



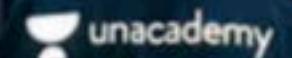
Number System - IV

Complete Course on General Aptitude for GATE 2023/2024

Saurabh Thakur • Lesson 6 • Oct 20, 2022



PREVIEW



HINDI GA,GS AND MATHEMATICS

Complete Course on General Aptitude
for GATE 2023/2024



Saurabh Thakur



Ends on Jan 29, 2023

Oct 14 - Jan 29 • 16 weeks

UNACADEMY
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COMPLETE COURSE ON
General Aptitude for
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IIM ROHTAK



NUMBER SYSTEM.



Factorisation

Prime No.

Natural No. \Rightarrow "Prime Factors"

1) $2^2 \times 3 = 2^2 \times 3$.

↓
1 × 12
2 × 6
3 × 4

2) $24 = 2^3 \times 3$.

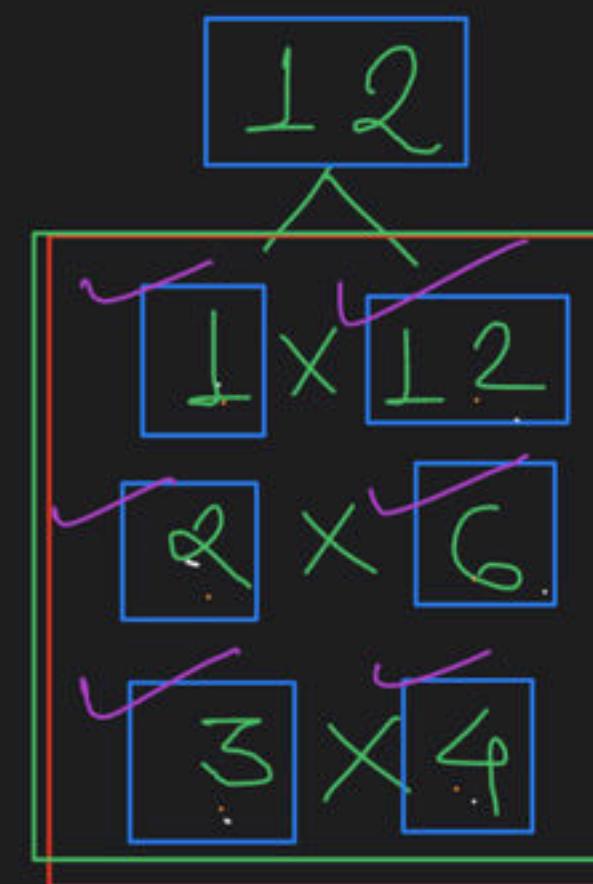
3) $48 = 2^4 \times 3$.

4) $144 = 2^4 \times 3^2$

Natural No.



Prime Factors



1. Factors = 06

2. Sum of the factors
= 28

3. Product of the
factors = 12³
→ 1728

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

Prime factors

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

Q) Number of factors :- $(P+1) \times (q+1) \times (r+1)$

$$(12) = (2+1) \times (1+1)$$

$$2 \times 2 = \boxed{06}$$

Q) $P_n = (n)^{\frac{3}{2}} = 12$



$$\mathcal{L}^4 = \mathcal{L}^{\boxed{3}} \times \mathcal{L}^{\boxed{1}}$$

$$\boxed{1} \quad n = 4 \times 2 = \boxed{08}$$

$$\boxed{3} \quad P_n = (\mathcal{L}^4)^{\frac{8}{2}} = \mathcal{L}^{4^4}$$

$$P_n = 96^6$$

TEST T.

1. $96 = 2^5 \times 3^1$ $\xrightarrow{(n)}$

$$\underline{\text{nodes}} = \underline{02}$$

n_{even}

$$n = 6 \times 2 = \boxed{12}$$
$$12 - 02 = \boxed{10}$$

$$P_n = 60^6$$

2. $60 = 2^2 \times 3^1 \times 5^1$

$$\underline{\text{nodes}} = 2 \times 2 = \boxed{04}$$
$$n_{\text{even}} = \frac{12 - 04}{2} = \boxed{08}$$

3. $P_n = 144^5$
 $\underline{\text{nodes}} = 03$

$$144 = 2^4 \times 3^2$$

$$n = 5 \times 3 = \boxed{15}$$
$$15 - 03 = \boxed{12}$$

$$P_n = (144)^{15/2}$$

$$= (12^4)^{15/4}$$

$$\frac{15}{12}$$

$$4 = 2^2$$

n = 3

$$P_n = (4)^{3/2}$$

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

$$= 2^3 - \textcircled{8}$$



$$49 = \textcircled{7}$$

$$\textcircled{1} \times \textcircled{49}$$

$$\textcircled{7} \times \textcircled{7}$$

$$n = \textcircled{5}$$

$$P_n = (49)^{n/2}$$

$$(\textcircled{7}^4)^{3/4}$$

$$\textcircled{7}^3 = \textcircled{343}$$

Perfect Square

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



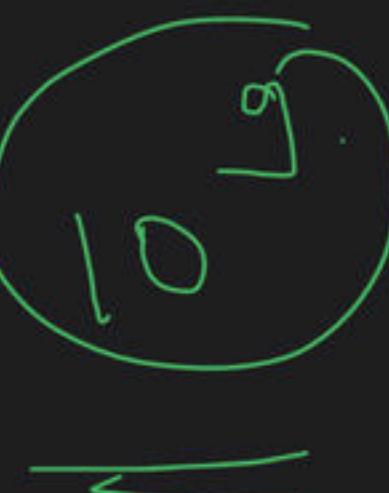
Ex. $\boxed{169} = 13^2$ (Prime factors)

1. $n = \boxed{13}$

2. $P_n = (169)^{3/2} = (13^2)^{3/2} = 13^3 = \boxed{2197}$

$\perp \text{od} =$ Perfect Sq.
Prime Factors = $2^2 \times 5^2$

1. $n = 3 \cdot 3 = 9$

2. $P_n = (\perp \text{od})^{9/2}$
 $= (10^2)^{9/2} =$ 

$$R = 2 \times 3 \times 2$$

$$n = 3 \times 2$$

$$= 6$$

$$n_{\text{odd}} = 2$$

$$= n - n_{\text{odd}}$$

$$= 6 - 2 = 4$$

n = n_{odd} + n_{even}

$$n_{\text{odd}} = 2$$

(2)

$$\underline{n = n_{\text{odd}} + n_{\text{even}}}$$

12

$$1 \times 12 \\ 2 \times 6 \\ 3 \times 4$$

$$\{ n = 6$$

n_{even} = n_{of even factors}

n_{even} = n_{of even factors}

$$= 4$$

↪ [Divisor → Factor]

$\begin{array}{r} 3 \\ \sqrt{6} \\ - 6 \\ \hline \times \end{array}$

TEST

$$1. \quad 2 \times 3 \times 5 \times 7$$

4

$$n = 3 \times 4 \times 2 \times 5 = \underline{\underline{120}}$$

$$n_{\text{odf}} = 4 \times 2 \times 5 = \underline{\underline{40}}$$

$$\text{Nemen} = \underline{\underline{80}}$$

$$2. \quad 2^4 \times 3^4 \times 5^4 \times 11^4$$

$$n = 5^4 = \underline{\underline{625}}$$

$$n_{\text{odf}} = 5^3 = \underline{\underline{125}}$$

$$\text{Nemen} = \underline{\underline{500}}$$

$$\begin{array}{r}
 12 \\
 \times 12 \\
 \hline
 144
 \end{array}$$

| | | |
|-----------------|--|------------------------------|
| $\frac{2}{3} 8$ | $8, 4, 6, 12$ $\overbrace{\quad\quad\quad}$ | \rightarrow 04 |
| $\div 3$ | $5, 6, 12$ $\overbrace{\quad\quad\quad}$ | \rightarrow 03 |
| $\div 4$ | $4, 12$ $\overbrace{\quad\quad\quad}$ | \rightarrow 02 $=$ |
| $\frac{2}{3} 6$ | $6, 12$ $\overbrace{\quad\quad\quad}$ | \rightarrow 02 |

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

n

$$2 \times 3.$$

$$\frac{0}{2}$$

$$2 \times 3$$

$$2 \times 2 + 04$$

$$2$$

$$\begin{aligned} & \times 2^0 \times 3^0 = 2 \\ & \times 2^1 \times 3^0 = 4 \\ & \times 2^0 \times 3^1 = 6 \\ & \times 2 \times 3 = 12 \end{aligned}$$

$$\div 3$$

$$\div 4$$

$$2 \times 3$$

$$2^2$$

$$3^1$$

$$2^1$$

$$03$$

$$02$$

$$(2 \times 3) \times 2^0$$

$$2$$

$$3^0$$

$$12$$

$$\begin{aligned} & \times 3^0 = 4 \\ & \times 3^1 = 12 \end{aligned}$$

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

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

newer
=

① $\boxed{2} \mid \boxed{\div 2}$ $\Rightarrow 2^1 \times 3^1 \Rightarrow n = 3 \times 2 = \boxed{106}$

$\boxed{2} \mid \boxed{\div 3} \Rightarrow 2^3 \Rightarrow n = 04$

③ $\boxed{4} \mid \boxed{\div 2}$ $\underline{\underline{2}}$ $2^1 \times 3^1 \Rightarrow n = 2 \times 2 = 04$

$$\frac{2^3 \times 3^4 \times 5^5}{n} = 4 \times 5 \times 6$$

= 120

Newer.

1 $\div 2 = 2^2 \times 3^4 \times 5^5 \Rightarrow 3 \cdot 5 \cdot 6 = 190$

2 $\div 8 \rightarrow 3^4 \times 5^5 \quad n = 5 \times 6 = 30$

3 $\frac{1}{5} \div 100 \rightarrow 2^1 \times 3^4 \times 5^{-3} \Rightarrow n = 2 \cdot 5 \cdot 4 = 10$

$$\text{GST} = \frac{2^2 \times 3^3 \times 5^5 \times 7^4}{(3^3)^3} \times \frac{6 \cdot 5}{10}$$

$\Rightarrow 2^2 \times 3^3 \times 5^5 \times 7^4 = 360$ neun

$\Rightarrow 2^1 \times 3^3 \times 5^5 \times 7^4$

$$2 \cdot 4 \cdot 5 \cdot 5 = 240$$

$$\therefore 100$$

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

$$4 \cdot 4 \cdot 5^2 = 80$$

$$\therefore 6 \cdot 5 \cdot 3^3 \times 5^5 \times 7^4$$

$$\frac{3 \cdot 4 \cdot 2 \cdot 5}{120}$$

$$240$$

$$(4)$$

$$2 \cdot 3 \times 5 \times 5$$

$$3 \cdot 4 \cdot 5 = 72$$

Natural no. $\in \mathbb{N}_0$

$$\boxed{\mathbb{N}} \times \boxed{2} \Rightarrow \boxed{\overline{\mathbb{E} \cup \mathbb{E}^c}}$$

$$\boxed{\mathbb{H}} \times \boxed{3} \Rightarrow \mathbb{E}_0$$

$$\mathbb{E} \times \mathbb{E} = \mathbb{E}$$

$$\mathbb{E} \times 0 = \mathbb{E}$$

$$\frac{0 \times 0 = 0 \text{ und}}{}$$

$\boxed{N} \Rightarrow n$

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

n even

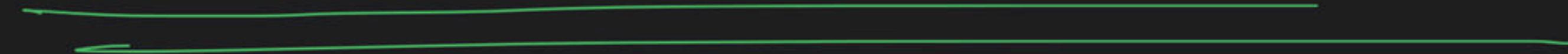
Node ✓

$$\div 2$$

$$\div 3$$

$$\div 5$$

$$\div 10$$



N = Prime Factors.

$$12 = 2^2 \times 3 \times \boxed{1}$$

Perf. Squ.

Prime Factors — Powers = Even

$$\begin{aligned} & 2^3 \times 3^1 \times 5^{-1} \times 7^2 \times 11^1 \\ & (\times 2 \times 5 \times 11) = \boxed{110} \end{aligned}$$

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

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

Perfect cube

Powers \rightarrow $\times 5$.

$$\begin{array}{r} \boxed{2} \quad \boxed{5} \quad \boxed{2} \quad \boxed{5} \\ 2 \times 5 \times 7 \times 5 \times 7 \times 5 \\ \hline 8871383920 \end{array}$$

$$\begin{array}{r} \boxed{2} \quad \boxed{3} \quad \boxed{7} \quad \boxed{5} \\ 2 \times 3 \times 7 \times 5 \\ \hline \end{array}$$

TEST

Puf. Sg.

12 60
2 2 $3 \times 5^-$

(3x5)

Puf. Ceme

(2⁻¹ × 3² × 5⁻²)

12 180
—
2⁻¹ × 3² × 5⁻¹

5

(2⁻¹ × 3¹ × 5⁻²)

$$\begin{array}{c} \boxed{} \\ \times \cancel{x} \\ \hline \end{array}$$

\cancel{x}

$$\begin{array}{c} \boxed{} \\ \rightarrow \\ \hline \end{array}$$

$\cancel{4}$

$$\begin{array}{c} 12 \\ \boxed{} \\ \hline \end{array}$$

$$\textcircled{a \times 3}$$

$$\begin{array}{c} 6 \\ (2 \times 3) \end{array}$$

A photograph of an open book lying flat. The left page is dark and mostly blank, while the right page features a vibrant, detailed illustration of a lush green landscape with rolling hills, a winding path, and a small white bird in flight. The book is resting on a light-colored wooden surface.

01



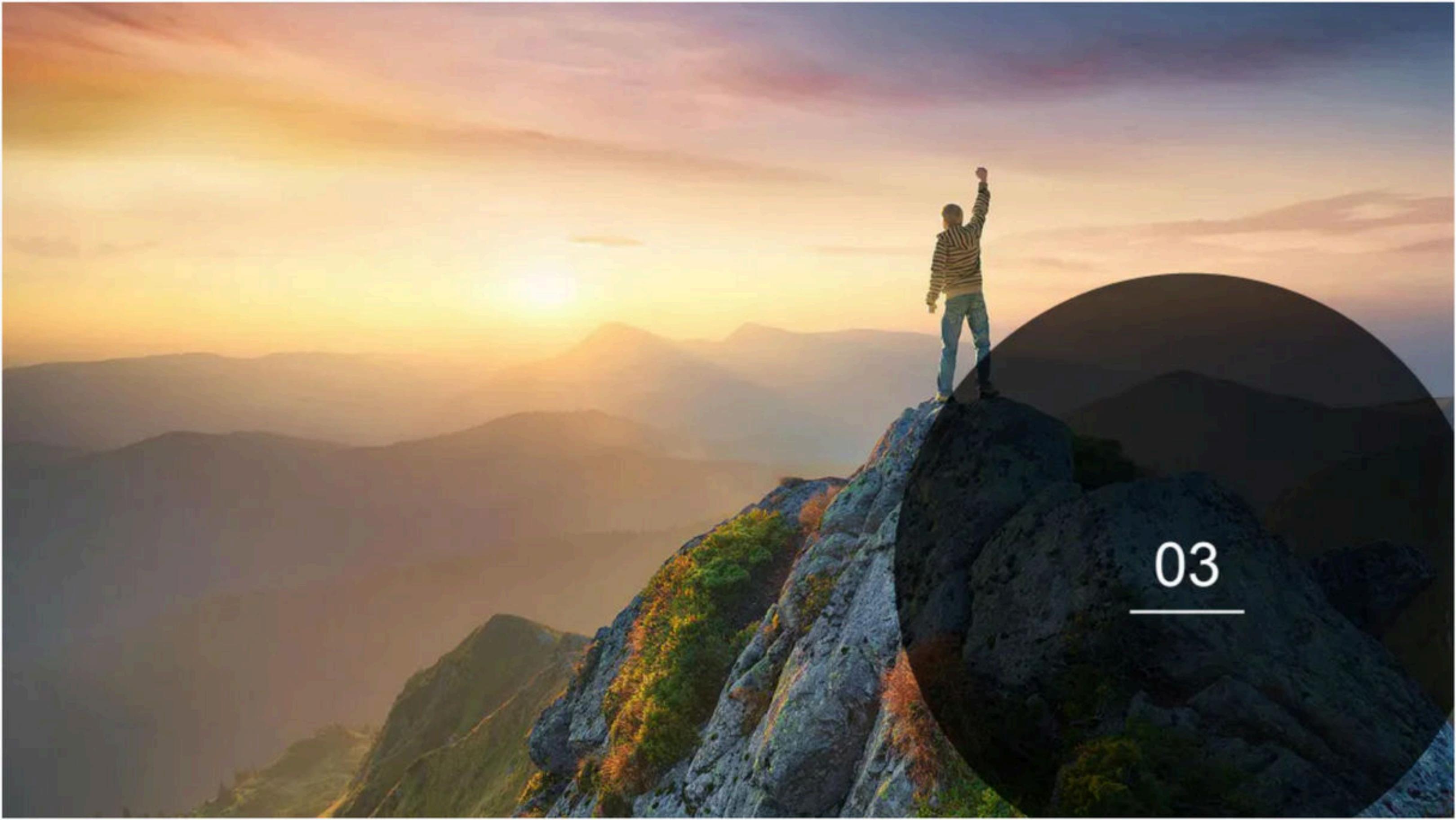
100!, 150!, 250!

A photograph of two people from behind, watching a sunset over a city skyline. The sky is a vibrant orange and yellow. In the foreground, the silhouettes of trees are visible against the bright sky.

05

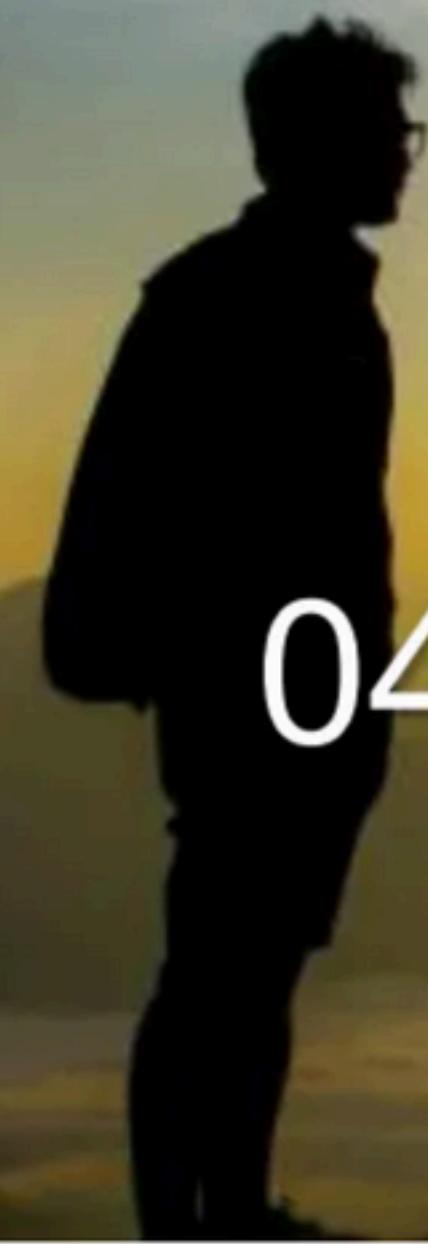
$2^{23}, 2^{51}, 3^{59}, 4^{99}, 3^{171}, 7^{208}$





03

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



04

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



05



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



06



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





The numeral in the units position of

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

[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

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

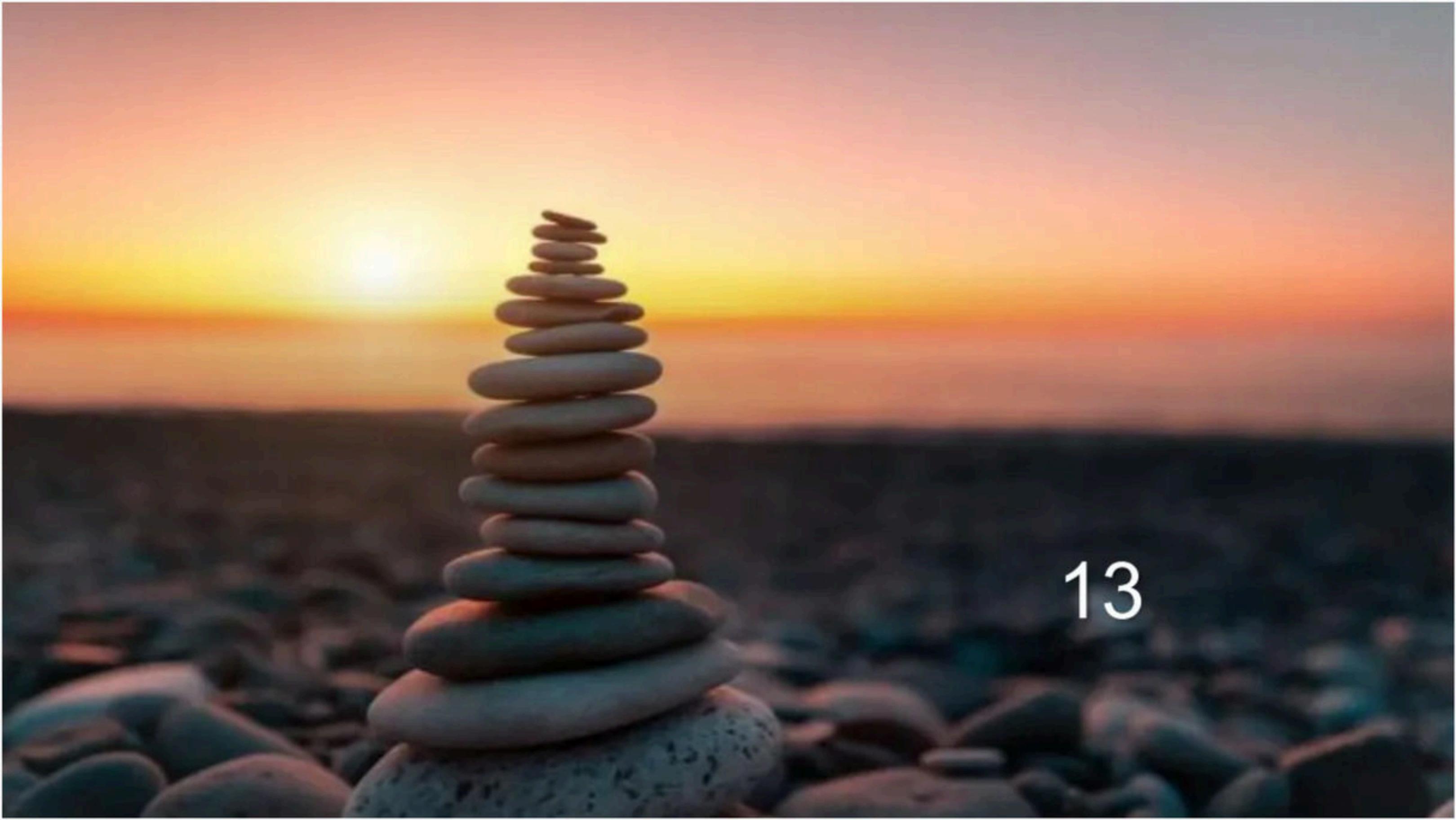




12

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



A photograph of a tall, spiraling stack of smooth, grey stones, likely zen stones, balanced on a pile of smaller stones. The background is a warm sunset or sunrise over a dark horizon.

13

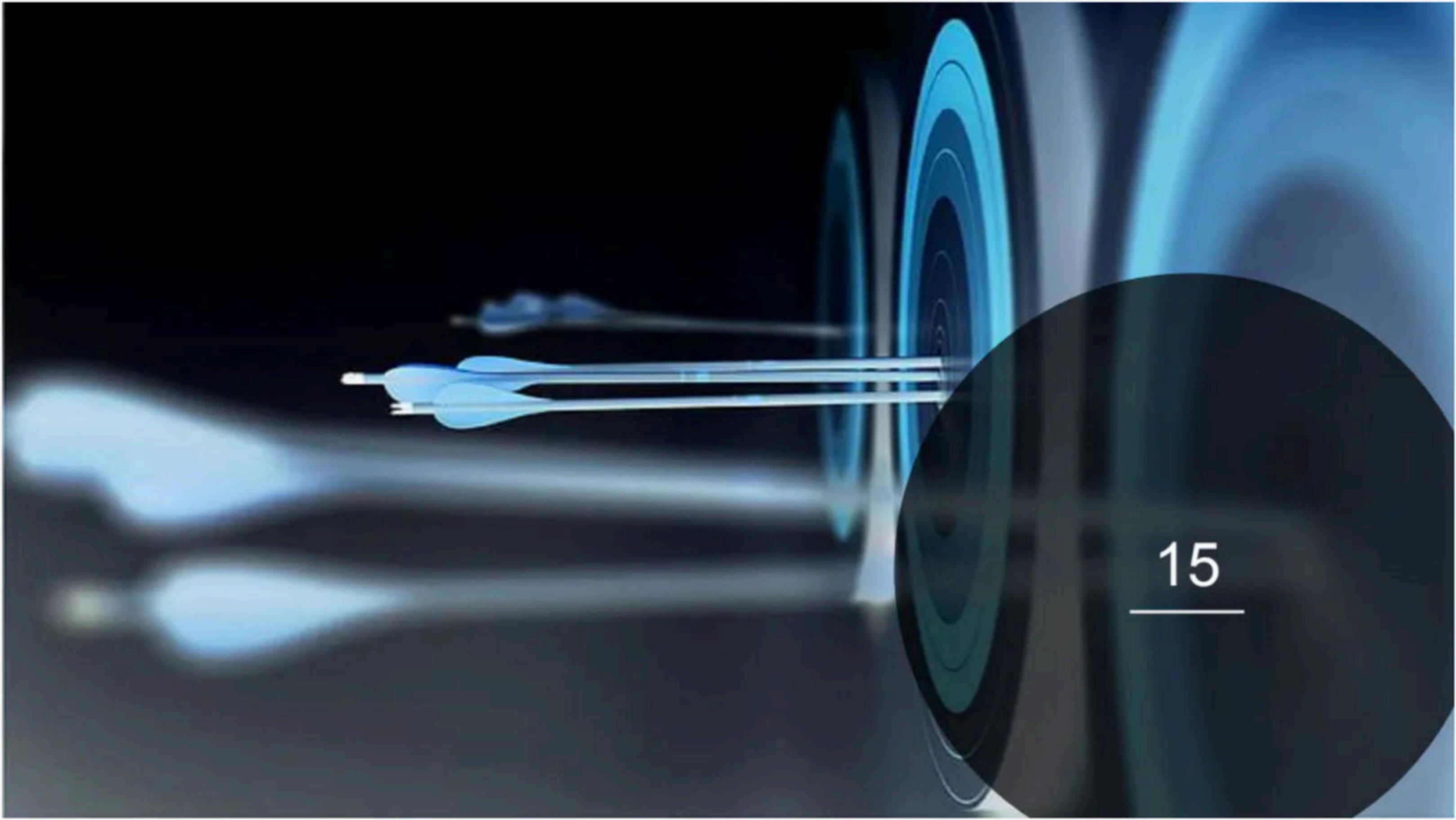
$$(1218 \times 1220 \times 1222 \times 1224) \div 9$$





14

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



15



The remainder when S is divided by 20 ,

$$\text{where } S = 1! + 2! + 3! + 4! + 5! + 6! + \dots + 19! + 20!$$

16





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



17

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





18

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





19


$$5^{123} \div 7$$

An aerial photograph of a coastal scene. The top half shows a light brown, textured cliff face with white foam where waves are crashing against its base. Below the cliff, the ocean is a deep blue, with white-capped waves crashing towards the shore. The perspective is from above, looking down at the coastline.

20

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



A wide-angle photograph of a dark night sky filled with stars and a prominent, hazy celestial body, likely the Milky Way or a distant galaxy. In the foreground, a two-lane road with white dashed lines stretches into the distance. On the right side of the road, a large, dark, circular shape, resembling a planet or a massive crater, dominates the scene. The horizon shows a faint glow of orange and yellow light.

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.

A close-up photograph of a person's hands writing in a notebook with a pencil. The person is wearing a white shirt. The background is blurred, showing what appears to be a classroom or office setting.

23

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

A photograph of a dartboard mounted on a wooden wall. Three blue-tipped darts are clustered tightly in the center bullseye. The background is a blurred indoor setting.

24



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

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

(B) 27

(D) 36

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

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



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



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.

A wide-angle photograph of a night sky over a mountain range. The sky is filled with stars, with a prominent, very bright star visible in the upper left quadrant. A small, thin white line or streak extends from this star towards the center-left of the frame. The mountains in the foreground and middle ground are dark and silhouetted against the sky. In the lower-left corner, a valley is visible with some lights, possibly from a town or campsite. The overall atmosphere is dark and serene.

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 _____.

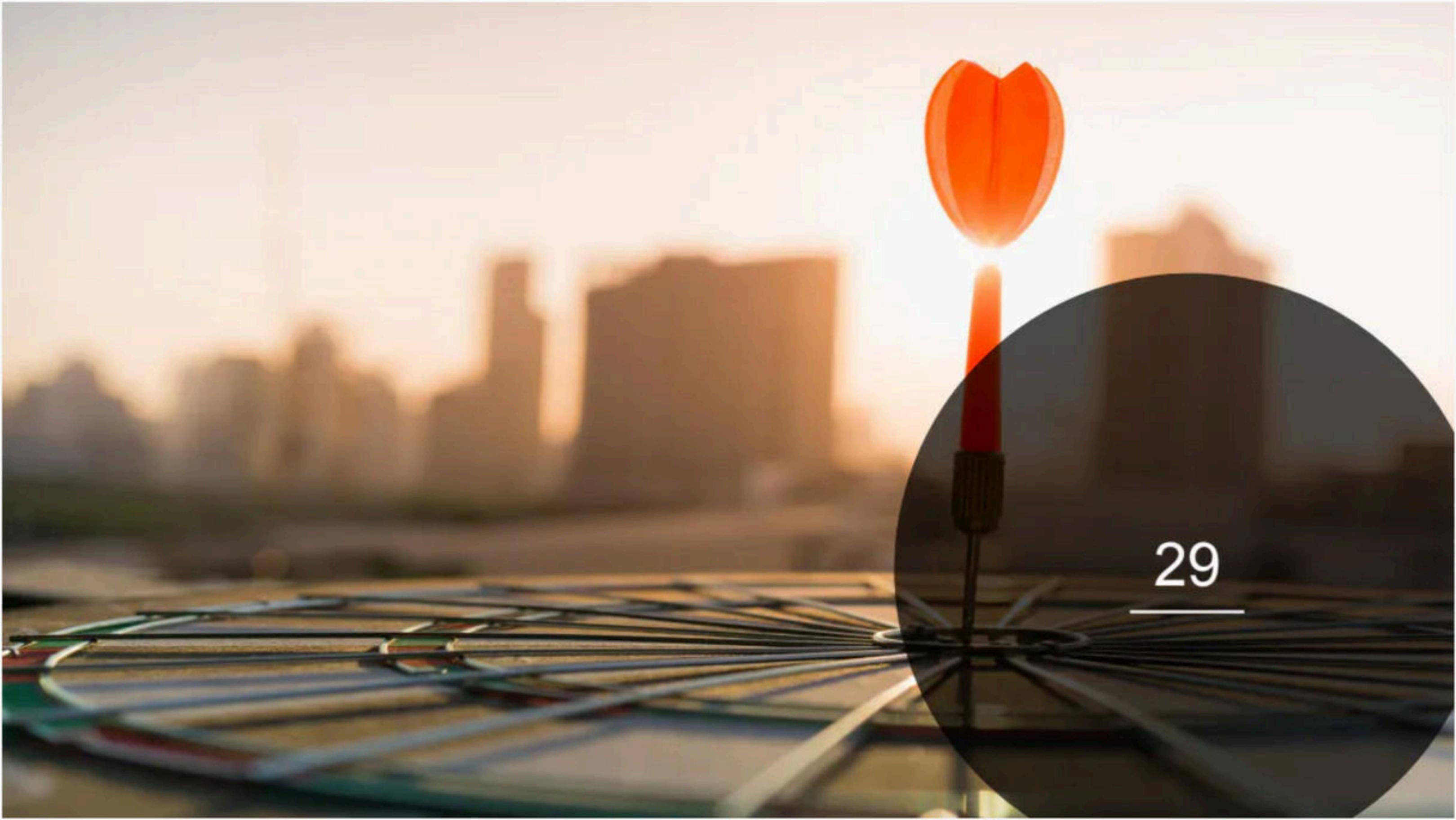
- A. 0
- B. 2
- C. 5
- D. 6

[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



29



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)]



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 even

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

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) $2x$

A silhouette of a person running towards the right is set against a vibrant sunset or sunrise. The background features a range of mountains with warm orange, yellow, and pink hues. The foreground is dark, suggesting a rocky or dirt path.

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

A photograph of a person's silhouette standing on a beach, facing the ocean at sunset. The sky is filled with warm orange and yellow clouds. The number "33" is overlaid in white text on the right side of the image.

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)]

34

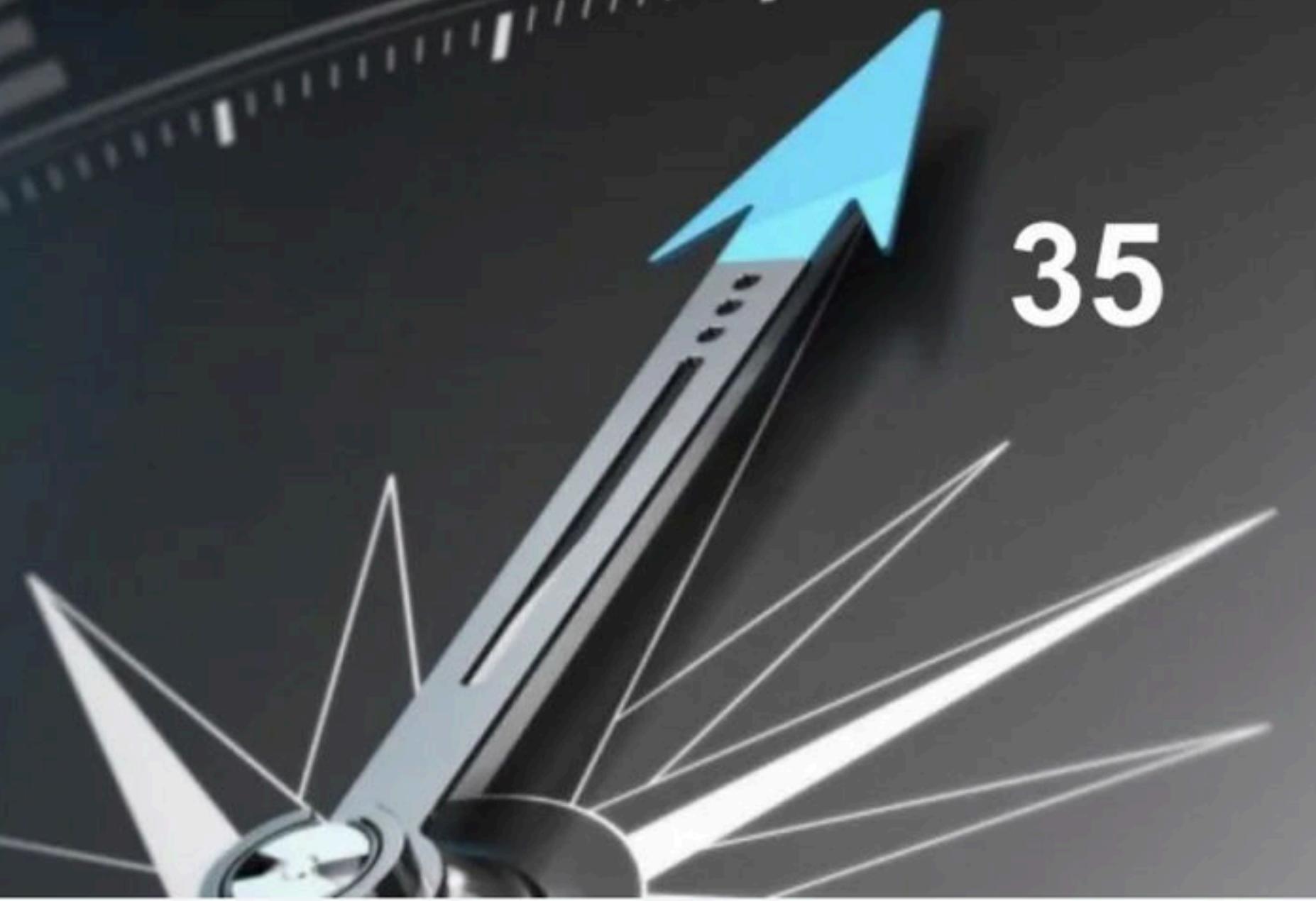


A number consists of two digits, the sum of digits is 9. If 45 is subtracted from the number, its digits are interchanged. What is the number?

- (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, $m = 1! + 2! + 3! + 4!$
+..... + 99! + 100!



37



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

Find the unit digit of “m”



38



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

Find the last two digits of 'm'

A silhouette of a person standing with arms raised against a sunset sky.

39



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

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



A digital illustration of a landscape at sunset. In the foreground, there's a grassy hillside with colorful autumn leaves. In the middle ground, a large, blue and purple planet dominates the left side, with a comet-like streak trailing across the sky. The sun is setting on the horizon, casting a warm orange glow. A tall, leafy tree stands on a hill on the right. The background features distant mountains and a star-filled sky.

40



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

If N is a natural number such that $10^{12} < N < 10^{13}$ and the sum of the digits of n is 2 , then the number of values n take is :

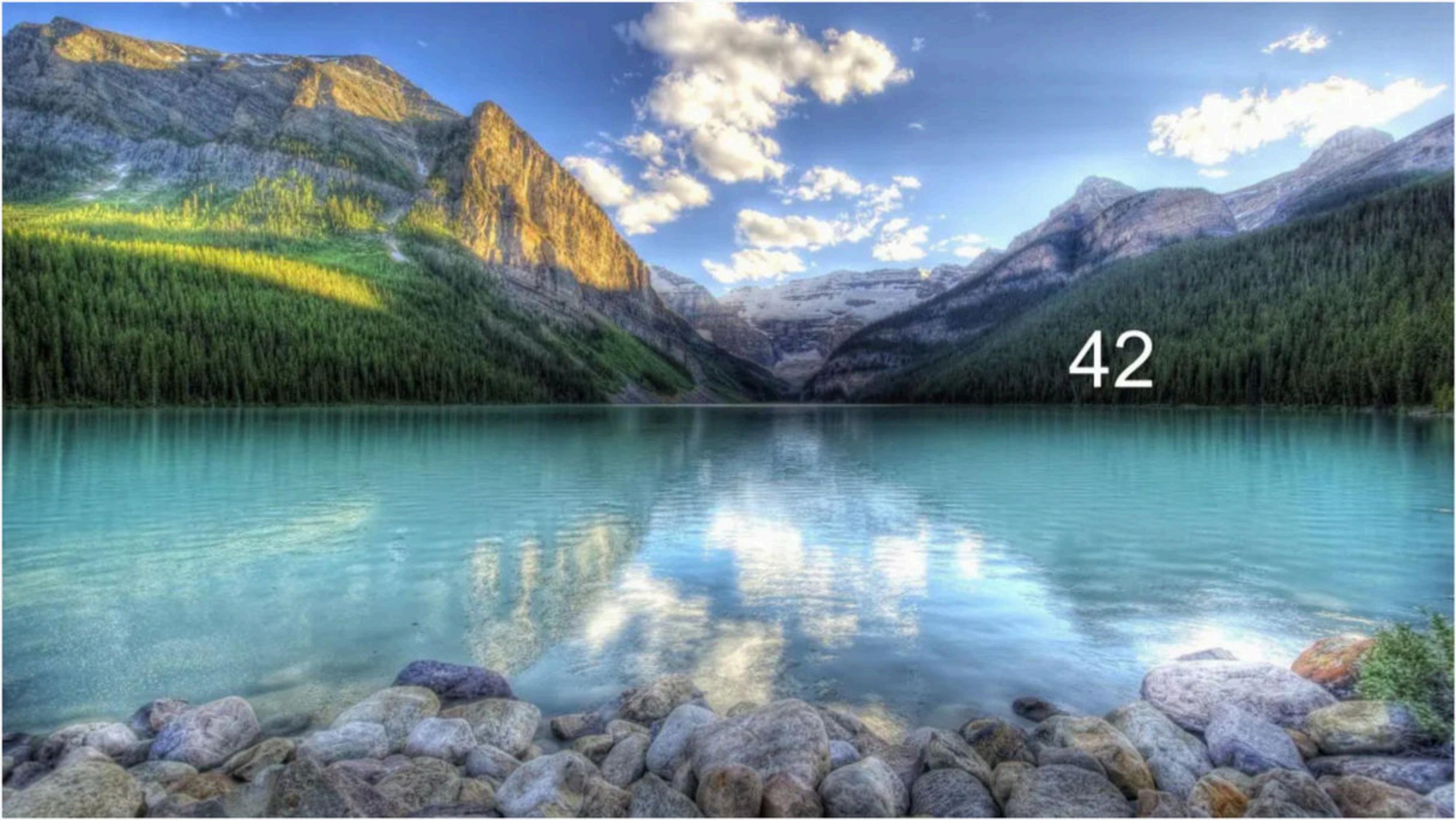
41



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

- (A) $2^{1/2}$
- (C) $4^{1/4}$

- (B) $3^{1/3}$
- (D) $6^{1/6}$

A wide-angle photograph of a mountainous landscape. In the foreground, a clear, turquoise-colored lake reflects the surrounding environment. The lake's edge is bordered by a rocky shoreline. The middle ground is dominated by a range of mountains with steep, rocky slopes covered in patches of green forest. The sky above is a vibrant blue, dotted with wispy, white clouds.

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)

A wide-angle photograph of a mountainous landscape at sunset. The sky is filled with warm, orange, and yellow hues. In the foreground, there's a rocky shoreline with some low-lying green vegetation. A body of water reflects the warm colors of the sky. In the background, there are several mountain peaks, some with snow or ice on their summits. The overall scene is very peaceful and scenic.

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 $N = 15 \times 30 \times 45 \times 60 \times \dots \times 1500$, 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)]



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) $(x-y)(y+z)(x+y-z)$ is odd
- (E) None of these