

# Number System, Simplification and Approximation

This chapter forms a basis of many other topics in mathematics. Let us begin by understanding various types of numbers.

- (1) **Natural Numbers:** All the counting numbers are called natural number.

**Example:** 1, 2, 3, 4, 5, .....

- (a) **Even Numbers:** The numbers which are exactly divisible by 2 are called even numbers.

**Example:** 2, 4, 6, 8, ...

- (b) **Odd Numbers:** The numbers which leave a remainder 1 when divided by 2 are called odd numbers.

**Example:** 1, 3, 5, 7, ....

- (c) **Prime Numbers:** If a number is not divisible by any other number except 1 and itself, it is called a prime number.

**Example:** 2, 3, 5, 7, 11, ....

**Co-primes** → Two numbers which have no common factor between them except 1 are said to be co-prime to each other. The two numbers individually may be prime or composite.

**Example:** 13 and 29 are co-primes.

- (d) **Composite Numbers:** Numbers which are divisible by other numbers along with 1 and itself are called composite numbers.

**Example:** 4, 6, 8, 9, 10, ....

The number 1 is neither prime nor composite.

- (2) **Whole Numbers:** Natural numbers along with '0' form the set of whole numbers.

**Example:** 0, 1, 2, 3, .....

- (3) **Integers:** All counting numbers and their negatives along with zero are called Integers.

**Example:** .....-4, -3, -2, -1, 0, 1, 2, 3, 4, .....

- (4) **Rational and Irrational Numbers:** Any number which can be expressed in the form of  $\frac{p}{q}$ , where p and q are integers and  $q \neq 0$ , is a rational number.

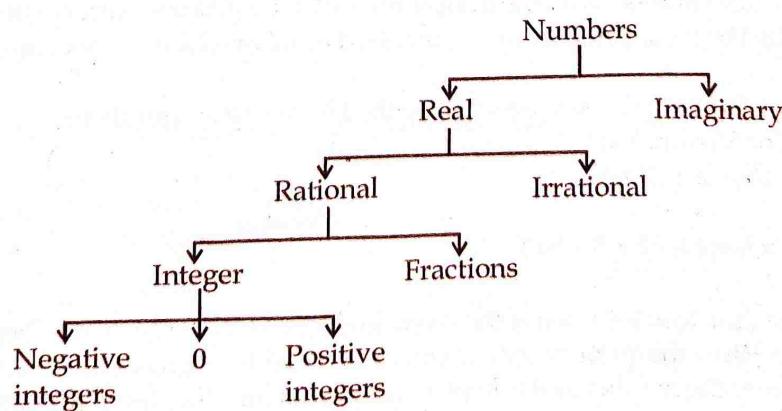
**Example:**  $\frac{3}{5}$ , 4, -6, etc.

Numbers which are represented by non-terminating and non-recurring decimals are called irrational numbers.

**Example:**  $\sqrt{2} = 1.414\ldots$ ,  $\sqrt{3} = 1.732\ldots$

- (5) **Real Numbers:** Rational and irrational number taken together are called real numbers.

We can summarise the above discussion as follows :



**Some important formula:**

1.  $a^2 - b^2 = (a + b)(a - b)$
2.  $(a + b)^2 = a^2 + b^2 + 2ab$
3.  $(a - b)^2 = a^2 + b^2 - 2ab$
4.  $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
5.  $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$
6.  $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$
7.  $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$
8.  $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$
9.  $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ac)$

**Tests of divisibility**

**Divisibility by 2:** A number is divisible by 2 if its unit digit is zero or an even number.

**Example:** 248, 130

**Divisibility by 3:** A number is divisible by 3 if the sum of its digits is divisible by 3.

**Example:**  $279 \rightarrow 2 + 7 + 9 = 18$ .

18 is divisible by 3, hence 279 is divisible by 3.

**Divisibility by 4:** A number is divisible by 4 if the number formed by its last two digits is divisible by 4.

**Example:** 236784

Here, 84 is divisible by 4, hence 236784 is divisible by 4.

**Divisibility by 5:** A number is divisible by 5 if the number or its unit digit is either 5 or 0.

**Example:** 115, 240, etc.

**Divisibility by 6:** A number is divisible by 6 if it is divisible by both 2 and 3.

**Example:** 318, 396, etc.

**Divisibility by 8:** A number is divisible by 8 if the number formed by its last 3 digits is divisible by 8.

**Example:** 23816.

Here, 816 is divisible by 8, hence 23816 is divisible by 8.

**Divisibility by 9:** A number is divisible by 9 if the sum of all its digits is divisible by 9.

**Example:**  $72936 \rightarrow 7 + 2 + 9 + 3 + 6 = 27$

27 is divisible by 9, hence 72936 is divisible by 9.

**Divisibility by 11:** A number is divisible by 11 if the difference of the sum of the alternate digits starting from the units digit and the sum of the alternate digits starting from the tens digit is either '0' or is a multiple of 11.

**Example:** 1331

$(1 + 3) - (3 + 1) = 0 \Rightarrow 1331$  is divisible by 11.

**Divisibility by 19:** A number is divisible by 19 if the sum of the number formed by digits other than the unit digit and twice the unit digit is divisible by 19.

**Example:**  $76 \rightarrow 7 + (2 \times 6) = 19$ .

Therefore 76 is divisible by 19.

**Least Common Multiple (LCM)**

LCM of two or more numbers is the least number which is divisible by each of these numbers.

**Finding LCM**

Write the numbers as product of prime factors. Then multiply the product of all the prime factors of the first number by those prime factors of the second number which are not common to the prime factors of the first number. The product is then multiplied by those prime factors of the third number which are not common to the prime factors of the first two numbers.

The final product after considering all the numbers will be the LCM of these numbers.

**Example:** Find the LCM of 540 and 108?

$$540 = 2 \times 27 \times 10 = 2^2 \times 3^3 \times 5$$

$$108 = 2^2 \times 3^3$$

$$\text{LCM} = 2^2 \times 3^3 \times 5 = 4 \times 27 \times 5 = 540$$

**Finding LCM by division**

Choose one prime factor common to at least two of the given numbers write the given numbers in a row and divide them by the above prime number. Write the quotient for each number under the number itself. If a number is not divisible by the prime factor selected, write the number as it is. Repeat this process until you get quotients which have no common factor.

The product of all the divisors and the numbers in the last line will be the LCM.  
**Example:** Find the LCM of 36, 84 and 90

3	36, 84, 90
3	12, 28, 30
2	4, 28, 10
2	2, 14, 5
	1, 7, 5

$$\text{LCM} = 3 \times 3 \times 2 \times 2 \times 7 \times 5 = 1260$$

### Highest Common Factor (HCF)

HCF is the largest factor of two or more given numbers.  
 HCF is also called Greatest Common Divisor (GCD).

#### Finding HCF by Factorisation method

Express each given number as a product of prime factors. The product of the prime factors common to all the numbers will be the HCF.

**Example:** Find the HCF of 144, 336 and 2016?

$$144 = 12 \times 12 = 3 \times 2^2 \times 3 \times 2^2 = 3^2 \times 2^4$$

$$336 = 2^4 \times 3 \times 7$$

$$2016 = 2^5 \times 7 \times 3^2$$

$$\text{HCF} = 3 \times 2^4 = 48$$

#### Finding HCF by Division method

Divide the greater number by the smaller number. Then divide the divisor by the remainder. Now, divide the second divisor by the second remainder

We repeat this process till no remainder is left. The last divisor is the HCF.

Then using the same method, find the HCF of this HCF and the third number. This will be the HCF of the three numbers.

**Example:** HCF of 144, 336

$$144 \overline{)336} (2$$

$$\begin{array}{r} 288 \\ -144 \\ \hline 144 \end{array}$$

$$48 \overline{)144} (3$$

$$\begin{array}{r} 144 \\ -144 \\ \hline 0 \end{array}$$

$$\text{HCF} = 48$$

#### LCM and HCF of fractions :

$$\text{LCM of fractions} = \frac{\text{LCM of Numerators}}{\text{HCF of Denominators}}$$

$$\text{HCF of fractions} = \frac{\text{HCF of Numerators}}{\text{LCM of Denominators}}$$

#### Simplification

#### BODMAS Rule

This rule depicts the correct sequence in which the operations are to be executed, so as to find out the value of a given expression.

B	$\rightarrow$	Bracket
O	$\rightarrow$	Of
D	$\rightarrow$	Division
M	$\rightarrow$	Multiplication
A	$\rightarrow$	Addition
S	$\rightarrow$	Subtraction

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Thus in simplifying an expression, first of all the brackets must be removed, strictly in the order  $( ) \{ \} [ ]$ . After removing the brackets, we must use the following operations strictly in the order :

- (i) of (ii) Division (iii) Multiplication (iv) Addition (v) Subtraction

**Approximation**

One needs to solve the questions of approximation by taking the nearest approximate values and mark the answer accordingly.

**Example:** If the given value is 3.009, then the approximate value is 3.  
If the given value is 4.45, then the approximate value is 4.50.

**Example 1:**  $2959.85 \div 16.001 - 34.99 = ?$   
(a) 160      (b) 150      (c) 140      (d) 180      (e) 170

$$\text{Sol. (b); } 2959.85 \div 16.001 - 34.99 \approx 2960 \div 16 - 35 = 185 - 35 = 150$$

**Example 2:**  $(1702 \div 68) \times 136.05 = ?$   
(a) 3500      (b) 3550      (c) 3450      (d) 3400      (e) 3525

$$\text{Sol. (d); } (1702 \div 68) \times 136.05 \approx (1700 \div 68) \times 136 \approx 3400$$

**Some shortcuts and tricks for calculations****Multiplication by a number close to 10, 100, 1000, etc**

**Example:**  $999 = 1000 - 1 ; 101 = 100 + 1$   
To multiply with such numbers, convert the number into the form of  $(10 \pm C)$  or  $(100 \pm C)$  etc.

**Example:**  $46 \times 98 = 46 \times (100 - 2) = 46 \times 100 - 46 \times 2 = 4600 - 92 = 4508$

**Multiplication by 5 or powers of 5:** can be converted into multiplication by 10 or powers of 10 by dividing it by 2 and its powers.

**Example:**  $2345 \times 125 = 2345 \times 5^3 = 2345 \times \left(\frac{10}{2}\right)^3 = \frac{2345000}{8} = 293125$

**Square of a number which ends with 5.**

- (1) Last two digits of the square are always 25.
- (2) To find the number which comes before 25, perform the operation  $n \times (n+1)$ , where n is the digit before 5 in the original number.
- (3) Put the number received in step 2 before 25 and you get the square.

**Example:**  $(65)^2 = ?$

- (1) Last two digits are 25.
- (2) The digit before 5 is 6 perform  $n \times (n+1)$  operation on this  $= 6 \times (6+1) = 6 \times 7 = 42$
- (3) Hence the square of 65 will be 4225.

**Square of a number containing repeated 1's**

- (1) Count the number of digits. Let the count be n.
- (2) Now, starting from 1, write the number till n.
- (3) Then, starting from n write the number till 1.

**Example:** Find the square of 1111?

**Sol.** There are four 1's. Now we write numbers from 1 to 4. Then again from 4 to 1. So,  $(1111)^2 = 1234321$

**Multiplying 2-digit numbers where the unit's digits add upto 10 and ten's digits are same**

**Example:**  $42 \times 48 = ?$

- (1) First multiply the unit digits of the numbers.  $2 \times 8 = 16$
- (2) Then multiply 4 by  $(4+1) \Rightarrow 4 \times 5 = 20$ .
- (3) The answer is 2016.

**Multiplying numbers just over/below 100**

**Example:**  $108 \times 109 = 11772$ .

The answer is in two parts : 117 and 72.  
117 is  $(108+9)$  or  $(109+8)$ , and 72 is  $8 \times 9$ .

new, check for  $107 \times 106 =$

$\begin{array}{r} 113 \\ \downarrow \\ (107+6) \end{array}$	$\begin{array}{r} 42 \\ \searrow \\ (7 \times 6) \\ \text{or} \\ (106+7) \end{array}$
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**Multiplication of a 2-digit number by a 2-digit number****Example:**  $12 \times 13?$ **Sol.** Steps:

1. Multiply the right-hand digits of multiplicand and multiplier (unit-digit of multiplicand with unit-digit of the multiplier).

$$\begin{array}{r} 1 & 2 \\ \downarrow \\ 1 & 3 \\ \hline 6(2 \times 3) \end{array}$$

2. Now, do cross-multiplication, i.e., multiply 3 by 1 and 1 by 2. Add the two products and write down to the left of 6.

$$\begin{array}{r} 1 & 2 \\ \times & 3 \\ \hline 56 \end{array}$$

3. In the last step we multiply the left-hand figures of both multiplicand and multiplier (ten's digit of multiplicand with ten's digit of multiplier).

$$\begin{array}{r} 1 & 2 \\ \downarrow \\ 1 & 3 \\ \hline 156(1 \times 1) \end{array}$$

So, the answer is 156.

**Example:**  $325 \times 17 = ?$ **Sol.** Steps:

$$\begin{array}{r} 3 & 2 & 5 \\ \downarrow \\ 1 & 7 \\ \hline 5 \end{array}$$

( $5 \times 7 = 35$ , put down 5 and carry over 3)

$$\begin{array}{r} 2 & 3 & 2 \\ \times & 1 & 7 \\ \hline 2 & 2 & 5 \end{array}$$

( $2 \times 7 + 5 \times 1 + 3 = 22$ , put down 2 and carry over 2)

$$\begin{array}{r} 3 & 2 & 5 \\ \times & 1 & 7 \\ \hline 2 & 2 & 5 \end{array}$$

( $3 \times 7 + 2 \times 1 + 2 = 25$ , put down 5 and carry over 2)

$$\begin{array}{r} 3 & 2 & 5 \\ \times & 1 & 7 \\ \hline 5 & 5 & 2 & 5 \end{array}$$

So, answer is 5525

**Multiplication of a 3-digit number by a 3-digit number****Example:**  $321 \times 132 = ?$ **Sol.** Steps:

$$\begin{array}{r} 3 & 2 & 1 \\ \downarrow \\ 1 & 3 & 2 \\ \hline 2(1 \times 2 = 2) \end{array}$$

2.

$$\begin{array}{r} 3 & 2 \\ 1 & 3 & 2 \\ \hline 72 \end{array} (2 \times 2 + 3 \times 1 = 7)$$

3.

$$\begin{array}{r} 3 & 2 \\ 1 & 3 & 2 \\ \hline (2 \times 3 + 3 \times 2 + 1 \times 1 = 13, \text{ write down } 3 \text{ and carry over } 1) \end{array}$$

4.

$$\begin{array}{r} 3 & 2 & 1 \\ 1 & 3 & 2 \\ \hline 2372 \end{array} (3 \times 3 + 1 \times 2 + 1 = 12, \text{ write down } 2 \text{ and carry over } 1)$$

5.

$$\begin{array}{r} 3 & 2 & 1 \\ \downarrow \\ 1 & 3 & 2 \\ \hline 42372 \end{array} (1 \times 3 + 1 = 4) \text{ So, answer is } 42372.$$

Some more short tricks:

- (1)  $2 + 22 + 222 + 2222 = 2(1 + 11 + 111 + 1111)$   
 $2(1234) = 2468$
- (2)  $0.2 + 0.22 + 0.222 + 0.2222 + 0.22222 = 2(0.1 + 0.11 + 0.111 + 0.1111 + 0.11111) = 2(0.54321) = 1.08642$
- (3)  $2 + 8 + 22 + 88 + 222 + 888 + 2222 + 8888 + 22222 + 88888 = 2(12345) + 8(12345)$   
 $= (12345)(2 + 8) = 12345 \times 10 = 123450$
- (4)  $(2222)^2 = 2^2 \times (1111)^2 = 4 \times (1234321) = 4937284$
- (5) If unit digit in each number is 5 and difference of the numbers is 10, then they are multiplied as:

Example: (1)  $65 \times 75 =$

$$\begin{array}{r} 65 \times 75 = \overbrace{\quad \quad}^{48} \overbrace{\quad \quad}^{75} \\ (6 \times 8) \quad (\text{Constant}) \end{array} \quad (2) 125 \times 135 = \begin{array}{r} 125 \times 135 = \overbrace{\quad \quad}^{168} \overbrace{\quad \quad}^{75} \\ (12 \times 14) \quad (\text{Constant}) \end{array}$$

Percentage - fraction conversion:

The following percentage values of corresponding fractions must be on your tips :

Example:  $62\frac{1}{2}\%$  of 256 can be easily calculated if we know the fractional value of  $62\frac{1}{2}\%$  i.e.,  $\frac{5}{8}$ .

$$\left[ \begin{array}{l} 1 = 100\% \\ \frac{1}{2} = 50\% \end{array} \right]$$

$$\left[ \begin{array}{l} \frac{1}{3} = 33\frac{1}{3}\% \\ \frac{2}{3} = 66\frac{2}{3}\% \end{array} \right]$$

$$\left[ \begin{array}{l} \frac{1}{4} = 25\% \\ \frac{3}{4} = 75\% \end{array} \right]$$

$$\left[ \begin{array}{l} \frac{1}{5} = 20\% \\ \frac{2}{5} = 40\% \end{array} \right]$$

$$\left[ \begin{array}{l} \frac{1}{6} = 16\frac{2}{3}\% \\ \frac{5}{6} = 83\frac{1}{3}\% \\ \frac{3}{5} = 60\% \\ \frac{4}{5} = 80\% \end{array} \right]$$

$$\begin{array}{ll} \left[ \begin{array}{l} \frac{1}{7} = 14\frac{2}{7}\% \\ \frac{2}{7} = 28\frac{4}{7}\% \\ \frac{3}{7} = 42\frac{6}{7}\% \\ \frac{4}{7} = 57\frac{1}{7}\% \\ \frac{5}{7} = 71\frac{3}{7}\% \\ \frac{6}{7} = 85\frac{5}{7}\% \end{array} \right] & \left[ \begin{array}{l} \frac{1}{8} = 12\frac{1}{2}\% \\ \frac{3}{8} = 37\frac{1}{2}\% \\ \frac{5}{8} = 62\frac{1}{2}\% \\ \frac{7}{8} = 87\frac{1}{2}\% \end{array} \right] \quad \left[ \begin{array}{l} \frac{1}{9} = 11\frac{1}{9}\% \\ \frac{2}{9} = 22\frac{2}{9}\% \\ \frac{4}{9} = 44\frac{4}{9}\% \\ \frac{5}{9} = 55\frac{5}{9}\% \\ \frac{7}{9} = 77\frac{7}{9}\% \\ \frac{8}{9} = 88\frac{8}{9}\% \end{array} \right] \quad \left[ \begin{array}{l} \frac{1}{11} = 9\frac{1}{11}\% \\ \frac{2}{11} = 18\frac{2}{11}\% \\ \frac{3}{11} = 27\frac{3}{11}\% \\ \frac{4}{11} = 36\frac{4}{11}\% \\ \frac{5}{11} = 45\frac{5}{11}\% \end{array} \right] \end{array}$$

$$\frac{1}{20} = 5\%, \quad \frac{1}{19} = 5 + \frac{5 \times 5}{100} = 5.25\%, \quad \frac{1}{21} = 5 - \frac{5 \times 5}{100} = 4.75\%$$

Similarly,

$$\frac{1}{25} = 4\%, \quad \frac{1}{24} = 4 + \frac{4 \times 4}{100} = 4.16\%, \quad \frac{1}{26} = 4 - \frac{4 \times 4}{100} = 3.84\%, \quad \frac{1}{11} = 9.09\%, \quad \frac{1}{7} = 14.2857\%, \quad \frac{1}{22} = 4.54\%, \quad \frac{1}{14} = 7.14\%$$

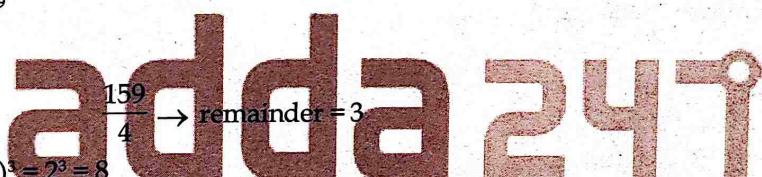
$$\frac{1}{33} = 3.03\%, \quad \frac{1}{28} = 3.57\%$$

#### Finding the unit place digit when a number is raised to some power

- (1) When the unit digit of a number is 0, 1, 5, or 6, then on raising that number to any power, the new number obtained will have its unit digit 0, 1, 5, or 6 respectively.
- (2) When the unit digit of a number is 2:

**Example:**  $(122)^{159}$

Divide 159 by 4

   
  $\frac{159}{4} \rightarrow \text{remainder} = 3$

(unit digit of  $122^3 = 2^3 = 8$ )

So, the unit digit of  $(122)^{159} = 8$

- (3) When the unit digit of the number is 3.

**Example:**  $(53)^{145}$

Sol.  $\frac{145}{4} \Rightarrow \text{Remainder} = 1$   
 $3^1 = 3$

So, unit digit of  $(53)^{145}$  is 3.

- (4) When the unit digit is 4:

**Example:** 144

if it is raised to an odd power  $\rightarrow$  Example:  $(144)^{145}$ , then unit place is 4.

if it is raised to an even power  $\rightarrow$  Example:  $(144)^{144}$ , then unit place is 6.

~~144~~ =

- (5) When the unit digit is 7:

**Example:**  $(327)^{329}$

Sol.  $329 \div 4 \Rightarrow \text{rem.} = 1 \Rightarrow 7^1 = 7 \Rightarrow \text{So, unit digit} = 7$ .

- (6) when the unit is 8:

**Example:**  $(88)^{178}$

Sol.  $178 \div 4 \Rightarrow \text{Rem.} = 2 \Rightarrow 8^2 = 64 \Rightarrow \text{So, unit digit of } (88)^{178} \text{ is } 4$

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(7) When the unit digit is 9;

**Example:** 119

if it is raised to an odd power  $\rightarrow$

**Example:**  $\rightarrow (119)^{119} \Rightarrow$  unit digit = 9

if it is raised to an even power  $\rightarrow$

**Example:**  $\rightarrow (119)^{118} \Rightarrow$  unit digit = 1

**Finding minimum and maximum values in fractions:**

**Example:** Find maximum value:

$$\frac{5}{7}, \frac{9}{4}, \frac{8}{13}, \frac{14}{15} \Rightarrow$$

Let us consider  $\frac{5}{7}$  and  $\frac{9}{4}$

$$\frac{5}{7} \leftarrow \begin{array}{c} \nearrow \\ \times \\ \searrow \end{array} \frac{9}{4}$$

$$5 \times 4 < 9 \times 7 \Rightarrow \frac{5}{7} < \frac{9}{4}$$

Now, let us take:  $\frac{9}{4}$  and  $\frac{8}{13}$

$$\frac{9}{4} \leftarrow \begin{array}{c} \nearrow \\ \times \\ \searrow \end{array} \frac{8}{13}$$

$$13 \times 9 > 4 \times 8 \Rightarrow \frac{9}{4} > \frac{8}{13}$$

$\frac{9}{4}$  is greater than both  $\frac{5}{7}$  and  $\frac{8}{13}$ .

Now, let us compare  $\frac{9}{4}$  and  $\frac{14}{15}$

$$\frac{9}{4} \leftarrow \begin{array}{c} \nearrow \\ \times \\ \searrow \end{array} \frac{14}{15}$$

$$15 \times 9 > 4 \times 14 \Rightarrow \frac{9}{4} > \frac{14}{15}$$

So,  $\frac{9}{4}$  is the greatest value among all given values.

**Foundation****Questions**

1. 320% of 40 = ?  
 (a) 128      (b) 140      (c) 180  
 (d) 60      (e) 210
2.  $69.69 - 51.54 + 73.64 = ? + 32.42$   
 (a) 47.44      (b) 53.88      (c) 58.38  
 (d) 44.34      (e) None of these
3. 14.28% of 49 = ?  
 (a) 8      (b) 11      (c) 7  
 (d) 16      (e) 15
4.  $1\frac{1}{3} - 1\frac{1}{9} + 1\frac{1}{6} = ?$   
 (a)  $1\frac{5}{18}$       (b)  $1\frac{7}{18}$       (c)  $1\frac{1}{9}$   
 (d)  $1\frac{4}{9}$       (e) None of these
5.  $\frac{3}{7}$  of  $\frac{49}{6}$  of  $\frac{4}{7} = ?$   
 (a) 1      (b) 2      (c) 3  
 (d) 4      (e) 5
6. 25% of 48 + 50% of 120 = ?% of 1200  
 (a) 4      (b) 5      (c) 6  
 (d) 8      (e) 16
7.  $\sqrt{52 \times 27 \div 6 + 26 - 4} = ?$   
 (a)  $\sqrt{24}$       (b)  $(16)^2$       (c) 24  
 (d)  $\sqrt{16}$       (e) None of these
8. 65% of 240 + ? % of 150 = 210  
 (a) 45      (b) 46      (c) 32  
 (d) 36      (e) None of these
9.  $4\frac{4}{5} \div 6\frac{2}{5} = ?$   
 (a)  $3\frac{3}{4}$       (b)  $5\frac{5}{7}$       (c)  $7\frac{7}{11}$   
 (d)  $5\frac{5}{8}$       (e) None of these
10. 26.5% of 488 = ?  
 (a) 205.65      (b) 211.72      (c) 145.67  
 (d) 129.32      (e) None of these
11. 140% of 56 + 56% of 140 = ?  
 (a) 78.4      (b) 158.6      (c) 156.8  
 (d) 87.4      (e) None of these
12.  $\frac{16}{24} + \frac{4}{10} - \frac{1}{6} = ?$
- (a)  $\frac{9}{10}$       (b)  $\frac{7}{10}$       (c)  $\frac{5}{10}$   
 (d)  $\frac{3}{10}$       (e) None of these
13.  $8000 \div 16 - 200 = ? \times 6$   
 (a) 75      (b) 60      (c) 50  
 (d) 25      (e) None of these
14.  $73 \times 18 + 486 = ? + (13)^2$   
 (a) 1485      (b) 1631      (c) 1525  
 (d) 1225      (e) None of these
15.  $\frac{1}{8}$  th of  $\frac{6}{7}$  th of 11200 = ?  
 (a) 1100      (b) 1220      (c) 1430  
 (d) 1200      (e) None of these
16.  $(6990 \div 15) \times (468 \div 18) = ?$   
 (a) 12161      (b) 12116      (c) 14000  
 (d) 13342      (e) None of these
17.  $\frac{3}{5}$  th of 24% of 500 - 32 = ?  
 (a) 20      (b) 30      (c) 50  
 (d) 40      (e) None of these
18.  $\frac{17}{29} \times \frac{87}{102} \times \frac{48}{27} \times \frac{3}{2} = ?$   
 (a)  $1\frac{2}{3}$       (b)  $2\frac{1}{3}$       (c)  $1\frac{1}{3}$   
 (d)  $2\frac{2}{3}$       (e) None of these
19.  $(\sqrt{2209} - 12) \times 5 = ?$   
 (a) 175      (b) 180      (c) 225  
 (d) 195      (e) None of these
20.  $(0.88 \times 880 \div 8) \times 6 = ?$   
 (a) 508.08      (b) 580.80      (c) 408.08  
 (d) 680.08      (e) None of these
21.  $90 \times \frac{6}{18} + 73 = ?$   
 (a) 130      (b) 110      (c) 103  
 (d) 120      (e) None of these
22.  $\sqrt{8 \times 220 \div 11 + 85} - 20 = ?$   
 (a) 15      (b) 25      (c) 35  
 (d) 20      (e) None of these

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23.  $1\frac{5}{6} + 2\frac{3}{5} + 4\frac{2}{3} = ?$

- (a)  $2\frac{1}{10}$       (b)  $7\frac{1}{10}$       (c)  $6\frac{1}{10}$   
 ✓ (d)  $9\frac{1}{10}$       (e) None of these

24.  $\frac{28 \times 36}{18\% \text{ of } 50} = ?$

- (a) 124      (b) 118      (c) 112  
 (d) 114      (e) None of these

25.  $2 \times 256 \times ? = 8^2 \times 10^2 \times 2$

- (a) 60      (b) 50      (c) 46  
 (d) 54      (e) None of these

26. 38% of ? = 3596 - 632

- (a) 7800      (b) 7900      (c) 8900  
 (d) 8700      (e) None of these

27.  $63 + 371 \div 7 = ?$

- (a) 62      (b) 116      (c) 52  
 (d) 123      (e) None of these

28.  $2\frac{3}{5} + 3\frac{4}{9} + 4\frac{3}{15} = ?$

- (a)  $9\frac{17}{15}$       (b)  $7\frac{8}{15}$       (c)  $9\frac{22}{15}$   
 (d)  $11\frac{22}{15}$       (e) None of these

29.  $92^2 - 12^2 = 3535 + ?$

- (a) 4885      (b) 4785      (c) 5795  
 (d) 11855      (e) None of these

30.  $958 \times 21 \div 4 = ?$

- (a) 5029.5      (b) 5039.3      (c) 5049.3  
 (d) 5019.5      (e) None of these

31.  $\frac{6}{5} \text{ of } \frac{3}{4} \text{ of } \frac{1}{2} \text{ of } ? = 3600$

- (a) 6000      (b) 7000      (c) 8000  
 (d) 18000      (e) None of these

32.  $36 + 451 \div 11 = ?$

- (a) 65      (b) 44.27      (c) 77  
 (d) 454.27      (e) None of these

33.  $11 \times 468 \div 26 = ? + 8$

- (a) 206      (b) 190      (c) 198  
 (d) 215      (e) None of these

34.  $(2 + \sqrt{5})^2 = ? + 4\sqrt{5}$

- (a)  $9 + 4\sqrt{5}$       (b) 9      (c)  $2\sqrt{5}$   
 (d)  $9 + 2\sqrt{5}$       (e) None of these

35.  $\frac{3}{23} \text{ of } \frac{5}{12} \text{ of } 1104 = ?$

- (a) 70      (b) 60      (c) 20313.6  
 (d) 50      (e) None of these

36.  $\sqrt{15 \times 163 \div 5 - 89} = ?$

- (a) 25      (b) 20      (c)  $\sqrt{578}$   
 (d) 26      (e) None of these

37.  $\frac{1}{4} \text{ th of } \frac{1}{2} \text{ of } \frac{3}{4} \text{ th of } 52000 = ?$

- (a) 4785      (b) 4877      (c) 4857  
 (d) 4875      (e) None of these

38.  $26 \times 451 - ? = 5109$

- (a) 5617      (b) 6517      (c) 6627  
 (d) 6597      (e) None of these

39.  $47 \times 251 - 13343 + 1547 = ?$

- (a) -3093      (b) 0      (c) 1  
 (d) 2      (e) None of these

40.  $\frac{3}{11} \text{ of } \frac{5}{7} \text{ of } (?) = 63$

- (a) 3134      (b) 312.4      (c) 323.4  
 (d) 3100      (e) None of these

## Moderate

1.  $9229.789 - 5021.832 + 1496.989 = ?$

- (a) 6500      (b) 6000      (c) 6300  
 (d) 5700      (e) 5100

2.  $1002 + 49 \times 99 - 1299 = ?$

- (a) 700      (b) 600      (c) 900  
 (d) 250      (e) 400

3.  $29.8\% \text{ of } 260 + 60.01\% \text{ of } 510 - 103.57 = ?$

- (a) 450      (b) 320      (c) 210  
 (d) 280      (e) 350

4.  $(21.98)^2 - (25.02)^2 + (13.03)^2 = ?$

- (a) 25      (b) 120      (c) 10  
 (d) 65      (e) 140

5.  $\sqrt{2498} \times \sqrt{626} \div \sqrt{99} = ?$

- (a) 110      (b) 90      (c) 200  
 (d) 160      (e) 125

6.  $1599 \times 199 \div 49 - 1398 + 3877 = ?$

- (a) 9400      (b) 9000      (c) 8700  
 (d) 8400      (e) 9200

7.  $4433.764 - 2211.993 - 1133.667 + 3377.442 = ?$   
 (a) 4466      (b) 4377      (c) 363  
 (d) 4144      (e) 3344

8.  $(13.96)^2 - (15.03)^2 + (18.09)^2 - 32.65 = ?$   
 (a) 223      (b) 264      (c) 334  
 (d) 354      (e) 201

9.  $[(7.99)^2 - (13.001)^2 + (4.01)^3]^2 = ?$   
 (a) -1800      (b) 1450      (c) -1660  
 (d) 1680      (e) -1450

10.  $(21.5\% \text{ of } 999)^{1/3} + (42\% \text{ of } 601)^{1/2} = ?$   
 (a) 18      (b) 22      (c) 26  
 (d) 30      (e) 33

11.  $(\sqrt{4489} - \sqrt{2601}) = (?)^2$   
 (a) 14      (b)  $(16)^2$       (c) 4  
 (d) 24      (e) None of these

12.  $9067 + 2065 - 8400 + 3045 - 1520 = ?$   
 (a) 4257      (b) 4157      (c) 4357  
 (d) 4047      (e) None of these

13.  $\frac{1}{16} \text{ of } 8432 + 50\% \text{ of } ? = 4429$   
 (a) 6804      (b) 8224      (c) 7884  
 (d) 7804      (e) None of these

14.  $250\% \text{ of } ? \div 250 - 444 = 200$   
 (a) 634000      (b) 6440      (c) 64400  
 (d) 64444000      (e) None of these

15.  $0.01024 \times (0.4)^9 = (0.4)^? \times (0.0256)^3$   
 (a) 1      (b) 2      (c) 3  
 (d) 4      (e) 5

16.  $18 \times 16 - 3445 \div 13 = ? - 344$   
 (a) 369      (b) 367      (c) 368  
 (d) 467      (e) None of these

17.  $[(3^2)^6]^5 = 9^?$   
 (a) 30      (b) 60      (c) 90  
 (d) 20      (e) None of these

18.  $1\frac{1}{4} + 1\frac{5}{9} \times 1\frac{5}{8} \div 6\frac{1}{2} = ?$   
 (a)  $1\frac{23}{36}$       (b) 17      (c) 27  
 (d) 18      (e) None of these

19.  $(2\sqrt{392} - 21) + (\sqrt{8} - 7)^2 = (?)^2$   
 (a) 5      (b) 6      (c) 7  
 (d) 8      (e) None of these

20.  $(\sqrt{9})^3 \times (\sqrt{81})^5 \div 27^2 = (3)^?$   
 (a) 21      (b) 25      (c) 29  
 (d) 7      (e) None of these

21.  $18.5\% \text{ of } 220 + 12.4\% \text{ of } 680 = ?$   
 (a) 132.05      (b) 125.02      (c) 142.07  
 (d) 118.7      (e) None of these

22.  $\sqrt[3]{1331} + \sqrt[3]{1728} = ?$   
 (a) 11      (b) 12      (c) 23  
 (d) 34      (e) None of these

23.  $5.6 \times 12.5 \div 0.5 + 15.5 = ? + 49.5$   
 (a) 105      (b) 106      (c) 104  
 (d) 200      (e) None of these

24.  $72\% \text{ of } 390 + 28\% \text{ of } 165 = (x - 3)$   
 (a) 320      (b) 325      (c) 327  
 (d) 330      (e) None of these

25. 42% of a number is 357. What is 63% of that number?  
 (a) 530      (b) 530.5      (c) 535  
 (d) 535.5      (e) None of these

26. What is least number added to 4042 to make it perfect square?  
 (a) 54      (b) 58      (c) 64  
 (d) 41      (e) None of these

27. What least number must be subtracted from 5500 to make it perfect square?  
 (a) 34      (b) 12      (c) 24  
 (d) 41      (e) None of these

28. The sum of 33% of a number and 14% of same number is 3055. What is 72% of that number?  
 (a) 4675      (b) 4685      (c) 4670  
 (d) 4680      (e) None of these

29. If 64 is subtracted from a number then it reduce to 36% itself then what is  $\frac{4}{5}$  of that number?  
 (a) 100      (b) 125      (c) 80  
 (d) 75      (e) None of these

30. If the sum of 4 consecutive odd number is 184 then find the largest number.  
 (a) 46      (b) 43      (c) 49  
 (d) 48      (e) None of these

31. If 35% of a number is 182 then, what is 150% of that number?  
 (a) 760      (b) 780      (c) 520  
 (d) 560      (e) None of these

32. Difference between one-fourth of a number and one seventh of same number is 24. What is number?  
 (a) 205      (b) 210      (c) 224  
 (d) 204      (e) 214

33. What is the value of 68% of two fifth of 550?  
 (a) 149.6      (b) 150      (c) 154  
 (d) 158      (e) None of these

## NUMBER SYSTEM, SIMPLIFICATION AND APPROXIMATION

34. 30% of a number is 190.8. What will be 175% of that number?  
 (a) 1113    (b) 1115    (c) 11502  
 (d) 1002    (e) None of these
35. What least number must be added to 1056, so that the sum is completely divisible by 23?  
 (a) 2    (b) 3    (c) 18  
 (d) 21    (e) None of these
36. The difference of two numbers is 1365. On dividing the larger number by the smaller, we get 6 as quotient and 15 as remainder. What is the smaller number?  
 (a) 240    (b) 270    (c) 295  
 (d) 360    (e) None of these
37. The sum of first 45 natural numbers is:  
 (a) 1035    (b) 1280    (c) 2140  
 (d) 2140    (e) None of these

## Difficult

1.  $(0.83 \times 0.83 \times 0.83 + 0.17 \times 0.17 \times 0.17)$  is equal to \_\_\_\_.  
 (a)  $1 + 0.51 \times 0.83$     (b)  $1 - 0.51 \times 0.83$   
 (c)  $0.51 \times 0.83 - 1$     (d)  $2 + 0.51 \times 0.83$   
 (e) None of these

2. Find the simplified value of  $63\sqrt{(729)^{\frac{2}{3}} + (343)^{\frac{-2}{3}}}$ ?  
 (a)  $63\sqrt{1072}$     (b)  $\frac{63}{\sqrt{30}}$     (c)  $63\sqrt{63}$   
 (d)  $\sqrt{130}$     (e) None of these

3. Find the units digit of  $(128)^{82}$ ?  
 (a) 8    (b) 4    (c) 2  
 (d) 6    (e) None of these

4. Find the square root of

$$(2.25)^2 + 16 - 4(2.25) - \frac{(2.25)^3}{2.25 + 4} ?$$

(a) 6.4    (b) 4.8    (c) 3.2  
 (d) 1.6    (e) None of these

5. What is the unit digit in  $((6374)^{1793} \times (625)^{317} \times (341)^{491})$ ?  
 (a) 0    (b) 2    (c) 3  
 (d) 5    (e) None of these
6. If a six digit number 53a 29 b is divisible by 88 then find the value of a and b.  
 (a) 2 and 8    (b) 8 and 2    (c) 8 and 6  
 (d) 4 and 8    (e) None of these

38.  $\frac{753 \times 753 + 247 \times 247 - 753 \times 247}{753 \times 753 \times 753 + 247 \times 247 \times 247} = ?$

- (a)  $1/1000$     (b)  $1/5056$     (c)  $253/500$   
 (d)  $260/550$     (e) None of these

39. If the number 481\*673 is completely divisible by 9, then the smallest whole number in place of \* will be

- (a) 2    (b) 5    (c) 6  
 (d) 7    (e) None of these

40. On dividing a number by 56, we get 29 as remainder. On dividing the same number by 8, what will be the remainder?

- (a) 4    (b) 5    (c) 6  
 (d) 7    (e) None of these

7. If a number is multiplied by  $\frac{3}{5}$  th of itself. The value so obtained is  $3^2$  less than  $12^2$ . What is fifth third of that number?  
 (a) 375    (b) 75    (c) 25  
 (d) 225    (e) None of these

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

- (a)  $\frac{1}{3}, \frac{2}{5}, \frac{3}{7}, \frac{4}{5}, \frac{5}{6}, \frac{6}{7}$     (b)  $\frac{1}{3}, \frac{2}{5}, \frac{3}{5}, \frac{4}{7}, \frac{5}{6}, \frac{6}{7}$   
 (c)  $\frac{1}{3}, \frac{2}{5}, \frac{3}{5}, \frac{4}{6}, \frac{5}{7}, \frac{6}{7}$     (d)  $\frac{6}{7}, \frac{5}{6}, \frac{4}{5}, \frac{3}{7}, \frac{2}{5}, \frac{1}{3}$   
 (e) None of these

9.  $\sqrt[3]{\sqrt[3]{\sqrt[3]{\sqrt[3]{\sqrt[3]{3}}}}} = ?$

- (a)  $3^{\frac{31}{64}}$     (b)  $3^{\frac{31}{32}}$     (c)  $3^{\frac{1}{64}}$   
 (d)  $3^{\frac{1}{65}}$     (e) None of these

10. P, Q and R scored 581 runs such that four times P's runs are equal to 5 times Q's runs which are equal to seven times R's runs. Find the difference between P and R.

- (a) 49    (b) 105    (c) 46  
 (d) 100    (e) None of these

11. How many natural numbers are there between 23 and 100 which are exactly divisible by 6?

- (a) 8      (b) 11      (c) 12  
 (d) 13      (e) None of these
12. The price of commodity X increases by 40 paise every year, while the price of commodity Y increases by 15 paise every year. If in 2001, the price of commodity X was Rs. 4.20 and that of Y was Rs. 6.30, in which year commodity X will cost 40 paise more than the commodity Y?  
 (a) 2010      (b) 2011      (c) 2012  
 (d) 2013      (e) None of these
13.  $24 - [2.4 - \{0.24 \times 2 - (0.024 - ?)\}] = 22.0584$   
 (a) 0.0024      (b) 0.024      (c) 0.24  
 (d) 0.00024      (e) None of these
14.  $3648.24 + 364.824 \div ? - 36.4824 = 3794.1696$   
 (a) 2      (b) 3      (c) 4  
 (d) 5      (e) None of these
15.  $6 - \left[ \frac{5}{6} + \left\{ 3\frac{7}{8} - 2\frac{1}{3} + 1\frac{7}{9} \right\} \right] = ?$   
 (a)  $3\frac{9}{13}$       (b)  $1\frac{9}{11}$       (c)  $2\frac{11}{72}$   
 (d)  $1\frac{51}{71}$       (e) None of these
16.  $\left[ 10 + \left\{ 4 \times \left( \frac{2}{3} + \frac{1}{4} \times \sqrt{\frac{144}{121}} + 23 \right) \div 12 + 5 \right\} - 3 \right] = ?$   
 (a) 20      (b) 8      (c) 10  
 (d) 15      (e) 5
17.  $8 + \left[ \left\{ \frac{21 \times \sqrt{\frac{9}{441}} - 1}{5} \text{ of } 60\% - \frac{1}{5} \right\} \times 625 + 7 \right] \div 4 = ?$   
 (a) 10      (b) 15      (c) 7  
 (d) 16      (e) 12
18.  $(0.25)^6 \div (0.125)^2 \times (0.5)^4 = (0.5)^{?+3}$   
 (a) 1      (b) 3      (c) 5  
 (d) 7      (e) None of these
19. Find the greatest fraction among the fractions  
 $\frac{17}{18}, \frac{21}{22}, \frac{26}{27}$  and  $\frac{36}{37}$ ?  
 (a)  $\frac{17}{18}$       (b)  $\frac{21}{22}$       (c)  $\frac{26}{27}$   
 (d)  $\frac{36}{37}$       (e) None of these
20. The square root of  $\left[ \frac{(3.25)^3}{3.25 - 1} - (3.25 + (3.25)^2 + 1) \right]$  is equal to:  
 (a)  $\frac{1}{3}$       (b)  $\frac{2}{3}$       (c)  $\frac{4}{3}$   
 (d)  $\frac{5}{3}$       (e) None of these

# adda247

**Previous Year (Memory Based)**

1.  $7\% \text{ of } 4000 - 12\% \text{ of } 550$   
 (a) 224      (b) 214      (c) 234  
 (d) 324      (e) None of these
2.  $18\% \text{ of } 125 \times 9\% \text{ of } 25 = ? - 100$   
 (a) 148.625      (b) 148.225      (c) 150.625  
 (d) 150.225      (e) None of these
3. How many 3-digit numbers are completely divisible by 6?  
 (a) 149      (b) 150      (c) 151  
 (d) 166      (e) None of these
4. On dividing a number by 5, we get 3 as remainder. What will the remainder when the square of this number is divided by 5?  
 (a) 0      (b) 1      (c) 2  
 (d) 4      (e) None of these
5.  $323.232 + 32.3232 + 3.23232 = ?$   
 (a) 678.324652      (b) 6687665.2      (c) 358.78752  
 (d) 368.76752      (e) None of these
6.  $525 \times 24 \div 8 + 25 = (?)^2$   
 (a) 50      (b) 30      (c) 40  
 (d) 60      (e) None of these
7.  $46818 + 34484 - 24642 - 21232 = ?$   
 (a) 35428      (b) 32468      (c) 58248  
 (d) 46428      (e) None of these
8.  $499.99 + 1999 \div 39.99 \times 50.01 = ?$   
 (a) 3200      (b) 2700      (c) 3000  
 (d) 2500      (e) 2400
9.  $\frac{601}{49} \times \frac{399}{81} \div \frac{29}{201} = ?$   
 (a) 520      (b) 360      (c) 460  
 (d) 500      (e) 420

## NUMBER SYSTEM, SIMPLIFICATION AND APPROXIMATION

10.  $(13.99)^2 - (15.02)^2 + (18.07)^2 - 36.64 = ?$   
 (a) 250      (b) 260      (c) 270  
 (d) 280      (e) 240

11.  $40.005\% \text{ of } 439.998 + ? \% \text{ of } 655.011 = 228.5$   
 (a) 8      (b) 17      (c) 12  
 (d) 20      (e) 5

12.  $6894.986 + 5025.005 + 600.020 = ?$   
 (a) 12170      (b) 13540      (c) 12950  
 (d) 11560      (e) 12520

13.  $149.9\% \text{ of } 149.9 + 149.9 = ?$   
 (a) 375      (b) 400      (c) 1000  
 (d) 1020      (e) 1060

14.  $\sqrt{2601} - \sqrt{1156} + \sqrt{484} = ?$   
 (a) 50      (b) 90      (c) 40  
 (d) 20      (e) 30

15.  $\frac{901}{29} \times \frac{91}{301} \div \frac{51}{599} = ?$   
 (a) 140      (b) 120      (c) 60  
 (d) 80      (e) 110

16.  $\sqrt{?}\% \text{ of } 160 = 128 \div 4$   
 (a) -20      (b)  $\sqrt{20}$       (c) 400  
 (d)  $\sqrt{400}$       (e) None of these

17.  $3\frac{6}{7} + 6\frac{1}{4} - 5\frac{1}{3} + 2\frac{1}{2} = ?$   
 (a)  $6\frac{11}{28}$       (b)  $7\frac{11}{28}$       (c)  $6\frac{17}{28}$   
 (d)  $7\frac{23}{84}$       (e) None of these

18. If the difference between a number and  $\frac{3}{5}$  th of the same number is 30 then find the number.  
 (a) 80      (b) 75      (c) 100  
 (d) 45      (e) None of these

19.  $5999.99 + 1999 \div 39.99 \times 50.01 = ?$   
 (a) 8500      (b) 8000      (c) 7500  
 (d) 850      (e) 750

20.  $[(7.98)^2 - (13.002)^2 + (4.02)^3]^2 = ?$   
 (a) 1703      (b) 1680      (c) 1650  
 (d) 2050      (e) 1600

21.  $74.01\% \text{ of } 1301 + 9.99\% \text{ of } 1901 = ?$   
 (a) 1150      (b) 1200      (c) 1125  
 (d) 1325      (e) 1400

22.  $5894 \div 15.01 + 590.01 - 111.98 = ?$   
 (a) 980      (b) 780      (c) 880  
 (d) 920      (e) 645

23.  $2438.79 - 1233.99 + 399.99 = ? + 989.99$   
 (a) 600      (b) 700      (c) 900  
 (d) 500      (e) 450

24.  $21.9\% \text{ of } 511.987 - 42.49 = ?$   
 (a) 440      (b) 450      (c) 380  
 (d) 300      (e) 315

25.  $1601 \times 198 \div 49 - 1399 + 3878 = ?$   
 (a) 8500      (b) 8700      (c) 8900  
 (d) 9100      (e) 9500

26.  $(13.95)^2 - (15.04)^2 + (18.08)^2 - 32.64 = ?$   
 (a) 260      (b) 300      (c) 350  
 (d) 400      (e) 450

27.  $441.01 - 232.99 + 1649.99 = ? + 1225.92$   
 (a) 600      (b) 630      (c) 660  
 (d) 690      (e) 720

28.  $\sqrt{624} \times \sqrt{63} + \sqrt{398} \div \sqrt{17} = ?$   
 (a) 205      (b) 225      (c) 175  
 (d) 170      (e) 180

29.  $1523.89 \div 19.95 + 496.28 + 249.927 = ?$   
 (a) 825      (b) 840      (c) 800  
 (d) 900      (e) 950

30.  $2439.97 - 1234.01 + 401.99 = ? + 989.99$   
 (a) 620      (b) 650      (c) 680  
 (d) 700      (e) 600.

31. Simplify  $\frac{(0.9743)^3 - (0.0257)(0.0257)(0.0257)}{(0.9743)^2 + (0.9743)(0.0257) + (0.0257)^2}$   
 (a) 0.9486      (b) 0.9362      (c) 1  
 (d) 1.028      (e) None of these

32.  $\sqrt[3]{6\frac{35}{216}}$  is equal to \_\_\_\_\_.

(a)  $\frac{13}{6}$       (b)  $\frac{7}{3}$       (c)  $\frac{11}{6}$   
 (d)  $\frac{11}{3}$       (e) None of these

33.  $(8.5 \times 8.5 + 93.5 + 5.5 \times 5.5)^{1/2}$  is equal to \_\_\_\_\_.  
 (a) 9      (b) 14      (c) 13  
 (d) 10      (e) None of these

34.  $\frac{8.25 \times 8.25 + 6.75 \times 6.75 - 2 \times 8.25 \times 6.75}{8.25 \times 8.25 - 6.75 \times 6.75}$ .

when simplified equals \_\_\_\_\_.

(a) 0.1      (b) 0.2      (c) 0.05  
 (d) 0.25      (e) None of these

35.  $(\sqrt[3]{8000} + \sqrt[3]{0.027} - \sqrt[3]{0.216})$  is \_\_\_\_\_.  
 (a) 19.97      (b) 19.997      (c) 19.9997  
 ✓ (d) 19.7      (e) None of these

36.  $\frac{(0.146 + 0.092)^2 + (0.092 - 0.146)^2}{0.073 \times 0.073 + 0.046 \times 0.046}$  is equal to  
 (a) 8      (b) 0.8      (c) 0.94  
 (d) 0.156      (e) None of these

37.  $6\frac{1}{15} - 4\frac{1}{12} + 7\frac{1}{3} - 2\frac{1}{6} = ?$   
 ✓ (a)  $\frac{3}{20}$       (b)  $8\frac{7}{20}$       (c)  $9\frac{11}{20}$   
 (d)  $10\frac{7}{20}$       (e) None of these

38.  $[(72)^2 \div 36 + (?)^2] \div 5 = 45$   
 ✓ (a) 9      (b) 81      (c) 6561  
 (d) 729      (e) None of these

39.  $\frac{(0.6^3 - 0.1^3 - 0.4^3 - 3 \times 0.6 \times 0.1 \times 0.4)}{(0.6^2 + 0.1^2 + 0.4^2 + 0.6 \times 0.1 + 0.6 \times 0.4 - 0.1 \times 0.4)}$   
 (a) 1.1      (b) 0.1      (c) 0.9  
 (d) 0.3      (e) None of these

40.  $\frac{(0.188 + 0.077)^2 + (0.188 - 0.077)^2}{0.188 \times 0.188 + 0.077 \times 0.077} = ?$   
 ✓ (a) 0.2      (b) 0.265      (c) 0.111  
 (d) 2      (e) None of these

## Foundation

### Solutions

1. (a);  $\frac{320 \times 40}{100} = 128$

2. (e);  $69.69 - 51.54 + 73.64 = ? + 32.42$   
 $\Rightarrow ? = 59.37$

3. (c); 14.28% of 49 =  $\frac{1}{7} \times 49 = 7$

4. (b);  $1\frac{1}{3} - 1\frac{1}{9} + 1\frac{1}{6} = (1 - 1 + 1) + \left(\frac{1}{3} - \frac{1}{9} + \frac{1}{6}\right)$   
 $= 1 + \left(\frac{6 - 2 + 3}{18}\right) = 1 + \frac{7}{18} = 1\frac{7}{18}$

5. (b);  $\frac{3}{7}$  of  $\frac{49}{6}$  of  $\frac{4}{7} = \frac{3}{7} \times \frac{49}{6} \times \frac{4}{7} = 2$

6. (c);  $\frac{1}{4} \times 48 + \frac{1}{2} \times 120 = x\% \text{ of } 1200$

$$12 + 60 = \frac{x \times 1200}{100} \Rightarrow x = \frac{72 \times 100}{1200} = 6$$

7. (e);  $\sqrt{52 \times \frac{27}{6} + 26 - 4} = \sqrt{26 \times 9 + 26 - 4} = \sqrt{256} = 16$

8. (d); 65% of 240 + x% of 150 = 210  
 $210 - 65\% \text{ of } 240 = x\% \text{ of } 150$

$$210 - \frac{65 \times 240}{100} = \frac{x \times 150}{100}$$

$$\frac{x \times 150}{100} = 210 - 156 = 54 \Rightarrow x = \frac{5400}{150} = 36$$

9. (a);  $\frac{24}{5} \times \frac{5}{32} = \frac{3}{4}$

10. (d);  $? = \frac{26.5 \times 488}{100} = \frac{265 \times 488}{100 \times 10} = 129.32$

11. (c);  $? = \frac{140 \times 56}{100} + \frac{56 \times 140}{100} = \frac{2 \times 56 \times 140}{100} = 156.8$

12. (a);  $\frac{16}{24} + \frac{4}{10} - \frac{1}{6} = \frac{5 \times 16 + 12 \times 4 - 1 \times 20}{120}$   
 $= \frac{80 + 48 - 20}{120} = \frac{108}{120} = \frac{9}{10}$

13. (c);  $8000 \div 16 - 200 = ? \times 6$

$$? = \frac{\frac{8000}{16} - 200}{6} = \frac{500 - 200}{6} = 50$$

14. (b);  $73 \times 18 + 486 = ? + (13)^2$   
 $? = 73 \times 18 + 486 - 169 = 1314 + 317 = 1631$

15. (d);  $\frac{1}{8} \text{ th of } \frac{6}{7} \text{ th of } 11200 = ?$

$$? = \frac{1}{8} \times \frac{6}{7} \times 11200 = \frac{1}{8} \times 6 \times 1600 = 6 \times 200 = 1200$$

16. (b);  $(6990 \div 15) \times (468 \div 18)$

$$= \frac{6990}{15} \times \frac{468}{18} = 466 \times 26 = 12116$$

17. (d);  $\frac{3}{5} \times \frac{24 \times 500}{100} - 32 = ? \Rightarrow ? = 72 - 32 = 40$

## NUMBER SYSTEM, SIMPLIFICATION AND APPROXIMATION

18. (c);  $\frac{17}{29} \times \frac{87}{102} \times \frac{48}{27} \times \frac{3}{2} = \frac{4}{3} = 1\frac{1}{3}$

19. (a);  $(\sqrt{2209} - 12) \times 5 = (47 - 12) \times 5 = 35 \times 5 = 175$

20. (b);  $(0.88 \times 880 \div 8) \times 6 = ?$

$$? = \left( 0.88 \times \frac{880}{8} \right) \times 6 = 96.8 \times 6 = 580.80$$

21. (c);  $90 \times \frac{6}{18} + 73 = 30 + 73 = 103$

22. (a);  $\sqrt{8 \times \frac{220}{11} + 85 - 20} = \sqrt{8 \times 20 + 85 - 20} = \sqrt{140 + 85} = \sqrt{225} = 15$

23. (d);  $1\frac{5}{6} + 2\frac{3}{5} + 4\frac{2}{3} = (1+2+4) + \left( \frac{5}{6} + \frac{3}{5} + \frac{2}{3} \right)$   
 $= \left( 7 + \frac{25+18+20}{30} \right) = 7 + \frac{63}{30}$   
 $= 7 + \frac{21}{10} = \frac{91}{10} = 9\frac{1}{10}$

24. (c);  $? = \frac{28 \times 36 \times 100}{18 \times 50} = 2 \times 2 \times 28 = 112$

25. (e);  $2 \times 256 \times ? = 64 \times 100 \times 2$

$$? = \frac{64 \times 100 \times 2}{2 \times 256} = 25$$

26. (a); 38% of ? = 3596 - 632

$$\frac{38 \times x}{100} = 2964$$

$$x = \frac{1482 \times 100}{19} = 78 \times 100 = 7800$$

27. (b);  $63 + \frac{371}{7} = ? \Rightarrow ? = 63 + 53 = 116$

28. (e);  $2\frac{3}{5} + 3\frac{4}{9} + 4\frac{3}{15}$

$$= (2+3+4) + \left( \frac{3}{5} + \frac{4}{9} + \frac{3}{15} \right)$$

$$= 9 + \frac{27+20+9}{45} = 9 + \frac{56}{45} = \frac{461}{45} = 10\frac{11}{45}$$

29. (b);  $92^2 - 12^2 = 3535 + ?$   
 $(92+12)(92-12) = 3535 + ?$   
 $104 \times 80 = 3535 + ?$   
 $? = 8320 - 3535 = 4785$

30. (a);  $958 \times \frac{21}{4} = 239.5 \times 21 = 5029.5$

31. (c);  $\frac{6}{5} \text{ of } \frac{3}{4} \text{ of } \frac{1}{2} \text{ of } x = 3600$

$$\frac{6}{5} \times \frac{3}{4} \times \frac{1}{2} \times x = 3600$$

$$x = \frac{3600 \times 5 \times 4 \times 2}{6 \times 3}$$

32. (c);  $36 + 451 \div 11 = 36 + 41 = 77$

33. (b);  $11 \times 468 \div 26 = ? + 8$   
 $11 \times 18 = ? + 8 \Rightarrow ? = 198 - 8 = 190$

34. (b);  $(2+\sqrt{5})^2 = ? + 4\sqrt{5}$

$$4+5+4\sqrt{5} = ? + 4\sqrt{5} \Rightarrow ? = 9$$

35. (b);  $\frac{3}{23} \text{ of } \frac{5}{12} \text{ of } 1104$

$$= \frac{3}{23} \times \frac{5}{12} \times 1104 = 3 \times 5 \times \frac{48}{12} = 3 \times 5 \times 4 = 60$$

36. (b);  $x = \sqrt{15 \times 163 \div 5 - 89}$

$$x = \sqrt{489 - 89} \Rightarrow x = \sqrt{400} = 20$$

37. (d);  $\frac{1}{4} \times \frac{1}{2} \times \frac{3}{4} \times 52000 = \frac{3}{4} \times 6500 = \frac{19500}{4} = 4875$

38. (e);  $26 \times 451 - ? = 5109$   
 $? = 26 \times 451 - 5109 = 11726 - 5109 = 6617$

39. (c);  $47 \times 251 - 13343 + 1547$   
 $= 11797 - 13343 + 1547 = 13344 - 13343 = 1$

40. (c);  $\frac{3}{11} \text{ of } \frac{5}{7} \text{ of } x = 63$

$$\frac{3}{11} \times \frac{5}{7} \times x = 63$$

$$x = \frac{63 \times 7 \times 11}{3 \times 5} = \frac{21}{5} \times 77 = 4.2 \times 77 = 323.4$$

1. (d);  
2. (a);

3. (d);  
4. (a);

5. (e);

6. (b);  
7. (a);

8. (d);  
9. (a);

10. (b);

11. (c);

12. (a);  
13. (d);

14. (c);  
15. (b);

**Moderate**

1. (d);  $9230 - 5022 + 1497 = 5705 \approx 5700$

2. (a);  $1002 + 49 \times 99 - 1299$

$$= \frac{1002}{49} \times 99 - 1299 \approx \frac{1000}{50} \times 100 - 1300$$

$$\approx 2000 - 1300 = 700$$

3. (d);  $\approx 30\% \text{ of } 260 + 60\% \text{ of } 510 - 100$

$$\approx 78 + 306 - 100 \approx 384 - 100 \approx 280$$

4. (a);  $(22)^2 - (25)^2 + (13)^2$

$$= 484 + 169 - 625 = 653 - 625 = 28 \approx 25$$

5. (e);  $\sqrt{2498} \times \sqrt{626} \div \sqrt{99}$

$$\approx \sqrt{2500} \times \sqrt{625} \div 10 \approx 50 \times \frac{25}{10} \approx 125$$

6. (b);  $1599 \times 199 \div 49 - 1398 + 3877$

$$\approx 1600 \times \frac{200}{50} - 1400 + 3900$$

$$= 6400 - 1400 + 3900 = 8900 \approx 9000$$

7. (a);  $4400 - 2200 - 1100 + 3400 = 4500 \approx 4466$

8. (b);  $14^2 - 15^2 + 18^2 - 32 = 196 - 225 + 324 - 32 \approx 264$

9. (d);  $[8^2 - 13^2 + 4^2]^2$

$$= (64 - 169 + 16)^2 = (-41)^2 = 1681 \approx 1680$$

10. (b);  $(22\% \text{ of } 1000)^{\frac{1}{3}} + (42\% \text{ of } 600)^{\frac{1}{2}}$

$$= (220)^{\frac{1}{3}} + (252)^{\frac{1}{2}} \approx (6^3)^{\frac{1}{3}} + (16^2)^{\frac{1}{2}} = 6 + 16 = 22$$

11. (c);  $\sqrt{4489} - \sqrt{2601} = x^2$

$$x^2 = 67 - 51 = 16$$

$$x = 4$$

12. (a);  $9067 + 2065 - 8400 + 3045 - 1520 = 4257$

13. (d);  $\frac{1}{16} \times 8432 + 50\% \text{ of } x = 4429$

$$527 + \frac{x}{2} = 4429 \Rightarrow \frac{x}{2} = 3902 \Rightarrow x = 7804$$

14. (c);  $250\% \text{ of } x \div 250 - 444 = 200$

$$\left( \frac{250 \times x}{100} \right) \div 250 = 644$$

$$x = \frac{644 \times 250 \times 100}{250} = 64400$$

15. (b);  $0.01024 \times (0.4)^9 = (0.4)^x \times (0.0256)^3$

$$\frac{1024}{10^9} \times (0.4)^9 = (0.4)^x \times \left( \frac{256}{10^4} \right)^3$$

$$= \frac{4^5 \times 4^9}{10^{14}} = \frac{4^x}{10^x} \times \left( \frac{4^4}{10^4} \right)^3$$

$$= \frac{4^{14}}{10^{14}} = \frac{4^x}{10^x} \times \frac{4^{12}}{10^{12}} = \frac{4^{12+x}}{10^{12+x}}$$

$$\Rightarrow 12 + x = 14 \Rightarrow x = 2$$

16. (b);  $18 \times 16 - 3445 \div 13 = x - 344$

$$x = 288 - 265 + 344 = 632 - 265 = 367$$

17. (a);  $\left[ (3^2)^6 \right]^5 = 9^x \Rightarrow (3^{12})^5 = 3^{2x} \Rightarrow 3^{60} = 3^{2x}$

$$\Rightarrow 2x = 60 \Rightarrow x = 30$$

18. (a);  $1\frac{1}{4} + 1\frac{5}{9} \times 1\frac{5}{8} \div 6\frac{1}{2} = \frac{5}{4} + \frac{14}{9} \times \frac{13}{8} \times \frac{2}{13}$

$$= \frac{5}{4} + \frac{14}{36} = \frac{45+14}{36} = \frac{59}{36} = 1\frac{23}{36}$$

19. (b);  $(2\sqrt{392} - 21) + (\sqrt{8} - 7)^2 = x^2$

$$= 2\sqrt{14 \times 14 \times 2} - 21 + 8 + 49 - 14\sqrt{8} = x^2$$

$$= 28\sqrt{2} - 21 + 57 - 14\sqrt{8} = x^2$$

$$x^2 = 36 \Rightarrow x = 6$$

20. (d);  $(\sqrt{9})^3 \times (\sqrt{81})^5 \div (27)^2 = 3^x$

$$\frac{3^3 \times 9^5}{3^6} = 3^x = \frac{3^3 \times 3^{10}}{3^6} \Rightarrow 3^x = 3^7 \Rightarrow x = 7$$

21. (b);  $\frac{18.5 \times 220}{100} + \frac{12.4 \times 680}{100}$

$$= \frac{185 \times 22 + 124 \times 68}{100} = \frac{4070 + 8432}{100}$$

$$= \frac{12502}{100} = 125.02$$

22. (c);  $\sqrt[3]{1331} + \sqrt[3]{1728} = (11^3)^{\frac{1}{3}} + (12^3)^{\frac{1}{3}} = 11 + 12 = 23$

23. (b);  $5.6 \times 12.5 \times 2 + 15.5 = x + 49.5$

$$70 \times 2 + 15.5 = x + 49.5$$

$$155.5 - 49.5 = x \Rightarrow x = 106$$

24. (d);  $\frac{72 \times 390}{100} + \frac{28 \times 165}{100} = x - 3$

$$\Rightarrow \frac{28080}{100} + \frac{4620}{100} = x - 3$$

$$\Rightarrow 327 = x - 3 \Rightarrow x = 330$$

**NUMBER SYSTEM, SIMPLIFICATION AND APPROXIMATION**

25. (d);  $\frac{42 \times x}{100} = 357 \Rightarrow x = \frac{357 \times 100}{42} \Rightarrow 63\% \text{ of } x$

$$= \frac{63 \times 357 \times 100}{42 \times 100} = \frac{3}{2} \times 357 = \frac{1071}{2} = 535.5$$

26. (a);  $64^2 = 4096$   
So, the least number to be added to 4042 is:  
 $4096 - 4042 = 54$

27. (c);  $5476 = (74)^2$   
So, the least number to be subtracted from 5500  
is  $5500 - 5476 = 24$

28. (d);  $\frac{33x}{100} + \frac{14x}{100} = 3055 \Rightarrow \frac{47x}{100} = 3055$

$$x = \frac{3055 \times 100}{47}$$

$$72\% \text{ of } x = \frac{72}{100} \times \frac{3055 \times 100}{47} = 65 \times 72 = 4680$$

29. (c);  $x - 64 = \frac{36 \times x}{100}$

$$x - \frac{36x}{100} = 64 \Rightarrow \frac{64x}{100} = 64 \Rightarrow x = 100$$

$$\frac{4}{5} \text{ of } x = \frac{4}{5} \times 100 = 80$$

30. (c); Sum = 184

$$\Rightarrow \text{Average} = \frac{184}{4} = 46$$

The average will be the middle term

43	45	47	49
\	/		
46			

Largest number = 49

31. (b);  $\frac{35 \times x}{100} = 182$

$$x = \frac{182 \times 100}{35}$$

$$150\% \text{ of } x = \frac{150 \times 182 \times 100}{35 \times 100} = 780$$

32. (c);  $\frac{x}{4} - \frac{x}{7} = 24 \Rightarrow 3x = 28 \times 24 \Rightarrow x = 8 \times 28 = 224$

33. (a);  $68\% \text{ of } \frac{2}{5} \text{ of } 550 = 68\% \text{ of } 220$   
 $= \frac{68 \times 220}{100} = 149.6$

34. (a);  $\frac{30 \times x}{100} = 190.8 \Rightarrow x = \frac{19080}{30} = 636$

$$175\% \text{ of } 636 = \frac{175 \times 636}{100} = 7 \times 159 = 1113$$

35. (a);  $\frac{1056}{23} \Rightarrow \text{remainder} = 21 \Rightarrow 23 - 21 = 2$

So, 2 must be added to 1056 to make it completely divisible by 23.

36. (b); Let two numbers are  $x$  and  $y$

$$x - y = 1365 \quad \dots \text{(i)}$$

$$x - 6y = 15 \quad \dots \text{(ii)}$$

Solving (i) and (ii)

$$y = 270, \quad x = 1365 + 270 = 1635$$

So, smaller number is 270

37. (a); Sum of first 45 natural numbers =  $\frac{n(n+1)}{2}$

$$= \frac{45 \times 46}{2} = \frac{2070}{2} = 1035$$

38. (a); Let  $a = 753, b = 247$

Then, the given expression is  $= \frac{a^2 + b^2 - ab}{a^3 + b^3}$

$$= \frac{(a^2 + b^2 - ab)}{(a+b)(a^2 + b^2 - ab)}$$

$$= \frac{1}{a+b} = \frac{1}{753+247} = \frac{1}{1000}$$

39. (d); Let the smallest whole number in place of \* be  $x$   
 $4 + 8 + 1 + x + 6 + 7 + 3 = (29 + x)$   
For the number to be completely divisible by 9,  
 $(29 + x)$  must be completely divisible by 9.  
out of the given options, if we add 7 to 29, we get 36 which is divisible by 9.

40. (b); Remainder on dividing by 56 = 29.  
Remainder on dividing the same number by 8 is equal to the remainder on dividing 29 by 8 i.e., 5

**Difficult**

1. (b); Required value =  $(0.83)^3 + (0.17)^3$

if  $a + b + c = 0$ ,  $a^3 + b^3 + c^3 = 3abc$

$$0.83 + 0.17 + (-1) = 0$$

$$\Rightarrow (0.83)^3 + (0.17)^3 + (-1)^3 = 3 \cdot (0.83) \cdot (0.17) \cdot (-1)$$

$$\Rightarrow (0.83)^3 + (0.17)^3 = 1 - (3 \times 0.83 \times 0.17 \times 1)$$

$$= 1 - 0.51 \times 0.83$$

$$2. (d); 63\sqrt{(729)^{\frac{2}{3}} + (343)^{\frac{2}{3}}} = 63\sqrt{\frac{1}{(729)^{\frac{2}{3}}} + \frac{1}{(343)^{\frac{2}{3}}}}$$

$$(729)^{\frac{2}{3}} = (9^3)^{\frac{2}{3}} = 9^2 \Rightarrow (343)^{\frac{2}{3}} = (7^3)^{\frac{2}{3}} = 7^2$$

So, The required value is:

$$63\sqrt{\frac{1}{9^2} + \frac{1}{7^2}} = 63\sqrt{\frac{7^2 + 9^2}{9^2 \cdot 7^2}}$$

$$= \frac{63}{9 \cdot 7} \sqrt{49 + 81} = \sqrt{130}$$

3. (b); Powers of 8 have a cyclicity of 4 for their unit digits. When we divide 182 by 4, we get 2 as the remainder so,  $(128)^{182}$  will have the same unit digit as  $8^2$  i.e; 64, which is 4.

4. (c); Let the required square root be  $\sqrt{k}$ .

$$k = \frac{\{(2.25)^2 + 4^2 - 4(2.25)\}(2.25+4) - (2.25)^3}{(2.25+4)}$$

$$k = \frac{(2.25)^3 + 4^3 - (2.25)^3}{(2.25+4)}$$

[because,  $(a+b)(a^2+b^2-ab)=a^3+b^3$ ]

$$\text{So, } k = \frac{64}{\frac{9}{4} + 4} = \frac{64}{\frac{25}{4}} \Rightarrow k = \frac{64 \times 4}{25}$$

$$\sqrt{k} = \frac{8 \times 2}{5} = \frac{16}{5} = 3.2$$

5. (a); When unit digit is 1 or 5, the number raised to any power will have unit digit 1 and 5 respectively

when unit digit is 4 then we have two cases:

If the number is raised to odd power, then unit digit is 4. If the number is raised to even power, then unit digit is 6.

$\{(6374)^{1793} \times (625)^{317} \times (341)^{491}\}$  will have the same unit digit as the unit digit in –

$$4 \times 5 \times 1 = 20$$

So, the required unit digit is 0.

6. (c); For the number to be divisible by 88, it must be divisible by both 8 and 11.

For the given number to be divisible by 8, the number formed by last three digits must be divisible by 8.

i.e.,  $29b$  must be divisible by 8.

$$\Rightarrow b = 6$$

For the number to be divisible by 11, the difference of the sum of alternate digits starting from the unit digit and the sum of alternate digits starting from ten's digit must be either zero or a multiple of 11.

i.e; the difference of  $(3 + 2 + 6)$  and  $(5 + a + 9)$  is either 0 or a multiple of 11.

$$\Rightarrow (14 + a) - 11 = 0$$

$$\text{or } (14 + a) - 11 = 11 \text{ (suppose)}$$

Clearly, it cannot be 0 as a cannot be negative.

So,

$$14 + a - 11 = 11 \Rightarrow 14 + a = 22 \Rightarrow a = 8$$

$$\text{So, } a = 8, b = 6$$

7. (c); Let the number be  $n$

$$\text{then, } n \times \frac{3}{5}n = 12^2 - 3^2$$

$$\frac{3}{5}n^2 = (12+3)(12-3) \Rightarrow \frac{3}{5}n^2 = 15 \times 9$$

$$n^2 = \frac{5 \times 15 \times 9}{3} = 5 \times 5 \times 3 \times 3$$

$$n = 5 \times 3 = 15$$

$$\text{Now, } \frac{5}{3}n = \frac{5}{3} \times 15 = 25$$

8. (d); We will have to check all options.  
check option (d):

$$\begin{array}{ccccccc} \frac{6}{7}, & \frac{5}{6}, & \frac{4}{5}, & \frac{3}{7}, & \frac{2}{5}, & \frac{1}{3} \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 0.857 & 0.833 & 0.8 & 0.428 & 0.4 & 0.33 \end{array} \xrightarrow{\text{Descending order}}$$

9. (e); Let,  $\sqrt{3\sqrt{3\sqrt{3\sqrt{3\sqrt{3}}}}} = x$

$$x^2 = 3\sqrt{3\sqrt{3\sqrt{3\sqrt{3}}}}$$

$$x^4 = 3^2 \cdot 3 \cdot \sqrt{3\sqrt{3\sqrt{3\sqrt{3}}}}$$

$$x^8 = 3^4 \cdot 3^2 \cdot 3 \cdot \sqrt{3\sqrt{3\sqrt{3}}}$$

$$x^{16} = 3^{12} \cdot 3^2 \cdot 3\sqrt{3}$$

$$x^{32} = 3^{24} \cdot 3^4 \cdot 3^2 \cdot 3\sqrt{3}$$

$$x^{64} = 3^{48} \cdot 3^8 \cdot 3^4 \cdot 3^2 \cdot 3 \Rightarrow x^{64} = 3^{63}$$

$$x = (3^{63})^{\frac{1}{64}} \Rightarrow x = 3^{\frac{63}{64}}$$

10. (b); Let the runs scored by P, Q, and R be P, Q and R.

$$4P = 5Q = 7R$$

$$\text{Let } 4P = 5Q = 7R = K$$

$$P = \frac{K}{4}, Q = \frac{K}{5}, R = \frac{K}{7} \Rightarrow P + Q + R = 581$$

$$\frac{K}{4} + \frac{K}{5} + \frac{K}{7} = 581 \Rightarrow \frac{35K + 28K + 20K}{140} = 581$$

$$83K = 140 \times 581 \Rightarrow K = \frac{140 \times 581}{83}$$

$$K = 980 \Rightarrow P = \frac{K}{4} = 245 \Rightarrow R = \frac{K}{7} = 140$$

Difference between P and R is:  $245 - 140 = 105$

11. (d); First number = 24

Last number = 96

$$96 = 24 + (n-1)6 \quad (n = \text{number of terms})$$

$$72 = (n-1)6 \Rightarrow (n-1) = 12 \Rightarrow n = 13$$

12. (b); Price of x increases by 40 paise every year, while price of y increases by 15 paise every year.

in 2001, price of x = Rs. 4.20 = 420 paise

price of y = Rs. 6.30 = 630 paise

Let number of years = x

According to question,

$$420 + 40x = 40 + 630 + 15x$$

$$25x = 250, \quad x = 10 \text{ years}$$

So, it will take 10 years for the price of x to be 40 paise above the price of y.

$$2001 + 10 = 2011$$

13. (a); Let the missing value be x

$$24 - [2.4 - \{0.48 - 0.024 + x\}] = 22.0584$$

$$24 - [2.4 - 0.48 + 0.024 - x] = 22.0584$$

$$24 - 2.4 + 0.48 - 0.024 + x = 22.0584$$

$$\Rightarrow x + 22.056 = 22.0584 \Rightarrow x = 0.0024$$

14. (a);  $3648.24 + 364.824 \div x - 36.4824 = 3794.1696$

$$3648.24 + \frac{364.824}{x} - 36.4824 = 3794.1696$$

$$\frac{364.824}{x} = 3794.1696 - 3648.24 + 36.4824$$

$$\frac{364.824}{x} = 182.412 \Rightarrow x = \frac{364.824}{182.412} = 2$$

$$15. (e); 6 - \left[ \frac{5}{6} + \left\{ 3\frac{7}{8} - 2\frac{1}{3} + 1\frac{7}{9} \right\} \right] = 6 - \left[ \frac{5}{6} + \frac{31}{8} - \frac{7}{3} + \frac{16}{9} \right]$$

$$= 6 - \left[ \frac{60 + 279 - 168 + 128}{72} \right] = 6 - \left[ \frac{299}{72} \right]$$

$$= \frac{432 - 299}{72} = \frac{133}{72} = 1\frac{61}{72}$$

$$16. (a); \left[ 10 + \left\{ 4 \times \left( \frac{2}{3} + \frac{1}{4} \times \sqrt{\frac{144}{121}} + 23 \right) \div 12 + 5 \right\} - 3 \right]$$

$$= \left[ 10 + \left\{ 4 \times \left( \frac{11}{12} \times \frac{12}{11} + 23 \right) \div 12 + 5 \right\} - 3 \right]$$

$$= [10 + \{4 \times (1+23) \div 12 + 5\} - 3]$$

$$= [10 + \{4 \times 24 \div 12 + 5\} - 3]$$

$$= [10 + \{8+5\} - 3] = 20$$

$$17. (d); \left[ 8 + \left\{ \left( \frac{21 \times \sqrt{\frac{9}{441}} - 1}{5} \text{ of } 60\% - \frac{1}{5} \right) \times 625 + 7 \right\} \div 4 \right]$$

$$= \left[ 8 + \left\{ \left( \frac{21 \times \frac{3}{21} - 1}{5} \text{ of } 60\% - \frac{1}{5} \right) \times 625 + 7 \right\} \div 4 \right]$$

$$= \left[ 8 + \left\{ \left( \frac{2}{5} \text{ of } 60\% - \frac{1}{5} \right) \times 625 + 7 \right\} \div 4 \right]$$

$$= \left[ 8 + \left\{ \left( \frac{2}{5} \times \frac{3}{5} - \frac{1}{5} \right) \times 625 + 7 \right\} \div 4 \right]$$

$$= \left[ 8 + \left\{ \frac{1}{25} \times 625 + 7 \right\} \div 4 \right] = [8 + 32 \div 4] = 16$$

18. (d);  $(0.25)^6 \div (0.125)^2 \times (0.5)^4 = (0.5)^{x+3}$

$$((0.5)^2)^6 \div ((0.5)^3)^2 \times (0.5)^4 = (0.5)^{x+3}$$

$$(0.5)^{12} \div (0.5)^6 \times (0.5)^4 = (0.5)^{x+3}$$

$$(0.5)^{x+3} = (0.5)^{12-6+4}$$

$$(0.5)^{x+3} = (0.5)^{10} \Rightarrow x+3=10 \Rightarrow x=7$$

$$19. (d); \frac{17}{18} = 1 - \frac{1}{18}, \quad \frac{21}{22} = 1 - \frac{1}{22}$$

$$\frac{26}{27} = 1 - \frac{1}{27}, \quad \frac{36}{37} = 1 - \frac{1}{37}$$

Now,

$$\frac{1}{18} > \frac{1}{22} > \frac{1}{27} > \frac{1}{37}$$

$$\Rightarrow -\frac{1}{18} < -\frac{1}{22} < -\frac{1}{27} < -\frac{1}{37}$$

$$1 - \frac{1}{18} < 1 - \frac{1}{22} < 1 - \frac{1}{27} < 1 - \frac{1}{37}$$

So, the greatest fraction is  $\left(1 - \frac{1}{37}\right)$  i.e;  $\frac{36}{37}$

20. (b); Let  $3.25 = a$

Let the given term be  $k$

$$\text{then, } \sqrt{k} = \left[ \frac{a^3}{a-1} - (a + a^2 + 1) \right]^{\frac{1}{2}}$$

$$\Rightarrow \sqrt{k} = \left( \frac{a^3}{a-1} - \frac{a^3 - 1}{a-1} \right)^{\frac{1}{2}} = \left( \frac{1}{a-1} \right)^{\frac{1}{2}} = \left( \frac{1}{2.25} \right)^{\frac{1}{2}} \\ = \left( \frac{1}{9} \right)^{\frac{1}{2}} = \sqrt{\frac{4}{9}} = \frac{2}{3}$$

### Previous Year (Memory Based)

1. (b);

2. (c);

3. (b); First 3 digit number completely divisible by 6 is 102.

Last 3 digit number completely divisible by 6 is 996

$$996 = 102 + (n - 1)6 \quad [a_n = a + (n - 1)d]$$

$$894 = (n - 1)6$$

$$n - 1 = \frac{894}{6} = 149 \Rightarrow n = 150$$

4. (d); Let the number be 8

$$\frac{8}{5} \Rightarrow 3 \text{ is remainder} \Rightarrow 8^2 = 64$$

$$\frac{64}{5} \Rightarrow \text{remainder} \rightarrow 4$$

5. (c);  $323.232 + 32.3232 + 3.23232 = 358.78752$

6. (c);

7. (a);

8. (c);  $500 + 2000 \div 40 \times 50$

$$= 500 + 50 \times 50 = 2500 + 500 = 3000$$

9. (e);  $\frac{601}{49} \times \frac{399}{81} \times \frac{201}{29} \approx \frac{600}{50} \times \frac{400}{80} \times \frac{200}{30} \approx 420$

10. (b);

11. (a);  $40\% \text{ of } 440 + x\% \text{ of } 655 = 228.5$

$$\Rightarrow \frac{x \times 655}{100} = 52 \Rightarrow x = \frac{100 \times 52}{655} = 8\%$$

12. (e);

13. (a);  $150\% \text{ of } 150 + 150 = 375$

14. (c);  $\sqrt{2601} - \sqrt{1156} + \sqrt{484}$   
 $= 51 - 34 + 22 = 73 - 34 = 39 \approx 40$

15. (e);  $\frac{900}{30} \times \frac{90}{300} \times \frac{600}{50} = 9 \times 12 = 108 \approx 110$

16. (c);

17. (d);  $(3 + 6 - 5 + 2) + \left( \frac{6}{7} + \frac{1}{4} - \frac{1}{3} + \frac{1}{2} \right)$

$$= 6 + \frac{107}{84} = 7 \frac{23}{84}$$

18. (b);

19. (a);  $6000 + 2000 \div 40 \times 50 = 6000 + 50 \times 50 = 8500$

20. (b);  $[8^2 - 13^2 + 4^3]^2 = [64 - 169 + 64]^2 = (-41)^2 \approx 1680$

21. (a);  $74\% \text{ of } 1300 + 10\% \text{ of } 1900 \approx 1150$

22. (c);  $5900 \div 15 + 600 - 112 \approx 880$

23. (a);  $2438 - 1234 + 400 - 1000 = 604 \approx 600$

24. (c);  $22\% \text{ of } 500 - 42 = \frac{x}{5.5}$

$$(110 - 42) \times 5.5 = x \Rightarrow x = 68 \times \frac{11}{2} = 34 \times 11$$

$$= 374 \approx 380$$

25. (c);

26. (a);  $(14)^2 - (15)^2 + (18)^2 - 32$   
 $196 - 225 + 324 - 32 = 263 \approx 260$

27. (b);  $440 - 230 + 1650 - 1226 \approx 630$

28. (a);  $\sqrt{625} \times \sqrt{64} + \sqrt{400} \div \sqrt{16}$   
 $= 25 \times 8 + 20 \div 4 = 200 + 5 = 205$

29. (a);  $1525 \div 20 + 500 + 250 \approx 825$

30. (a);  $2440 - 1234 + 402 - 990 = 618 \approx 620$

31. (a); Let  $a = 0.9743$ ,  $b = 0.0257$

Required value is of the form  $\rightarrow \frac{a^3 - b^3}{a^2 + ab + b^2}$

$$= (a - b) = (0.9743 - 0.0257) = 0.9486$$

32. (c);  $\sqrt[3]{6 \frac{35}{216}} = \sqrt[3]{\frac{6 \times 216 + 35}{216}} = \sqrt[3]{\frac{1331}{216}} = \frac{11}{6}$

## NUMBER SYSTEM, SIMPLIFICATION AND APPROXIMATION

33. (b);  $\left[ (8.5)^2 + 2 \cdot (8.5) \cdot (5.5) + (5.5)^2 \right]^{\frac{1}{2}}$

$$\left[ (8.5 + 5.5)^2 \right]^{\frac{1}{2}} = 14$$

34. (a); Let  $8.25 = a$ ,  $6.75 = b$

$$\frac{a^2 + b^2 - 2ab}{a^2 - b^2} = \frac{(a-b)^2}{(a+b)(a-b)}$$

$$= \frac{a-b}{a+b} = \frac{8.25 - 6.75}{8.25 + 6.75} = \frac{1.5}{15} = 0.1$$

35. (d);  $\sqrt[3]{8000} + \sqrt[3]{0.027} - \sqrt[3]{0.216}$   
 $= 20 + 0.3 - 0.6 = 19.7$

36. (a); Let  $0.146 = a$ ,  $0.092 = b$

$$\Rightarrow 0.073 = \frac{a}{2} \Rightarrow 0.046 = \frac{b}{2}$$

So, the required value is of the form

$$\Rightarrow \frac{(a+b)^2 + (b-a)^2}{\left(\frac{a}{2}\right)^2 + \left(\frac{b}{2}\right)^2} = \frac{2(a^2 + b^2)}{\frac{a^2 + b^2}{4}} = 8$$

37. (a);  $6\frac{1}{15} - 4\frac{1}{12} + 7\frac{1}{3} - 2\frac{1}{6}$

$$= (6-4+7-2) + \left( \frac{1}{15} - \frac{1}{12} + \frac{1}{3} - \frac{1}{6} \right)$$

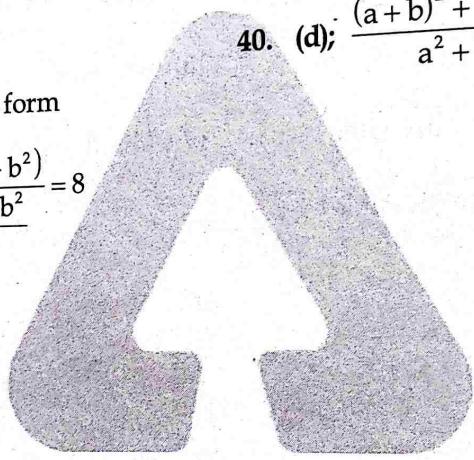
$$= 7 + \left( \frac{4-5+20-10}{60} \right) = 7 + \frac{9}{60} = 7 + \frac{3}{20} = 7\frac{3}{20}$$

38. (a);

39. (b); Let  $a = 0.6$ ,  $b = -0.1$ ,  $c = -0.4$ .  
 Then, the required value is of the form

$$\Rightarrow \frac{a^3 + b^3 + c^3 - 3abc}{a^2 + b^2 + c^2 - ab - bc - ca} \\ = a + b + c = 0.6 - 0.1 - 0.4 = 0.1$$

40. (d);  $\frac{(a+b)^2 + (a-b)^2}{a^2 + b^2} = 2$ ; [where,  $a = 0.188$ ,  $b = 0.077$ ]



...କୌଣସି...