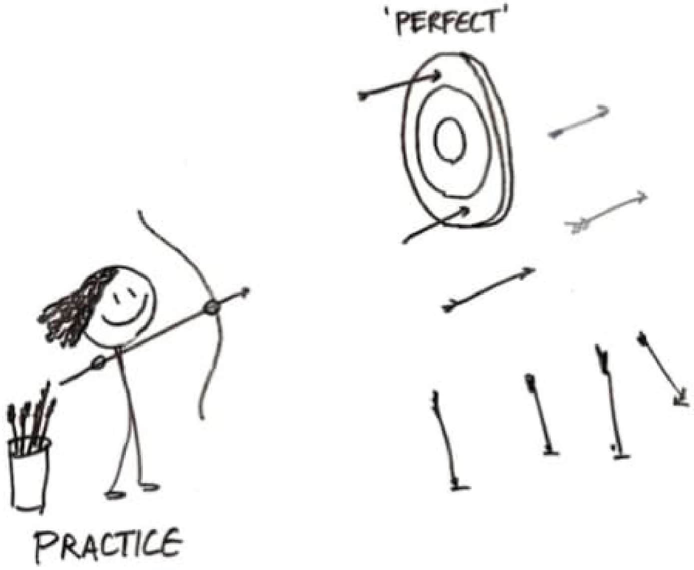
- Practice:

1. The six digit number 54321A is divisible by 9 where A is a single digit whole number. Find A.
2. Find the greatest 6-digit number, which is a multiple of 12.
3. Simplify the expression using BODMAS rule $(105 + 206) - 550 \div 5^2 + 10$
4. What is the difference between the greatest 5 digit number and the smallest 5 digit number?
5. What is the unit digit in the product $(365 \times 659 \times 771)$?

- Practice:

6. There are 20 people in a party. If every person shakes hand with every other person, what is the total number of handshakes?
7. The unit digit in the sum of (124) to the power of 372 + (124) to the power of 373 is?
8. Find the unit place digit in 71 x 72 x 73 x 74 x 76 x 77 x 78 x 79.
9. Find the remainder ➔ 19^{77} divided by 7?
10. Find the remainder ➔ 4^{4436} divided by 9?



Assignment - I
(Divisibility)

1) The six digit number 54321A is divisible by 9 where A is a single digit whole number. Find A.

Ans:- Given number, 54321A

Step-1:- Add known digits:

$5+4+3+2+1 = 15$

Step2:- Nearest multiple of 9

So, multiple of 9 after 15 is 18.

Step3:- difference = A

$\Rightarrow 18-15 = 3$

$\Rightarrow A$

where

diff $\Rightarrow$ A $\Rightarrow$ (multiple of 9) − (Sum of known digits)

$= 18 - 15 = 3$

add remainder:

$5+4=9$ (x)

$\Rightarrow 3+2+1=6 \Rightarrow$ remainder

$\Rightarrow$ Carry this step,

To make divisible by 9, we need remainder 0,

So, $(6+A) \bmod 9 = 0$

$6+A = 0 \bmod 9$

$\Rightarrow A = 3 \bmod 9 \Rightarrow A=3$

(or)

1. add the no: $5+4+3+2+1=15$

2. Condition: $15 \bmod 9 \Rightarrow 6$ (cond.)

3. diff $\Rightarrow 9-6=3$

2) Find the greatest 6-digit no. which is multiple of 12

Ans:- for divisibility by 12, It should be divisible by 3 & 4.

3 → Sum of digits } div

4 → last two digit of no.

Step-1:- 999,999 → Six digit no.

Step-2:- Check divisibility by 4

Take last two digit: $99 \div 4 = 24$ rem 3
⇒ 24 is not divisible by 4

Try next no ⇒ $99 - 3 = 96$ ⇒ 999996

⇒ $96 \div 4 = 24$; rem $= 0$

Step-3:- Check divisibility by 3.

Sum of digit $= 9+9+9+9+9+6 = 51$

⇒ $51 \div 3 = 17$ ⇒ It is divisible

Since 999996 is divisible by 3 & 4
⇒ 999996 is divisible by 12.

$\frac{17}{3}$

Q.) Simplify the expression using BODMAS Rule $(105 + 206) - 550 \div 5^2 + 10$

Ans:- $(105 + 206) - 550 \div 5^2 + 10$

$= 311 - 550 \div 5^2 + 10 = 311 - 550 \div 25 + 10$

206
105
311

$= 311 - 550 \div 25 + 10$
$= 311 - 22 + 10 = 311 - 32$
$= 279$

4) What is the difference b/w the greatest 5 digit no & ~~greatest~~ smallest 5 digit no

Ans:- Greatest 5 digit no :- 99999
Smallest 5 digit no :- 10,000

Diff = 99,999 - 10,000 = 89,999

Note:- Greatest 5 Digit No => 99,999
" " " odd No => 99,999
" " " even No => 99,998

By 2 → 99,998
By 3 → 99,999
By 4 → 99,996
By 5 → 99,995
By 6 → 99,996
By 9 → 99,999
By 10 => 99,990 By 12 => 99,996

5) What is unit digit in product (365 × 659 × 771)?

Ans:- Step-1:- Identify the unit digits

- Unit digit of 365 : 5
  unit digit of 659 is 9
  unit digit of 771 is 1

Step 2:- Multiply unit digits

i.e $5 \times 9 \times 1$
- $5 \times 9 = 45 \rightarrow$ unit digits is 5,
  $5 \times 1 = 5 \rightarrow$ unit digits is 5

So unit digit is 5

6) There are 20 people in a party. If every person shakes hand with every other person, what is total no. of shake hand

Ans:- Given $n = 20$,

So, No. of Handshake $= \binom{n}{2} = \frac{n(n-1)}{2}$
$= 20(20-1)/2 = 20 \times 19/2 = 190$

7) The unit digit in the sum of (124) to the power of 372 + (124) to the power of 373 is?

Ans:- Given, $(124)^{372} + (124)^{373}$

Step 1:- Focus on unit digit of 124

The unit digit of 124 is 4

$$4\overline{)372}$$
18 4 32 32 0

So, we need to find unit digit of: $4^{372} + 4^{373}$

Step 2:- Analyze the pattern of unit digit to its power of 4. (using no. cycle)

power of 4 cycle every 2 terms:

93
$4\overline{)372}$
36
12
12
0

$4^1 = 4$	$4^5 = 4$	$4^9 = 4$
$4^2 = 6$	$4^6 = 6$	$4^{10} = 6$
$4^3 = 4$	$4^7 = 4$	$4^{11} = 4$
$4^4 = 6$	$4^8 = 6$	$4^{12} = 6$

64
4
256

So, $4^{372} \Rightarrow \frac{372}{4} =$ remainder $= 0$

So, $4^{373} = \frac{73}{4} = 1$ remainder.

$\Rightarrow 4^{372} + 4^{373}$

(or) $\Rightarrow 10 \Rightarrow 0$ // unit digit

Step-3:- Find unit digit of every terms.

- $4^{372} \Rightarrow \frac{372}{2} = 186$ (even), unit digit is $\underline{\underline{6}}$

- $4^{373} \Rightarrow \frac{373}{2} = 186$ (odd) with remainder = 1, unit digit is $(6-2) = \underline{\underline{4}}$

$$\begin{array}{r} 186 \\ 2\overline{)373} \\ \underline{2} \\ 17 \\ \underline{16} \\ 13 \\ \underline{12} \\ 1 \end{array}$$

So, the sum's unit digit is:

$\Rightarrow 6+4 = 10$ // $\Rightarrow$ unit digit $\Rightarrow 0$ //

8) Find the unit place digit in $71 \times 72 \times 73 \times 74 \times 76 \times 77 \times 78 \times 79$

Ans:- Step-1:- Identify the unit digit

- unit digit of $71 = \underline{1}$

" " of $72 = 2$

unit digit of 73 = 3
" " " 74 = 4
" " " 76 = 6
" " " 77 = 7
" " " 78 = 8
" " " 79 = 9

So, unit digit: 1×2×3×4×6×7×8×9

Step-2:- Multiply unit digits.

i.e. 1×2 = 2
2×3 = 6
6×4 = 24 => unit digit 4
4×6 = 24 => " " 4
4×7 = 28 => " " 8
8×8 = 64 => " " 4
4×9 = 36 => " " 6

Final:- 6

9) Find the remainder → 1977 divided by 7?

Ans:- Step-1:- Simplify base mod 7

$19 \div 7 = 2$ remainder ~~7~~ $\Rightarrow 19 \equiv 5 \bmod 7$

So the problem simplifies to:

$5^{77} \bmod 7$

Step-2:- Find the pattern of $5^n \bmod 7$

- $5^1 = 5 \bmod 7$
$5^2 = 25 = 25 \bmod 7 = 4 \bmod 7$
$5^3 = 125 = 125 \bmod 7 = 6 \bmod 7$
$5^4 = 625 = 625 \bmod 7 = 2 \bmod 7$
$5^5 = (2 \times 5) = 10 = 3 \bmod 7$
$5^6 = (3 \times 5) = 15 = \underline{1} \bmod 7$

Step-3:- $77 \div 6 = 12$ remainder 5

(use expomodule cycle)

So: $5^{77} = 5^5 \bmod 7$

(or) $(7-1) = 6$

$5^5 = \underline{3} \bmod 7$

10) Find the remainder $\rightarrow 4^{4486}$ divided by 9?

Ans:- Step-1:- Simplify base mod 9

~~4~~ So problem is already simplifies to:

$\cancel{4}^{36}$ mod 9

Step-2:- Find pattern of 4^n mod 9

$4^1 = 4$ mod 9
$4^2 = 16$ mod 9 $= 7$ mod 9
$4^3 = 64$ mod 9 $= 1$ mod 9
$4^4 = 256$ mod 9 $= 4$ mod 9

Step-3:- Find position in cycle by expo.

$4436 \div 3 = 1478$ remainder 2

So, $4^{4436} = 4^2$ mod 9

$4^2 = 7$ mod 9 //

~~Step~~

10) A no exceeds by 25 from its $\frac{3}{8}$ th

1, 3, 5, 7, 9, ~~11~~

part. Then the no is?

Ans:- Let the ~~Given~~ nuber $= x$

According to ~~question~~,

$$x = \frac{3}{8}x + 25$$

$$x - \frac{3}{8}x = 25$$

$$\Rightarrow 5x = 200 \quad \boxed{x = 40}$$

1) Find the product of first prim no & composite no. (odd - 9, even - 4)

2) Find the sum of first n natural odd number (1 to 100)

1) Ans:- first Prime no $\rightarrow$ 2
composite no $\rightarrow$ 4
Product $= 2 \times 4 = 8$

(formula)

2 Ans:- So, first n natural odd no: $2n-1$

So, Series: 1, 3, 5, 7 . . . 99