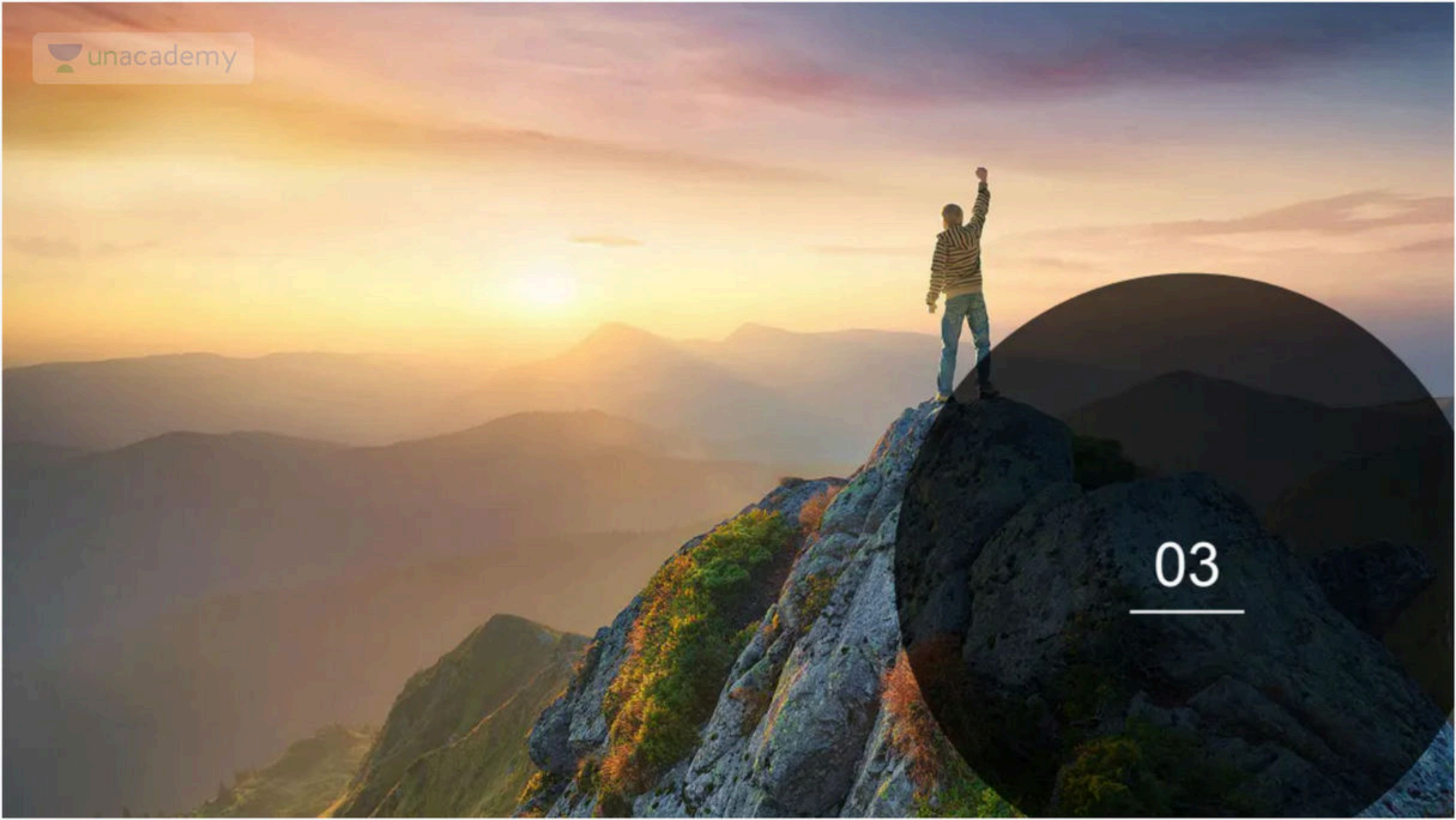
05

$2^{23}, 2^{51}, 3^{59}, 4^{99}, 3^{171}, 7^{208}$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03

$12^{71}, 16^{51}, 21^{99}, 39^{235}, 17^{999}, 37^{897}, 127^{200899}$


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04

$$13^{666} \times 44^{777} \times 616^{333} \times 777^{444}, 8898^{222} \times 999^{555},$$


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05

$$1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots\ldots + 99^2 + 100^2$$


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06

$$1^1 + 2^2 + 3^3 + \ldots\ldots\ldots + 9^9 + 10^{10}$$


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07

The numeral in the units position of

$211^{870} + 146^{127} + 3^{424}$ is.....

[GATE 2016 : IISc Bangalore (EE Set - 2)]


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08

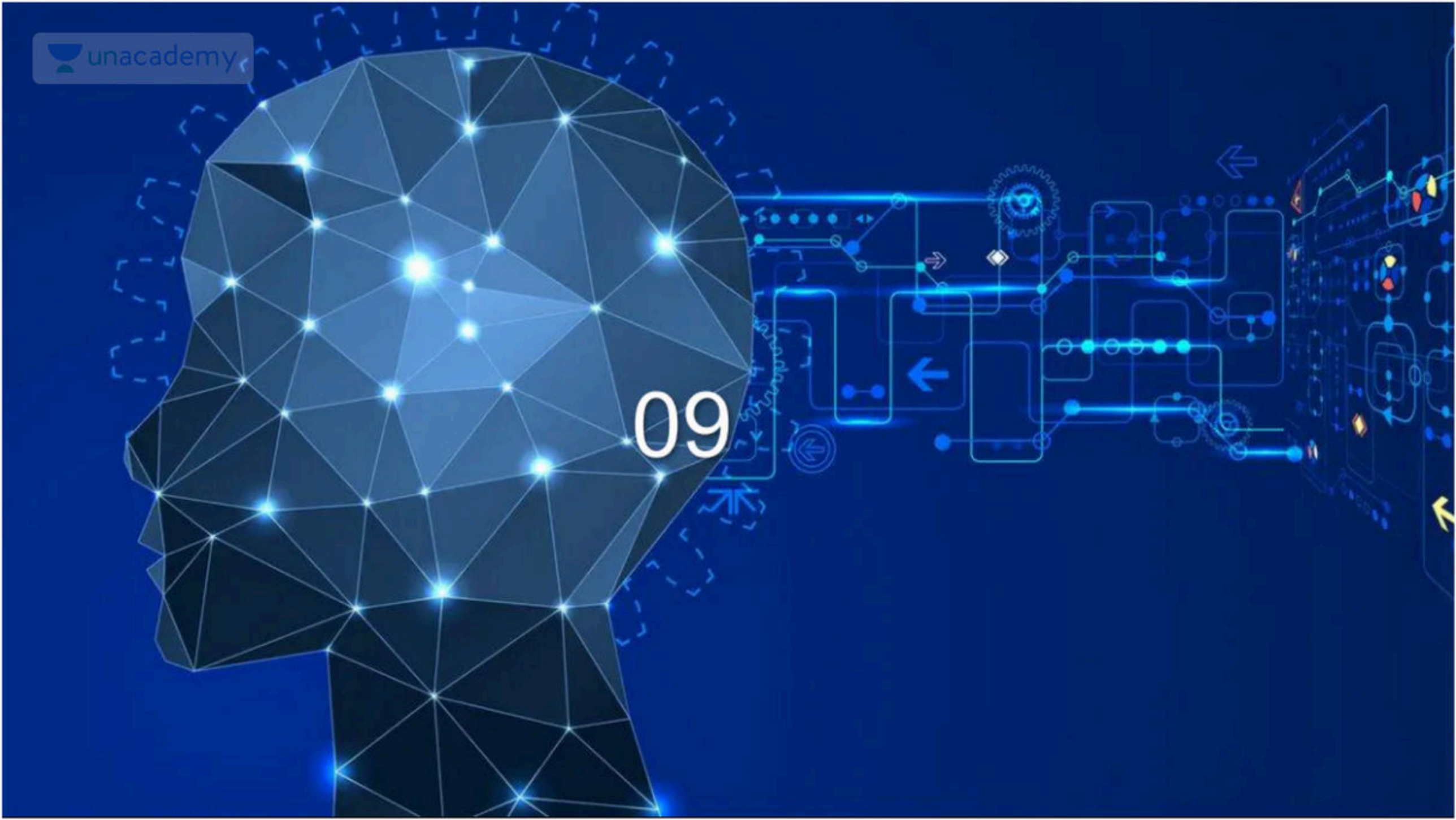
The last digit of

$(2171)^7 + (2172)^9 + (2173)^{11} + (2174)^{13}$ is

(A) 2 (B) 4

(C) 6 (D) 8

[GATE 2017 : IIT Roorkee (CH, CE, Set - 1)]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09

$21^{23}, 31^{53}, 51^{93}$


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10

$3^{53}, 7^{53}, 9^{93}$


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11

$2^{53}, 4^{83}, 8^{93}$


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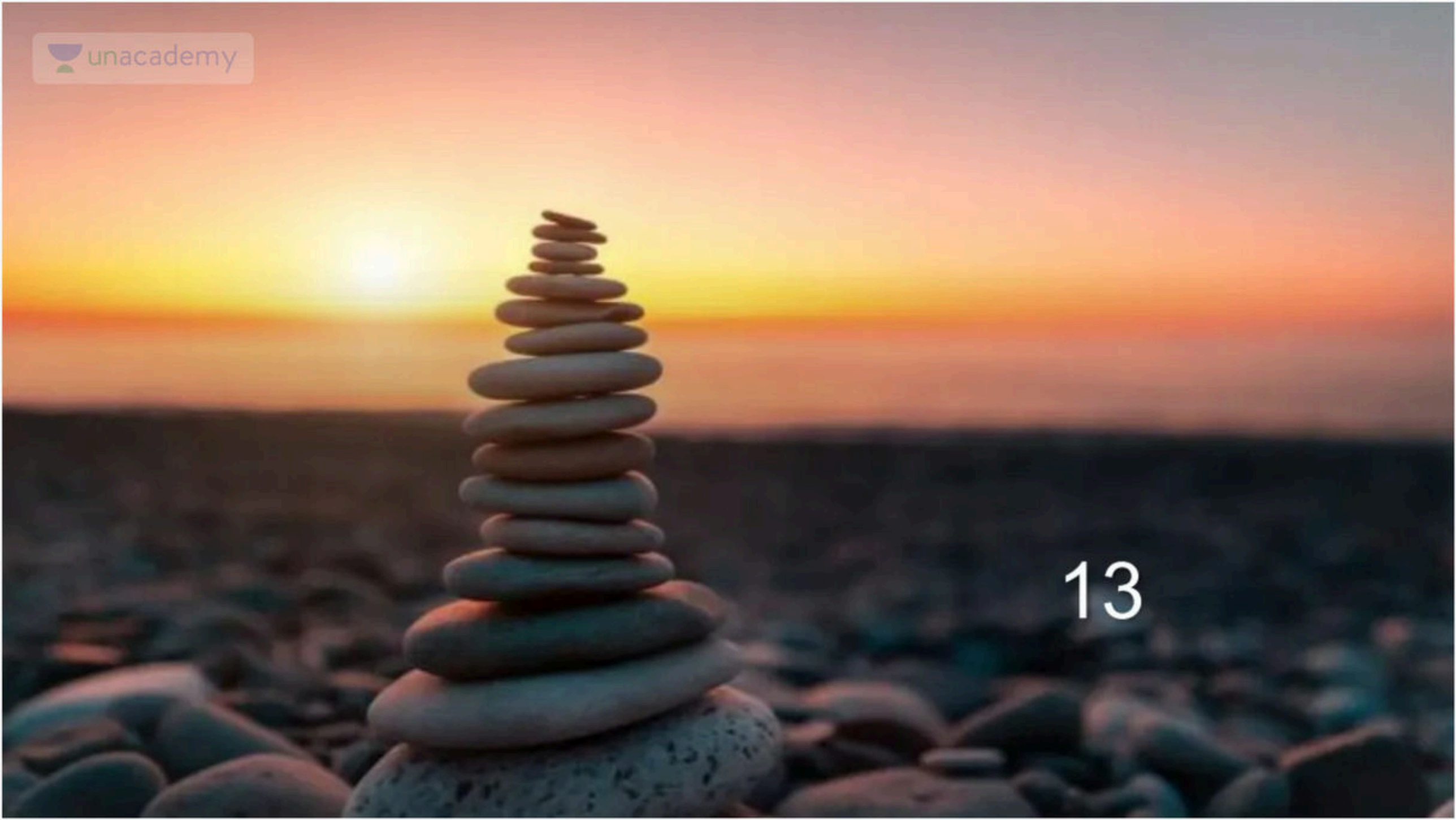
1
12

$$\frac{(123\ 1234)}{15}$$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$(1218 \times 1220 \times 1222 \times 1224) \div 9$


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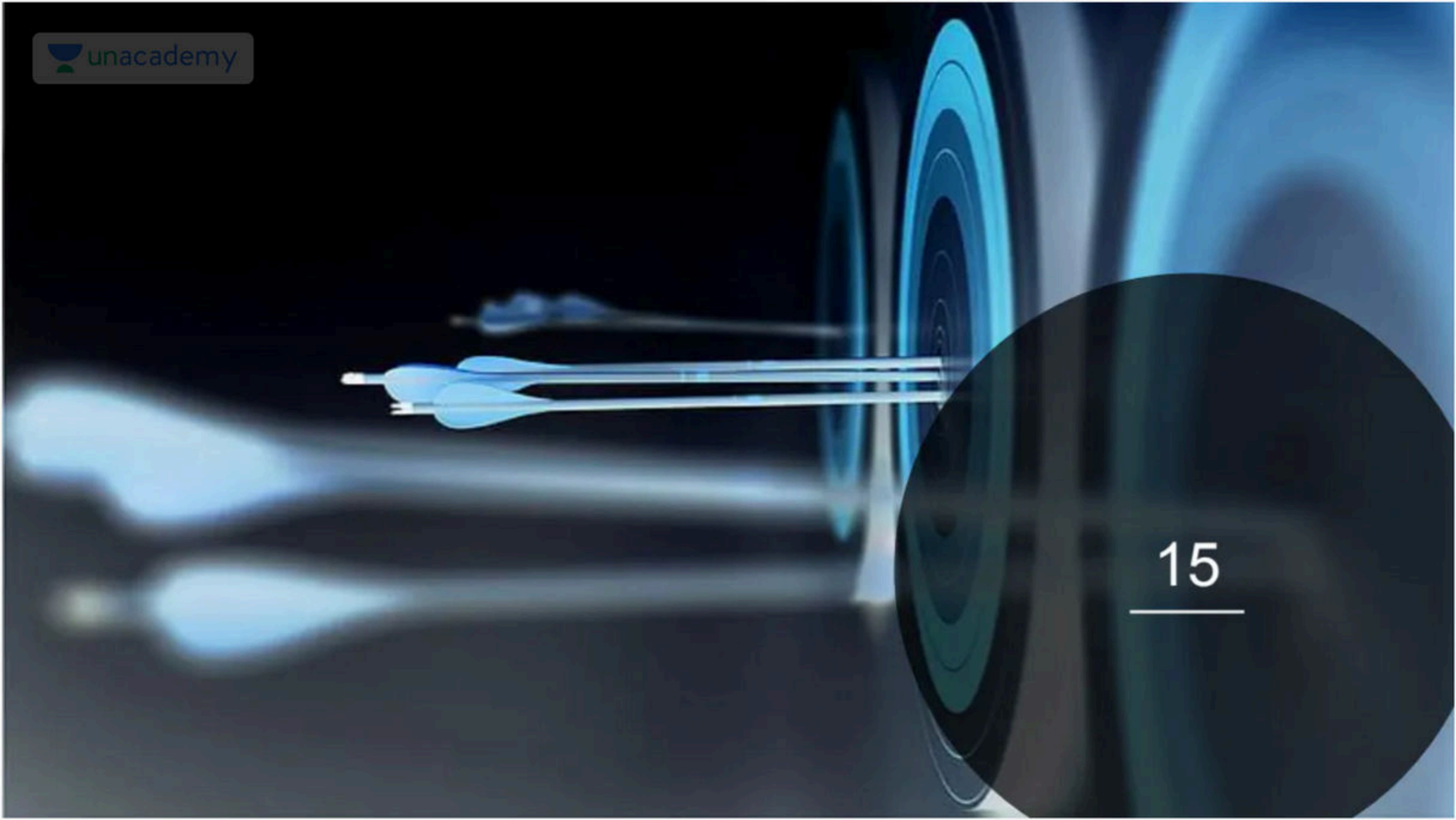
14

$$(1719 \times 1721 \times 1723 \times 1725 \times 1727) \div 18$$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The remainder when S is divided by 20 ,

where $S = 1! + 2! + 3! + 4! + 5! + 6! + \ldots\ldots\ldots + 19! + 20!$


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The rightmost non- zero digit of the number 30^{2720}.


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$7^{77} \div 4$


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18

$11^{88} \div 7$


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19

$5^{123} \div 7$


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20

$$7^{84} \div 342$$


21

Find : Number of factors, Sum of factors and Product of factors of the following :

12, 24, 288.

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▲ 2 • Asked by Prabhat

My doubt

39^235 last two digits

Explain sir please

L2D

3 | 9 | 7

$34 = 81$

$9^2 = 81$

$7^4 = 2401$

$(39^2)^{127} \times 39$

$(21)^{127} \times 39$


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22

How many factors of 12 are divisible by : 2, 3, 4, 6, 12.


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23

How many factors of 24 are divisible by : 2, 3 , 4, 6 , 8.

1α

$\wedge$

1×2

2×2

3×4

$\Rightarrow \quad n = 0, 2$

$\Rightarrow \quad T_n = 12^3$

$N = a^p \times b^q \times c^r$

$$T_n = (N)^{n/2}$$

$(12)^{6/2} = 12^3$


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24

Find the smallest number y such that : $y \times 162$ is a perfect cube.

(A) 24 (B) 27
(C) 32 (D) 36

[GATE 2017 : IIT Roorkee (EE, CS, Set - 1)]


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If all the natural numbers starting from 1 are written side by side then find the :

25^{th}, 50^{th}, 100^{th}, digit of the sequence.


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In the above question find the remainder when the sequences are divided by : 2, 4,8,16 , 5 , 25 , 125 , 3 ,9


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If the number $715 \blacksquare 423$ is divisible by 3 ($\blacksquare$ denotes the missing digit in the thousandths place), then the smallest whole number in the place of $\blacksquare$ is _____.

A. 0
B. 2
C. 5
D. 6

[GATE 2018 : IIT Guwahati (EC Set – 1)]


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How many numbers less than 21 are co-primes to 21?

(A) 24 (B) 96
(C) 11 (D) 12


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If a and b are integers and a - b is even, which of the following must always be even?

(A) ab
(B) $a^2 + b^2 + 1$
(C) $a^2 + b + 1$
(D) ab - b

[GATE 2017 : IIT Roorkee (ME Set – 2)]


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30

Given that a and b are integers and $a + a^2 b^3$ is odd then, which one of the following statements is correct?

(A) a and b are both odd
(B) a and b are both even
(C) a is even and b is odd
(D) a is odd and b is eve

[GATE 2018 : IIT Guwahati (ME Set – 1)]


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31

If x = - 0.5, then which of the following has the smallest value?

(A) $2^{1/x}$

(B) $\frac{1}{x}$

(C) $\frac{1}{x^2}$

(D) 2x

The sum of the digits of a two-digit number is 12. If the new number formed by reversing the digits is greater than the original number by 54, find the original number.

(A) 39
(B) 57
(C) 66
(D) 93


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A number is as much greater than 75 as it is smaller than 117. The number is:

(A) 91 (B) 93
(C) 89 (D) 96

[GATE 2013 : IIT Bombay (CE)]


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34

A number consists of two digits, the sum of digits is 9. If 45 is subtracted from the number, its digits are interchanged. What is the number?

(A) 63
(B) 72
(C) 81
(D) 90


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SUCCESS
35

The sum of eight consecutive odd numbers is 656. The average of four consecutive even numbers is 87. What is the sum of the smallest odd number and second largest even number?

[GATE 2014 : IIT Kharagpur (EC Set – 2, ME Set - 2)]


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In a sequence of 12 consecutive odd numbers, the sum of the first 5 numbers is 425. What is the sum of the last 5 numbers in the sequence?

[GATE 2014 : IIT Kharagpur (EC Set - 4, ME Set - 4)]

Direction (37 – 40) : Given, m = 1! + 2! + 3! + 4! +..... + 99! + 100!


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MALIK

Given, $m = 1! + 2! + 3! + 4! + \ldots\ldots\ldots\ldots\ldots\ldots + 99! + 100!$

Find the unit digit of “m”


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Given, $m = 1! + 2! + 3! + 4! + \ldots\ldots\ldots\ldots\ldots\ldots + 99! + 100!$

Find the last two digits of ‘m’


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Given, $m = 1! + 2! + 3! + 4! + \ldots\ldots\ldots\ldots\ldots\ldots + 99! + 100!$

Find the remainder, when 'm' is divided by 168.


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Given, m = 1! + 2! + 3! + 4! +..... + 99! + 100!

If N is a natural number such that 10^{12}< N < 1013 and the sum of the digits of n is 2 , then the number of values n take is :


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Which among $2^{1/2}$, $3^{1/3}$, $4^{1/4}$, $6^{1/6}$ and $12^{1/12}$ is the largest ?

(A) $2^{1/2}$
(B) $3^{1/3}$
(C) $4^{1/4}$
(D) $6^{1/6}$


42

If $\frac{a}{b} = \frac{1}{3}$, $\frac{b}{c} = 2$, $\frac{c}{d} = \frac{1}{2}$, $\frac{d}{e} = 3$ and $\frac{e}{f} = \frac{1}{4}$, then what is the value of $\frac{abc}{def}$?

(A) $\frac{3}{8}$

(B) $\frac{27}{8}$

(C) $\frac{3}{4}$

(D) $\frac{27}{4}$

(2006)


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S is a 6 digit number beginning with 1 . If the digit 1 is moved from the leftmost place to the rightmost place the number obtained is three times of S . Then the sum of the digits of S is-


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If N = 15 × 30 × 45 × 60 × ……..× 1500, what will be the number of zeroes at the end of N?

(A) 63
(B) 55
(C) 97
(D) 124

[GATE 2016 : IISc Bangalore (CE Set – 2)]


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45

Let x, y and z be distinct integers, that are odd and positive. Which one of the following statements cannot be true?

(A) xyz^2 is odd
(B) $(x-y)^2 z$ is even
(C) (x+y-z) (x+y) is even
(D) (x-y) (y+z) (x+y-z) isodd
(E) None of these