How to Solve: Units' Digit of Product of Exponents

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YouTube Video Link to this Post is Here

Following is Covered in this post

Theory of Units' Digit of Product of Exponents

- **Find Units' digit of $4^{23}*3^{46}$?**
- **Find Units' digit of $2^{34}*3^{45}$?**
- **Find Units' digit of $1452^{48}*25463^{123}*798^{241}$?**
- **Find Units' digit of $145^{2367}*156^{10987}$?**
- **Find Units' digit of $224^{12987}*28569^{1879}$?**
- **Cyclicity of Units' digit of numbers (1 to 10)**

Theory of Units' Digit of Product of Exponents

To find the units' digit of a product of exponents, follow these steps:

1. Examine if the exponents can be rearranged to consolidate them into a single exponent and then find the units' digit using cyclicity of the number.
2. If rearrangement is not possible, determine the units' digit of each exponent and multiply them to obtain the units' digit of the entire expression.

Q1. Find Units' digit of $4^{23}*3^{46}$?

Sol: $4^{23} = (2^2)^{23} = 2^{46}$

=> $4^{23}*3^{46} = 2^{46}*3^{46} = (2*3)^{46} = 6^{46}$

Cyclicity of units' digit of power of 6 is 1

[Go through this post to **MASTER Cyclicity of Units' digit of numbers from 2-9**]

=> Units' digit of $4^{23}*3^{46} = 6$

Q2. Find Units' digit of $2^{34}*3^{45}$?

Sol: Cyclicity of units' digit of power of 2 and 3 is 4
Units' digit of 2^{34} = Units' digit of 2^2 (as remainder of 34 by 4 is 2) = 4
Units' digit of 3^{45} = Units' digit of 3^1 (as remainder of 45 by 4 is 2) = 1
=> Units' digit of $2^{34}*3^{45}$ = 4 * 1 = 4

Q3. Find Units' digit of $1452^{48} * 25463^{123}*798^{241}$?

Sol: Whenever we have to find units digit of power of a big number then we just need to focus on the units' digit of the number and take its power.
=> Units' digit of $1452^{48}*25463^{123}*798^{241}$ = Units' digit of $2^{48}*3^{123}*8^{241}$
Cyclicity of units' digit of power of 2, 3 and 8 is 4
Units' digit of 2^{48} = Units' digit of 2^4 (as remainder of 48 by 4 is 0 so we take unit's digit of the power of the cycle, which is 4) = 6
Units' digit of 3^{123} = Units' digit of 3^3 (as remainder of 123 by 4 is 3) = 7
Units' digit of 8^{241} = Units' digit of 8^1 (as remainder of 241 by 4 is 1) = 8
=> Units' digit of $1452^{48}*25463^{123}*798^{241}$ = 6 * 7 * 8 = 42 * 8 = ...6

Q4. Find Units' digit of $145^{2367}*156^{10987}$?

Sol: Units' digit of $145^{2367}*156^{10987}$ = Units' digit of $5^{2367}*6^{10987}$
=> Both 5 and 6 have a cycle of 1
=> Units' digit of $145^{2367}*156^{10987}$ = 5 * 6 = 0

Q5. Find Units' digit of $224^{12987}*28569^{18792}$?

Sol: Units' digit of $224^{12987}*28569^{1879}$ = Units' digit of $4^{12987}*9^{1879}$
Cyclicity of units' digit of power of 4 and 9 is 2
=> Units' digit of 4^{12987} = Units' digit of 4^1 = 4
=> Units' digit of 9^{1879} = Units' digit of 9^1 = 9
=> Units' digit of $224^{12987}*28569^{1879}$ = 4 * 9 = 6

Cyclicity of Units' digit of numbers (1 to 10)

Number	Cyclicity	Units' Digit Cycle
1	1	1
2	4	2, 4, 8, 6
3	4	3, 9, 7, 1
4	2	4, 6
5	1	5
6	1	6
7	4	7, 9, 3, 1
8	4	8, 4, 2, 6
9	2	9, 1
10	1	0

MASTER Units' Digit of Exponents by going through this post.

Hope it helps!