

Unit digit

इकाई का अंक

coaching center

Concept:

- **UD of $(a + b) = \text{UD of } a + \text{UD of } b$**
- **UD of $(a - b) = \text{UD of } a - \text{UD of } b$**
- **UD of $(a \times b) = \text{UD of } a \times \text{UD of } b$**

$$[35\textcircled{1} + 43\textcircled{2}] \rightarrow 1+2 \rightarrow 3$$

$$35\textcircled{1} - 43\textcircled{2} \rightarrow 1-2 \rightarrow -1/9$$

$$\begin{array}{r} 43\textcircled{2} \times 35\textcircled{7} \rightarrow 4 \\ \hline 14 \end{array}$$

230. Find the unit digit of 9!.

9! की इकाई अंक ज्ञात करें:

a) 9

~~b) 0~~

c) 2

d) 8

$$2! \rightarrow 2$$

$$3! \rightarrow 6$$

$$4! = 4 \times 3 \times 2 \times 1 \rightarrow 4$$

$$5! \rightarrow 0$$

$$9! = 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

$$\boxed{} \times 10 = 0$$

$$321 \times 10 = 321\underline{0}$$

$$453 \times 10 = 453\underline{0}$$

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231. What is the last digit of $2! + 3! + 4! + \dots + 90!$?

$$3! = 3 \times 2!$$

$2! + 3! + 4! + \dots + 90!$ का आखिरी अंक ज्ञात करें।

a) 2

b) 3

c) 4

d) 6

$$2 + 6 + 4 + 0 + 0 + \dots + 0$$

$$= \boxed{12}$$

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232. If the unit digit of $433 \times 456 \times 43N$ is $(N+2)$.
Then what is the value of N ?

यदि $433 \times 456 \times 43N$ का इकाई अंक $(N+2)$ है,
तो N का मान क्या है?

UD of $8 \times N = N+2$

~~a) 1~~

~~b) 8~~

~~c) 3~~

d) 6

$$\begin{array}{r} 3 \\ 8 \times N \rightarrow N+2 \\ 1 \rightarrow 8 \\ 8 \rightarrow 4 \\ 6 \rightarrow 4 \end{array}$$

Diagram illustrating the unit digit calculation for $8 \times N = N+2$. The diagram shows the unit digit of $8 \times N$ is 3, and the unit digit of $N+2$ is 4. The unit digit of $8 \times N$ is 1, and the unit digit of $N+2$ is 8. The unit digit of $8 \times N$ is 8, and the unit digit of $N+2$ is 4. The unit digit of $8 \times N$ is 6, and the unit digit of $N+2$ is 4. A box around the 8 in the final row indicates the correct answer.

$$\cancel{2} \times 3 \times \boxed{5} \times 7 \times 11$$

odd

$$5 \times \text{odd} \rightarrow 5$$

$$5 \times \text{even} \rightarrow 0$$

233. All odd prime numbers up to 110 are multiplied together. What is the unit digit in this product?

110 तक की सभी विषम अभाज्य संख्याओं को एक साथ गुणा किया जाता है। इस गुणनफल में इकाई का अंक क्या है?

a) 0

b) 3

~~c) 5~~

d) None of the above

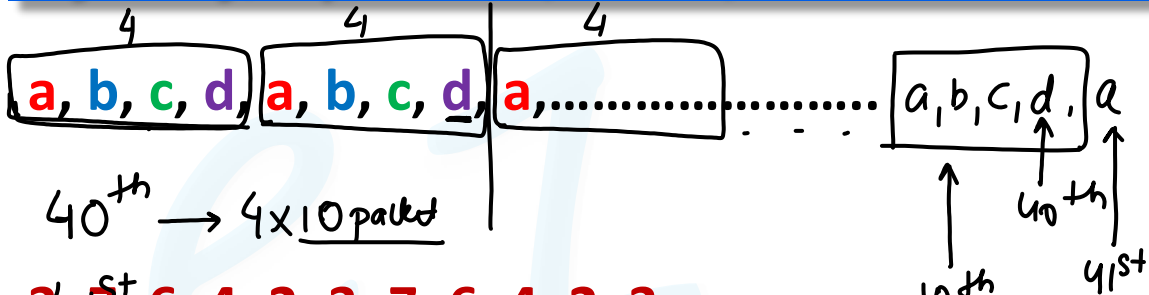
$$5 \times 1 = 5$$

$$5 \times 3 = 15$$

$$5 \times 5 = 25$$

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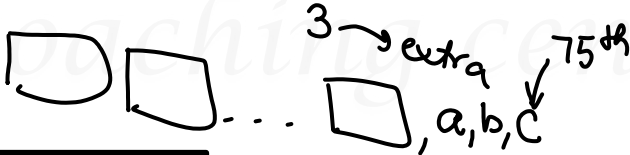
Cyclicity/repetition (चक्रियता):



3, 7, 6, 4, 2, 3, 7, 6, 4, 2, 3.....

75th → $4 \overline{) 75} \begin{matrix} 18 \\ \underline{72} \\ 3 \end{matrix}$ (18 → पूरे packet)

$\frac{511^{st}}{4} \Big| R = 3^{rd} \rightarrow c$



$$78^{\text{th}} \rightarrow 4 \overline{) 78} \begin{array}{r} 19 \\ \underline{76} \\ 2 \end{array} \rightarrow \text{किताबें पूरे packet}$$

$$2 \rightarrow b$$

$$\frac{123^{\text{rd}}}{4} \Big|_R = 3 \rightarrow C$$

$$\frac{76^{\text{th}}}{4} \Big|_R = 0/M$$

$$4 \overline{) 76} \begin{array}{r} 19 \\ \underline{76} \\ 0 \end{array}$$

$$4 \overline{) 76} \begin{array}{r} 18 \\ \underline{72} \\ 4 \end{array}$$

3, 7, 6, 4, 2, 3, 7, 6, 4, 2, 3, 7, 6, - - - - .

$$\frac{53^{\text{rd}}}{5} \Big| \begin{array}{l} \rightarrow 3 \rightarrow 6 \\ R \end{array}$$

$$\frac{116^{\text{th}}}{5} \Big| \begin{array}{l} \rightarrow 1 \rightarrow 3 \\ R \end{array}$$

$$\frac{125^{\text{th}}}{5} \Big| \begin{array}{l} \rightarrow 0 \rightarrow 2 \\ R \end{array}$$

↖ last

234. Find the 123rd number of the sequence a, b, e, k, a, b, e, k, a.....

अनुक्रम a, b, e, k, a, b, e, k, a..... का 123वां पद ज्ञात करें।

a) a

b) b

c) e

d) k

$$\frac{123}{4} \Big| R = 3^{\text{rd}} \rightarrow e$$

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235. What is the 72nd number in the following sequence 3, 2, 1, 8, 4, 3, 2, 1, 8, 4, 3, ...

अनुक्रम 3, 2, 1, 8, 4, 3, 2, 1, 8, 4, 3, ... का 72वां पद ज्ञात करें ।

- a) 3 ~~b) 2~~ c) 1 d) 8

$$\frac{72}{5} \text{ R} = 2^{\text{nd}} \rightarrow 2$$

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236. The 50th number of the sequence 3, 7, 2, 3, 7, 2, 3, 7...

अनुक्रम 3, 7, 2, 3, 7, 2, 3, 7... का 50वां पद ज्ञात करें।

a) 3

b) 2

c) 7

d) Can't say

$$\frac{50}{3} \Big|_R = 2^{\text{nd}} \rightarrow 7$$

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237. The 149th number of the sequence 1, 8, 1, 8,

1.....^{1st} ^{2nd} ^{3rd} ^{4th}

अनुक्रम 1, 8, 1, 8, 1, 8, 1.....का
149वां पद ज्ञात करें।

~~a) 1~~

b) 8

c) None of these

d) Can't say

$$\frac{149}{2} \Big|_R = 1^{st} \rightarrow I$$

1, 2, 3, 4, 5, 6, 7, 8, ...

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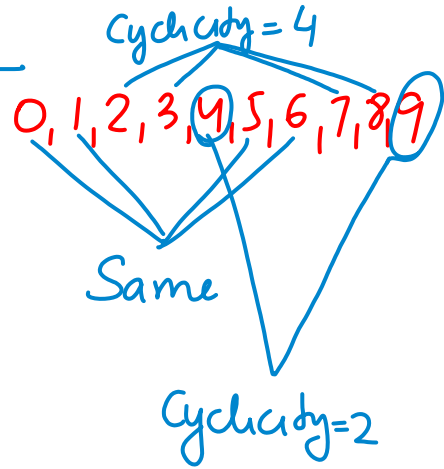
Cyclicity of All digits' powers:

$$(57\underline{0})^{125} = 0^{125} = 0$$

$$(57\underline{1})^{175} = 1^{175} = 1$$

$$(37\underline{5})^{237} = 5^{237} = 5$$

$$(2\underline{016})^{173} = 6^{173} = 6$$



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$$4^1 = 4$$

$$4^2 = 16$$

$$4^3 = 64$$

$$4^4 = 256$$

$$9^1 = 9$$

$$9^2 = 81$$

$$9^3 = 729$$

1
9
1

odd/even

$$4^{\text{odd}} \rightarrow 4$$

$$4^{\text{even}} \rightarrow 6$$

$$9^{\text{odd}} \rightarrow 9$$

$4^1 = 4$

$4^{1073} \rightarrow 4$

$4^{1032} \Rightarrow 6$

$4^2 = 16$

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$2^1 =$	<u>2</u>	2
$2^2 =$	<u>4</u>	4
$2^3 =$	<u>8</u>	8
$2^4 =$	<u>16</u>	6
$2^5 =$	<u>32</u>	2
$2^6 =$	<u>64</u>	4
$2^7 =$	<u>128</u>	8
$2^8 =$	<u>256</u>	6

$$2^{179} \rightarrow \frac{79}{4} \text{ R} = 3^{\text{rd}} \rightarrow 8$$

$$2^{237} \rightarrow 2^1 = \underline{2}$$

$$2^{414} \rightarrow 2^2 = 4 \checkmark$$

$$2^{156} \rightarrow 2^4 = 16$$

$$\text{R} = 0/4$$

$$\cancel{2} + \cancel{7} 3 \xrightarrow{1578} \boxed{9}^{3^2}$$

ei

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Unit digit of m^n :

Number	Unit Digit
57 <u>6</u> ¹²⁷	6
<u>78</u> ²³¹ → 8 ³ → 51②	
<u>94</u> ⁷⁴³ → odd 4 ¹ = 4 ✓	
1287 ¹²⁷⁸ <u>7</u>	7 ² = 4⑨
343 ³⁴⁴ <u>3</u> → R=0/4 3 ⁴ = 8①	
<u>2019</u> ²⁰¹⁹ → 9	

0, 1, 5, 6

2, 3, 7, 8

4, 9

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238. Unit digit of $2169^{1793} \times 615^{317} \times 132^{491}$ is
की इकाई

$$\underline{2169^{1793}} \times \underline{615^{317}} \times \underline{132^{491}}$$

अंक ज्ञात कीजिये:

a) 5

b) 0

c) 8

d) 9

0, 1, 5, 6 \rightarrow Same

4, 9 \rightarrow 2 [0/e]

2, 3, 7, 8 \rightarrow 4

9 \times 5 \times 8 \Rightarrow 0

5 \times odd = 5
5 \times even = 0

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239. Find the unit digit of $264^{102} + 264^{103}$

$264^{102} + 264^{103}$ की इकाई अंक ज्ञात कीजिये:

$$4^2 = 16$$

$$4^1 = 4$$

~~a) 0~~

b) 2

c) 4

d) 6

$$6 + 4 = 10$$

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240. Let $x = (633)^{24} - (277)^{38} + (266)^{54}$.
What is the units digit of x ?

यदि $x = (633)^{24} - (277)^{38} + (266)^{54}$ है,
तो x का इकाई अंक क्या है?

a) 7

b) 6

c) 4

~~d) 8~~

$$\begin{array}{r} 351 \\ -157 \\ \hline 20-6 \end{array} \quad \times$$

$$3^4 - 7^2 + 6$$

$$1 - 9 + 6 = -2 \mid 8$$

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24. If $x = (164)^{169} + (333)^{337} - (727)^{726}$,
then what is the units digit of x ?

यदि $x = (164)^{169} + (333)^{337} - (727)^{726}$
है, तो x का इकाई अंक क्या है?

a) 5

b) 7

c) 8

d) 9

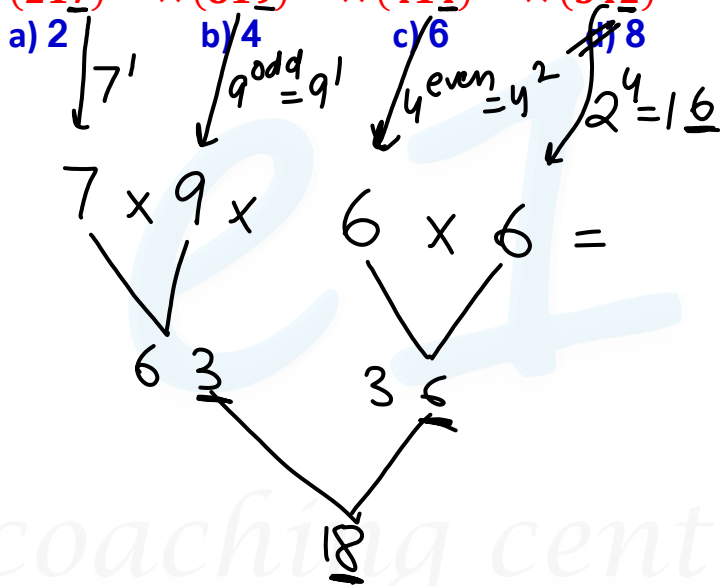
Handwritten solution showing the calculation of the units digit:

$$4 + 3 - 9 = -2/8$$

Arrows indicate the mapping from the options to the terms in the equation: a) 5 points to 4, b) 7 points to 3, and c) 8 points to 9. The result $-2/8$ is written below the equation.

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242. What is the unit digit of $(217)^{413} \times (819)^{547} \times (414)^{624} \times (342)^{812}$?
 $(217)^{413} \times (819)^{547} \times (414)^{624} \times (342)^{812}$ का इकाई अंक क्या है?



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243. The last digit of 17^n is 3. Then which of the following cannot be the value of n ?

17ⁿ का अंतिम अंक 3 है। तो निम्न में से कौनसी संख्या n का मान नहीं हो सकती?

$$7^n \rightarrow 3$$
$$\downarrow$$
$$4k+3$$

a) 51

b) 55

c) 63

d) 77

$$7^1 = 7$$

$$7^2 = 49$$

$$7^1 \times 7^2 = 7^3 = 343 \quad \boxed{3}$$

$$7^4 =$$

1
7
9
3
1

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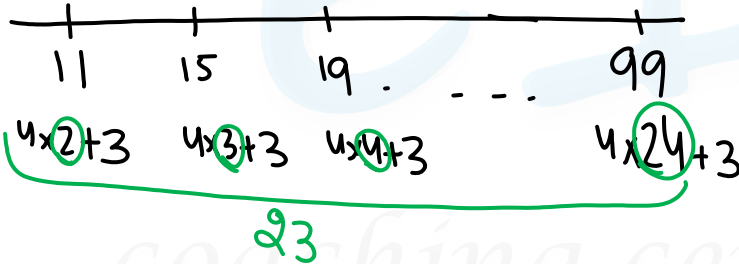
244. Let p be a two digit integer such that the last digit of 12^p is 8. How many values p can take?

$$2^p \rightarrow 8$$

$$4k+3$$

p एक दो अंको का पूर्णांक इस प्रकार है कि 12^p का अंतिम अंक 8 है। p के कितने मान हो सकते हैं?

- a) 19 b) 20 c) 21 ~~d) 23~~



$$\left. \begin{array}{l} 2^1 = 2 \\ 2^2 = 4 \\ 2^3 = 8 \\ 2^4 = 16 \end{array} \right\} \rightarrow$$

20
15
10
5
0

245. The right most nonzero digit of 120^{250} is:

120²⁵⁰ का दाईं ओर से पहला शून्येतर अंक

a) 2

~~b) 4~~

c) 6

d) 8

$$\begin{aligned} & 120^{250} \\ &= (12 \times 10)^{250} \\ &= \dots 40 \underbrace{\text{oooooooo}}_{250 \text{ zeros}} \end{aligned}$$

Handwritten work showing the decomposition of 120^{250} into $(12 \times 10)^{250}$ and identifying the trailing zeros. A box around the 0 in 120 is crossed out with an 'x'. The number 250 is written above the 10 in the first step. The number 22 is written below the 10 in the second step. The number 250 is written below the 10 in the third step. The number 40 is written below the 12 in the third step. The number 250 zeros is written below the 0 in the third step.

$$(50)^3 = (5 \times 10)^3 = 5^3 \times 10^3 = 125,000$$

Handwritten work showing the calculation of $(50)^3$ to find the rightmost nonzero digit. The number 50 is circled. The number 5 is circled. The number 10 is circled. The number 3 is circled. The number 125,000 is circled. An arrow points from the 5 to the 125,000. The text "non zero right most" is written below the 125,000.

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246. The right most non zero digit of $20^{50} \times 140^{72}$ is:

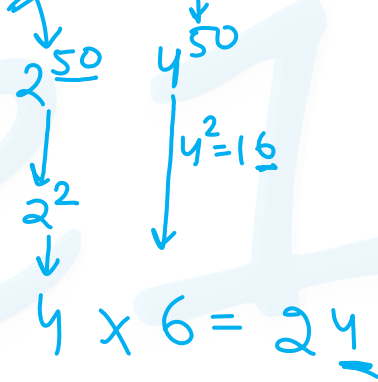
$20^{50} \times 140^{50}$ का दाईं ओर से पहला शून्येतर अंक -

~~a) 4~~

b) 6

c) 2

d) 8



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247. Find the right most nonzero digit of $130^{180} + 180^{130}$.

$130^{180} + 180^{130}$ का दाईं ओर से पहला शून्येतर अंक -

- a) ~~4~~ b) 1 c) 5 d) 3

$$\begin{array}{r} 3150000 \\ 213000 \\ \hline 713000 \end{array}$$

$$\begin{array}{r} \cancel{4} \\ \downarrow \\ 3^{180} \\ \downarrow 3^4 \\ 1 \end{array} + \begin{array}{r} b) 1 \\ \downarrow \\ 8^{130} \\ \downarrow 8^2 \\ 4 = \cancel{5} \end{array}$$

$$130^{180} = \dots\dots\dots + 180^{130} =$$

$$\begin{array}{r} 180 \text{ zeroes} \\ \hline 10000 \quad 000 \\ 400 \quad 000 \\ \uparrow \\ 130 \\ \text{zeros} \\ \hline 400 \quad 00 \\ \hline 130 \end{array}$$

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248. What is the right most non zero digit of $230^{170} - 80^{100}$?

$230^{170} - 80^{100}$ का दाईं ओर से पहला शून्येतर अंक -

a) 9

b) 3

~~c) 4~~

d) 6

Handwritten solution showing the calculation of the rightmost non-zero digit of $230^{170} - 80^{100}$.

Left side calculation:

$$230^{170} =$$

$$- 80^{100} =$$

Right side calculation (mod 10):

$230^{170} \equiv 3^{170} \pmod{10}$

$80^{100} \equiv 0^{100} \equiv 0 \pmod{10}$

Therefore, the rightmost non-zero digit is 3.

Additional handwritten notes:

- $230^{170} = 23 \times 10^{170}$
- $80^{100} = 8 \times 10^{100}$
- $23 \times 10^{170} = 23 \times 10^4 \times 10^{166} = 230000 \dots 0000$ (170 zeros)
- $8 \times 10^{100} = 80000 \dots 0000$ (100 zeros)
- The difference is $230000 \dots 0000 - 80000 \dots 0000 = 222000 \dots 0000$ (100 zeros)
- The rightmost non-zero digit is 2.

249. What is the unit digit of $973^{234!} \times 234^{973!}$?

$973^{234!} \times 234^{973!}$ का इकाई अंक क्या है?

$$234! = 1 \times 2 \times 3 \times \textcircled{4} \times \dots \times 234$$

$$973! = 1 \times \textcircled{2} \times 3 \times 4 \times \dots \times 973$$

a) 2 b) 6 c) 7 d) 9

3^4 $4^{\text{even}} = 4^2$

1 X 6 = 6

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250. What is the unit digit of $1^5 + 2^5 + 3^5 + \dots + 20^5$?

$1^5 + 2^5 + 3^5 + \dots + 20^5$ का इकाई अंक क्या है?

- a) 0 b) 5 c) 2 d) 4

2, 3, 7, 8 → Cyclicity 4

$2^1 \ 2^2 \ 2^3 \ 2^4 \ 2^5 \ 2^6$

2 4 8 6 2 4 8 6 -

$$\begin{aligned} &\rightarrow 1^1 + 2^1 + 3^1 + \dots + 20^1 \\ &= 1 + 2 + 3 + \dots + 20 \\ &= \frac{20 \times 21}{2} = 210 \end{aligned}$$

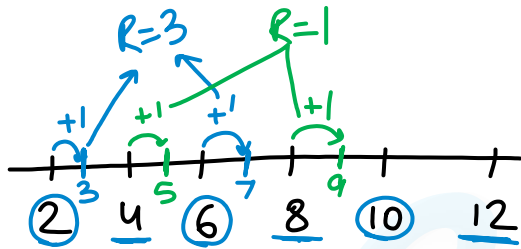
0, 1, 5, 6 → Cyclicity 1

$5^1 \ 5^2 \ 5^3 \ 5^4 \ 5^5 \dots$
5 5 5 5 5 - -

4, 9 → Cyclicity = 2

$4^1 \ 4^2 \ 4^3 \ 4^4 \ 4^5 \ 4^6 \dots$
4 6 4 6 4 6 - -

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



$$4 \overline{) 2n+1} \\ R=7$$

251. If n is a positive integer, then what is the digit in the unit place of $3^{2n+1} + 2^{2n+1}$?

यदि n एक धन पूर्णांक है, तो $3^{2n+1} + 2^{2n+1}$ के इकाई स्थान में अंक क्या है?

a) 0

b) 3

c) 5

d) 7

2 का multiple + 1

Case I ($R=1$)

$$3^1 + 2^1 = 5$$

Case ($R=3$)

$$3^3 + 2^3 \\ = 27 + 8 \\ = 35$$