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NUMBER SYSTEM

$$1 + 2 + 3 + ----+ n = \frac{n(n+1)}{2}$$

$$(1^2 + 2^2 + 3^2 ----+ n^2) = \frac{n(n+1)(2n+1)}{6}$$

$$(1^3 + 2^3 + 3^3 ----+ n^3) = \left[\frac{n(n+1)}{2} \right]^2$$

Points to Remember:

Difference between Arithmetic Progression and Geometric Progression:

Arithmetic Progression: It is the sequence of numbers in which each term after first is obtained by adding a constant to preceding term. The constant term is called as the common difference.

Geometric Progression: It is a sequence of non-zero numbers. The ratio of any term and its preceding term is always constant.

Types of Numbers	Definition	Example	Points to remember
Natural Numbers	Numbers used for counting and ordering	**1, 2, 3, 4, 5, -----** natural numbers	
Whole Numbers	All counting numbers along with zero form a set of whole numbers	**0, 1, 2, 3, 4 ------** whole numbers	Any natural number is a whole number 0 is a whole no. which is not a natural no.
Integers	Counting numbers + negative counting numbers + zero, all are integers	**-2, -1, 0, 1, 2, ----** integers	**Positive integers:** 0, 1, 2, 3, ------- **Negative integers:** -1, -2, -3, -4, ---------
Even Numbers	Number **divisible by 2** is called as even number	**0, 2, 4, 6, 8, ------** even numbers	

Odd Numbers	Number **not divisible by 2** is called as even number	**1, 3, 5, 7, 9, ------** odd numbers	
Prime Numbers	A number having exactly two factors i.e 1 and itself is called as prime number	**2, 3, 5, 7, 11, -----** prime numbers	
Composite Numbers	Natural numbers which are not prime numbers are called as composite numbers	**4, 6, 8, 9, 10, -----** composite nos.	
Co Primes	Any two natural numbers x and y are co-prime if their HCF is 1	**(4, 5), (7, 9), ---**Co-prime numbers	

Divisibility of Numbers

1) Number divisible by 2

Units digit – 0, 2, 4, 6, 8

Ex: 42, 66, 98, 1124

2) Number divisible by 3

Sum of digits is divisible by 3

Ex: 267 ---(2 + 6 + 7) = 15

15 is divisible by 3

3) Number divisible by 4

Number formed by the last two digits is divisible by 4

EX: 832

The last two digits is divisible by 4, hence 832 is divisible by 4

5) Number divisible by 6

The number is divisible by both 2 and 3

EX: 168

Last digit = 8 ---- (8 is divisible by 2)

Sum of digits = (1 + 6 + 8) = 15 ----- (divisible by 3)

Hence, 168 is divisible by 6

6) Number divisible by 11

If the difference between the sums of the digits at even places and the sum of digits at odd places is either 0 or divisible by 11.

Ex: 4527039

Digits on even places: 4 + 2 + 0 + 9 =15

Digits on odd places: 5 + 7 + 3 = 15

Difference between odd and even = 0

Therefore, number is divisible by 11

7) Number divisible by 12

The number is divisible by both 4 and 3

Ex: 1932

Last two digits divisible by 4

Sum of digits = (1 + 9 + 3 + 2) = 15 ---- (Divisible by 3)

Hence, the number 1932 is divisible by 12

Question No. - 1

Find the least number which when divided by 12, 27 and 35 leaves 6 as a remainder?

a) 3774

b) 3780

c) 3786

d) 4786

e) None of these

Answer – **c) 3786**

Explanation :

Number = LCM (12, 17, 35) + 6 = 3780 + 6 = 3786

Question No. - 2

Find the least number which will leaves remainder 5 when divided by 8, 12, 16 and 20.

A. 240

B. 245

C. 265

D. 235

Answer & Solution

Answer: **Option B**

Solution:

We have to find the Least number, therefore we find out the LCM of 8, 12, 16 and 20.

$8 = 2 \times 2 \times 2$;

$12 = 2 \times 2 \times 3$;

$16 = 2 \times 2 \times 2 \times 2$;

$20 = 2 \times 2 \times 5$;

LCM $= 2 \times 2 \times 2 \times 2 \times 3 \times 5 = 240$;

This is the least number which is exactly divisible by 8, 12, 16 and 20

Thus,

Required number which leaves remainder 5 is,

$240 + 5 = 245$

Question No. - 3

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

A. $2^{\frac{1}{2}}$

B. $3^{\frac{1}{3}}$

C. $4^{\frac{1}{4}}$

D. $12^{\frac{1}{12}}$

Answer & Solution

Answer: **Option B**

Solution:

LCM in power 2, 3, 4, 6, 12 is 12

We multiplied the LCM to the power of the numbers.

$2^{\frac{1\times12}{2}}, 3^{\frac{1\times12}{3}}, 4^{\frac{1\times12}{4}}, 6^{\frac{1\times12}{6}}$ and $12^{\frac{1\times12}{12}}$

We get,

$= 2^6, 3^4, 4^3, 6^2, 12$

= 64, 84, 64, 36, 12

Hence, greatest number would be $3^{\frac{1}{3}}$

Question No. - 4

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

A. 1

B. 3

C. 7

D. 9

Answer & Solution

Answer: Option A

Solution:

$(30)^{2720}$, we can write it as$[(30)^4]^{680}$

Or,$[(10 \times 3)^4]^{680}$

The right most non-zero digit depends on the unit digit of $[(3)^4]^{680}$

Unit digit of $[(3)^4]^{680}$,

Or, $(81)^{680}$

The unit digit of 81 is 1 so any power of 81 will always give its unit digit as 1

Thus, required unit digit is 1

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Question No. - 5

On a road three consecutive traffic lights change after 36, 42 and 72 seconds respectively. If the lights are first switched on at 9:00 AM sharp, at what time will they change simultaneously?

A. 9:08:04

B. 9:08:24

C. 9:08:44

D. None of these

Answer & Solution

Answer: **Option B**

Solution:

LCM of 36, 42 and 72,

$36 = 2 \times 2 \times 3 \times 3$

$42 = 2 \times 3 \times 7$

$72 = 2 \times 2 \times 2 \times 3 \times 3$

LCM = $2 \times 2 \times 2 \times 3 \times 3 \times 7 = 504$ seconds.

LCM of 36, 42 and 72 is 504

Hence, the lights will change simultaneously after 8 minutes and 24 seconds.

Question No. - 6

The last digit of the number obtained by multiplying the numbers $81 \times 82 \times 83 \times 84 \times 86 \times 87 \times 88 \times 89$ will be

A. 0

B. 6

C. 7

D. 2

E. 8

Answer & Solution

Answer: **Option B**

Solution:

The last digit of multiplication depends on the unit digit of (81 × 82 × 83 × 84 × 86 × 87 × 88 × 89) which is given by the remainder obtained on dividing it by 10.

$$\frac{(81 \times 82 \times 83 \times 84 \times 86 \times 87 \times 88 \times 89)}{10}$$

We take individual remainder of each digit,

$$\frac{(1 \times 2 \times 3 \times 4 \times 6 \times 7 \times 8 \times 9)}{10}$$

Numbers multiplied,

$$\frac{(24 \times 42 \times 72)}{10}$$

Individual Remainder has been taken,

$$\frac{(4 \times 2 \times 2)}{10}$$

$$Or,\ \frac{(16)}{10}$$

$$Or,\ 6$$

$$\text{Remainder} = 6$$

So, the last digit will be 6

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Question No. - 7

The smallest number which must be subtracted from 8112 to make it exactly divisible by 99 is :

A. 91

B. 92

C. 93

D. 95

Answer & Solution

Answer: **Option C**

Solution:

On dividing 8112 by 99, we get 93 as remainder.

So, the required number to be subtracted is 93.

Question No. - 8

The greatest number by which the product of three consecutive multiples of 3 is always divisible is :

A. 54

B. 81

C. 162

D. 243

Answer & Solution

Answer: **Option C**

Solution:

Three consecutive multiples of 3 are $3m$, $3(m + 1)$ and $3(m + 2)$

Their product $= 3m \times 3(m + 1) \times 3(m + 2)$

$= 27 \times m \times (m + 1) \times (m + 2)$

Putting $m = 1$, this product is $(27 \times 1 \times 2 \times 3) = 162$

So, this product is always divisible by 162

Question No. - 9

Given that $(1^2 + 2^2 + 3^2 + ... + 20^2) = 2870$, the value of $(2^2 + 4^2 + 6^2 + ... + 40^2)$ is :

A. 2870

B. 5740

C. 11480

D. 28700

Answer & Solution

Answer: **Option C**

Solution:

$= (2^2 + 4^2 + 6^2 + \ldots\ldots + 40^2)$

$= (1 \times 2)^2 + (2 \times 2)^2 + (2 \times 3)^2 + \ldots\ldots + (2 \times 20)^2$

$= 2^2 \times (1^2 + 2^2 + 3^2 + \ldots\ldots + 20^2)$

$= (4 \times 2870)$

$= 11480$

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Question No. - 10

If $a + b + c = 0$, $(a + b)(b + c)(c + a)$ equals

A. $ab(a + b)$

B. $(a + b + c)^2$

C. $-abc$

D. $a^2 + b^2 + c^2$

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Answer & Solution

Answer: **Option C**

Solution:

$a + b + c = 0$

$\Rightarrow (a + b) = - c$

$(b + c) = - a$

and $(c + a) = - b$

$\Rightarrow (a + b)(b + c)(c + a)$

$= (- c) \times (- a) \times (- b)$

$= - (abc)$