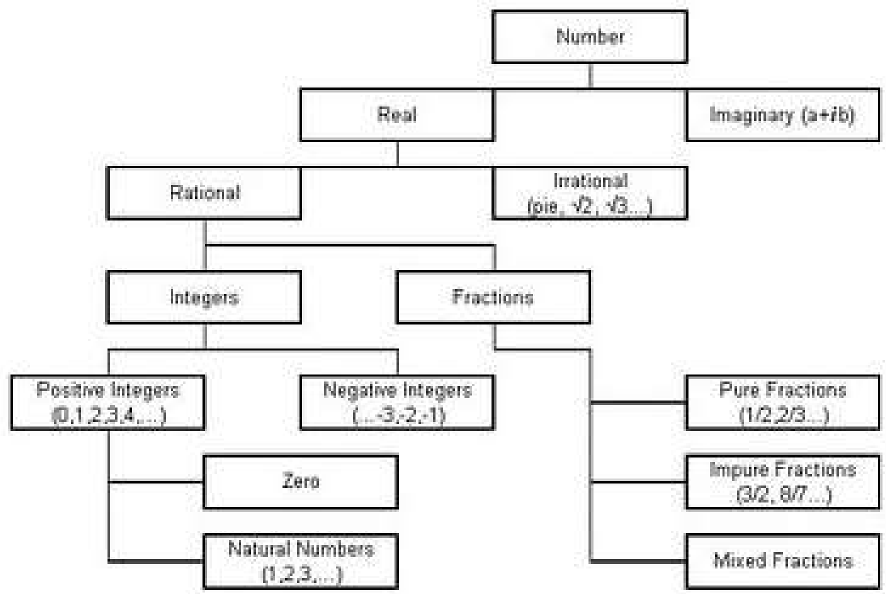
NUMBER SYSTEM

Classification of the numbers

The concept of numbers is made clear from the number tree.



1. **Natural Numbers:** The numbers 1, 2, 3, 4, 5….are called natural numbers or positive numbers.

   Example: 1, 2, 3, 4, 5…………..∞

2. **Whole Numbers: –**The numbers including “0” and all natural numbers are called the while numbers.

   Example: 0, 1, 2, 3, 4, 5………..∞

3. **Integers –** The numbers including 0 and all the positive and negative of the natural numbers are called integers.

   Example: -∞…………………-3, -2, -1, 0, 1, 2, 3……………………∞

4. **Rational Numbers: –** A number which can be expressed in the form p/q where p and q are integers and $q \neq 0$ is called a rational number.

   For example, 4 is a rational number since 4 can be written as 4/1 where 4 and 1 are integers and the denominator $1 \neq 0$. Similarly, the numbers 3/4, -2/5, etc. are also rational numbers.

   Between any two numbers, there can be infinite number of other rational numbers.

   Any terminating or recurring decimal is a rational number.

5. **Irrational Numbers: –** Numbers which are not rational but which can be represented by points on the number line are called irrational numbers. Examples for irrational numbers are

   Example: $\sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{8}$, etc.

   Numbers like π, e are also irrational numbers.

   Between any two numbers, there are infinite numbers of irrational numbers.

Any non-terminating non-recurring decimal is an irrational number.

6. **Real numbers: –** The set of natural numbers, integers, whole numbers, rational numbers, and irrational numbers constitute the set of real numbers.

7. **Even Numbers: –** The numbers that are divisible by 2 are called even numbers.

   Example: 2, 4, 6, 8, 16, 32 etc.

8. **Odd Numbers: –** The numbers that are not divisible by 2 are called odd numbers.

   Example: 3, 5, 7, 9, 15 etc.

9. **Prime Numbers: –** Those numbers which are divisible by themselves and 1 are called prime numbers or a number which has only two factors 1 and itself is called a prime number.

   Example: 2, 3, 5, 7 etc.

10. **Twin Primes: –** A pair of prime numbers when they differ by 2 is called twin prime numbers.

    Example: (3, 5), (5, 7), (11, 13), (17, 19) etc.

11. **Co-prime Numbers: –** A pair of two natural numbers (may or may not be prime number) are said to be co-prime if their G.C.D. or H.C.F. is 1.

    Example: H.C.F. (3, 4) = 1, H.C.F. (13, 15) = 1 then (3, 4) and (13, 15) are co-prime numbers.

12. **Composite Numbers: –** The natural numbers which are not prime numbers are called composite numbers OR numbers that have factors other than itself and 1, are called composite numbers.

    Example: 4, 6, 9, 16, 25 etc.

    Note: 1 is neither a composite number nor a prime number.

13. **Perfect Numbers: –** If the addition of all the factors of a number excluding the number itself happens to be equal to the number, it is called a perfect number.

    First perfect number is 6.

    Factors of 6 are 1, 2, 3, 6.

    Now add all the factors excluding 6.

    1+2+3 = 6, hence 6 is a perfect number.

    Example: 28, 496 and 8128.

14. **Complex Numbers: –** The number which have real and imaginary component is called a complex number.

    Example: 3+4i, 5+6i, where $i = \sqrt{-1} = a\ imaginary\ number$

15. **Face Value** of a digit in a number is its own value.

    Example: 6728, Face Value ⇒ 6 = 6, 7 = 7, 2 = 2 and 8 = 8

16. **Place Value** of a digit is given by multiplying it with value of place where it is placed.

    Example: 6729

    Place Value of 9 ⇒ 9 × 1 = 9
    Place Value of 2 ⇒ 2 × 10 = 20
    Place Value of 7 ⇒ 7 × 100 = 700
    Place Value of 6 ⇒ 6 × 1000 = 6000

17. **Fractions:** A fraction is a quantity which expresses a part of the whole,

    Example: 1/4 means one fourth of the whole

Types of Fractions

i. Proper Fraction: is one whose numerator is less than its denominator
Example: 2/3 is proper fraction, as 2<3
ii. Improper Fraction is one whose numerator is equal to or greater than its denominator
Example: 3/2 is an improper fraction, as 3>2 ;

3/3 is an improper fraction, as 3=3

Some Important Points:

1. Addition or subtraction of any two odd numbers will always result in an even number or zero. *Example:* $1 + 3 = 4$.
2. Addition or subtraction of any two even numbers will always result in an even number or zero. *Example:* $2 + 4 = 6$.
3. Addition or subtraction of an odd number from an even number will result in an odd number. *Example:* $4 + 3 = 7$.
4. Addition or subtraction of an even number from an odd number will result in an odd number. *Example:* $3 + 4 = 7$.
5. Multiplication of two odd numbers will result in an odd number. *Example:* $3 \times 3 = 9$.
6. Multiplication of two even numbers will result in an even number. *Example:* $2 \times 4 = 8$.
7. Multiplication of an odd number by an even number or vice versa will result in an even number. *Example:* $3 \times 2 = 6$.
8. An odd number raised to an odd or an even power is always odd.
9. An even number raised to an odd or an even power is always even.
10. The standard form of writing a number is m × 10n where m lies between 1 and 10 and n is an integer.
    - If n is odd. $n(n^2 – 1)$ is divisible by 24.
      Take $n = 5 \Rightarrow 5(5^2 – 1) = 120$, which is divisible by 24.
    - If n is odd prime number except 3, then $n^2 – 1$ is divisible by 24.
    - If n is odd. $2^n + 1$ is divisible by 3.
    - If n is even. $2^n – 1$ is divisible by 3.
    - If n is odd. $2^{2n} + 1$ is divisible by 5.
    - If n is even. $2^{2n} – 1$ is divisible by 5.
    - If n is odd. $5^{2n} + 1$ is divisible by 13.
    - If n is even. $5^{2n} – 1$ is divisible by 13
11. Some properties of Prime Numbers
    - The lowest prime number is 2.
    - 2 is also the only even prime number.
    - The lowest odd prime number is 3.
    - There are 25 prime numbers between 1 to 100.
    - The remainder of the division of the square of a prime number $p \geq 5$ divided by 24 or 12 is 1.

Divisibility Rules

Divisibility by	**Criteria**
2	A number is divisible by 2 when its units place is 0 or divisible by 2. Example: 130, 128 etc.
3	A number is divisible by 3 when the sum of its digits is divisible by 3. Example: 6561 ⇒ 6+5+6+1 = 18 is divisible by 3 17281 ⇒ 1+7+2+8+1 = 19 is not divisible by 3
4	When the last two digits of the number are 0's or divisible by 4. Example: 17400, 132, 12348 etc.
5	If the unit digit is 5 or 0, the number is divisible by 5. Example: 895, 100, 125, 625, 400 etc.
6	A number is divisible by 6, if it is divisible by both 2 and 3.
7	A number is divisible by 7, if and only if the number of tens added to 5 times the number of units, is divisible by 7 Example: 105 is divisible by 7, since 10+5*5= 10+25=35, which is divisible by 7.
8	If the last three digits of the number are 0's or divisible by 8, the number is divisible by 8. Example: 125128, 135000 etc.
9	If sum of digits is divisible by 9, the number is also divisible by 9. Example: 729 ⇒ 7+2+9 = 18 is divisible by 9. 46377 ⇒ 4+6+3+7+7 = 27 is divisible by 9.
10	A number is divisible by 10 if and only if the unit place digit is 0. Example: 100, 23450, 1100 etc.
11	When difference between sum of digits at odd places and sum of digits at even places is either 0 or 11, the number is divisible by 11. Example: 65967 ⇒ (6+9+7) – (5+6) = 22 – 11 = 11 is divisible by 11.

Important Results:

- $\boldsymbol{\Sigma n} = \frac{n(n+1)}{2}$, Σn is the sum of first n natural numbers.
- $\boldsymbol{\Sigma n^2} = \frac{n(n+1)(2n+1)}{6}$, Σn^2 is the sum of first n perfect squares.
- $\boldsymbol{\Sigma n^3} = \frac{n^2(n+1)^2}{4} = (\Sigma n)^2$, Σn^3 is the sum of first n perfect cubes.

Recurring Decimals

A decimal in which a digit or set of digits is repeated continually is called a recurring decimal. Recurring decimals are written in a shortened form, the digits which are repeated being marked by dots placed over the first and the last of them, thus

8/3 =2.666….. = 2.6 or $2.\overline{6}$;

1/7 = 0.142857142857142857… = $0.\overline{142857}$

Example: Express $0.\overline{3}$ in the form of a fraction.

Solution: $0.\overline{3}$ = 0.3333 → (1)

As the period is of one digit, we multiply by 10^1

i.e. 10

$\therefore$ 10 x $0.\overline{3}$ = 3.333 → (2)

(2) – (1) gives

9 x $0.\overline{3}$ = 3 $\Rightarrow$ $0.\overline{3}$ = 3/9 = 1/3

Pure Recurring Decimal: It is equivalent to a vulgar fraction which has the number formed by the recurring digits 9 called the period of the decimal) for its numerator, and for its denominator the number which has for its digits as many nines as their digits in the period.

Thus, $0.\overline{37}$ can be written as equal to 37/99

$0.\overline{225}$ can be written as equal to 225/999 which is the same as 25/111

$0.\overline{63}$ = 63/99 = 7/11

Mixed Recurring Decimal: In the numerator write the entire given number formed by the (recurring and non-recurring parts) and subtract from it the part of the decimal that is not recurring. In the denominator, write as many nines as the period (i.e., as many nines as the number of digits recurring) and then place next to it as many zeroes as there are digits without recurring in the given decimal.

i.e. $0.1\overline{56}$ = 156 -1/990 = 155/990 = 31/198

$0.7\overline{3}$ = 73-7/90 = 66/90 = 11/15

HCF and LCM

Factors and Multiples: If a number a divides another number b exactly, we say that a is a ***factor*** of b. In this case, b is called a ***multiple*** of a.

Highest Common Factor (H.C.F.) or Greatest Common Measure (G.C.M.) or Greatest Common Divisor (G.C.D.): The H.C.F. of two or more than two numbers is the greatest number that divides each of them exactly.

Least Common Multiple: The least number which is exactly divisible by each one of the given numbers is called their L.C.M.

H.C.F. and L.C.M. of Fractions:

H.C.F. = $\frac{\text{H.C.F.of Numerators}}{\text{L.C.M.of Denominators}}$

L.C.M. = $\frac{\text{L.C.M.of Numerators}}{\text{H.C.F.of Denominators}}$

The product of the two fractions is always equal to the product of LCM and HCF of the two fractions i.e. HCF * LCM = Product of two numbers

Example 1: Find the HCF of 24, 30 and 42.

Solution:

2	24	2	30	2	42
2	12	3	15	3	21
2	6	5	5	7	7
3	3		1		1
	1				

Factors of 24 = $2 \times 2 \times 2 \times 3 = (2^3 \times 3^1)$
Factors of 30 = $2 \times 3 \times 5 = (2^1 \times 3^1 \times 5^1)$
Factors of 42 = $2 \times 3 \times 7 = (2^1 \times 3^1 \times 7^1)$

∴ The product of common prime factors with the least powers = $2^1 \times 3^1 = 6$

Example 2: Find the HCF of 26 and 455.

Solution:

26) 455 (17
26
195
182
13) 26 (2
26
X

∴ Required HCF = 13.

Example 3: Find the HCF of $\frac{36}{51}$ and $3\frac{9}{17}$.

Solution: Here, $\frac{36}{51} = \frac{12}{17}$ and $3\frac{9}{17} = \frac{60}{17}$

Now, we have to find the HCF of $\frac{12}{17}$ and $\frac{60}{17}$.

According to the formula,

HCF of fractions = $\frac{\text{HCF of Numerators}}{\text{LCM of Denominators}} = \frac{\text{HCF of 12 and 60}}{\text{LCM of 17 and 17}} = \frac{12}{17}$.

Some important Facts:

1. If a, b and c give remainders p, q and r respectively, when divided by the same number H, then H is HCF of (a-p), (b-q), (c-r).
2. If the HCF of two numbers 'a' and 'b' is H, then, the numbers (a+b) and (a-b) are also divisible by H.
3. If a number N always leaves a remainder R when divided by the numbers a, b and c, then N = LCM (or a multiple of LCM) of a, b and c + R.
4. If a Number when divided by a,b,c leaves a remainders of x,y,z respectively and a-x= b-y= c-z= P, then the smallest number satisfying this condition is L.C.M(a,b,c)- P.

Example: Which is the smallest numbers which leaves a common remainder of 4 when divided by 6, 7, and 9?

Solution: Here you should remember that the smallest number is 4.The next such number will be (LCM of 6,7,9) + 4 i.e. 126+4 or 130.

REMAINDERS

A number M when divided by N leaves remainder R, and quotient is Q can be represented by M=NQ + R. where M is dividend, N is divisor, Q is quotient and R is remainder. The above rule is what is commonly called as the Division algorithm.

The concepts required to solve the questions of remainders are enumerated below

- Reducing remainders
- Negative remainders
- Fermat's little theorem
- Chinese remainders
- Wilson's rule.
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1. Reducing remainders

Some basic rules are given below:

Remainders (axb)/c= remainder(a/c) x remainder(b/c)
Remainder (a+b)/c= remainder (a/c) + remainder (b/c)
Remainder (a-b)/c=remainder (a/c) – remainder (b/c)

Example 1: (142+143+145)/7. What is the remainder.?
Solution: (2 + 3+ 5)/7 = remainder is 5

Example 2: (142x142x142x-------------------100 times) /7.what is the remainder?
Solution: (2x2x2x………………..100 times)/7.
=> (8x8x8……33 times x2)/7
=> 2.
Keep on dividing the remainders till the final remainder is less than divisor.

2. Concept of Negative Remainder

Remainder 27/7 =6 or its conjugate -1
Remainder 26/7 =5 or its conjugate -2

Example: What is the remainder $15^{97}/8$?
Solution: (15x15x15x……………97 times)/8
(-1x-1x-1x………………… 97 times)/8
-1 or its conjugate7

3. Fermat's little theorem

Remainder (M^{N-1})/N =1
Where M and N are co-prime and N is a prime number.

Example 1: Find the remainder of $(2^{100})/101$?
Solution: $(2^{100})/101$ =1 (using Fermat's Theorem)

Example 2: Find the remainder when (5^{1000}) is divided by 77?
Solution: (5^{1000}) / (7x11)
Using Fermat's rule 5^6 /7 = remainder is 1 so $5^{30}/7$ (remainder) =1
Using Fermat's rule $5^{10}/11$= remainder 1 so $5^{30}/11$ (remainder) =1
$5^{30}/77$ remainder =1

$((5^{30})^{33} \times 5^{10}) /77$ = remainder 23;
Where ($5^{10}/77$) remainder is 23 has to be dealt separately by reducing remainders theory.

4. **Chinese remainders**

Remainder N/ (axb) =apr_1+bqr_2:

Where remainder of N/a = r_2 and N/b = r_1 and ap+ bq =1.

Example: Find the remainder (5^{1000}) /(7x11)

Solution: remainder $(5^{1000})/7 = ((5^6)^{166} \times 5^4)$ /7 = 2 (using Fermat's rule 5^6 /7 =Remainder is 1.)

Remainder (5^{1000})/ 11 = $(5^{10})^{100}$ /11 =1 (using Fermat's rule $5^{10}/11$= remainder 1

7p+11q=1 for p= -3, q= 2

So the final remainder is = 7x-3x1 + 11x2x2 =23.

5. Wilson's rule:

Remainder ((N-1)!+1) when divided by N has a remainder of 0

Example: (4! + 1) / 5 = remainder is 0,
(6! + 1) /7 =remainder is 0.

Example: Find the remainder for (96!+1000)/97 :

(96! + 1) is divisible by 97

So final remainder is remainder 999/97 =29.

Important result:

- Theorem: $a^n + b^n$ is divisible by a + b when n is ODD.
- Theorem 2: $a^n – b^n$ is divisible by a + b when n is EVEN.
- Theorem 3: $a^n – b^n$ is ALWAYS divisible by a – b.

Cyclicity / Unit Digit

Number	^1	^2	^3	^4	Cyclicity
2	2	4	8	6	4
3	3	9	7	1	4
4	4	6	4	6	2
5	5	5	5	5	1
6	6	6	6	6	1
7	7	9	3	1	4
8	8	4	2	6	4
9	9	1	9	1	2

We can summarize it as:
Cyclicity of 2, 3, 7 and 8 is 4.
Cyclicity of 4 and 9 is 2.
Cyclicity of 0, 1, 5 and 6 is 1.

Steps to find unit digit

1. Consider only Unit Digit of a number. Divide power by the Cyclicity of unit digit of a number or by 4 and find the remainder.

Eg: Find the units place digit of 2^{99}

$2^{99/4}$ => 99/4 => remainder is 3

2. Make remainder as a power of a unit digit and consider only last digit.

$2^3=8$

So, unit digit of $2^{99}= 8$

3. If remainder is 0, then Cyclicity will become the power of unit digit.

Example: Find the units place digit of 252^{84}?

Solution: Consider only unit digit of a number i.e. 2^{84}

84/4 = 0 (Remainder)

So, power of 2 will become its Cyclicity i.e. 4.

Therefore, Unit digit of $2^4 = 6$.

Example: What is the unit digit in the product (3^{65} x 6^{59} x 7^{71})?

Solution: firstly, find the unit digit of 3^{65}

$3^{65/4} = 3^1 = 3$

Unit digit of 6^{59} = 6 (Cyclicity of 6 is 1 i.e. unit digit of 6 is always 6)

Unit digit of $7^{71} = 7^{71/4} = 7^3 = 3$

3*6*3=4

FACTORIAL

Factorial is an important topic in quantitative aptitude preparation. The factorial of a non-negative integer n is denoted as n! The notation was introduced by Christian Kramp in 1808.n! is calculated as the product of all positive integers less than or equal to n.

i.e 6! = 1 * 2 * 3 * 4 * 5 * 6 = 720

n! = 1 when n = 0, and n! = (n-1)! * n if n > 0

n! is the number of ways we can arrange n distinct objects into a sequence.

2! = 2 means numbers 1, 2 can be arranged in 2 sequences (1, 2) and (2, 1).

We can arrange 0 in one way. So 0! = 1, not zero. Now we know why, and no need to say “its like that” if someone asks ;-)

Find the highest power of a prime number in a given factorial

The highest power of prime number p in n! = [n/p1] + [n/p2] + [n/p3] + [n/p4] + ….. where [n/p1] denotes the quotient when n is divided by p

Example 1: The maximum power of 5 in 60!

Sol: 60! = 1 x 2 x 3 ....60 so every fifth number is a multiple of 5. So there must be 60/5 = 12

In addition to this 25 and 50 contribute another two 5's. so total number is 12 + 2 = 14

Short cut: [60/5]+[60/52]=12+2=14

Here [ ] Indicates greatest integer function.

Example 2: How many zero's are there at the end of 100!

Sol: A zero can be formed by the multiplication of 5 and 2. Since 100! contains more 2's than 5's, we can find the maximum power of 5 contained in 100!

⇒100/2+100/4+100/8+100/16+100/32+100/64 = 50 + 25 + 12 + 6 + 3 + 1 = 97

⇒100/5+100/25=20+4=24

LEVEL - I

1. Find the least value of * for which 4832*18 is divisible by 11.
   A] 5 B] 3 C] 7 D] 11

2. Is 52563744 divisible by 24?
   A] Yes B] No C] can’t be determined D] None of these

3. What least number must be subtracted from 1672 to obtain a number which is completely divisible by 17?
   A] 5 B] 7 C] 3 D] 6

4. What least number must be added to 2010 to obtain a number which is completely divisible by 19?
   A] 5 B] 4 C] 19 D] None of these

5. On dividing 12401 by a certain number, we get 76 as quotient and 13 as remainder. What is the divisor?
   A] 163 B] 173 C] 183 D] None of these

6. On dividing a certain number by 342, we get 47 as reminder. If the same number is divided by 18, what will be the remainder?
   A] 7 B] 9 C] 11 D] 13

7. A number when successively divide by 3, 5 and 8 leaves remainders 1, 4 and 7 respectively. Find the respective remainders if the order of divisors be reversed.
   A] 5, 4, 2 B] 6, 4, 2 C] 1, 1, 3 D] None of these

8. What is the least perfect square divisible by 8, 9 and 10?
   A] 4000 B] 6400 C] 3600 D] 14641

9. 4a56 is a four-digit numeral divisible by 33. What is the value of a?
   A] 3 B] 4 C] 5 D] 6

10. The sum of five distinct whole numbers is 337. If 60 is the smallest of them, what is the maximum value the largest number can have?
    A] 91 B] 70 C] 97 D] 274

11. The number of 2 digit prime number is
    A] 25 B] 17 C] 21 D] None of these

12. If n^2 = 12345678987654321, what is n?
    A] 12344321 B] 1235789 C] 111111111 D] 11111111

13. 46917 × 9999 =?
    A] 4586970843 B] 469123083 C] 4691100843 D] 584649125

14. Which of the following has fractions in ascending order?
    A] $\frac{1}{3}, \frac{2}{5}, \frac{4}{7}, \frac{3}{5}, \frac{5}{6}, \frac{6}{7}$ B] $\frac{1}{3}, \frac{2}{5}, \frac{3}{5}, \frac{4}{7}, \frac{5}{6}, \frac{6}{7}$

    C] $\frac{1}{3}, \frac{2}{5}, \frac{3}{5}, \frac{5}{6}, \frac{4}{7}, \frac{6}{7}$ D] $\frac{2}{5}, \frac{3}{5}, \frac{1}{3}, \frac{4}{7}, \frac{5}{6}, \frac{6}{7}$

15. Which of the following are in descending order or their value?

A] $\frac{5}{9}, \frac{7}{11}, \frac{8}{15}, \frac{11}{17}$ B] $\frac{5}{9}, \frac{8}{15}, \frac{11}{17}, \frac{7}{11}$

C] $\frac{11}{17}, \frac{7}{11}, \frac{8}{15}, \frac{5}{9}$ D] $\frac{11}{17}, \frac{7}{11}, \frac{5}{9}, \frac{8}{15}$

16. When $0.\overline{47}$ is converted into a fraction, the result is:

A] $\frac{46}{90}$ B] $\frac{46}{99}$ C] $\frac{47}{90}$ D] $\frac{47}{99}$

17. The value of $0.\overline{57}$ is:

A] $\frac{57}{10}$ B] $\frac{57}{99}$ C] $\frac{26}{45}$ D] $\frac{52}{9}$

18. The value of $4.1\overline{2}$ is:

A] $4\frac{11}{90}$ B] $4\frac{11}{99}$ C] $\frac{371}{900}$ D] None of these

19. The value of $2.1\overline{36}$ is:

A] $\frac{47}{220}$ B] $\frac{68}{495}$ C] $2\frac{3}{22}$ D] None of these

20. Reduce $\frac{391}{667}$ to lowest terms.

A] $\frac{17}{29}$ B] $\frac{11}{23}$ C] $\frac{13}{25}$ D] $\frac{14}{27}$

LEVEL – II

1. Find the HCF of $2^3 \times 3^2 \times 5 \times 7^5$; $2^2 \times 5^2 \times 7^3$ and $2^3 \times 5^3 \times 7^2$.
   A] 940 B] 980 C] 930 D] 925

2. Find the highest common factor of (34, 85)
   A] 4 B] 12 C] 17 D] 19

3. The LCM of (198, 252, 308) is:
   A] 2072 B] 2772 C] 2727 D] 2770

4. Which of the following is a pair of co-primes?
   A] (16, 62) B] (18, 24) C] (20, 27) D] (23, 92)

5. The HCF of $\left(\frac{3}{4}, \frac{5}{6}, \frac{6}{7}\right)$ is
   A] $\frac{2}{93}$ B] $\frac{1}{84}$ C] $\frac{1}{83}$ D] $\frac{3}{91}$

6. The product of two numbers is 5476. If the HCF of these numbers is 37. The greater number is:
   A] 107 B] 111 C] 148 D] 185

7. The product of two numbers is 2028 and their HCF is 13. How many pairs of such numbers are possible?
A] 1 B] 2 C] 3 D] 4

8. The greatest possible length which can be used to measure exactly the lengths: 20 m 6 cm, 11m 90 cm and 14 m 45 cm is:
A] 17 B] 18 C] 19 D] 121

9. Find the greatest number that will divide 48, 97 and 188 and leaves the reminder 6 in each case.
A] 4 B] 7 C] 2 D] 6

10. The greatest number, which when divides 1358, 1870, and 2766 leaves the same remainder 14 in each case, is:
A] 124 B] 64 C] 156 D] 260

11. What will be the least number which when doubled becomes exactly divisible by 9, 15, 21, and 30?
A] 196 B] 189 C] 630 D] 315

12. The least five digit number which is exactly divisible by 12, 18, and 21 is:
A] 10010 B] 10015 C] 10080 D] 10020

13. The greatest four digit number which is divisible by 18, 25, 30, and 48 is:
A] 9000 B] 9200 C] 7200 D] 9729

14. Find the least multiple of 23 which when divided by 24, 21, and 18 leaves the remainders 13, 10, and 7 respectively.
A] 3004 B] 3024 C] 3013 D] 3026

15. The least number which when divided by 5, 6, 7, and 8 leaves the remainder 3. But when divided by 9 leaves no remainder, is:
A] 1766 B] 1683 C] 2327 D] 1895

16. Four different devices beep after every half hour, 60 min, 1 and half hours, and 135 min respectively. All the devices beeped together at 12 noon. They will beep together again at:
A] 12 midnight B] 6 AM C] 9 PM D] 7:30 AM

17. X, Y, Z start at the same time in the same direction to run around a circular stadium. X completes a round in 63 seconds, Y in 105 seconds and Z in 210 seconds. If they start at the same time, then at what time will they meet again at the starting point?
A] 9 min 9 seconds B] 10 min 30 seconds
C] 10 min 6 seconds D] 8 min 4 seconds

18. What is the unit digit in the product (684 x 759 x 413 x 676)?
A] 6 B] 8 C] 2 D] None of these

19. What is the unit digit in the product $(3547)^{153} \times (251)^{72}$?
A] 1 B] 3 C] 7 D] None of these

20. What is the unit digit in $\{(264)^{102} + (264)^{103}\}$?
A] 0 B] 1 C] 2 D] 4