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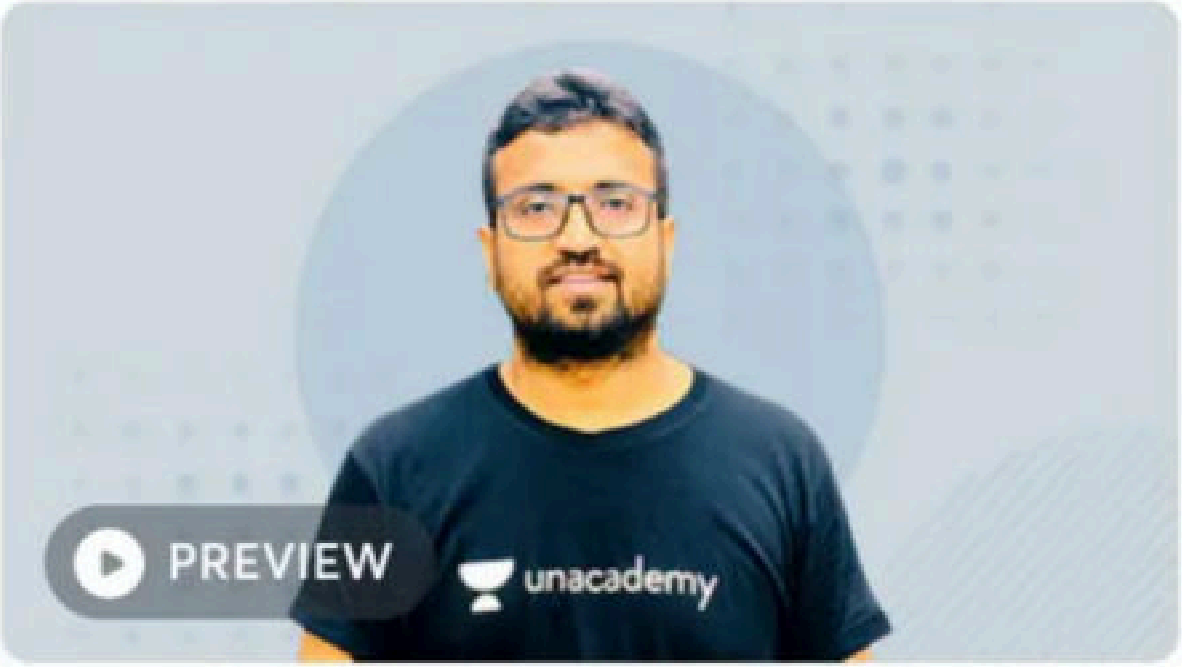
Number System - Part IV

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

Saurabh Thakur • Lesson 5 • May 11, 2023



HINDI GA,GS AND MATHEMATICS

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

Saurabh Thakur

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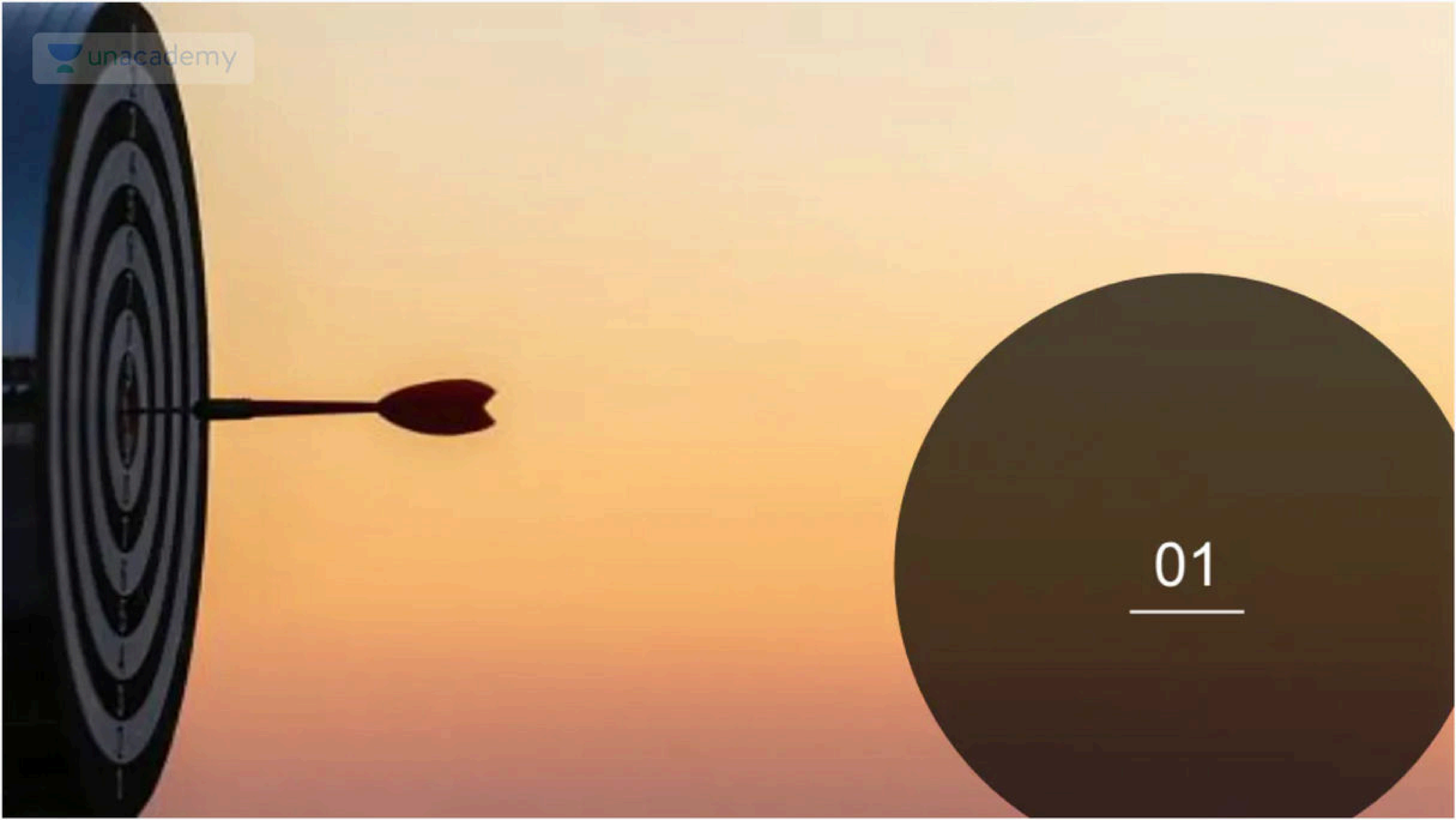
Number system


01

24 mango trees, 56 apple trees and 72 orange trees have to be planted in rows such that each row contains the same number of trees of one variety only. Find the minimum number of rows in which the above mentioned trees may be planted.

- 17
- 15
- 19
- 18

Ans. (C)

Given:

24 mango trees, 56 apple trees and 72 orange trees have to be planted in rows such that each row contains the same number of trees of one variety only.

Calculations:

There are 24 mangoes trees, 56 apple trees & 72 Orange trees.

To get the minimum number of rows, we need maximum trees in each row.

In each row, we need the same number of trees

So we need to calculate HCF

HCF of 24, 56 & 72

$\Rightarrow 24 = 2^3 \times 3$

$\Rightarrow 56 = 2^3 \times 7$

$\Rightarrow 72 = 2^3 \times 3^2$

HCF = $2^3 = 8$

Number of minimum rows = (24 + 56 + 72)/8 = 152/8

$\Rightarrow 19$

∴ The correct choice will be option 3.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02

If a six digit number 838A5A is divisible by 11 and a three digit number 76X is divisible by 9, then the value of (A + 2X) is:

- 10
- 15
- 17
- 19

Ans. (D)

Concept:

Divisibility of 11 = If the difference of the sum of alternative digits of a number is divisible by 11, then that number is divisible by 11 completely.

Divisibility of 9 = Sum of the digit is divisible by 9 then, whole number is divisible by 9

Calculation:

Digits of even place = 8 + 8 + 5 = 21

Digits on odd place = 3 + A + A = 3 + 2A

Now subtract both the equations

$\Rightarrow 21 - 3 - 2A = 0$

$\Rightarrow 18 = 2A$

$\Rightarrow A = 9$

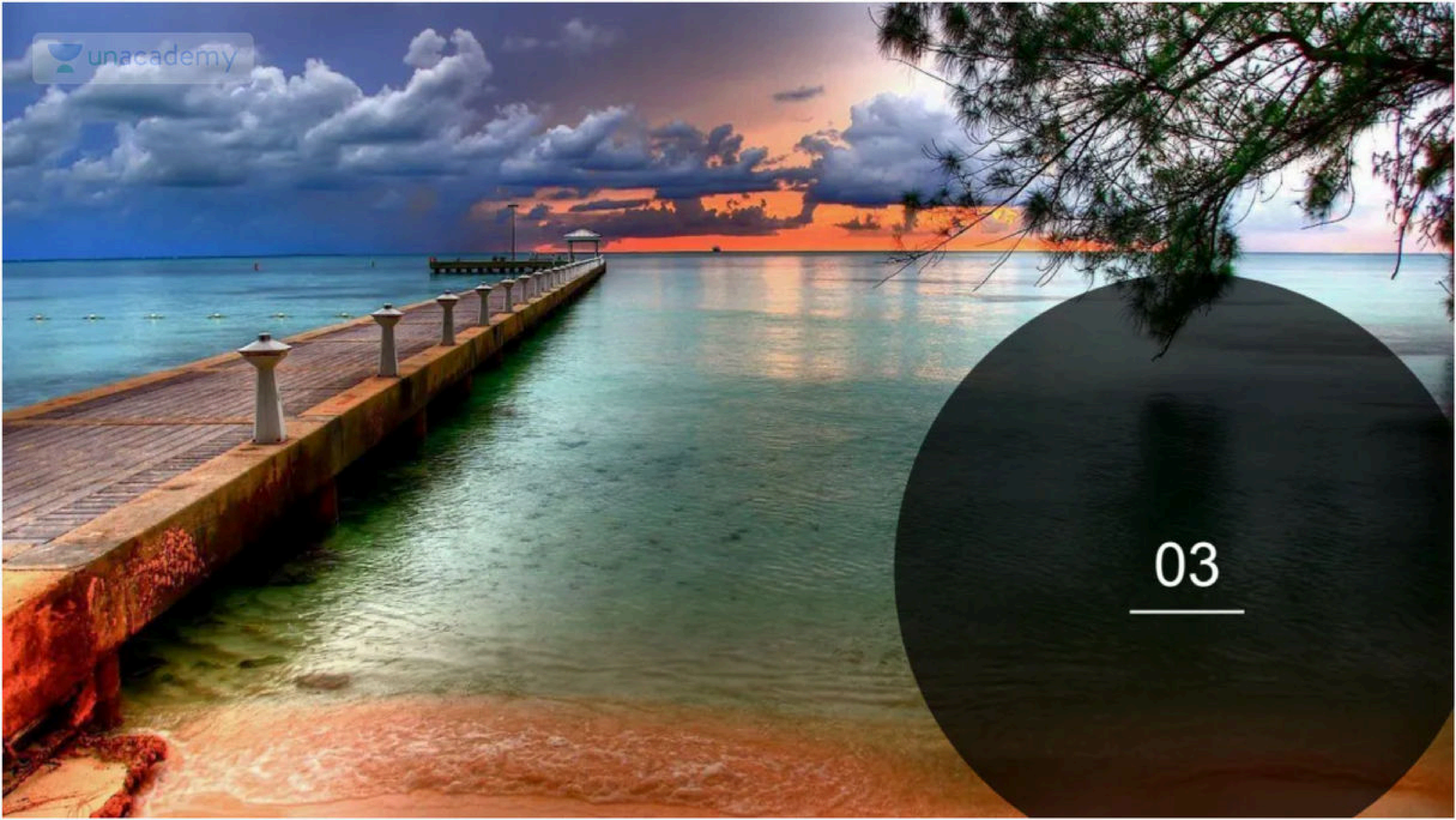
76X is divisible by 9

$7 + 6 + X$

$\Rightarrow 13 + X = 18$ ----(Nearest value of 13 which is divisible by 9 is 18)

$\Rightarrow X = 5$

$(A + 2X) = (9 + 2 \times 5) = 19$


03

If 4A3164B is divisible by 88, then what is the value maximum possible value of 2A × B ?

- 50
- 70
- 60
- 80

Ans. (D)

Given:

A number having unknown digits which is divisible by 88.

Formula Used:

Divisibility rules of 8 and 11.

Divisibility rules of 11: If the difference between sum of digits at odd places and sum of digits at even places of a number is 0 or 11, then the number will be divisible by 11.

Divisibility rules of 8: If the last three digits of a number are divisible by 8, then the number will be divisible by 8.

Calculation:

Considering he given number 4A3164B.

By the rule of divisibility value of B = 0 and 8,

Maximum value is 8

648 is a multiple of 8.

Now the number will be 4A31648

Thus, $(4 + 3 + 6 + 8) - (A + 1 + 4) = 11$

$\Rightarrow 21 - 5 - A = 11$

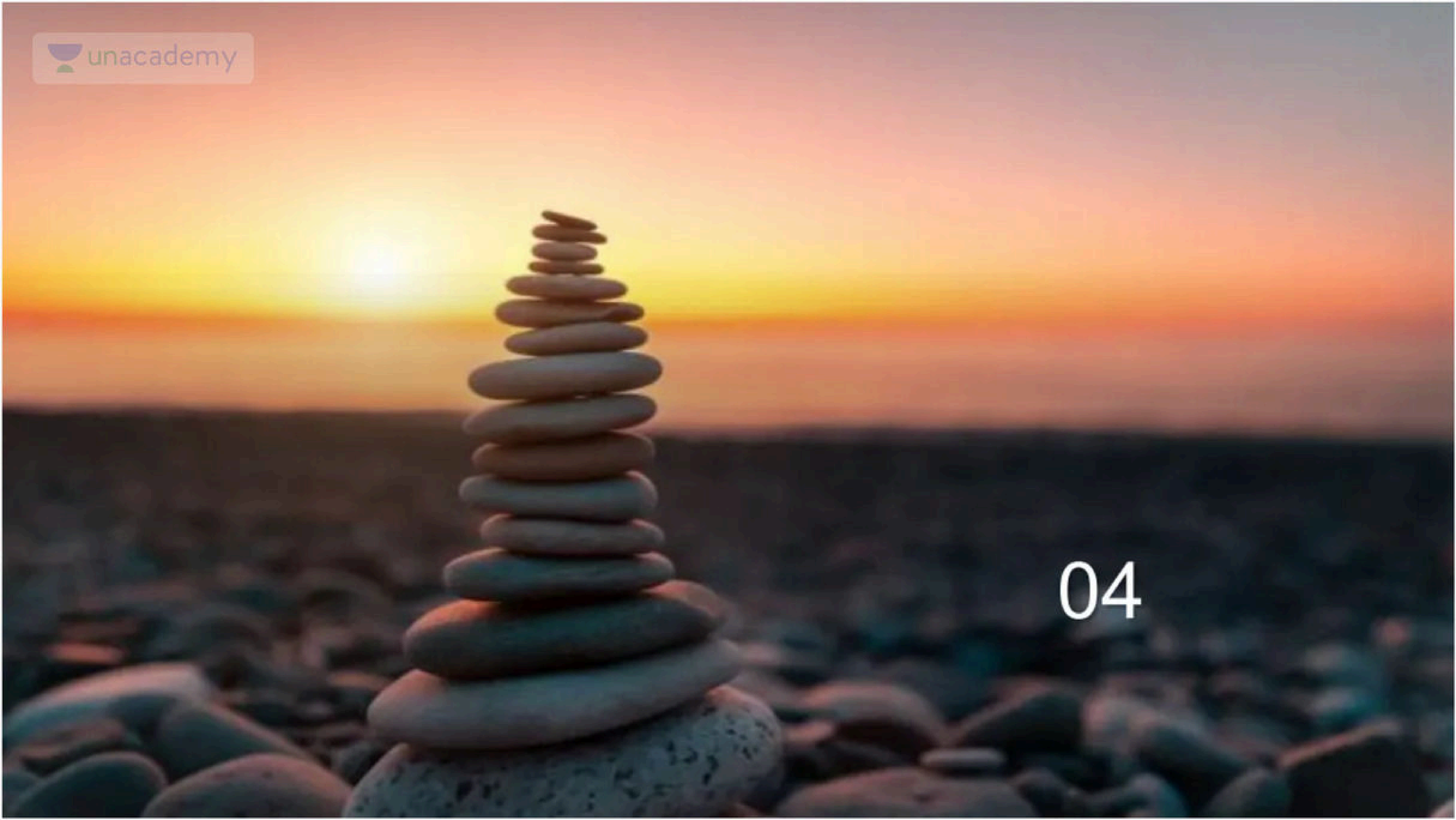
$\Rightarrow A = 5$

Number will be 4531648

So, $A = 5$, $B = 8$

The value of $2A \times B = 2 \times 5 \times 8 = 80$

$\therefore$ The required answer is 80.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04

A number consists of three digits of which the middle one is zero and their sum is 4. If the number formed by interchanging the first and last digits is greater than the number itself by 198, then the difference between the first and last digits is

- 1
- 2
- 3
- 4

Ans. (B)

Given :

A number consists of three digits of which the middle one is zero and their sum is 4. If the number formed by interchanging the first and last digits is greater than the number itself by 198.

Calculations :

Let the number be $100x + 10y + z$
Then the number of reversed digit will be $100z + 10y + x$

According to the question

$100z + x - (100x + z) = 198 \qquad (y = 0)$

$99z - 99x = 198$

$z - x = 2$

∴ The difference of the 1st and last digit is 2.


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05

If the number “741259AB” is divisible by 40, then for the least value of A, the value of 5A + 3B is:

- 8
- 10
- 15
- 25

Ans. (B)

Given:

"741259AB" is divisible by 40

Concept:

Divisibility rule of 8: The number from the last 3-digits should be divided by 8

Divisibility rule of 5: The unit digit should be 0 or 5

Calculation:

741259AB

Checking for 5:

The value of B has to be 0 or 5 to be divisible by 5

As it has to be divisible by 40, it has to be even. So, B has to be 0

Number becomes 741259A0

Now checking for 8:

Last 3 digits = 9A0

Dividing 9A0 by 8, A has to be 2 or 6(as 1 will remains when 9 will be divided by 8) for it to be completely divisible by 8.

Least value of A = 2; B = 0

$\therefore 5A + 3B = 10$


06

How many numbers are there between 100 and 300 which either begin with or end with 2?

- ○ 110
- ○ 111
- ○ 112
- ○ None of the above

Ans. (A)

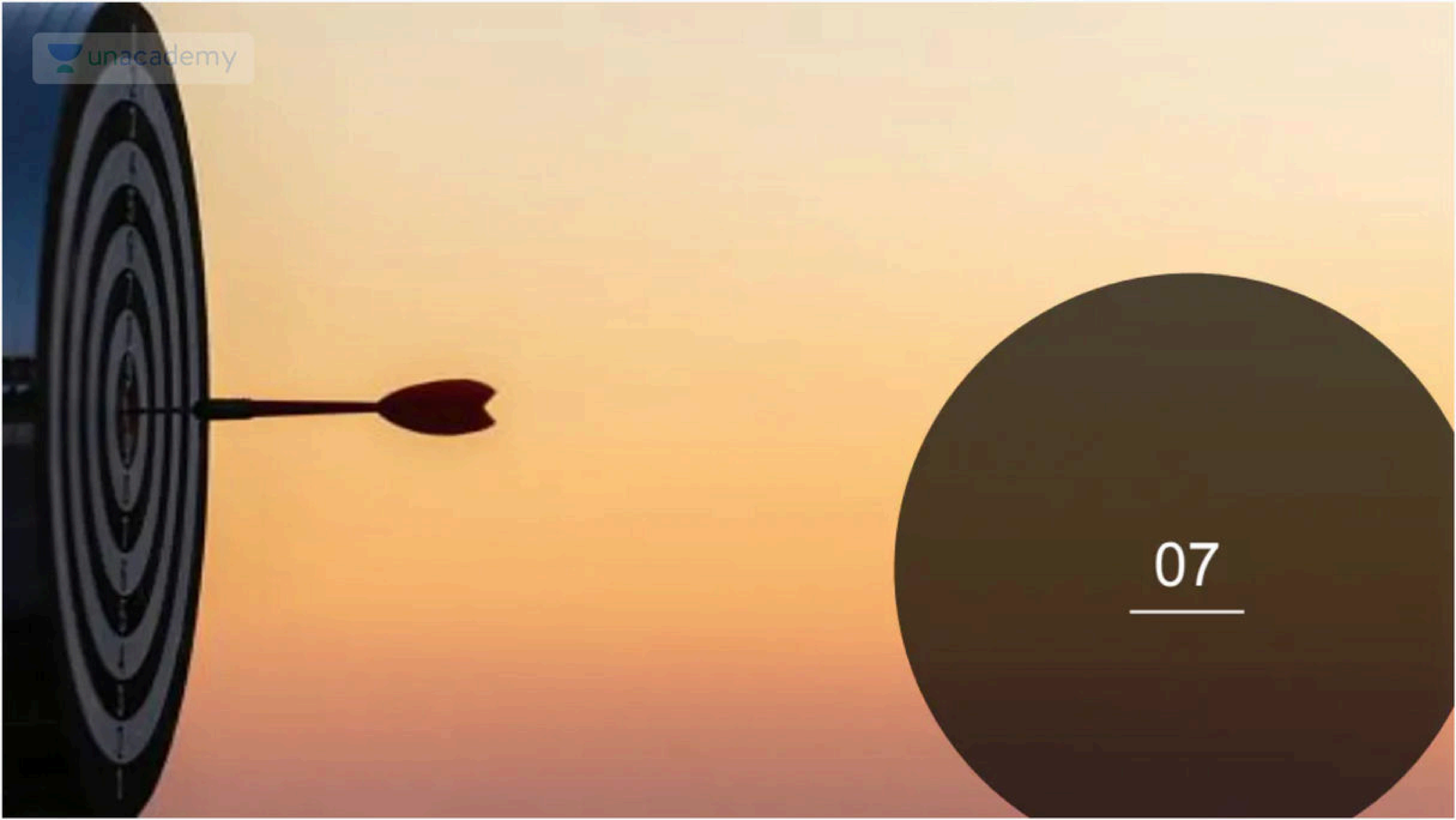
Calculation

⇒ From 100 to 199 , total number ends with 2 are 102, 112 ......192 = 10

⇒ From 200 to 299 , total number ends or begin with 2 are 200, 201, 202 ....299 = 100

⇒ so total number are there between 100 and 300 which either begin or end with 2 = 100 + 10 =110

∴ 110 numbers are there between 100 and 300 which either begin with or end with 2


07

Three electronic bells are fixed in three adjoining temples. The priests of these temples decided to ring the bells at different times with the intervals of 2, 3 and 5 min. If the bells start tolling together for the first time at 8:00:00 in the morning. up to 9:00:00 in the morning they will toll together:

- 2 times after the starting time
- 4 times after the starting time
- 15 times after the starting time
- 5 times after the starting time

Ans. (A)

Given:

Priest of 1st temple ring the bells at an interval of 2 minutes

Priest of 2nd temple ring the bells at an interval of 3 minutes

Priest of 3rd temple ring the bells at an interval of 5 minutes

They start tolling for the first time at 8:00:00

Calculation:

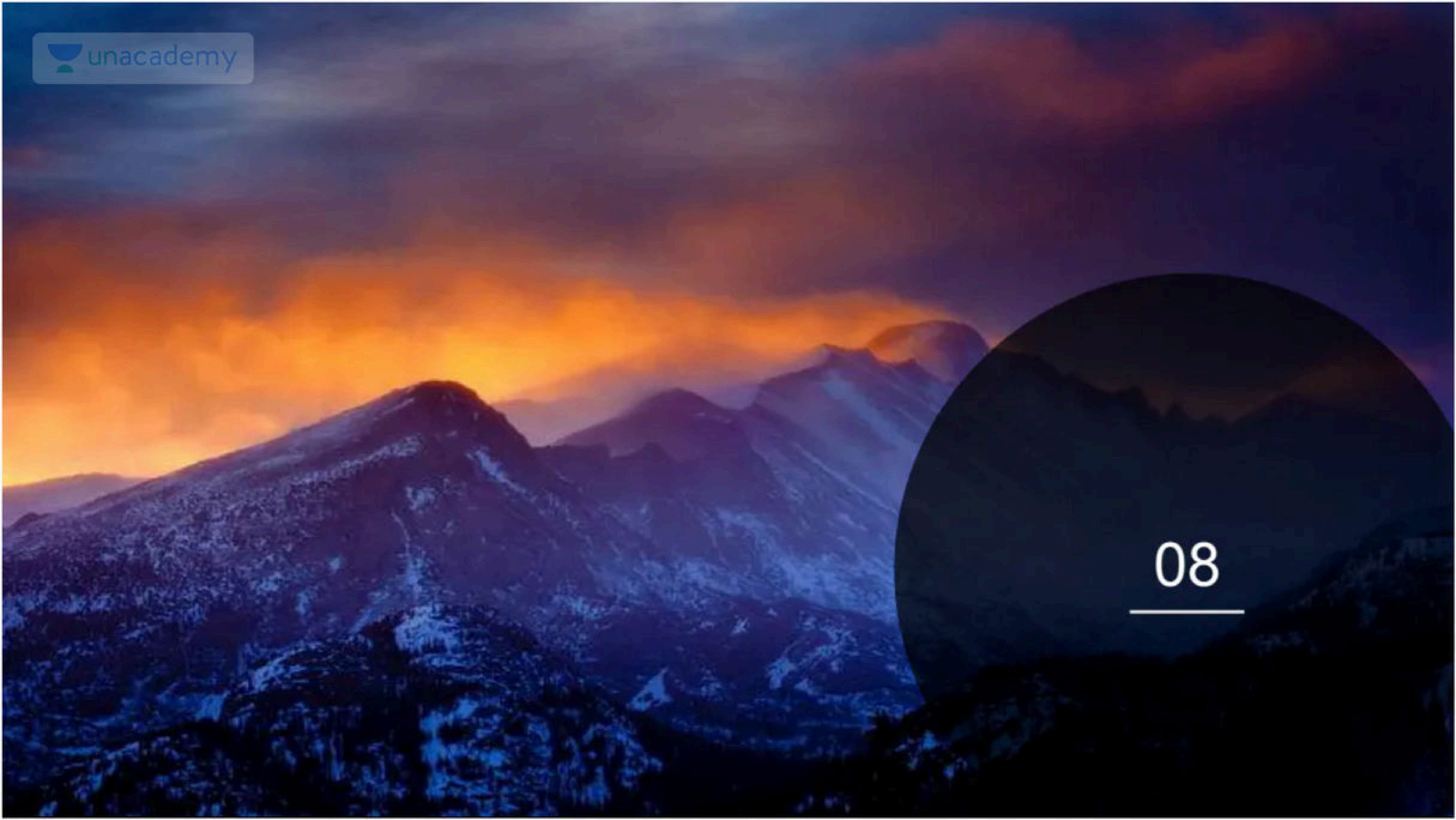
LCM of 2, 3 and 5 is 30 min

Difference between 8:00 – 9:00 = 1 hour

Hence, Bell will ring in 60 min = 60/30

⇒ 2 times

∴ Bell will ring 2 times after the starting time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08

The smallest six-digit number which is completely divisible by 4, 8, 12 and 16 is:

- 100032
- 100900
- 100800
- 100700

Ans. (A)

Given:

Smallest six-digit number which is divisible by 4, 8, 12 and 16.

Concept:

LCM (Lowest Common Multiple)

Dividend = Divisor × Quotient + Remainder

Calculation:

LCM of 4, 8, 12 & 16 will be calculated by writing them as the product of their prime factors.

$4 = 2^2$

$8 = 2^3$

$12 = 2^2 \times 3$

$16 = 2^4$

So, LCM (4, 8, 12, 16) = $2^4 \times 3 = 48$

The smallest six-digit number is 100000.

By dividing 100000 by 48, we get the remainder 16.

So, we need to add the difference between the Divisor and Remainder to 100000 (Dividend) in order to get the smallest six-digit number divisible by 48.

$\Rightarrow 100000 + (48 - 16) = 48 \times 2083 + 16 + (48 - 16)$

$\Rightarrow 100032 = 48 \times 2083 + 16 + 32$

$\Rightarrow 100032 = 48 \times 2083 + 48$

$\Rightarrow 100032 = 48 \times 2083 + 48$

$\therefore$ **The smallest six-digit number which is completely divisible by 4, 8, 12 and 16 is 100032.**


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09

A box can carry a total weight of 32 kg. Candies have to be packed inside the box. If the weight of each candy is 20 g, how many candies can be packed inside the box?

- ○ 16
- ○ 16000
- ○ 160
- ○ 1600

Ans. (D)

Given:

Weight of box = 32 kg

Weight of each candy = 20 g

Formula Used:

Number of items = Total weight/Weight of each item

Calculation:

1 kg = 1000 g

⇒ 32 kg = 32 × 1000 = 32000g

⇒ Number of packs = 32000/20

⇒ Number of packs = 1600

∴ 1600 packs of candies can be packed.

The correct option is 4 i.e. 1600


10

The maximum number of students among whom 1001 pens and 910 pencils can be distributed in such a way that each student gets same number of pens and same number of pencils, is:

- 91
- 910
- 1001
- 1911

Ans. (A)

Given

The total number of pens are = 1001

The total number of pencils = 910.

Calculation:

The total number of pens is = 1001 and the total number of pencils is 910.
Understand that the maximum number of students who get the same number of pens and pencils is the H.C.F of 1001 and 910

Calculate prime factors of
1001 and 910:

$\Rightarrow 1001 = 11 \times 91$

$\Rightarrow 910 = 10 \times 91$
Calculate H.C.F of
1001 and 910:

$\Rightarrow 91 \times 1 = 91$

∴ 91 students receive the same number of pens and pencils.


12

If M and N are two digits of the number 43M8N such that this number is divisible by 80, then find the maximum possible value of 2M + 3N.

- 12
- 8
- 16
- 4

Ans. (A)

Given:

A number 43M8N with two 2 unknown digits M and N, such that it is divisible by 80.

Formula Used:

Divisibility rule of 16: If the last four digits of a number are divisible by 8, then the number will be divisible by 8.

Divisibility rule of 5: If the last digit of the number is 0 or 5, then the number will be divisible by 5.

Calculation:

Factors of 80 are 5 and 16.

If the number is divisible by both 8 and 10, we can decide that the given number is divisible by 80.

Also, the unit digit of the given number is 0, to be divisible by 80.

So $N = 0$

Also, it is divisible by 16, so the number formed by the last four digits should be divided by 16.

So $M = 2, 6$

Maximum possible value will be $2M + 3N = 2 \times 6 + 3 \times 0 = 12 + 0 = 12$

∴ The required value is 12.


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13

The difference between two numbers is 1365. When larger number is divided by the smaller one, the quotient is 6 and the remainder is 15. The smaller number is

- 240
- 270
- 295
- 360

Ans. (B)

Concept:

Divisor × Quotient + Remainder = Dividend

Calculation:

Let the smaller number = a

Let the bigger number = 1365 + a

Accordingly

$a \times 6 + 15 = 1365 + a$

$5a = 1350$

$a = 270$

∴ The smaller number is 270


14

What is the least value of K. so that 123K578 is divisible by 11.

- 6
- 8
- 5
- 3

Ans. (B)

Given:

The number is 123K578

Concept used:

The number is divisible by 11 when the difference between the sum of the digit at odd places and the sum of the digit at even places is either 0 or divisible by 11.

Difference = the sum of odd the digit at the odd place - the sum of the digit at even place

Calculation:

Number = 123K578

Odd place digits are 8, 5, 3 and 1.

Even place digits are 7, K, and 2

Difference = the sum of odd the digit at the odd place - the sum of the digit at even place

$\Rightarrow 0 = (8 + 5 + 3 + 1) - (7 + K + 2)$

$\Rightarrow 0 = 17 - 9 - K$

$\Rightarrow K = 8$

∴ **The least value of K is 8.**


1
15

120 chocolates were distributed in a classroom. If the number of students is one-fourth of the total number of chocolates, and the number of boys is double the number of girls. Find the number of chocolates got by each boy if the number of chocolates got by each girl is twice that of each boy.

- 3 chocolates
- 4 chocolates
- 5 chocolates
- 6 chocolates

Ans. (A)

Given:

Total chocolates = 120

Concept used:

Concept of ratio and proportion

Calculation:

According to the question,

Number of students = 120 × 1/4 = 30

Since Ratio of boys and girls = 2 : 1

⇒ Number of boys = 30 × 2/3 = 20

⇒ Number of girls = 30 × 1/3 = 10

Let the number of chocolates got by each boy and girl be x : 2x

20x + 20x = 120

⇒ 40x = 120

⇒ x = 3

∴ The number of chocolates got by each boy is 3.

NUMBER SYSTEM

Prime +100

Factors

12 → Factorisation ⟹ Prime Factors

1 × 12

2 × 6

3 × 4

$12 = 2^2 \times 3$

Factors = 1, 2, 3, 4, 6 & 12

12 →

$n = 06$ → No. of factors

$S_n = 28$ ⟹ Sum of factors

$P_n = 12^3 = 1728$ — Prod. of fact

NUMBER SYSTEM

Prime No.

Factors

$\boxed{12} \rightarrow$ Factorisation $\rightarrow$ Prime facto

1×12

2×6

3×4

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

Sau

Factors = 1, 2, 3, 4, 6 & 12

12 $\rightarrow$

$n = 06 \rightarrow$ No. of fact

$S_n = 28 \rightarrow$ Sum of fact

$P_n = 12^3 = 1728$ — Prod of

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

Prime Factors

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

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

$$3 \times 2 = 6$$

① No. of factors $= (p+1) \times (q+1) \times (r+1)$

$$24 = 2^{\boxed{3}} \times 3^{\boxed{1}}$$

$n = 4 \times 2 = \boxed{08} \longrightarrow$

1×24
2×12
3×8
4×6

n

Factorisation

↓

(power+1) × (power+1)

Perfect sq:

TEST

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

1. $60 = 2^{2}\times 3\times 5^{1} \Rightarrow 3\cdot 2\cdot 2 = \boxed{12}$

$\times\ (3\times 5)$

2. $144 = 2^{4}\times 3^{2} \Rightarrow 5\times 3 = \boxed{15}$

3. $288 = 2^{\boxed{5}}\times 3^{2} \Rightarrow 6\times 3 = \boxed{18}$

$\times\ 2$

$4 = 2^{\boxed{2}} \Rightarrow$ even

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

Perfect Sq. $\Rightarrow$ – $\boxed{\text{even}}$

Power

$(2 \times 3 \times 7)$

$8 = 2^{\boxed{3}} \Longrightarrow$

3^{5}

Perfect $\boxed{\text{Cube}}$

Power $= \boxed{3n}$

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

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$$2^{1} \times 7^{3} \times 11^{2} \times 13^{2}$$

$5 - 4$

8, 0

$\times 1$

Cube

5^{2}

8, 0

2×7

Cube

$2^{2} \times 11 \times 13$

$\boxed{N}$

Natural No.

Prime Factors.

$4^3 \rightarrow$

NOTE :

Shiv.

Perf. Sq.

Ajay ⇒ Power - Even

$\boxed{n}$

$4 = 2^{2} \rightarrow 3$

$9 = 3^{2} \rightarrow 3$

$16 = 2^{4} = 4^{2} \rightarrow 5$

$36 = 2^{2} \times 3^{2} \rightarrow 9$

odd

Sahil

NOTE:

Ajay ⇒ Power - Even

Shiv. Perfect sq.

$4 = 2^2 \rightarrow 3$

$9 = 3^2 \rightarrow 3$

$16 = 2^4 = 4^2 \rightarrow 5$

$36 = 2^2 \times 3^2 \rightarrow 9$

n

Odd Sahi

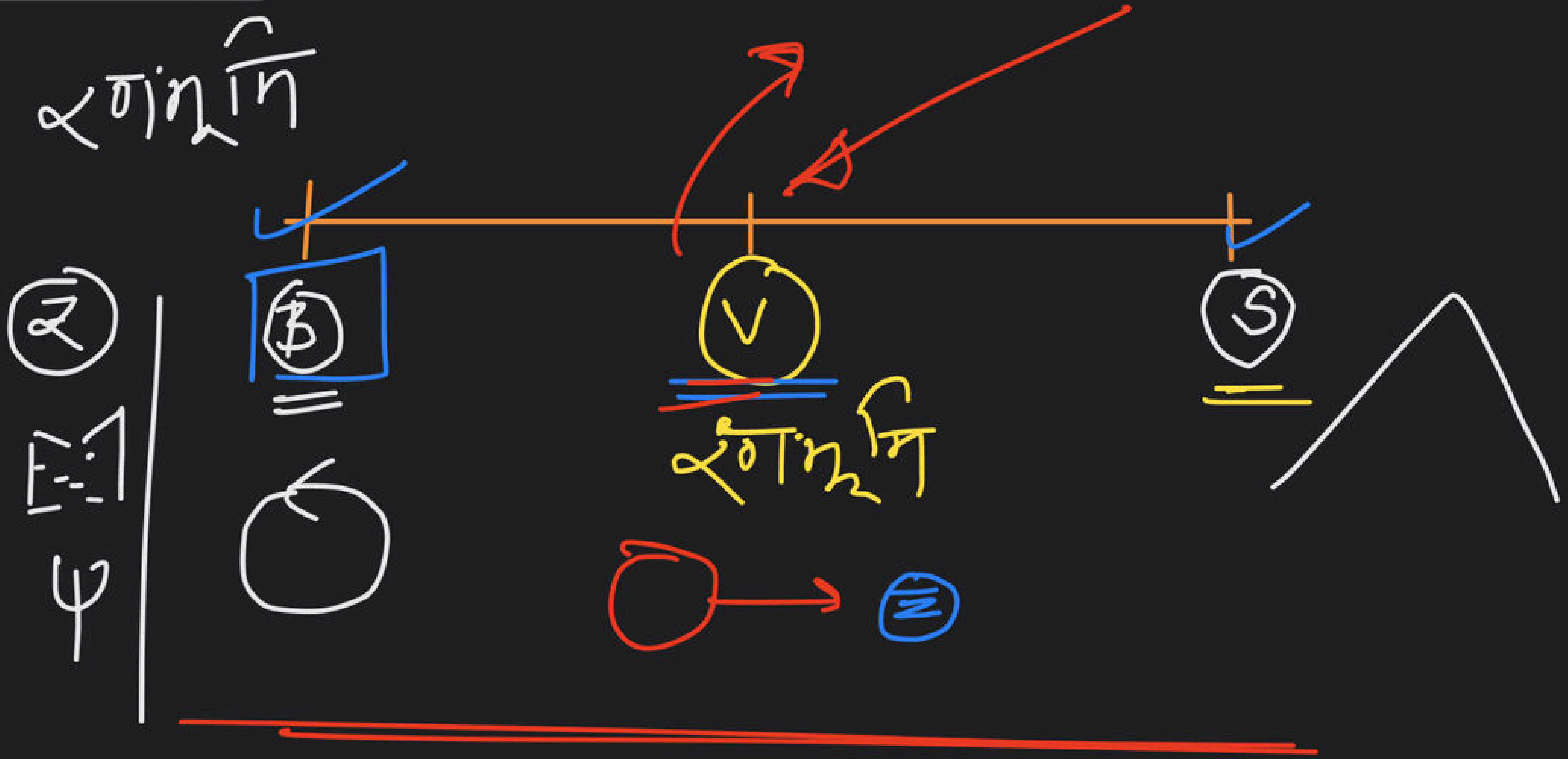
$n = (p+1) \times (q+1) \times (r+1)$

Odd × Odd × Odd = Odd

* Perfect sq. ⟹ $\boxed{\text{Power} = \text{Even}}$

$\boxed{n = \text{Odd}}$

*


B
V
S


01

100!,150!, 250!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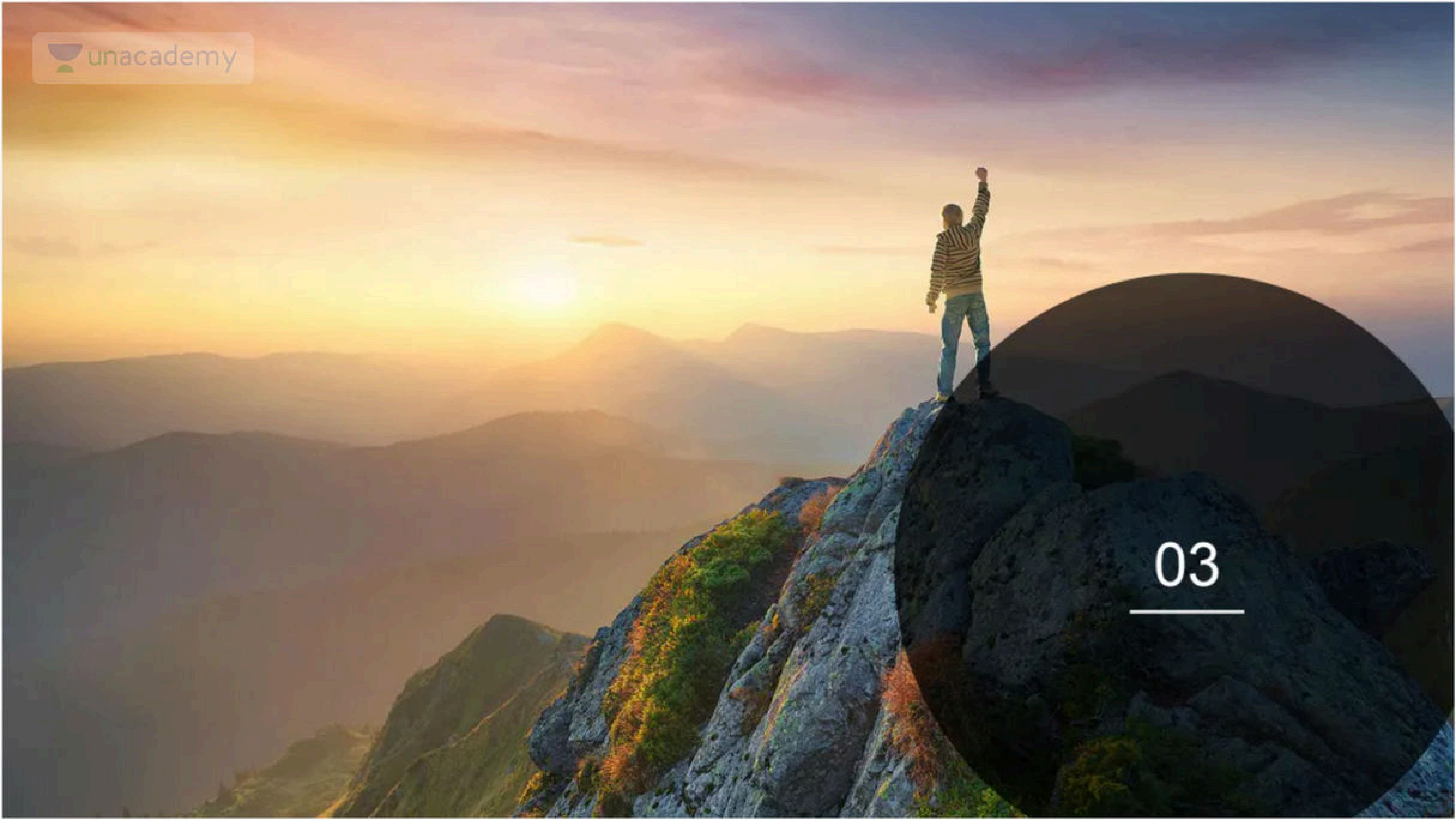
05

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

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


05

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


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06

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


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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)]


08

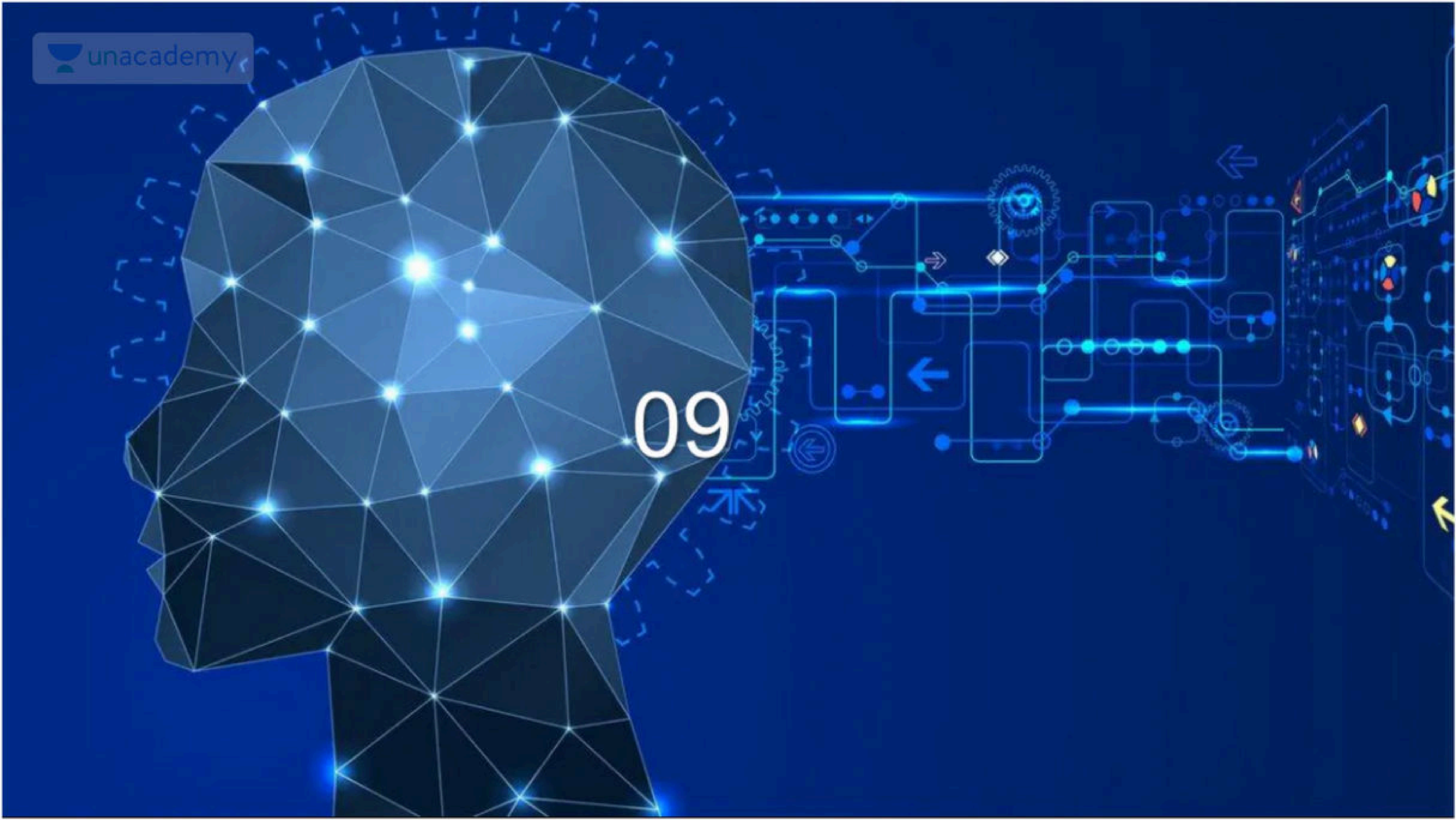
The last digit of

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

(A) 2 (B) 4

(C) 6 (D) 8

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


09

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


10

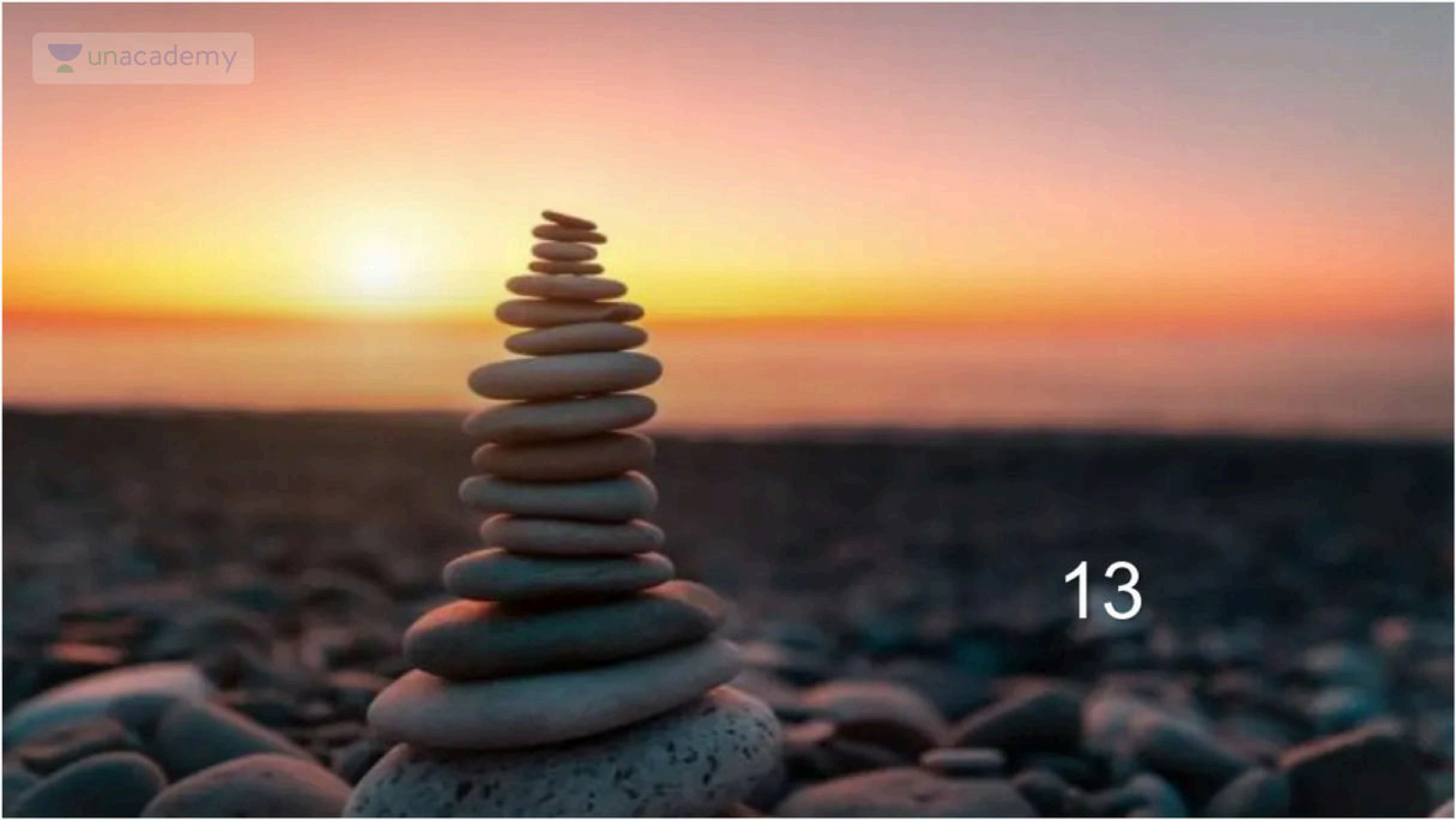
$3^{53}, 7^{53}, 9^{93}$


11

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


12

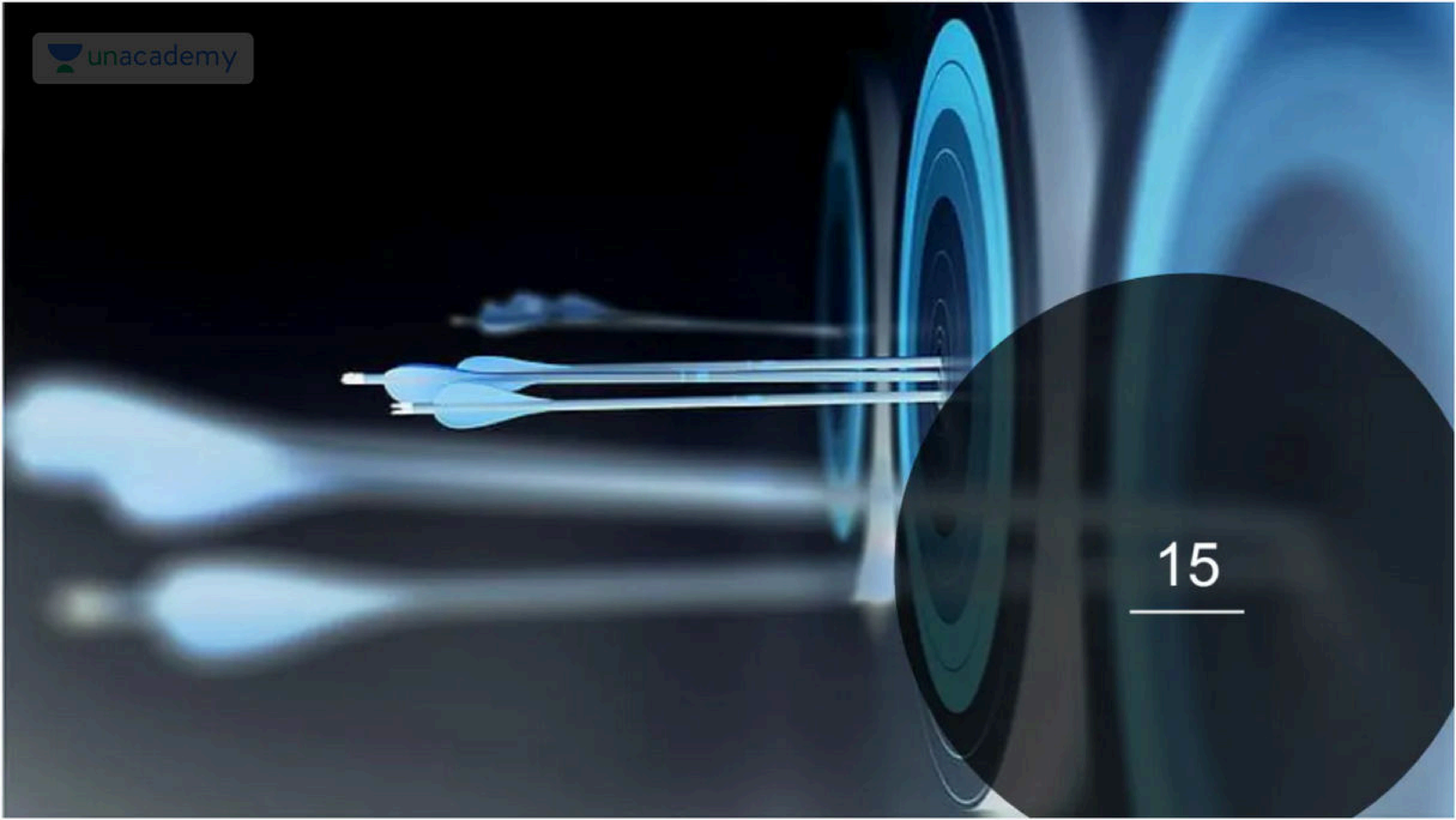
$$\frac{(123\ 1234)}{15}$$


13

$$(1218 \times 1220 \times 1222 \times 1224) \div 9$$


14

$$(1719 \times 1721 \times 1723 \times 1725 \times 1727) \div 18$$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15

The remainder when S is divided by 20 ,

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


16

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


17

$$7^{77} \div 4$$


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18

$$11^{88} \div 7$$


19

$5^{123} \div 7$


20

$7^{84} \div 342$


21

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

12, 24, 288.


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.


24

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

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

$(2 \times 3^4) \times 2^2 \times 3^2$

4×9

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

NOTE:

Odd + Odd = E

Odd + Even = Odd

Even + Even = E

Odd − Odd = E

Odd ~ Even = Odd

Even − Even = E

O × O = Odd

O × E = E

E × E = E


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25

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.


26

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


27

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)]


28

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

(A) 24 (B) 96

(C) 11 (D) 12


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29

even | odd < CAT GMAT] ✓

0, ±1, ±2, ±3 ... given (can) could

If a and b are integers and a - b is even, which of the following $\cancel{\text{must}}$ always be even?

E×E - even

(A) ab   odd × odd = odd

(B) $a^2 + b^2 + 1$

(C) $a^2 + b + 1$

(D) ab - b

① E - E = even

② odd - odd = E

E + E + 1 = E + 1 = odd

E×E - E = E

odd × odd - odd = E

4 - 2 = 2

3 - 1 = 2

2 | 4 | 12

24

1 | D

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

Must be true, except = false

Must be false, except = true

Paradox = Oxymorons

5 — OH4

4H

24

Integers

$0, \pm 1, \pm 2, \pm 3, \pm 4 \ldots$

Even Integer

$\boxed{0}, \pm 2, \pm 4, \pm 6$

Odd Integers

$\pm 1, \pm 3, \pm 5, \ldots$


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$0, \pm 1, \pm 2 \ldots$

Given that a and b are $\boxed{\text{integers}}$ 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 even

odd + odd × odd = EVEN

$1 + 1 \times 1 = 2$

$2 + 4 \times 6 = E$

$2 + 4 \times 1 = E$

$1 + 1^2 \times 2^3 = \text{Odd}$

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

Inequality.


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31

Decending order

$-\frac{1}{2}$

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) $2x$

$\frac{1}{x^2} > 2^{1/x} > 2x > \frac{1}{x}$

C A D B

A. $2^{1/x} = 2^{\frac{1}{-1/2}} = 2^{-2} = \frac{1}{2^2} = \frac{1}{4} = \boxed{0.25}$

B. $\frac{1}{x} = \frac{1}{-\frac{1}{2}} = \boxed{-2}$

C. $\frac{1}{x^2} = \frac{1}{\left(-\frac{1}{2}\right)^2} = (2)^2 = \boxed{4}$

D. $2x$

$2 \times \left(-\frac{1}{2}\right)$

$\boxed{-1}$


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32

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


33

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


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)]


36

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


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MALIK

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

Find the unit digit of "m"

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

Find the last two digits of 'm'


39

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

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


40

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

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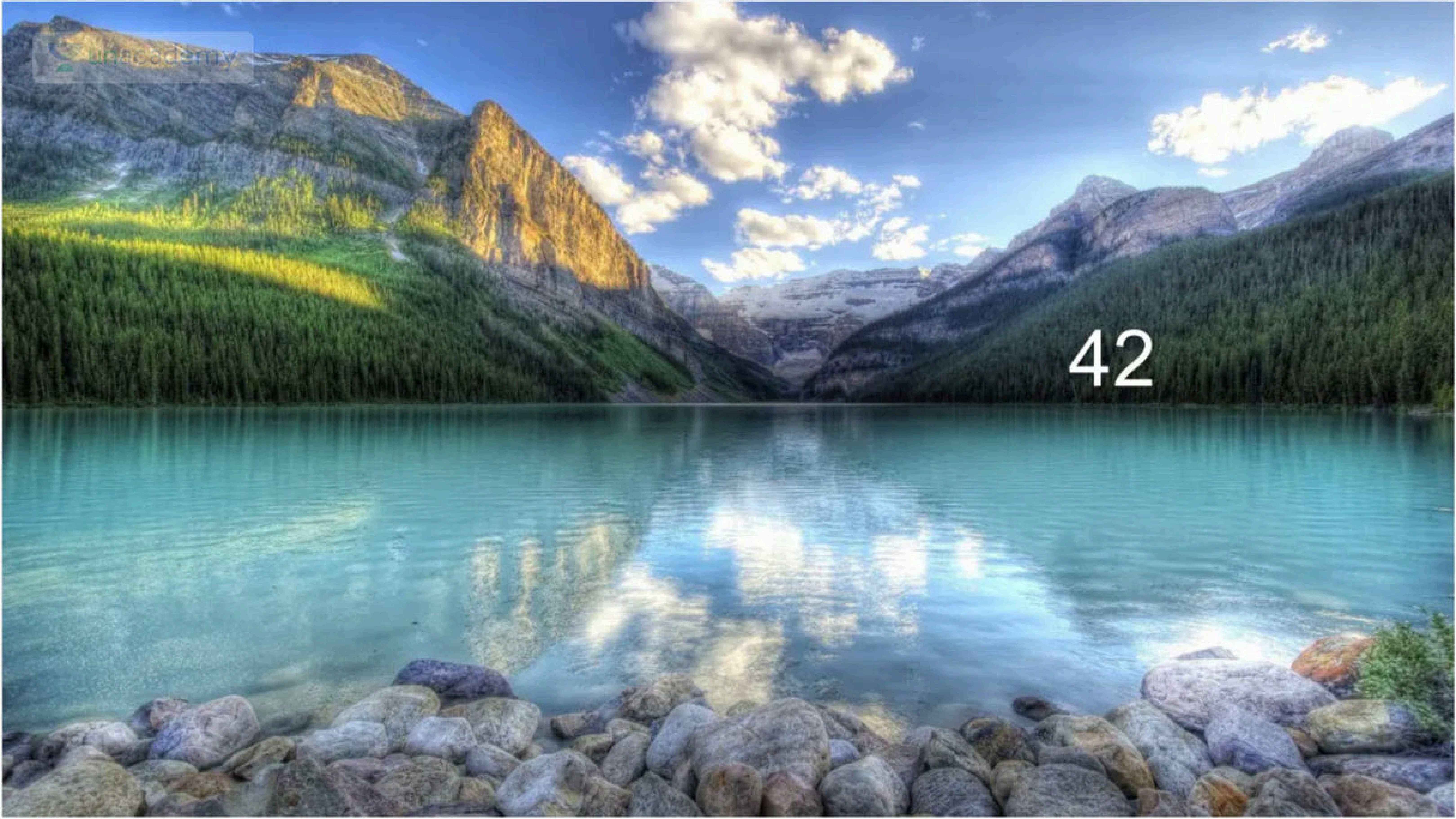
Which among $2^{1/2}$, $3^{1/3}$, $4^{1/4}$, $6^{1/6}$ and $12^{1/12}$ is the largest ?

(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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43

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-


44

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