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IAS Prelims Paper 2

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10th Edition

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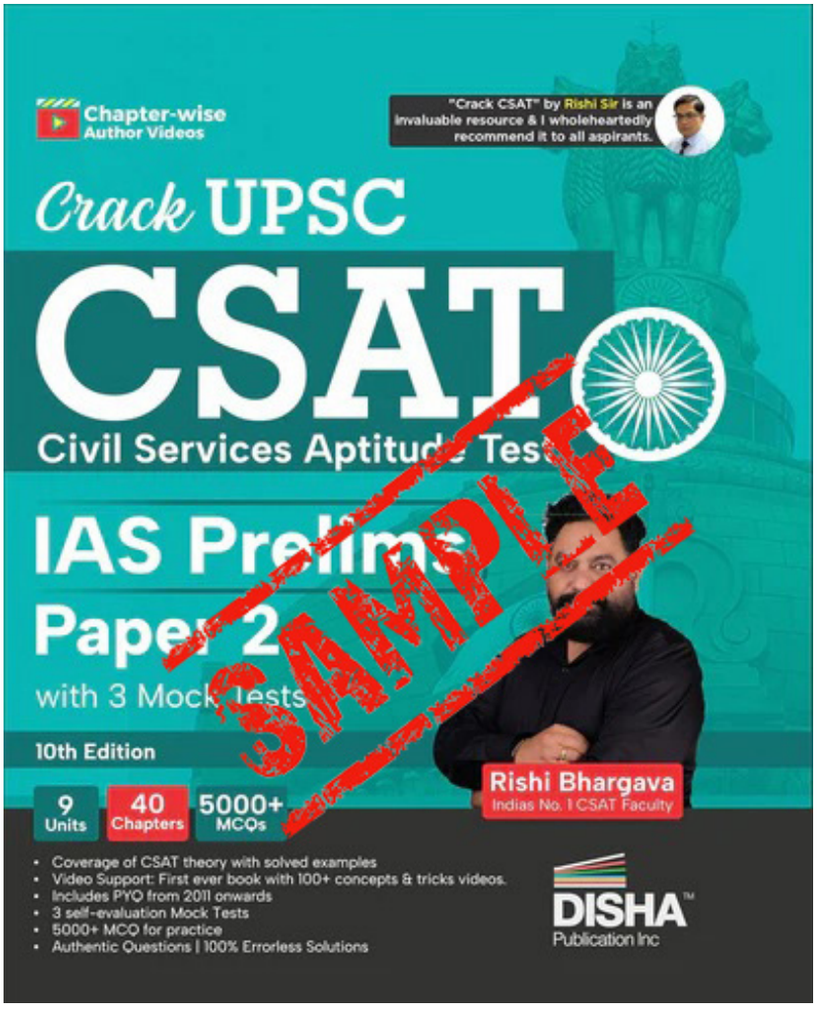

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CONTENTS

GENERAL MENTAL ABILITY GM-1-188

LOGICAL REASONING AND ANALYTICAL ABILITY LR-1-106

MOCK TESTS MT-1-32

1 Number System

NUMBERS

Digits

The ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are called digits.

Natural Numbers

Counting numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, etc. are called natural numbers/ positive integers. There are infinite natural numbers and smallest natural number is 1.

Negative Integers

Natural numbers with negative (–) sign i.e. –1, –2, –3, –4, etc. are called negative integers.

Whole Numbers / non negative integers

Zero (0) and natural numbers are called whole numbers i.e. 0, 1, 2, 3, 4, etc.

Integers

Natural numbers, their negative and zero (0) are called integers i.e. .....–4, –3, –2, –1, 0, 1, 2, 3, 4, ...

Even Natural Numbers

Those natural numbers which are divisible by 2 are called even natural numbers i.e. 2, 4, 6, 8, ...

Each even natural number is formed by $2n$ where n is a natural number.

Odd Natural Numbers

Those natural numbers which are not divisible by 2 are called odd natural numbers i.e. 1, 3, 5, 7, ...

Each odd number is formed by $(2n - 1)$ where n is a natural number.

Prime Numbers

A number other than 1 is called a **prime number** if it is divisible by only 1 and itself.

All prime numbers less than 100 are:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.

Note that 2 is the smallest prime number. 2 is the only even prime number.

Smallest odd prime number is 3.

Co-primes or Relative Primes

A pair of numbers are said to be co-primes or relative primes to each other if they do not have any common factor other than 1.

For example: 13 and 21.

REAL NUMBERS

All the existing numbers are real numbers. They are collectively represented by 'R'.

For example: $5, -2, 0, \frac{4}{7}, \sqrt{3}, \frac{\sqrt{4}}{3}, 2+\sqrt{2}, 5.4, 2.7070070007.....,$ $3.41\overline{25}$ etc. are real numbers.

FACE VALUE AND PLACE VALUE

Face value is absolute value of a digit.

Place value (or Local value) is value of a digit in relation to its position in the number.

For example: Face value and Place value of 9 in 14921 are 9 and 900 respectively.

SIGN OF THE PRODUCT OF TWO NUMBERS

(a) Product of two positive numbers is always a positive number.

$(+a) \times (+b) = +(a \times b)$

For example: $(+4) \times (+3) = (+)12 = 12$

(b) Product of two negative numbers is always a positive number.

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

For example: $(-4) \times (-3) = (+)12 = 12$

(c) Product of a negative number and a positive number is always a negative number.

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

For example: $(4) \times (-3) = (-)12 = -12$

ABSOLUTE VALUE OR MODULUS OF A NUMBER

Absolute value of a number is its numerical value irrespective of its sign.

If N be a real number, then $|N|$ indicates the absolute value of N.

Thus $|6| = 6, |-6| = 6, |0| = 0, |1| = 1, |3.4| = 3.4,$
$|-6.8| = 6.8$, etc.

$|-6| = 6$ can also be written as $|-6| = -(-6) = 6$. Thus, if x is a negative number, then $|x| = -x$ and if x is non-negative number, then $|x| = x$

$$\text{Hence } |x| = \begin{cases} x, \text{ if } x \geq 0 \\ -x, \text{ if } x < 0 \end{cases}$$

Illustration – 1

Solution of the equation $|x-2|=5$ is

(a) 3, – 7 **(b) – 3, 7**

(c) 3, 6 **(d) None of these**

Solution : (b) $|x-2|=5 \Rightarrow x-2=5$ or $x-2=-5$

$\Rightarrow x=7$ or $x=-3$

Illustration – 2

The minimum value of the expression $|17x-8|-9$ is

(a) 0 (b) – 9 (c) $\frac{8}{17}$ (d) None of these

Solution : (b) The value of expression $|17x-8|-9$ is minimum only when $|17x-8|$ is minimum. But the minimum value of $|k|$ is zero.

Hence minimum value of $|17x-8|-9=0-9=-9$

DIVISIBILITY RULES

Divisibility by 2

A number is divisible by 2 if its unit's digit is even or 0.

Divisibility by 3

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

Divisibility by 4

A number is divisible by 4 if the last 2 digits are divisible by 4, or if the last two digits are 0's.

Divisibility by 5

A number is divisible by 5 if its unit's digit is 5 or 0.

Divisibility by 6

A number is divisible by 6 if it is simultaneously divisible by 2 and 3.

Divisiblity by 7

A number is divisible by 7 if unit's place digit is multiplied by 2 and subtracted from the remaining digits and the number obtained is divisible by 7.

For example:

$1680\boxed{7} = 1680 - 7\times 2 = 1666$

It is difficult to decide whether 1666 is divisible by 7 or not. In such cases, we continue the process again and again till it become easy to decide whether the number is divisible by 7 or not.

$166\boxed{6} \longrightarrow 166 - 6\times 2 = 154$

Again $15\boxed{4} \longrightarrow 15 - 4\times 2 = 7$, divisible by 7

Hence 16807 is divisible by 7.

Divisibility by 8

A number is divisible by 8 if the last 3 digits of the number are divisible by 8, or if the last three digits of a number are zeros.

Divisibility by 9

A number is divisible by 9 if the sum of its digits is divisible by 9.

Divisibility by 10

A number is divisible by 10 if its unit's digit is 0.

Divisibility by 11

A number is divisible by 11 if the sum of digits at odd and even places are equal or differ by a number divisible by 11.

Divisibility by 12

A number is divisible by 12 if the number is divisible by both 4 and 3.

Divisibility by 13

A number is divisible by 13 if its unit's place digit is multiplied by 4 and added to the remaining digits and the number obtained is divisible by 13.

For example:

$219\boxed{7} \longrightarrow 219 + 7\times 4 = 247$

Again $24\boxed{7} \longrightarrow 24 + 7\times 4 = 52$, divisible by 13.

Hence 2197 is divisible by 13.

Divisibility by 14

A number is divisible by 14 if the number is divisible by both 2 and 7.

Divisibility by 15

A number is divisible by 15 if the number is divisible by both 3 and 5.

Divisibility by 16

A number is divisible by 16 if its last 4 digits is divisible by 16 or if the last four digits are zeros.

Divisibility by 17

A number is divisible by 17 if its unit's place digit is multiplied by 5 and subtracted from the remaining digits and the number obtained is divisible by 17.

For example:

$491\boxed{3} \longrightarrow 491 - 3\times 5 = 476$

Again, $47\boxed{6} \longrightarrow 47 - 6\times 5 = 17$, divisible by 17.

Hence 4913 is divisible by 17.

Divisibility by 18

A number is divisible by 18 if the number is divisible by both 2 and 9.

Divisibility by 19

A number is divisible by 19 if its unit's place digit is multiplied by 2 and added to the remaining digits and the number obtained is divisible by 19.

For example:

$4873\boxed{7} \longrightarrow 4873 + 7\times 2 = 4887$

$488\boxed{7} \longrightarrow 488 + 7\times 2 = 502$

$50\boxed{2} \longrightarrow 50 + 2\times 2 = 54$ not divisible by 19.

Hence 48737 is not divisible by 19.

PROPERTIES OF DIVISIBILITY

(i) The product of 3 consecutive natural numbers is divisible by 6.

(ii) The product of 3 consecutive natural numbers, the first of which is even, is divisible by 24.

(iii) Difference between any number and the number obtained by writing the digits in reverse order is divisible by 9.

(iv) Any number written in the form $(10^n - 1)$ is divisible by 3 and 9.

(v) Any number with number of digits equal to multiple of 6, is divisible by each of 7, 11 and 13 if all of its digits are same.
For example: 666666, 888888, 333333333333 are all divisible by 7, 11 and 13.
Note that multiples of 6 are 6, 12, 18, 24, 30,.... etc.

(vi) Any number in the form abcabc (a, b, c are three different digits) is divisible by 1001.

(vii) (a) $(a^n - b^n)$ is divisible both by $(a + b)$ and $(a - b)$, when n is even.
(b) $(a^n - b^n)$ is divisible only by $(a - b)$, when n is odd.

DIVISION ALGORITHM

Divisor) Dividend (Quotient

Remainder

Dividend = (Divisor × Quotient) + Remainder
where, Dividend = The number which is being divided
Divisor = The number which performs the division process
Quotient = Greatest possible integer as a result of division
Remainder = Rest part of dividend which cannot be further divided by the divisor.

Illustration – 3

On dividing 397246 by a certain number, the quotient is 865 and the remainder is 211. Find the divisor.

(a) 549 (b) 546 (c) 548 (d) 459

Solution : (d) Applying are above formula, we get

$$\text{Divisor} = \frac{397246 - 211}{865} = 459$$

GENERAL OR EXPANDED FORM OF 2 AND 3 DIGITS NUMBERS

(i) In a two digits number AB, A is the digit of tenth place and B is the digit of unit place, therefore AB is written using place value in expanded form as
$AB = 10A + B$
For example: $35 = 10 \times 3 + 5$

(ii) In a three digits number ABC, A is the digit of hundred place, B is the digit of tenth place and C is the digit of unit place, therefore ABC is written using place value in expanded form as
$ABC = 100A + 10B + C$
For example: $247 = 100 \times 2 + 10 \times 4 + 7$

These expanded forms are used in forming equations related to 2- and 3- digits numbers.

Illustration – 4

In a two digit prime number, if 18 is added, we get another prime number with reversed digits. How many such numbers are possible?

Solution : Let a two-digit number be pq.
$\therefore \quad 10p + q + 18 = 10q + p$
$\Rightarrow \quad -9p + 9q = 18 \Rightarrow q - p = 2$
Satisfying this condition and also the condition of being a prime number (pq and qp both), there are 2 numbers 13 and 79.

PRIME FACTORISATION

It is a process of representing a given number as a product of two or more prime numbers.
Each prime number which is present in the product is called a **prime factor** of the given number.
For example: 12 is expressed in the factorised form in terms of its prime factors as $12 = 2 \times 2 \times 3 = 2^2 \times 3$.

SQUARE OF A NUMBER

When a number is multiplied by itself, then we get the square of the number.
For example: Square of $5 = 5 \times 5 = (5^2) = 25$.
Square of 2 and 3 digits numbers are very useful for calculations. For this it is advised to learn the square of 1 to 30 as given in the table.

Number	Square	Number	Square
1	1	16	256
2	4	17	289
3	9	18	324
4	16	19	361
5	25	20	400
6	36	21	441
7	49	22	484
8	64	23	529
9	81	24	576
10	100	25	625
11	121	26	676
12	144	27	729
13	169	28	784
14	196	29	841
15	225	30	900

PROPERTIES OF SQUARE OF A NUMBER

(i) No square number ends in 2, 3, 7 or 8 i.e. unit place digit in a square number can never be 2, 3, 7 or 8.

(ii) If a number is even then its square is also even. If a number is odd then its square is also odd.

(iii) Number of zeroes at the end of a perfect square number is always even. In other words we can say that numbers ending with odd numbers of zeroes are never perfect squares.

(iv) The difference of squares of two consecutive numbers will always be equal to the sum of the numbers i.e.

$a^2 - b^2 = a + b$, where a and b are two consecutive natural numbers and a is greater than b.

For example: $16^2 - 15^2 = 16 + 15 = 31$

(v) Square of any number is always a positive number.

SQUARE ROOTS OF A NUMBER

Square root of a number is that number, the square of which is equal to the given number. There are two types of square roots of a number, positive and negative. Square root is also known as under-root or 2nd root.

Symbolically, square root of a positive number 'n' is written as

$\sqrt{n}$ or $(n)^{\frac{1}{2}}$.

We know that $4 \times 4 = 16$ [or $(+4) \times (+4) = 16$]

And $(-4) \times (-4) = 16$.

$\therefore \sqrt{16} = \pm 4$ also $(16)^{\frac{1}{2}} = \pm 4$

Here +4 (i.e. 4) is called positive square root of 16 and – 4 is called negative square root of 16.

Also, $\sqrt{a} \times \sqrt{a} = a$

Note that normally, we consider only positive square root of a number.

If the number whose square root is to be find out is a perfect square, then its square root is an integer otherwise square root is not an integer.

PROPERTIES OF SQUARE ROOTS OF A NUMBER

(i) If a number has a natural number square root, then its unit digit must be 0, 1, 4, 5, 6 or 9.

Unit digit of square number	0	1	4	5	6	9
Unit digit of square root	0	1 or 9	2 or 8	5	4 or 6	3 or 7

(ii) If unit digit of a number be 2, 3, 7 or 8; then it does not have a natural number square root.

(iii) If a number ends in an odd number of zeros, then it does not have a natural number square root. If a square number is followed by an even number of zeros, it has a square root in which the number of zeros at the end is half the number of zeros in the number at the end.

(iv) Negative number has no square root.

METHODS TO FIND SQUARE ROOTS OF A PERFECT SQUARE NUMBER

Method-I: Prime Factorisation Method

(i) Express the given number into prime factors by successive division.

(ii) Make pairs of prime factors such that both the factors in each pair are equal.

(iii) Take one factor from each pair.

(iv) Find the product of factors obtained in step (iii).

The product thus obtained is the required square root.

Illustration – 5

Show that 63504 is a perfect square. Also, find the number whose square is 63504.

Solution :

Resolving 63504 into prime factors, we obtain

$63504 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 7 \times 7$

Grouping the factors in pairs of equal factors, we obtain

$63504 = (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (3 \times 3) \times (7 \times 7)$

Clearly, no factor is left over in grouping the factors in pairs of equal factors, So, 63504 is a perfect square.

2	63504
2	31752
2	15876
2	7938
3	3969
3	1323
3	441
3	147
7	49
7	7
	1

Again,

$63504 = (2 \times 2 \times 3 \times 3 \times 7) \times (2 \times 2 \times 3 \times 3 \times 7)$

[Grouping first factors in each group]

$= 252 \times 252 = 252^2$

Thus, 63504 is the square of 252.

Method-II: Division Method

This method can be easily understood with the help of the following example:

Let us find the square root of 54756.

Step-(i): Place bars over every pair of digits starting with the unit digit. Also place a bar on one digit (5) not forming a pair on the extreme left. Each pair and remaining one digit (if any) on the extreme left is called a period. Here we find three periods.

		2	3	4
2		$\overline{5}$	$\overline{47}$	$\overline{56}$
		4		
43	1	47		
	1	29		
464			18	56
			18	56
				0

$\therefore \sqrt{54756} = 234$

Step-(ii): The first period has only one digit 5. Think the largest number whose square is less than or equal to the first period. Clearly the largest number whose square is less than 5 is 2. Take this number 2 as divisor and quotient both and put the quotient above the first period i.e. 5.

Step-(iii): Subtract the product of divisor and quotient from the first period. Here, on subtracting, we get 1 as remainder. Bring down the next period i.e. 47 to the right of the remainder. By doing this, we get 147 as new dividend.

Step-(iv): For the next divisor double the previous quotient i.e. 2. We take this i.e. 4 as the left most digit of the new divisor. Now, 3 is the largest digit such that $43 \times 3 = 129$, which is just less than new dividend 147. So, take 43 as the new divisor and 3 as the next digit of the quotient.

Step-(v): Now subtract 129 from 147. Here on subtracting, we get 18 as new remainder. Bring down the next period 56 to the right of 18. By doing this we get 1856 as the new dividend.

Step-(vi): For the next divisor double the quotient 23. We take this i.e. 46 as the left most digit of the new divisor. Now 4 is the largest digit such that $464 \times 4 = 1856$, which is equal to the new dividend 1856. So, we take 464 as the new divisor and 4 as the next digit of the quotient. Subtract 1856 from the new dividend 1856. Here, on subtracting, we get 0 as remainder. Now no period left to bring down to make new dividend, therefore, the last quotient is 234. This last quotient is the required square root.

Note that, number of periods = Number of digits in the square root.

Illustration – 6

Find the square root of 24336.

(a) 144 (b) 154 (c) 156 (d) 166

Solution : (c)

	1 5 6
1	2 43 36
	1
25	1 43
	1 25
306	18 36
	18 36
	0

$\sqrt{24336} = 156$

Illustration – 7

Find the square root of 12327121.

(a) 3511 (b) 3601 (c) 3519 (d) 3611

Solution : (a)

	3 5 1 1
3	12 32 71 21
	9
65	3 32
	3 25
701	7 71
	7 01
7021	7021
	7021
	0

$\sqrt{12327121} = 3511$

SQUARE ROOTS OF NUMBERS WHICH ARE NOT PERFECT SQUARES.

Division method can also be applied for finding square root of numbers which are not perfect square numbers. Method is explained with the following illustrative examples.

Illustration – 8

Find square root of 3 upto 3 decimal places.

Solution :

	1.732
1	3.00 00 00
	1
27	2 00
	1 89
343	11 00
	10 29
3462	71 00
	69 24
	1 76

Here we have added 3 pairs of zeros after decimal. One pair each for 1 digit after decimal point.

$\therefore \sqrt{3} = 1.732$ upto three decimal places.

SQUARE ROOT OF DECIMAL NUMBERS

To find the square root of a decimal number, first count the number of digits after decimal in the given number, if it is not even, then put a 0 (zero) at the extreme right, so that there will be an even number of digits after decimal point.

Now, periods are marked by putting the bar over it as marked for finding the square root of a perfect square number starting from right hand side before the decimal and from the left hand side after the decimal point.

For example, 1 46 96 . 71 29

Direction of marking periods

After marking the periods, follow the same steps as for finding the square root of a perfect square number without considering the decimal point. In the final answer, put decimal point after as many number of digits from right as the number of periods after point in the given number.

	1 2 1 . 2 3
1	1 46 96 . 71 29
	1
22	46
	44
241	296
	241
2422	5571
	4844
24243	72729
	72729
	0

$\sqrt{14696.7129} = 121.23$

SQUARE ROOT OF A FRACTION

To find the square root of a fraction, we find the square root of numerator and denominator both separately.

For example: $\sqrt{\frac{1369}{1521}} = \frac{\sqrt{1369}}{\sqrt{1521}} = \frac{37}{39}$

TO FIND SMALLEST AND LARGEST *N*-DIGITS NUMBER WHICH IS A PERFECT SQUARE

This can be understand through the following illustrations.

Illustration – 9

Find the smallest 6-digit number which is a perfect square.

Solution : Smallest 6-digit number = 100000.

	3 1 7
3	$\overline{10}$ $\overline{00}$ $\overline{00}$
	9
61	1 0 0
	6 1
627	3 9 0 0
	4 3 8 9
	– 4 8 9

Since $626 \times 6 = 3756$
$627 \times 7 = 4389$
Now, $3756 < 3900 < 4389$
$\Rightarrow 626 \times 6 < 3900 < 627 \times 7$
Clearly smallest 6-digit number which is perfect square will be 489 greater than 100000.
Therefore, required number = 100000 + 489
= 100489.

Illustration – 10

Find the greatest 7-digits number which is a perfect square.

Solution : Greatest 7-digits number = 9999999

	3 1 6 2
3	$\overline{9}$ $\overline{99}$ $\overline{99}$ $\overline{99}$
	9
61	9 9
	6 1
626	3 8 9 9
	3 7 5 6
6322	1 4 3 9 9
	1 2 6 4 4
	1 7 5 5

Clearly greatest 7-digits number which is a perfect square will be 1755 less than 9999999.
Therefore, required number = 9999999 – 1755 = 9998244.

INDICES

When a number is multiplied by itself, it gives the square of the number. i.e., $a \times a = a^2$
(Example $5 \times 5 = 5^2$)
If the same number is multiplied by itself twice we get the cube of the number i.e., $a \times a \times a = a^3$
(Example $4 \times 4 \times 4 = 4^3$)
In the same way $a \times a \times a \times a \times a = a^5$ and $a \times a \times a \times \ldots$ upto n times $= a^n$
In a^n, 'n' is called power, index or exponent and 'a' is called base. a^n is known as n^{th} power of 'a' and is read as 'a' raised to the power 'n' or 'a' to the power 'n'.

BASIC RULE OF INDICES (OR POWER)

(i) $a^m \times a^n = a^{m+n}$

(Example: $5^3 \times 5^4 = 5^{3+4} = 5^7$)

(ii) $\frac{a^m}{a^n} = a^{m-n}$, if $m > n$

$\left(\text{Example: } \frac{6^5}{6^2} = 6^{5-2} = 6^3\right)$

$\frac{a^m}{a^n} = \frac{1}{a^{n-m}}$, if $m < n$

$\left(\text{Example: } \frac{4^3}{4^8} = \frac{1}{4^{8-3}} = \frac{1}{4^5}\right)$

and $\frac{a^m}{a^n} = a^0 = 1$, if $m = n$

$\left(\text{Example: } \frac{3^4}{3^4} = 3^{4-4} = 3^0 = 1\right)$

(iii) $\left(a^m\right)^n = a^{mn} = \left(a^n\right)^m$

$\left(\text{Example: } \left(6^2\right)^4 = 6^{2\times4} = 6^8 = \left(6^4\right)^2\right)$

(iv) $(ab)^n = a^n . b^n \left(\text{Example: } (6 \times 4)^3 = 6^3 \times 4^3\right)$

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0 \left(\text{Example: } \left(\frac{5}{3}\right)^4 = \frac{5^4}{3^4}\right)$

and $\left(\frac{b}{a}\right)^{(-n)} = \left(\frac{a}{b}\right)^n \left(\text{Example: } \left(\frac{3}{5}\right)^{-4} = \left(\frac{5}{3}\right)^4\right)$

(v) $a^{-n} = \frac{1}{a^n}$ $\left(\text{Example: } 5^{-3} = \frac{1}{5^3}\right)$

(vi) $\frac{1}{a^{-n}} = a^n$ $\left(\text{Example: } \frac{1}{5^{-3}} = 5^3\right)$

(vii) For any non-zero real number a, $a^0 = 1$

Previous Years Questions

1. How many times the digit 9 occurs in the numbers from 100 to 999? **[BPSC 2017]**
(a) 280 (b) 218 (c) 229 (d) 228
(e) None of the above/More than one of the above

2. A number, when divided by 342, gives a remainder 47. When the same number is divided by 19, what would be the remainder? **[BPSC 2018]**
(a) 0 (b) 9 (c) 18 (d) 8
(e) None of the above/More than one of the above

3. How many prime numbers are there between 1 and 50? **[BPSC 2018]**
(a) 17 (b) 15 (c) 14 (d) 16
(e) None of the above

4. If x= [(0.00001225)]/(0.00005329)]^1/2, then value of x is **[BPSC 2018]**
(a) 35/73 (b) 525/933 (c) 205/403 (d) 135/233
(e) None of the above

5. Which one of the following ***cannot*** be the square of a natural number? **[BPSC 2020]**
(a) 26569 (b) 143642 (c) 30976 (d) 28561
(e) None of the above/More than one of the above

6. $\frac{(598+479)^2-(598-479)^2}{598\times 479}=?$ **[BPSC 2020]**
(a) 4 (b) 10 (c) 132 (d) 8
(e) None of the above

7. A group of friends decided to go on a picnic with an estimated expenditure of ₹ 960. But at the last minute four of them did not turn up. As a consequence, the remaining ones had to contribute ₹ 40 each extra. Then the number of friends who went to the picnic is **[KPSC 2015]**
(a) 12 (b) 24 (c) 8 (d) 16

8. A two-digit number is such that the product of its digits is 14. When 45 is added to this number the digits interchange their position (like 12+9 = 21). What is that number ? **[KPSC 2020]**
(a) 54 (b) 27 (c) 36 (d) 72

9. The students of a class donated ₹4624 for Chief Minister's State Relief Fund. Each student donated as many rupees as the number of students in the class. Find the number of students in the class **[TNPSC 2019]**
(a) 64 (b) 68
(c) 62 (d) 78

10. In a two digit number, the digit in the unit place is twice of the digit in the tenth place. 'If the digits are reversed, the new number is 27 more than the given number. Find the number. **[TNPSC 2019]**
(a) 63 (b) 36
(c) 93 (d) 39

11. Find the greatest number of four digits exactly divisible by 15, 21 and 27. **[TNPSC-2019]**
(a) 9999 (b) 9450
(c) 9845 (d) 8505

12. A troop has provisions for 276 soldiers for 20 days. How many soldiers leave the troop so that the provisions may last for 46 days. **[TNPSC-2019]**
(a) 136 (b) 156
(c) 146 (d) 164

13. Find the 3 digit natural number which is divisible by 6 **[TNPSC-2019]**
(a) 151 (b) 150
(c) 152 (d) 149

14. If A = 2^{65} and B = $2^{64} + 2^{63} + 2^{62} + ... + 2^0$ which of the following is true? **[TNPSC-2021]**
(a) B is larger than A by 1 (b) A is larger than B by 1
(c) A and B are equal (d) B is 26^{64} more than A

15. A man has a certain number of small boxes to pack into parcels. If he packs 3, 4, 5 or 6 in a parcel, he is left with one; if he packs 7 in a parcel, none is left over. What is the number of boxes he may have to pack ? **[WBPSC 2019]**
(a) 106 (b) 301 (c) 309 (d) 400

16. Choose the two correct numbers in the '•' marked places of the multiplication below. **[WBPSC 2020]**

$$\begin{array}{r} \bullet\ 7\ \bullet\ 9 \\ \times\quad 5 \\ \hline 3\ 3\ 9\ 4\ 5 \end{array}$$

(a) 8, 4 (b) 6, 8 (c) 4, 8 (d) 8, 6

17. The binary equivalent of decimal number 4.625 is **[WBPSC 2021]**
(a) 100.001 (b) 100.110
(c) 100.101 (d) 100.011

18. Which of the following fractions is greater than $\frac{3}{4}$ and less than $\frac{5}{6}$? **[WBPSC 2022]**
(a) $\frac{2}{3}$ (b) $\frac{1}{2}$
(c) $\frac{4}{5}$ (d) $\frac{9}{10}$

19. In a box of marbles, there are three less white marbles than the red ones and five more white marbles than the green ones. If there are a total of 10 white marbles, how many marbles are there in the box? **[UPSC 2015]**
(a) 26 (b) 28 (c) 32 (d) 36

20. If R and S are different integers both divisible by 5, then which of the following is not necessarily true? **[UPSC 2016]**
(a) R – S is divisible by 5
(b) R + S is divisible by 10
(c) R × S is divisible by 25
(d) $R^2 + S^2$ is divisible by 5

21. How many numbers are there between 100 and 300 which either begin with or end with 2? **[UPSC 2016]**
(a) 110 (b) 111
(c) 112 (d) None of the above

22. In a class, there are 18 very tall boys. If these constitute three-fourths of the boys and the total number of boys is two-thirds of the total number of students in the class, what is the number of girls in the class? **[UPSC 2016]**
(a) 6 (b) 12 (c) 18 (d) 21

23. If there is a policy that 1/3rd of a population of a community has migrated every year from one place to some other place, what is the leftover population of that community after the sixth year, if there is no further growth in the population during this period? **[UPSC 2017]**
(a) 16/243rd part of the population
(b) 32/243rd part of the population
(c) 32 / 729th part of the population
(d) 64/ 729th part of the population

24. Six boys A, B, C, D, E and F play a game of cards. Each has a pack of 10 cards. F borrows 2 cards from A and gives away 5 to C who in turn gives 3 to B while B gives 6 to D who passes on 1 to E. Then the number of cards possessed by D and E is equal to the number of cards possessed by **[UPSC 2017]**
(a) A, B and C (b) B, C and F
(c) A, B and F (d) A, C and F

25. How many numbers are there between 99 and 1000 such that the digit 8 occupies the units place? **[UPSC 2017]**
(a) 64 (b) 80 (c) 90 (d) 104

26. A 2-digit number is reversed. The larger of the two numbers is divided by the smaller one. What is the largest possible remainder **[UPSC 2017]**
(a) 9 (b) 27 (c) 36 (d) 45

27. There are certain 2-digit numbers. The difference between the number and the one obtained on reversing it is always 27. How many such maximum 2-digit numbers are there? **[UPSC 2017]**
(a) 3 (b) 4
(c) 5 (d) None of the above

28. What is the total number of digits printed, if a book containing 150 pages is to be numebred from 1 to 150? **[UPSC 2017]**
(a) 262 (b) 342 (c) 360 (d) 450

29. A clock strikes once at 1o'clock, twice at 2o'clock and thrice at 3 o'clock, and so on. If it takes 12 seconds to strike at 5 o'clock, what is the time taken by it to strike at 10 o'clock? **[UPSC 2017]**
(a) 20 seconds (b) 24 seconds
(c) 28 seconds (d) 30 seconds

30. A bookseller sold 'a' number of Geography textbooks at the rate of ₹ x per book, 'a + 2' number of History textbooks at the rate of ₹ $(x + 2)$ per book and 'a – 2' number of mathematics textbooks at the rate of ₹ $(x - 2)$ per book. What is his total sale in ₹? **[UPSC 2018]**
(a) $3x + 3a$ (b) $3ax + 8$
(c) $9ax$ (d) x^3a^3

31. A student has to get 40% marks to pass in an examination. Suppose he gets 30 marks and fails by 30 marks, then what are the maximum marks in the examination? **[UPSC 2018]**
(a) 100 (b) 120 (c) 150 (d) 300

32. Sunita cuts a sheet of paper into three pieces. Length of first piece is equal to the average of the three single digit odd prime numbers. Length of the second piece is equal to that of the first plus one-third the length of the third. The third piece is as long as the other two pieces together. The length of the original sheet of paper is **[UPSC 2019-II]**
(a) 13 units (b) 15 units
(c) 16 units (d) 30 units

33. An 8-digit number 4252746B leaves remainder 0 when divided by 3. How many values of B are possible? **[UPSC 2019-II]**
(a) 2 (b) 3 (c) 4 (d) 6

34. Number 136 is added to 5B7 and the sum obtained is 7A3, where A and B are integers. It is given that 7A3 is exactly divisible by 3. **[UPSC 2019-II]**
The only possible value of B is
(a) 2 (b) 5 (c) 7 (d) 8

35. The number of times the digit 5 will appear while writing the integers from 1 to 1000 is **[UPSC 2019-II]**
(a) 269 (b) 271 (c) 300 (d) 302

36. Raju has ₹ 9000 with him and he wants to buy a mobile handset; but he finds that he has only 75% of the amount required to buy the handset. Therefore, he borrows ₹ 2000 from a friend. Then **[UPSC 2019-II]**
(a) Raju still does not have enough amount to buy the handset.
(b) Ruju has exactly the same amount as required to buy the handset.
(c) Ruju has enough amount to buy the handset and he will have ₹ 500 with him after buying the handset.
(d) Ruju has enough amount to buy the handset and he will have ₹ 1000 with him after buying the handset.

37. The ratio of a two-digit natural number to a number formed by reversing its digits is 4 : 7.The number of such pairs is **[UPSC 2019-II]**
(a) 5 (b) 4 (c) 3 (d) 2

38. In an examination, A has scored 20 marks more than B. If B has scored 5% less marks than A, how much has B scored? **[UPSC 2019-II]**
(a) 360 (b) 380 (c) 400 (d) 420

39. How many integers are there between 1 and 100 which have 4 as a digit but are not divisible by 4? **[UPSC 2020-II]**
(a) 5 (b) 11 (c) 12 (d) 13

40. Let A3BC and DE2F be four-digit numbers where each letter represents a different digit greater than 3. If the sum

of the numbers is 15902, then what is the difference between the values of A and D? **[UPSC 2020-II]**
(a) 1 (b) 2 (c) 3 (d) 4

41. How many zeroes are there at the end of the following product? **[UPSC 2020-II]**
$1 \times 5 \times 10 \times 15 \times 20 \times 25 \times 30 \times 35 \times 40 \times 45 \times 50 \times 55 \times 60$
(a) 10. (b) 12 (c) 14 (d) 15

42. Let XYZ be a three-digit number, where (X + Y + Z) is not a multiple of 3. Then (XYZ + YZX + ZXY) is **not** divisible by **[UPSC 2020-II]**
(a) 3 (b) 9
(c) 3 (d) (X + Y + Z)

43. Let p, q, r and s be natural numbers such that
$p - 2016 = q + 2017 = r - 2018 = s + 2019$ **[UPSC 2020-II]**
Which one of the following is the largest natural number?
(a) p (b) q (c) r (d) s

44. How many pairs of natural numbers are there such that the difference of whose squares is 63? **[UPSC 2020-II]**
(a) 3 (b) 4 (c) 5 (d) 2

45. Which one of the following will have minimum change in its value if 5 is added to both numerator and the denominator of the fractions $\frac{2}{3}, \frac{3}{4}, \frac{4}{5}$ and $\frac{5}{6}$? **[UPSC 2020-II]**
(a) $\frac{2}{3}$ (b) $\frac{3}{4}$ (c) $\frac{4}{5}$ (d) $\frac{5}{6}$

46. A digit $n > 3$ is divisible by 3 but not divisible by 6. Which one of the following is divisible by 4? **[UPSC 2020-II]**
(a) $2n$ (b) $3n$ (c) $2n + 4$ (d) $3n + 1$

47. The recurring decimal representation 1.272727 ... is equivalent to **[UPSC 2020-II]**
(a) 13/11 (b) 14/11 (c) 127/99 (d) 137/99

48. What is the remainder when $51 \times 27 \times 35 \times 62 \times 75$ is divided by 100? **[UPSC 2020-II]**
(a) 50 (b) 25 (c) 5 (d) 1

49. For what value of n, the sum of digits in the number $(10^n + 1)$ is 2? **[UPSC 2020-II]**
(a) For $n = 0$ only
(b) For any whole number n
(c) For any positive integer n only
(d) For any real number n

50. What is the largest number among the following? **[UPSC 2020-II]**
(a) $\left(\frac{1}{2}\right)^{-6}$ (b) $\left(\frac{1}{4}\right)^{-3}$ (c) $\left(\frac{1}{3}\right)^{-4}$ (d) $\left(\frac{1}{6}\right)^{-2}$

51. Two Statements are given followed by two Conclusions: **[UPSC 2020-II]**
Statements:
All numbers are divisible by 2.
All numbers are divisible by 3.
Conclusion-I:
All numbers are divisible by 6.
Conclusion-II:
All numbers are divisible by 4.
Which of the above Conclusions logically follows/follow from the two given Statements?
(a) Only Conclusion-I
(b) Only Conclusion-II
(c) Neither Conclusion-I nor Conclusion-II
(d) Both Conclusion-I Conclusion-II

52. Consider all 3-digit numbers (without repetition of digits) obtained using three non-zero digits which are multiples of 3. Let S be their sum.
Which of the following is/are correct ? **[UPSC-2021]**
1. S is always divisible by 74.
2. S is always divisible by 9.
Select the correct answer using the code given below :
(a) l only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

53. Integers are listed from 700 to 1000. In how many integers is the sum of the digits 10 ? **[UPSC-2021]**
(a) 6 (b) 7 (c) 8 (d) 9

54. If 3^{2019} is divided by 10, then what is the remainder? **[UPSC-2021]**
(a) l (b) 3 (c) 7 (d) 9

55. The number 3798125P369 is divisible by 7. **[UPSC-2021]**
What is the value of the digit P?
(a) l (b) 6 (c) 7 (d) 9

56. The difference between a 2-digit number and the number obtained by interchanging the positions of the digits is 54.
Consider the following statements : **[UPSC-2021]**
1. The sum of the two digits of the number can be determined only if the product of the two digits is known.
2. The difference between the two digits of the number can be determined.
Which of the above statements is/are correct ?
(a) l only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

57. When a certain number is multiplied by 7, the product entirely comprises ones only (1111...). **[UPSC-2021]**
What is the smallest such number ?
(a) 15713 (b) 15723 (c) 15783 (d) 15873

58. Consider the following statements : **[UPSC-2021]**
1. The sum of 5 consecutive integers can be 100.
2. The product of three consecutive natural numbers can be equal to their sum.
Which of the above statements is/are correct ?
(a) l only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

59. Consider the following addition problem: **[UPSC-2021]**
3P + 4P + PP + PP = RQ2; where P, Q and R are different digits.
What is the arithmetic mean of all such possible sums ?
(a) 102 (b) 120 (c) 202 (d) 220

60. Consider the following multiplication problem: **[UPSC-2021]**
(PQ) × 3 = RQQ, where P, Q and R are different digits and $R \neq 0$.
What is the value of (P + R) ÷ Q?
(a) 1 (b) 2 (c) 5
(d) Cannot be determined due to insufficient data

61. Half of the villagers of a certain village have their own houses. One-fifth of the villagers cultivate paddy. One-third of the villagers are literate. Four-fifth of the villagers are under 25 years of age. Which one of the following statements is certainly correct ? **[UPSC-2021]**
(a) All the villagers who have their own houses are literate.
(b) Some villagers under 25 years of age are literate.
(c) Only half of the villagers who cultivate paddy are literate.
(d) No villager under 25 years of age has his own house.

62. If you write down all the numbers from 1 to 100, then how many times do you write 3? **[UPPCS 2020-II]**
(a) 20 (b) 11 (c) 21 (d) 10

63. A monkey climbs a 12 meters high slippery pillar. In his first minute, he climbs 2 meters and in the next minute, he slips one meter down. In this way, how much time will he take to reach the top of the pillar? **[UPPCS 2020-II]**
(a) 10 minutes (b) 21 minutes
(c) 12 minutes (d) 11 minutes

64. Consider the following numbers: **[UPPSC 2017-II]**
1. Every irrational number is a real number.
2. Every real number is rational number.
3. Every rational number is a real number
4. Every integer is a real number.
Which of the above statements are correct?
(a) 1, 2 and 3 (b) 1, 3 and 4
(c) 2 and 3 only (d) 3 and 4 only

65. How many times will the digit 5 come in counting from 1 to 99 excluding those which are divisible by 3? **[UPPSC 2017-II]**
(a) 13 (b) 14 (c) 15 (d) 20

66. How many numbers from 1 to 100 are there each of which is not only exactly divisible by 4 but also has 4 as a digit? **[UPPSC 2021-II]**
(a) 7 (b) 10
(c) 20 (d) 21

67. What will be the minimum value of x for which the number $\{3(x + 63) + 640\}$ is completely divisible by 17? **[UPPSC 2021-II]**
(a) 82 (b) 24 (c) 7 (d) 3

68. Which one of the following numbers is neither prime nor composite? **[OPSC2021]**
(a) 1 (b) 3
(c) 5 (d) 7

69. Which one of the following numbers is the smallest composite number? **[OPSC 2021]**
(a) 2 (b) 3
(c) 4 (d) 6

70. An Identity Card has the number ABCDEFG, not necessarily in that order, where each letter represents a distinct digit (1, 2, 4, 5, 7, 8, 9 only). The number is divisible by 9. After deleting the first digit from the right the resulting number is divisible by 6. After deleting two digits from the right of original number, the resulting number is divisible by 5 . After deleting three digits from the right of original number, the resulting number is divisible by 4 . After deleting four digits from the right of original number, the resulting number is divisible by 3. After deleting five digits from the right of original number. the resulting number is divisible by 2. Which of the following is a possible value for the sum of the middle three digits of the number? **[UPSC-2022]**
(a) 8 (b) 9 (c) 11 (d) 12

71. Which number amongst 2^{40}, 3^{21}, 4^{18} and 8^{12} is the smallest? **[UPSC-2022]**
(a) 2^{40} (b) 3^{21} (c) 4^{18} (d) 8^{12}

72. On one side of a 1·01 km long road, 101 plants are planted at equal distance from each other. What is the total distance between 5 consecutive plants? **[UPSC-2022]**
(a) 40 m (b) 40·4 m (c) 50 m (d) 50·5 m

73. Let p be a two-digit number and *q* be the number consisting of same digits written in revers order. If $p \times q = 2430$, then what is the difference between p and q? **[UPSC-2022]**
(a) 45 (b) 27
(c) 18 (d) 9

74. Consider the following statements in respect of two natural numbers p and q such that p is a prime number and q is a composite number: **[UPSC-2022]**
1. p x q can be an odd number.
2. q / p can be a prime number.
3. p + q can be a prime number.
Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

75. If $15 \times 14 \times 13 \times \cdots \times 3 \times 2 \times 1 = 3^m \times n$ where m and n are positive integers, then what is the maximum value of m? **[UPSC-2022]**
(a) 7 (b) 6
(c) 5 (d) 4

76. A has some coins. He gives half of the coins and 2 more to B. B gives half of the coins and 2 more to C. C gives half of the coins and 2 more to D. The number of coins D has now', is the smallest two digit number. How many coins does A have in the beginning? **[UPSC-2022]**
(a) 76 (b) 68
(c) 60 (d) 52

77. Let A, B and C represent distinct non zero digits. Suppose x is the sum of all possible 3-digit numbers formed by A, B and C without repetition. **[UPSC-2022]**
Consider the following statements:
1. The 4-digit least value of x is 1332.
2. The 3-digit greatest value of x is 888.
Which of the above statements is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

78. Number of prime factors $\left(\frac{1}{6}\right)^{12} \times 8^{25} \times \left(\frac{3}{4}\right)^{15}$ is **[UPPSC 2022-II]**

(a) 33 (b) 52
(c) 36 (d) None of these

79. What is the remainder when $85 \times 87 \times 89 \times 91 \times 95 \times 96$ is divided by 100? **[CSAT 2023]**

(a) 0 (b) 1
(c) 2 (d) 4

80. What is the unit digit in the expansion of $(57242)^{9\times7\times5\times3\times1}$? **[CSAT 2023]**

(a) 2 (b) 4
(c) 6 (d) 8

81. If ABC and DEF are both 3-digit numbers such that A, B, C, D, E and F are distinct non-zero digits such that ABC + DEF = 1111, then what is the value of A + B + C + D + E + F? **[CSAT 2023]**

(a) 28 (b) 29
(c) 30 (d) 31

82. D is a 3-digit number such that the ratio of the number to the sum of its digits is least. What is the difference between the digit at the hundred's place and the digit at the unit's place of D? **[CSAT 2023]**

(a) 0 (b) 7
(c) 8 (d) 9

83. Three of the five positive integers p, q, r, s, t are even and two of them are odd (not necessarily in order). Consider the following: **[CSAT 2023]**

1. p + q + r – s – t is definitely even.
2. 2p + q + 2r – 2s + t is definitely odd.

Which of the above statements is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

84. Consider the following in respect of prime number p and composite number c. **[CSAT 2023]**

1. can be even 2. 2p + c can be odd
3. pc can be odd.

Which of the statements given above are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

85. A 3-digit number ABC, on multiplication with D gives 37DD where A, B, C and D are different non-zero digits. What is the value of A + B + C? **[CSAT 2023]**

(a) 18
(b) 16
(c) 15
(d) Cannot be determined due to insufficient data

86. A number N is formed by writing 9 for 99 times, What is the remainder if N is divided by 13? **[CSAT 2023]**

(a) 11 (b) 9 (c) 7 (d) 1

87. What is the remainder if 2^{192} is divided by 6? **[CSAT 2023]**

(a) 0 (b) 1
(c) 2 (d) 4

88. Let X be a two-digit number and Y be another two-digit number formed by interchanging the digits of X. If (X + Y) is the greatest two-digit number, then what is the number of possible values of X? **[CSAT 2024]**

(a) 2 (b) 4
(c) 6 (d) 8

89. Let *p*, *q*, *r* and *s* be distinct positive integers. Let *p*, *q* be odd and *r*, *s* be even. Consider the following statements: **[CSAT 2024]**

1. $(p - r)^2 (qs)$ is even
2. $(q - s)\, q^2 s$ is even
3. $(q + r)^2 (p + s)$ is odd

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

90. $222^{333} + 333^{222}$ is divisible by which of the following numbers? **[CSAT 2024]**

(a) 2 and 3 but not 37 (b) 3 and 37 but not 2
(c) 2 and 37 but not 3 (d) 2, 3 and 37

91. What is the rightmost digit preceding the zeroes in the value of 30^{30}? **[CSAT 2024]**

(a) 1 (b) 3
(c) 7 (d) 9

92. Consider the following statements in respect of the sum $S = x + y + z$, where *x*, *y* and *z* are distinct prime numbers each less than 10: **[CSAT 2024]**

1. The unit digit of S can be 0.
2. The unit digit of S can be 9.
3. The unit digit of S can be 5.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

93. How many consecutive zeros are there at the end of the integer obtained in the product $1^2 \times 2^4 \times 3^6 \times 4^8 \times \ldots \times 25^{50}$? **[CSAT 2024]**

(a) 50
(b) 55
(c) 100
(d) 200

94. $32^5 + 2^{27}$ is divisible by **[CSAT 2024]**

(a) 3 (b) 7
(c) 10 (d) 11

Exercise

1. How many numbers are there in all from 6000 to 6999 (Both 6000 and 6999 included) having at least one of their digits repeated?
(a) 216 (b) 356 (c) 496 (d) 504

2. The four integers next lower than 81, and the four next higher than 81, are written down and added together, this sum is divisible by
(a) 7 (b) 9 (c) 11 (d) 13

3. If all the numbers from 501 to 700 are written, what is the total number of times does the digit 6 appear?
(a) 138 (b) 139 (c) 140 (d) 141

4. How many numbers, between 1 and 300 are divisible by 3 and 5 together?
(a) 16 (b) 18 (c) 20 (d) 100

5. A divisor is $\frac{2}{3}$ of the dividend and 2 times the remainder If the remainder is 75, then find the dividend.
(a) 85 (b) 145 (c) 225 (d) 65

6. How many numbers from 0 to 999 are ***not*** divisible by either 5 or 7?
(a) 313 (b) 341 (c) 686 (d) 786

7. A number when divided by 5 leaves a remainder 3. What is the remainder when the square of the same number is divided by 5?
(a) 9 (b) 3 (c) 0 (d) 4

8. If one-eights of the pencil is black, half of remaining is yellow and the remaining $3\frac{1}{2}cm$ is blue, then length of the Pencil is:
(a) 7 cm (b) 8 cm (c) 6 cm (d) 11 cm

9. If 5432* 7 is divisible by 9, then the digit in place of * is
(a) 0 (b) 1 (c) 6 (d) 8

10. If x 959 y is divisible by 44 and y >5, then what are values of the digit x and y?
(a) x = 7, y = 6 (b) x = 4, y = 8
(c) x = 6, y = 7 (d) None of these

11. The quotient arising from the division of 24162 by a certain number x is 89 and the remainder is 43. Find x.
(a) 271 (b) 281
(c) 261 (d) 251

12. A boy multiplied a certain number x by 13. He found that the resulting product consisted of all nines entirely. Find the smallest value of x.
(a) 76913 (b) 76933
(c) 76923 (d) 75933

13. A number is successively divided by 5, 6, 8; leaving remainders 3, 4, 7 respectively. What will be the remainders if the order of divisors be reversed?
(a) 7, 4, 3 (b) 5, 3, 4
(c) 2, 5, 4 (d) 1, 5, 4

14. A certain number is divided by 385 by division by factors. The quotient is 102, the first remainder is 4, the second is 6 and the third is 10. Find the number.
(a) 39654 (b) 32754
(c) 38554 (d) None of these

15. The number 311311311311311311 is:
(a) divisible by 3 but not by 11
(b) divisible by 11 but not by 3
(c) divisible by both 3 and 11
(d) neither divisible by 3 nor by 11

16. There is one number which is formed by writing one digit 6 times (e.g. 111111, 444444 etc.). Such a number is always divisible by:
(a) 7 and 11 (b) 11 and 13
(c) 7, 11 and 13 (d) None of these

17. The smallest number that must be added to 803642 in order to obtain a multiple of 11 is:
(a) 1 (b) 4 (c) 7 (d) 9

18. A number when divided by 296 gives a remainder 75. When the same number is divided by 37, then the remainder will be:
(a) 1 (b) 2 (c) 8 (d) 11

19. A number was divided successively in order by 4, 5 and 6. The remainders were respectively 2, 3 and 4. The number is
(a) 214 (b) 476 (c) 954 (d) 1908

20. What least number must be subtracted from 427398 so that the remaining number is divisible by 15?
(a) 3 (b) 6 (c) 11 (d) 16

21. How many times must 79 be subtracted from 5×10^4 so as to obtain 43759?
(a) 77 (b) 78 (c) 79 (d) 80

22. The digit in the unit's place of the number represented by $(7^{95} - 3^{58})$ is:
(a) 0 (b) 4 (c) 6 (d) 7

23. A number A4571203B is divisible by 18. Find the value of A and B.
(a) 8, 6 (b) 6, 8 (c) 4, 6 (d) 6, 4

24. Let x and y be positive integers such that x is prime and y is composite. Then
(a) y – x cannot be an even integer
(b) xy cannot be an even integer.
(c) (x + y)/x cannot be an even integer
(d) None of the above statements is true.

25. Let n(> 1) be a composite integer such that $\sqrt{n}$ is not an integer. Consider the following statements
I: *n* has a perfect integer-valued divisor which is greater than 1 and less than $\sqrt{n}$.
II: *n* has a perfect integer-valued divisor which is greater than $\sqrt{n}$ but less than *n*
Then,
(a) Both I and II are false (b) I is true but II is false
(c) I is false but II is true (d) Both I and II are true

26. Let *a*, *b*, *c*, *d* and *e* be integers such that a = 6b = 12c, and 2b = 9d = 12e. Then which of the following pairs contains a number that is not an integer?

(a) $\left(\frac{a}{27}, \frac{b}{e}\right)$ (b) $\left(\frac{a}{36}, \frac{c}{e}\right)$

(c) $\left(\frac{a}{12}, \frac{bd}{18}\right)$ (d) $\left(\frac{a}{6}, \frac{c}{d}\right)$

27. If a, a + 2 and a + 4 are prime numbers, then the number of possible solutions for a is

(a) one (b) two

(c) three (d) more than three

28. What is the least fraction which, when added to or subtracted from $\frac{29}{12}+\frac{15}{16}$, will make the result a whole number?

(a) $\frac{21}{38}$ (b) $\frac{31}{38}$ (c) $\frac{31}{48}$ (d) $\frac{17}{48}$

29. If the numerator and the denominator of a proper fraction are increased by the same quantity, then the resulting fraction is:

(a) always greater than the original fraction

(b) always less than the original fraction

(c) always equal to the original fraction

(d) none of these

30. If x = – 0.5, then which of the following has the smallest value?

(a) $2^{\frac{1}{x}}$ (b) $\frac{1}{x}$ (c) $\frac{1}{x^2}$ (d) 2^x

31. How many pairs of positive integers *m*, *n* satisfy $\frac{1}{m}+\frac{4}{n}=\frac{1}{12}$ where *n* is an odd integer less than 60?

(a) 3 (b) 6 (c) 4 (d) 7

32. A 3-digit number 4a3 is added to another 3 digit number 984 to give a 4-digit number 13b7 which is divisible by 11. Then, (a + n) = ?

(a) 11 (b) 12 (c) 10 (d) 15

33. The maximum value of 17– | 3x – 7| is

(a) 24 (b) $\frac{58}{3}$

(c) 17 (d) None of these

34. Solve the equation | 3x – 11| = 14

(a) $\frac{25}{3}, -1$ (b) $\frac{25}{3}, -\frac{25}{3}$

(c) 1, –1 (d) None of these

35. The minimum value of $|7x^2 - 9| + 8$ is

(a) 17 (b) 8

(c) $\frac{65}{7}$ (d) None of these

36. Solve the equation $|\frac{2}{3}x+\frac{5}{9}|=\frac{4}{9}$

(a) $\frac{-3}{2}, \frac{1}{6}$ (b) $\frac{-3}{2}, \frac{-1}{6}$

(c) $\frac{3}{2}, \frac{-1}{6}$ (d) None of these

37. Find the square root of $28-\sqrt{300}$

(a) $\sqrt{3}-5$ (b) $\sqrt{3}+5$

(c) $5-\sqrt{2}$ (d) $4-\sqrt{3}$

38. Which one of the following is equal to $\frac{8\sqrt{7}+7\sqrt{8}}{8\sqrt{7}-7\sqrt{8}}$?

(a) $\frac{\left(840+56\sqrt{56}\right)}{52}$ (b) $\frac{\left(840-56\sqrt{56}\right)}{52}$

(c) $\frac{\left(840+56\sqrt{56}\right)}{48}$ (d) None of these

39. Find the value of *x* if $\sqrt{x}^{\sqrt{x}^{\sqrt{x}^{\sqrt{x}^{\cdots^{\infty}}}}} = 9$

(a) $\sqrt{3}$ (b) $3^{\frac{1}{4}}$ (c) $3^{\frac{1}{6}}$ (d) $3^{\frac{4}{9}}$

40. If $x = 3^{1/3} + 3^{1/3}$, then the value of $3x^3 - 9x$ would be

(a) $72-18\sqrt[3]{3}$ (b) $72+18\sqrt[3]{3}$

(c) $36-18\sqrt[3]{3}$ (d) $36+18\sqrt[3]{3}$

41. The smallest perfect square number which can be divided by 21, 36 and 66 is

(a) 214344 (b) 214434 (c) 213444 (d) 231444

42. p is a prime number and $(p^2 + 3)$ is also a prime number. The number of numbers that p can assume is:

(a) 3 (b) 2 (c) 1 (d) can't say

43. A number N is divisible by 3 and 4 but not by 9 then which one of the following cannot be an integer?

(a) N/6 (b) N/42 (c) N/18 (d) N/21

44. Which of the following is/are true?

(i) $43^3 - 1$ is divisible by 11

(ii) $56^2 + 1$ is divisible by 19

(iii) $50^2 - 1$ is divisible by 17

(iv) $(729)^5 - 729$ is divisible by 5

(a) (i) and (ii) (b) (iii) and (iv)

(c) (ii), (iii) and (iv) (d) (ii) and (iii)

45. If the product of first sixty positive consecutive integers be divisible by 8^n, where n is an integer, then the largest possible value of n is

(a) 18 (b) 19 (c) 17 (d) 16

46. Which digits should come in place of * and $ if the number 62684*$ is divisible by both 8 and 5?

(a) 4, 0 (b) 0, 4 (c) 0, 0 (d) 4, 4

47. Two different numbers when divided by the same divisor, left remainder 11 and 21 respectively, and when their sum

was divided by the same divisor, remainder was 4. What is the divisor?
(a) 36 (b) 28 (c) 14 (d) 9

48. A number when successively divided by 7 and 8 leaves the remainders 3 and 5 respectively. What is the remainder when the same number is divided by 56?
(a) 38 (b) 31 (c) 37 (d) 26

49. A boy wanted to write the numbers from the smallest number to the greatest number of three digits. How many times he needs to press the keys of the computer to do this job?
(a) 2708 (b) 2889 (c) 2644 (d) 2978

50. A boy had to divide 49471 by 210. He made a mistake in copying the divisor and obtained his quotient as 246 with a remainder 25. What divisor did the boy copy?
(a) 310 (b) 201 (c) 102 (d) 120

51. Two numbers when divided by a certain divisor leave the remainders 4375 and 2986 respectively; but when the sum of the two numbers be divided by the same divisor, the remainder is 2361. The divisor is
(a) 2014 (b) 5000 (c) 625 (d) 2639

52. A boy multiplies 987 by a certain number and obtains 559981 as his answer. If in the answer, both 9's are wrong but the other digits are correct, then the correct answer will be:
(a) 553681 (b) 555181
(c) 555681 (d) 556581

53. After the division of a number successively by 3, 4 and 7, the remainders obtained are 2, 1 and 4 respectively. What will be the remainder if 84 divides the same number?
(a) 80 (b) 76 (c) 41 (d) 53

54. At a college football game, 4/5 of the seats in the lower deck of the stadium were sold. If 1/4 of all the seating in the stadium is located in the lower deck, and if 2/3 of all the seats in the stadium were sold, then what fraction of the unsold seats in the stadium was in the lower deck?
(a) 3/20 (b) 1/6 (c) 1/5 (d) 1/3

55. A student was asked to divide a number by 6 and add 12 to the quotient. He, however, first added 12 to the number and then divided it by 6, getting 112 as the answer. The correct answer should have been:
(a) 122 (b) 118 (c) 114 (d) 124

56. The digits of a three-digit number A are written in the reverse order to form another three-digit number B. If **B** > **A** and **B–A** is perfectly divisible by 7, then which of the following is necessarily true?
(a) $100 < \mathbf{A} < 299$ (b) $106 < \mathbf{A} < 305$
(c) $112 < \mathbf{A} < 311$ (d) $118 < \mathbf{A} < 317$

57. A man fills a basket with eggs in such a way that the number of eggs added on each successive day is the same as the number already present in the basket. This way the basket gets completely filled in 24 day. After how many days the basket was $\frac{1}{4}$ th full?
(a) 6 (b) 12 (c) 17 (d) 22

58. A person has only ₹ 1 and ₹ 2 coins with her. If the total number of coins that she has is 50 and the amount of money with her is ₹ 75, then the number of ₹ 1 and ₹ 2 coins are, respectively
(a) 15 and 35 (b) 35 and 15
(c) 30 and 20 (d) 25 and 25

59. In a Zoo, there are rabbits and pigeons. If heads are counted there are 200 in all and if legs are counted there are 580 in all. How many pigeons are there in the Zoo?
(a) 90 (b) 110 (c) 121 (d) 130

60. The numbers 1 to 29 are written side by side as follows
1234567891011.....28 29
If the number is divided by 9, then what is the remainder?
(a) 3 (b) 1
(c) 0 (d) None of these

61. Highest power of 7 in 81!
(a) 11 (b) 14 (c) 17 (d) 12

62. The unit's digit in the product $(3127)^{173}$ is:
(a) 1 (b) 3 (c) 7 (d) 9

63. The unit's digit in the product $(7^{71} \times 6^{59} \times 3^{65})$ is:
(a) 1 (b) 2 (c) 4 (d) 6

64. $55^3 + 17^3 - 72^3$ is divisible by
(a) both 3 and 13 (b) both 7 and 17
(c) both 3 and 17 (d) both 7 and 13

65. What is the unit digit of $(217)^{413} \times (819)^{547} \times (414)^{624} \times (342)^{812}$?
(a) 2 (b) 4 (c) 6 (d) 8

66. Which of the following is TRUE?
I. $\frac{1}{\sqrt[3]{12}} > \frac{1}{\sqrt[4]{29}} > \frac{1}{\sqrt{5}}$ II. $\frac{1}{\sqrt[4]{29}} > \frac{1}{\sqrt[3]{12}} > \frac{1}{\sqrt{5}}$
III. $\frac{1}{\sqrt{5}} > \frac{1}{\sqrt[3]{12}} > \frac{1}{\sqrt[4]{29}}$ IV. $\frac{1}{\sqrt{5}} > \frac{1}{\sqrt[4]{29}} > \frac{1}{\sqrt[3]{12}}$
(a) Only I (b) Only II
(c) Only III (d) Only IV

67. Which of the following is TRUE?
I. $\sqrt[3]{11} > \sqrt{7} > \sqrt[4]{45}$ II. $\sqrt{7} > \sqrt[3]{11} > \sqrt[4]{45}$
III. $\sqrt{7} > \sqrt[4]{45} > \sqrt[3]{11}$ IV. $\sqrt[4]{45} > \sqrt{7} > \sqrt[3]{11}$
(a) Only I (b) Only II
(c) Only III (d) Only IV

68. A and B are positive integers. If $A + B + AB = 65$, then what is the difference between A and B (A, $B \le 15$)?
(a) 3 (b) 4 (c) 5 (d) 6

69. What is the value of $14^3 + 16^3 + 18^3 + \ldots + 30^3$?
(a) 134576 (b) 120212 (c) 115624 (d) 111672

70. If 6A = 4B = 9C; What is A : B : C?
(a) 6 : 4 : 9 (b) 9 : 4 : 6 (c) 4 : 9 : 6 (d) 6 : 9 : 4

71. The value of $22.\overline{4} + 11.5\,\overline{67} - 33.5\overline{9}$ is:
(a) $0.\overline{32}$ (b) $0.\overline{412}$
(c) $0.3\overline{1}$ (d) $0.4\overline{16}$

72. Let a, b and c be the fractions such that $a < b < c$. If c is divided by a, the result is $\frac{5}{2}$, which exceeds b by $\frac{7}{4}$. If $a + b + c = 1\frac{11}{12}$, then $(c - a)$ will be equal to:

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{1}{2}$

73. Let $x = (633)^{24} - (277)^{38} + (266)^{54}$. What is the units digit of x?

(a) 7 (b) 6 (c) 4 (d) 8

74. If the six digit number $15x1y2$ is divisible by 44, then $(x + y)$ is equal to:

(a) 8 (b) 7 (c) 6 (d) 9

75. If 20% of (X + Y) = 50% of (X – Y), then X : Y is equal to

(a) 3 : 7 (b) 5 : 7

(c) 7 : 3 (d) 7 : 5

76. Two numbers are such that their sum, difference and product are in the ratio 5 : 1 : 18. The difference of their squares is

(a) 36 (b) 45

(c) 42 (d) 54

77. The sum of the three prime numbers is 100. If one of them exceeds another number by 24, then one of the other number is

(a) 7 (b) 29

(c) 43 (d) 61

78. How many numbers from 11 to 50 are divisible by 7 but NOT by 3?

(a) 2 (b) 4 (c) 5 (d) 6

ANSWER KEY

Previous Years Questions

1	(a)	11	(b)	21	(a)	31	(*)	41	(a)	51	(a)	61	(b)	71	(b)	81	(d)	91	(d)
2	(b)	12	(b)	22	(b)	32	(d)	42	(b)	52	(c)	62	(a)	72	(b)	82	(c)	92	(c)
3	(b)	13	(b)	23	(d)	33	(c)	43	(c)	53	(d)	63	(b)	73	(d)	83	(a)	93	(d)
4	(a)	14	(b)	24	(b)	34	(d)	44	(a)	54	(c)	64	(b)	74	(d)	84	(d)	94	(c)
5	(b)	15	(b)	25	(c)	35	(c)	45	(d)	55	(b)	65	(b)	75	(b)	85	(a)		
6	(a)	16	(b)	26	(d)	36	(a)	46	(d)	56	(c)	66	(a)	76	(d)	86	(a)		
7	(a)	17	(c)	27	(d)	37	(b)	47	(b)	57	(d)	67	(c)	77	(a)	87	(d)		
8	(b)	18	(c)	28	(b)	38	(b)	48	(a)	58	(c)	68	(a)	78	(d)	88	(d)		
9	(b)	19	(b)	29	(b)	39	(c)	49	(b)	59	(c)	69	(c)	79	(a)	89	(d)		
10	(b)	20	(b)	30	(c)	40	(c)	50	(c)	60	(b)	70	(a)	80	(a)	90	(b)		

Exercise

1	(c)	11	(a)	21	(c)	31	(a)	41	(c)	51	(b)	61	(d)	71	(d)				
2	(b)	12	(c)	22	(b)	32	(c)	42	(c)	52	(c)	62	(c)	72	(d)				
3	(c)	13	(d)	23	(b)	33	(c)	43	(c)	53	(d)	63	(c)	73	(d)				
4	(c)	14	(a)	24	(d)	34	(a)	44	(b)	54	(a)	64	(c)	74	(b)				
5	(c)	15	(d)	25	(d)	35	(b)	45	(a)	55	(a)	65	(d)	75	(c)				
6	(c)	16	(c)	26	(d)	36	(b)	46	(a)	56	(b)	66	(c)	76	(b)				
7	(d)	17	(c)	27	(a)	37	(a)	47	(b)	57	(d)	67	(c)	77	(a)				
8	(b)	18	(a)	28	(d)	38	(d)	48	(a)	58	(d)	68	(c)	78	(b)				
9	(c)	19	(a)	29	(a)	39	(d)	49	(b)	59	(b)	69	(d)						
10	(a)	20	(a)	30	(b)	40	(a)	50	(b)	60	(a)	70	(d)						

Hints & Explanations

Previous Years Questions

1 (a) Number of times the digit 9 occurs between

100 –200 = 20
201 –300 = 20
301 –400 = 20
401 –500 = 20
501 –600 = 20
601 –700 = 20
701 –800 = 20
801 –900 = 21
901–999 = 119

Total number of times the digit 9 occurs between 100 – 999 = 280.

2. (b) When number is divided by 342 then remainder is 47.

Let the number is $(342\ k + 47)$
where k = integer
When same number is divided by 19.

Then, $\frac{(342k+47)}{19} = \frac{18\times19k+(19\times2+9)}{19}$

Hence, remainder = 9.

3. (b) Prime numbers between 1 and 50
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43 and 47
Hence, number of prime numbers = 15.

4. (a) $x = \left[\frac{0.00001225}{0.00005329}\right]^{\frac{1}{2}} = \left[\frac{0.0035\times0.0035}{0.0073\times0.0073}\right]^{\frac{1}{2}}$

$= \frac{0.0035}{0.0073} = \frac{35}{73}$.

5. (b)

(a) Square root of 26569 $= \sqrt{26569} = 163$.

(b) Square root of 143642 $= \sqrt{143642} = 379.0013$.

(c) Square root of 30976 $= \sqrt{30976} = 176$.

(d) Square root of 28561 $= \sqrt{28561} = 169$.

Hence, number '143642' is not square root of natural number.

6. (a) $\frac{(598+479)^2-(598-479)^2}{598\times479}$

From, $\frac{(a+b)^2-(a-b)^2}{ab} = 4$.

Here, a = 598 and b = 479.

Hence given expression = 4.

7. (a) Let the number of friends who attended the picnic be x.

We have $\frac{960}{x-4} - \frac{960}{x} = 40$ which gives x = 12.

8. (b) Let the no be 'xy' with $x \times y = 14$

As $xy + 45 = yx$ $(x, y > 0)$

$\Rightarrow (10x + y) + 45 = 10y + x$

$\Rightarrow 9x - 9y + 45 = 0$

$\Rightarrow x - y + 5 = 0$ & $x \times y = 14$

$\Rightarrow x - \frac{14}{x} + 5 = 0$

$\Rightarrow x^2 + 5x - 14 = 0$

$\Rightarrow x = 2, -7$ & $y = 7, -2$

Ad $x, y > 0 \Rightarrow$ number is 27

9. (b) Let the no of students in the class are x.

$\therefore$ Each student donates ₹x.

$\therefore$ Total donated amount $= x \times x = x^2$

ATQ, $X^2 = 4624$

$\therefore x = 68$

So, no of students in the class are 68.

10. (b) Let the number is $10x + y$

$\therefore y = 2x$ .....(i)

ATQ,

$10y + x - 10x - y = 27$

$9y - 9x = 27$

$y - x = 3$

From, Eqn. (i)

$x = 3, y = 6$

so, the number is = 10 × 3 + 6= 36

11. (b) L.C.M. of 15, 21 and 27 = 945

Greatest four digit no. = 9999

$945\overline{)9999}\ (1$
$\quad\ \underline{945}$
$\quad\ 549$

So, the greatest four digit no. which is exactly divisible by 945 is = 9999 – 549 = 9450

12. (b) Let n soliders should leave the troop

$\therefore 276 \times 20 = (276 - n) \times 46$

$6 \times 20 = 276 - n$

$120 = 276 - n$

$\Rightarrow n = 156$.

13. (b) If a no. is divisible by 6, then it will be divisible by 2 and 3 also. From the option, only option (b) is divisible by 3. So, the numbers are 150.

14. (b) We know

$a^n - b^n = (a-b)\left(a^{n-1} + a^{n-2}b + ... + b^{n-1}\right)$

$2^{65} - 1^{66} = (2-1)\left(2^{64} + 2^{63} + ... + 2^{\circ}\right)$

$2^{64} + 2^{63} + ... + 2^{\circ} = \frac{2^{65}-1^{65}}{2-1} = 2^{65} - 1$

So, $B = 2^{65} - 1$, $A = 2^{65}$.

Hence, A is larger than B by 1

15. (b) Required number = k(L.C.M. of (3, 4, 5, 6) + 1)
= A number divisible by 7.
= 300 + 1 = 301

16. (b)
$$\begin{array}{r} 6\ 7\ 8\ 9 \\ \times\ \ \ 5 \\ \hline 33\ 9\ 4\ 5 \end{array}$$

Hence dots are 6 and 8.

17. (c) Divide 4 by 2 keeping notice of the quotient and the remainder. Continue dividing the quotient by 2 until you get a quotient of zero.
Then just write out the remainders in the reverse order to get the equivalent binary number.

Divisor	Quotient	Remainder
2	4	0
2	2	0
2	1	1
	0	

So $4 = (100)_2$ in decimal.
For converting decimal fraction 0.625 to a binary number. Follow these steps.

1. Multiply 0.625 by 2 keeping notice of the resulting integer and fractional part. Continue multiplying by 2 until you get a resulting fractional part equal to zero.
2. Then just write out the integer parts from the results of each multiplication to get the equivalent binary number.

$0.625 \times 2 = 1 + 0.25$
$0.25 \times 2 = 0 + 0.5$
$0.5 \times 2 = 1 + 0$
So, $0.625 = (0.101)_2$ in binary
$4.625 = (100.101)_2$ in binary

18. (c) $\frac{3}{4} = 0.75$; $\frac{5}{6} = 0.833$

From options

$\frac{2}{3} = 0.67$

$\frac{1}{2} = 0.5$; $\frac{4}{5} = 0.8$; $\frac{9}{10} = 0.9$

it is clear that $\frac{4}{5}$ is correct answer. Because it is greater than $\frac{3}{4}$ and less than $\frac{5}{6}$.

19. (b) White Marbles 10, Red Marbles 13
White Marbles 10, Green Marbles 5
Now, total number of Marbles = 5 + 10 + 13 = 28

20. (b) By looking at all the options, we observe that option (b) is not necessarily true.
We know that, a number is divisible by 10 if it has 0 at the unit's place.
(R + S) may or may not have 0 at the unit's place. Therefore, it may or may not be divisible by 10.
Thus, it is not necessarily true.

21. (a) From 100 to 199, there are 10 numbers ending with 2. They are 102, 112, 122, 132, 142, 152, 162, 172, 182, 192.
And from 200 to 300, there are 100 numbers beginning with 2. They are 200, 201, 202...,299.
$\therefore$ There are 110 numbers between 100 and 300 which either begin with or end with 2.

22. (b) Let no. of boys = x
Total = y
Here, $\frac{3}{4} \times x = 18$
$x = 24$
Boys = 24 and $\frac{2}{3} \times y = 24$
$y = 36$
Total students = 36
The number of girls in the class = 36 – 24 =12.

23. (d) Population of the Community after every year = $\frac{2}{3}$ of the previous year. Hence, the population of the community after 6 year = $\left(\frac{2}{3}\right)^6$ of the original population of the Community.

$\left(\frac{2}{3}\right)^6 = \frac{64}{729}$th part.

24. (b)

A	B	C	D	E	F
8	7	12	15	11	7

Hence, D + E = B + C + F.

25. (c) — — 8
There are 9 values (1 to 9) for hundreds place digit.
While 10 values (0 to 10) for ten's place digit.
Hence, 9 × 10 = 90 Numbers.

26. (d) 94 divided by 49 leaves the largest remainder 45.

27. (d) Let the two digit numbers are of the form ab.
So, 10a + b – (10b + a) = 27
$\Rightarrow$ 9a – 9b = 27
$\Rightarrow$ a – b = 3
(a, b) $\Rightarrow$ (9, 6), (8, 5), (7, 4) (6, 3) (4,1), (5, 2)

Hence, 96 , 85 , 74 , 63 , 41, 52 and 25, 14, 36, 47, 58, 69 are the required numbers.

28. (b) Number of digits used For 1 – 9 = 9 × 1 = 9
Number of digits used For 10 – 99 = 90 × 2 = 180
Number of digits used for 100 – 150 = 51 × 3 = 153
Hence, 153 + 180 + 9 = 342 digits.

29. (b) Time taken to strike at 5'o clock = 12 s
So time taken strike at 10'o clock = 12×2=24 s

30. (b) Total price of geography textbooks = $a \times x =$ ` ax
Total price of History textbooks = $(a + 2)(x + 2)$
$= ax + 2a + 2x + 4$
Total Price of Mathematics text books $(a - 2)(x - 2)$
$= ax - 2a - 2x + 4$
Total price = $ax+ax+2a+ 2x + 4+ax - 2a - 2x + 4$
$= 3ax + 8$

31. (c) Total passing marks = 30 + 30 = 60
Percentage of passing marks = 40%
Let total marks be x
According to the question

$$x \times \frac{40}{100} = 60 \quad \therefore x = \frac{60 \times 100}{40} = 150$$

32. (d) Let first Piece, second Piece and third Piece are x, y and z respectively.

Now $\frac{3+5+7}{3} = 5 \quad \therefore \quad x = 5$

According to question,

$$y = x + \frac{z}{3} \Rightarrow y = 5 + \frac{z}{3}$$

$$\text{and } z = x + y \Rightarrow z = 5 + 5 + \frac{z}{3}$$

$$\Rightarrow z - \frac{z}{3} = 10 \Rightarrow \frac{3z - z}{3} = 10$$

$$\therefore \quad z = \frac{10 \times 3}{2} = 15$$

$$\therefore \quad y = 5 + \frac{z}{3} \Rightarrow y = 5 + \frac{15}{3} = 10$$

$\therefore$ The length of the original sheet = x + y + z
= 5 + 10 + 15
= 30 units

33. (c) A number is divisible by '3' if sum of its digits be divisible by 3.
Here, Given number is 4252746 B
Sum of its digits = 4 + 2+ 5 + 2 + 7 + 4 + 6 + B
= 30 + B.
For, B = 0, 3, 6, 9;
Sum of digits will be divisible by '3'.
Hence, number of values of B = 4.

34. (d) '7 A3' is divisible by 3 only when sum of its digits be divisible by 3.
7 + A + 3 = 10 + A
For, A = 2, 5 and 8. (10 + A) would be divisible by 3.
ATQ,

$$\begin{array}{r} 13\,6 \\ +5\,B\,7 \\ \hline 7\,A\,3 \end{array}$$

for A = 2, B = 8,
136 + 587 = 723
Hence, B = 8

35. (c) Number of times '5' appear from 1 to 100 = 20
Number of times '5' appear from 101 to 200 = 20
Similary, number of times '5' appear from 201 to 499 = 60
Number of times '5' appear from '600 to 1000' = 80
Number of times '5' appear from '500 to 599'. = 120
Total number of times '5' appear from 1 to 1000
= 20 + 20 + 60 + 80 + 120 = 300

36. (a) Price of the mobile phone

$$= 9000 \times \frac{100}{75} = 12000$$

After taking ₹ 2000 from his friend, Raju has 9000 + 2000 = ₹ 11000.
Thus, he still does not have enough amount to buy the handset.

37. (b) Let the two-digit natural number are 10x + y
on reversing its digits, number formed 10y + x
ATQ,

$$\frac{10x + y}{10y + x} = \frac{4}{7}$$

7(10x + y) = 4(10y + x)
70x + 7y = 40y + 4x
66x = 33y
2x = y
Hence, such number are (12, 24, 36, 48)

38. (b) Let B's score is n
and, A's score is m
ATQ, m – n = 20

$$\text{and } \left(\frac{m-n}{m}\right) \times 100 = 5$$

$$\frac{20}{m} \times 100 = 5 \Rightarrow m = 400$$

B's score = 400 – 20 = 380

39. (c) Between 1 to 100, there are 12 integer numbers that have 4 as a digit but are not divisible by 4. Those numbers are, 14, 34, 41, 42, 43, 45, 46, 47, 49, 54, 74 and 94.

40. (c) Sum of numbers are :

$$\begin{array}{r} A\ 3\ B\ C \\ D\ E\ 2\ F \\ \hline 1\ 5\ 9\ 0\ 2 \\ \hline \end{array}$$

Here, $C + F = 12$ (since 2 is at unit place of the sum)
As all letters represents different value,
so, $(C, F) \neq (2, 3)$.
Now, possible values of $(C, F) = (4, 8), (5, 7)$ ...(i)
Again, $B + 2 = 10 - 1 \Rightarrow B = 9 - 2 = 7$ ...(ii)
and, $3 + E = 9 - 1 \Rightarrow E = 8 - 3 = 5$ ...(iii)

$A + D = 15 \Rightarrow 9 + 6 = 15$ ...(iv)
From (i), (ii) and (iii), $(C, F) = (4, 8)$
From (i), (ii), (iii) and (iv)

$$\begin{array}{r} 9\ 3\ 7\ 4 \\ 6\ 5\ 2\ 8 \\ \hline 1\ 5\ 9\ 0\ 2 \end{array}$$

Thus, $A - D = 9 - 6 = 3$.

41. (a) Given product
$1 \times 5 \times 10 \times 15 \times 20 \times 25 \times 30 \times 35 \times 40 \times 45 \times 50 \times 55 \times 60$
$= 1 \times 5 \times 10 \times (15 \times 2) \times 10 \times 25 \times 30 \times (35 \times 2) \times 10 \times (2 \times 45) \times 50 \times (55 \times 2) \times 30$
$= 1 \times 5 \times \underline{10} \times \underline{30} \times \underline{10} \times 25 \times \underline{30} \times \underline{70} \times \underline{10} \times \underline{90} \times \underline{50} \times \underline{110} \times \underline{30}$
Total number of zeroes = 10.

42. (b) $xyz = 100x + 10y + z$
$yzx = 100y + 10z + x$
$zxy = 100z + 10x + y$
$xyz + yzx + zxy = 100(x + y + z) + 10(x + y + z) + (x + 4 + z)$
$xyz + yzx + zxy = (x + y + z)(111)$
$= (x + y + z) \times 37 \times 3$ ....(i)
Since $(x + y + z)$ is not a multiple of 3. So $(xyz + yzx + zxy)$ is not divisible by 9 although it is clearly visible in equation (i) that $xyz + yzx + zxy$ is divisible by $(x+y+z)$, 37 and 3.

43. (c) $p - 2016 = r - 2018$
$\Rightarrow r - p = 2018 - 2016 = 2$
$\therefore r > p.$
Again, $p - 2016 = s + 2019$
$p - s = 2019 + 2016 \Rightarrow p - s = 4035$
$\therefore p > s.$
Also, $r - 2018 = q + 2017$
$\Rightarrow r - q = 2017 + 2018 \Rightarrow r - q = 4035$
$\therefore r > q.$
Hence, r is the largest natural number.

44. (a) Let two natural numbers are m and n, such that $m > n$.
Then, $m^2 - n^2 = 63$
$\Rightarrow (m - n)(m + n) = 63$
Now, 63 = (1, 63), (3, 21), (7, 9)

(I) $m - n = 1$, $m + n = 63$ ⇒ $m = 32$, and $n = 31$

(II) $m - n = 3$, $m + n = 21$ ⇒ $m = 12$, $n = 9$

For $m - n = 7$, $m + n = 9$
$m = 8$ and $n = 1$
$\therefore (m, n) = (8, 1), (12, 9)$ and $(32, 31)$

45. (d) $\frac{2}{3} = \frac{2+5}{3+5} = \frac{7}{8} \Rightarrow \frac{2}{3} < \frac{7}{8}$,
Difference = 0.875 – 0.667 = 0.208
$\frac{3}{4} = \frac{3+5}{4+5} = \frac{8}{9} \Rightarrow \frac{3}{4} < \frac{8}{9}$,
Difference = 0.889 – 0.75 = 0.139
$\frac{4}{5} = \frac{4+5}{5+5} = \frac{9}{10} \Rightarrow \frac{4}{5} < \frac{9}{10}$,
Difference = 0.9 – 0.8 = 0.1
$\frac{5}{6} = \frac{5+5}{6+5} = \frac{10}{11} \Rightarrow \frac{5}{6} < \frac{10}{11}$,
Difference = 0.909 – 0.833 = 0.076.
Hence, minimum change is observed in $\frac{5}{6}$.

46. (d) n is a digit, which is divisible by 3 but not by 2.
$\therefore n = 9$
Now, 2 × 9 = 18; 18 is not divisible by 4.
3 × 9 = 27; 27 is not divisible by 4.
2 × 9 + 4 = 22; 22 is not divisible by 4.
3 × 9 + 1 = 28; 28 is divisible by 4.

47. (b) $1.272727..... = \frac{127 - 1}{99} = \frac{126}{99} = \frac{14}{11}$.

48. (a) $(51 \times 27 \times 35 \times 62 \times 75) \div 100$
$= (51 \times 27 \times 35 \times 31 \times 150) \div 100 = (K \times 150) \div 100$
where $K = 51 \times 27 \times 35 \times 31$
Now, when we divided 150 by 100,
remainder = 150 – 100 = 50.

49. (b)

Value of n	Number	Sum of digits
$n = 0$	$(10)^0 + 1 = 1 + 1 = 2$	2
$n = 1$	$(10)^1 + 1 = 11$	1 + 1 = 2
$n = 2$	$(10)^2 + 1 = 100 + 1 = 101$	1 + 0 + 1 = 2
$n = 3$	$(10)^3 + 1 = 1000 + 1 = 1001$	1 + 0 + 0 + 1 = 2

Hence, for n = whole number, sum of digits of number $((10)^n + 1)$ is always 2.

50. (c)
(a) $\left(\frac{1}{2}\right)^{-6} = (2)^6 = 64.$
(b) $\left(\frac{1}{4}\right)^{-3} = (4)^3 = 64.$
(c) $\left(\frac{1}{3}\right)^{-4} = (3)^4 = 81.$ (Maximum)
(d) $\left(\frac{1}{6}\right)^{-2} = (6)^2 = 36.$
Hence, $\left(\frac{1}{3}\right)^{-4}$ is maximum.

51. (a)
I. Number divisible by 2 are 2, 4, 6, 8, 10, ...
II. Number divisible by 3 are 3, 6, 9, 12, ...
Thus, Number divisible by 2 and 3 are 6, 12, 18, 24, ...
Conclusion-I : Number, divisible by 6 are, 6, 12, 18, 24, ...
Hence conclusion I is true.
Conclusion-II : Numbers divisible by 4 are, 4, 8, 12, 16, ...
Here 6, 18, 30, ... are not divisibile by 4 but divisible by 2 and 3.
Hence, conclusion II is not correct.

52. (c) 3 digit numbers obtained using multiple of 3 i.e. 3, 6 and 9.
So, numbers are 369, 396, 639, 693, 936 and 963.
So, sum S = 369 + 396 + 639 + 693 + 936 + 963 = 3996
Here, number 3996 is divisible by 74 and 9.

53. (d) Number between 700 to 1000 in which sum of its digits = 10 are, 703, 712, 721, 730, 802, 811, 820, 901, 910.
Hence, Number of numbers = 9.

54. (c) Periodicity of 3 = 4
Now $2019 = 504 \times 4 + 3$
Now, $(3)^{2019} = (3)^{504 \times 4 + 3} = 3^3 = 27$
When this number is divided by 10.
then, remainder = 7

55. (b) For P = 6,
Number = 37981256369.
Divisor = 7
Q = 37981256369 ÷ 7
= 5425893767
Hence, P = 6.

56. (b) Let number is 10x + y
then, 10x + y – (10y + x) = 54
x – y = 6
Statement-2 is correct, the difference of two digits of the number can be determined.
Statement-1 is incorrect, as if we know the ratio of no. then also we can find sum of digits.

57. (d) Product of 15873 × 7 = 111111
Hence, least number = 15 873

58. (c) 1. Let five consecutive integers are (n – 2), (n – 1), n, (n + 1) and (n + 2).
then, $5n = 100 \Rightarrow n = 20$.
2. Product of three consecutive natural numbers = Sum of the same number
$\Rightarrow 1 \times 2 \times 3 = 1 + 2 + 3 = 6$.
Hence, both (1) and (2) are true.

59. (c)

take P = 3	take P = 8
33	38
43	48
33	88
33	88
142	262
R = 1	R = 2
Q = 4	Q = 6

$$\text{Arithmetic Sum} = \frac{142 + 262}{2} = 202.$$

60. (b) PQ × 3 = RQQ
Q = 5

$$\begin{array}{r} P\ \ 5 \\ \times\ \ 3 \\ \hline R\ \ 55 \end{array} \qquad \boxed{P = 8}$$

$$\begin{array}{r} 8\ \ 5 \\ \times\ \ 3 \\ \hline 2\ \ 55 \end{array} \qquad \boxed{R = 2}$$

(P + R) ÷ Q = (8 + 2) ÷ 5 = 2

61. (b) Let total villagers = 30

$$\text{own houses} = \frac{1}{2} \times 30 = 15$$

$$\text{cultivate paddy} = \frac{1}{5} \times 30 = 6$$

$$\text{literate} = \frac{1}{3} \times 30 = 10$$

$$\text{under 25 years of age} = \frac{4}{5} \times 30 = 24$$

Some villagers under 25 years of age are literate

62. (a) Clearly, from 1 t o 100, there are ten numbers with 3 as the units digit 3, 13, 23, 33, 43, 53, 63, 73, 83, 93; and ten numbers with 3 as the ten's digit 30, 31, 32, 33, 34, 35, 36, 37, 38, 39
So, the required number = 10 + 10 = 20.

63. (b) In 2 minutes, net height climbed = 2 – 1 = 1 m.
In next 20 minutes, monkey climbed
$= \frac{20}{2} \times 1 = 10\text{m}.$
In 21st minute, monkey climbed = 10 + 2 = 12m

64. (b) Real number containing both rational and irrational numbers.

65. (b) Number of times digit 5 comes in counting 1 to 99 excluding those numbers divisible by 3 = 14.
5, 25, 35, 50, 52, 53, 55, 56, 58, 59, 65, 85, 95

66. (a) 4, 24, 40, 44, 48, 64, 84
Total 7 numbers.

67. (c) Minimum number = 7
3 (7 + 63) + 640 = 3 × 70 + 640
= 210 + 640 = 850
850 completely divisible by 17.

68. (a) 1 is neither prime nor composite.

69. (c) 4 is the smallest comnposite number.

70. (a) Sum of the digits = 1 + 2 + 4 + 5 + 7 + 8 + 9 = 36
$\because$ 36 ÷ 9 = 4, then number is divisible by 9.
After deleting right most digit, number is divisible by 6 when sum of its digits is divisible by 3 and also last digit be even number.
Thus, right most digit is 9 and second digit from the right end is either 2, 4 or 8.
After deleting, last two digits, the resulting number is divisible by 5. So, third digit from right is 5.

Again, after deleting last 3 digits resulting number is divisible by 4. This is only when last two digits of the number formed by remaining digits is divisible by 4. And after deleting last 5 digits, number is divisible by 2. i.e second digit (from left end) is an even number.

Based on all statements, we get a number

I^{st}	2^{nd} digit	3^{rd} digit	4^{th} digit	5^{th} digit	6^{th} digit	7^{th} digit
Y	X	Y	X	5	X	9

Where X = 2 or 4 or 8 only Y = 1 or 7

Case–I: When 6^{th} digits = 2

Then, Number formed by first 4 digits are, 1874, 1478, 7418 and 7814. Here all these number is not divisible by 4. Hence, 6^{th} digit is either 4 or 8.

Case–II: When 6^{th} digit is 4. then, number formed by first 4 digits are, 1278, 1872, 7218 and 7812. Here, only 1872 and 7812 are divisible by 4.

Case–III: When 6^{th} digit is 8 then number formed by first 4 digits are 1274, 1472, 7214 and 7412. Here, only 7412 and 1472 are divisible by 4

Thus, from case II and III, we get that sum of middle three digits are

1 + 2 + 5 = 8 or 7 + 2 + 5 = 14

Thus option (a) is correct.

71. (b) $(2)^{40} = (2)^{40}$
$(4)^{18} = (2)^{2\times18} = (2)^{36}$
$(8)^{12} = (2)^{3\times12} = (2)^{36}$
$(3)^{21} = (3)^{21}$
Hence among the given number, it is obvious that $(3)^{21}$ is smallest and $(2)^{40}$ is greatest.

72. (b) Distance between two consecutive plants (in meter)

$$= \frac{1.01\times1000}{(101-1)} = 10.1\,\text{m}$$

$\therefore$ Distance between 5 consecutive plants
= (5–1) × 10.1 = 40.4 m.

73. (d) This question is a tricky question.
To get unit digit zero after multiplying two digits number and number obtained by reversing its digits number must have its digit 5 and factor of 2
Such that 25 × 52 = 1300
45 × 54 = 2430
65 × 56 = 3640
and, 85 × 58 = 4930
Hence, p = 45, q = 54
difference, q – p = 54 – 45 = 9

74. (d) p = prime number i.e. 2, 3, 5, ...
q = composite number i.e. 4, 6, 8, 9, 10 .....
(i) p × q = 3 × 9 = 27 (odd number)

(ii) $\frac{q}{p} = \frac{6}{2} = 3$ (prime number)

(iii) p + q = 2 + 9 = 11 (prime number)
Hence, all statements are correct.

75. (b) 15 × 14 × 13 × 12 × ..... × 2 × 1 = 3^m × n.
(3 × 5) × (14) × 13 × (4 × 3) × (11) × (10) × (3 × 3) × 8 × 7 × (2 × 3) × 5 × 4 × (3) × 2 × 1 = 3^6 × n.
$\therefore$ m = 6

76. (d) Number of coins D have = 10 (smallest 2-digits number)
Number of coins C have = (10–2) × 2 = 16
Number of coins B have = (16–2) × 2 = 28
Number of coins A have = (28–2) × 2 = 52

77. (a) Let A, B, C are 1, 2, 3 respectively.
then
x = 123 + 132 + 231 + 213 + 312 + 321
x = 1332
So smallest 4 digit value of x = 1332. Hence statement 1 is correct but statement 2 is not because me have tkaen smallest values possible for A, B, C, thus we are getting smallest value for x which 1332.

78. (d) $\left(\frac{1}{6}\right)^{12} \times (8)^{25} \times \left(\frac{3}{4}\right)^{15}$

$= \left(\frac{1}{3\times2}\right)^{12} \times (2)^{3\times25} \times \left(\frac{3}{2^2}\right)^{15}$

$= 2^{(75-12-30)} \times 3^{(15-12)}. = 2^{33} \times 3^3$

$\therefore$ Number of prime factors = 2 only (i.e. 2, 3)

79. (a) Let P = 85 × 87 × 91 × 95 × 96
= 5 × 17 × 3 × 29 × 7 × 13 × 5 × 19 × 8 × 3 × 4
= $2^5 \times 3^2 \times 5^2 \times 7 \times 13 \times 17 \times 19 \times 29$
$\therefore$ Number of Zeroes at the end of the product
= Highest power of 2 or 5 = 2
Now P ÷ 100 aH Remainder = 0

80. (a)

$2^1 = 2$	$2^2 = 4$	$2^3 = 8$	$2^4 = 16$
$2^5 = 32$	$2^6 = 64$	$2^7 = 128$	$2^8 = 256$

Here, Periodicity of 2 = 4

Now, $\frac{9\times7\times5\times3\times1}{4} = \frac{945}{4}$ = 236, Remainder = 1

$\therefore$ Unit digit of $2^1 = 2$

81. (d)
$$\begin{array}{cccc} & A & B & C \\ & D & E & F \\ \hline 1 & 1 & 1 & 1 \end{array}$$

Here, C + F = 11
Possible pair (C, F) = (2, 9) , (3, 8), (4, 7), (5, 6)
Similarly B + E = 10
Possible pair (B, E) = (1, 9) , (2, 8), (3, 7), (4, 6)
Similarly A + D = 10
Possible pair (A, D) = (1, 9) , (2, 8), (3, 7), (4, 6)
A + B + C + D + E + F = (A + D) + (B + E) + (C+F) = 10 + 10 + 11 = 31

82. (c) A fraction is minimum when numerator is minimum and donominator is maxium

Ratio (R) = $\frac{100x+10y+z}{(x+y+z)}$ For a three digit number

D = (100x + 10y + z)
Here, 1 d" x d" 9 and 0 d" (y, z) d" 9.
For minimum numerator and maximum denominator,
x = 1, y = z =9

$$R = \frac{100\times1+10\times9+9}{1+9+9} = \frac{199}{19} = 10.47$$

$\therefore$ Difference = $|x - z| = |1 - 9| = 8$

83. (a) We know that
(i) Even ± Even = Even
(ii) Odd ± Odd = Even
(iii) Even ± Odd = Odd
(iv) Odd ± Even = Odd
S1: case I : P, Q, R are even and S, T are odd.
P + Q + R – S – t = (P + Q + R) – (S + t)
= Even – Even = Even.
Case II: P, Q, S are even and r, t are odd.
(P+Q–S) + (R – t) = Even + Even = Even
Case III : P, S, t are even and Q, R are odd
(P– (S + T)) + (Q + R)
= Even – Even + Even = Even
Hence, P + Q + R – S –t is definifely even. Hence, S1 is correct.
S2 : Let P, r, s are even and Q, t are odd
2 P + E + 2r – 2S + T
= 2(P + r – s) + (q + t) = Even + Even = Even
Hence, S2 is not correct.

84. (d) Let Prime number, P = 11
Composite number, C = 9

1. $\frac{P+C}{P-C} = \frac{11+9}{11-9} = \frac{20}{2} = 10$ (Even)

2. 2P + C = 2 × 11 + 9
= 22 + 9 = 31 (Odd)
3. P. C. = 11 × 9 = 99 (Odd)

85. (a)
$$\begin{array}{cccc} A & B & C & \\ & & & D \\ \hline 3 & 7 & D & D \end{array}$$

C × D = D
For C = 6, D = 4, $\Rightarrow 6 \times 4 = 24$
For B = 3, D = 4 $\Rightarrow 3 \times 4 = 12$
For A = 9, D = 4 $\Rightarrow 9 \times 4 = 36$
Now,
$$\begin{array}{cccc} 9 & 3 & 6 & \\ & & & 4 \\ \hline 3 & 7 & 4 & 4 \end{array}$$

$\therefore$ A + B + C = 9 + 3 + 6 = 18

86. (a) Rule of divisibility by 13:
From the right most group of 3 digits apply the subtraction and addition operations alternatively and find the result. If the result is either 'O' or multiple of 13, then whole number is divisible by 13.
Here N = 999999999 ... 999999
↓
99th times
= 999,999,999, ... 999, 999
33th group
= Now, (999 + 999 + ... 17 times) – (999 + 999 ... 16 times) = 999
when 999 ÷ 13, remainder R = 11.

87. (d) $2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
Periodicity of '2' is '4'
192 ÷ 4 = 48
$\therefore$ 2^{192} = ...6
(Unit digit)
Now, when we divide 8, 16, 32, 64, 128, 256 ..... by 6, we get remainders 2, 4, 2, 4, 2, 4.....
When we divide odd exponent of 2 by 6,
i.e. 2^3 or 2^5 or $2^7 \div 6$; remainder is 2
Again, when we divide even exponent of 2 by 6,
i.e. 2^4 or 2^6 or $2^8 \div 6$, remainder is 4
$\therefore$ $2^{192} \div 6 \equiv$ Remainders = 4

88. (d) Let number X = 10 a + b and Y = 10 b + a.
(X + Y) = (10 a + b) + (10 b + a)
99 = 11 (a + b) {99 is greatest 2-digit number}
$\therefore$ (a + b) = 9 ... (i)
Possible (a, b) = (8, 1), (7, 2), (6, 3), (5, 4), (4, 5), (3, 6), (8, 7) and (1, 8)

89. (d) p, q, $\rightarrow$ Odd number.
r, s $\rightarrow$ Even number,
Now,
1. (odd – even)^2 (odd × even)
$\Rightarrow$ (odd)^2 × (even) = Even
2. (odd – even) × (odd)^2× even
$\Rightarrow$ odd × odd × even = even
3. (odd + even)^2 × (odd + even)
$\Rightarrow$ (odd)^2 × (odd) = odd.
Hence, all three are correct.

90. (b) $(222)^{333} + (333)^{222}$
$\{(2\times111)^3\}^{111} + \{(3\times111)^2\}^{111}$
$\{2^3\times(111)^3\}^{111} + \{(3^2\times111)^2\}^{111}$
$\{8\times(111)^3\}^{111} + \{(9\times(111)^2\}^{111}$
$(111^2)^{111}[(8\times111)^{111} + (9)^{111}]$
$(111)^{222}[(8\times111)^{111} + (9)^{111}]$
As (111) is divisible by 3 and 37 but not 2.
$\therefore$ Given expression is divisible by 3 and 37 but not 2.

91. (d) Calculation for right most digit:
$(30)^{30} = \{(3\times10)^{30}\} = (3^3)^{10} \times (10)^{30} = (27)^{10} \times (10)^{30}$
Periodicity of 7 is 4.
$\therefore$ $(27)^{10} = (27)^{4K+2} = (27)^2$
$\therefore$ Rightmust digit before zero = 9

92. (c) Prime number (< 10) = 2, 3, 5, 7
S_1: s = 2 + 3 + 5 = 10 (correct)
S_3: s = 3 + 5 + 7 = 15 (correct)

93. (d) Given product : $1^2 \times 2^4 \times 3^6 \times 4^8 \times ... (25)^{50}$
exponent on factor of 10.
$(10)^{20}, (20)^{40}$.
Sum of exponents = 20 + 40 = 60.
exponent on 5 are $(5)^{10}, (15)^{30}, (25)$
Sum of exponent = 10 + 30 + 2 × 50 = 140.
$\therefore$ Total number of zero = 140 + 60 = 200.

94. (c) $32^5 + 2^{27}$
$(2^5)^5 + (2)^{27} = 2^{25} + 2^{27} = 2^{24}(2 + 2^3) = 2^{24} \times 10$
Hence, number is divisible by 10.

Exercise

1. (c) Total numbers between 6000 to 6999 = 1000. Now, when all the digits are different, then thousands place is always to be filled by 6, next place by any of the remaining 9 digits and the remaining two places by any of the 8 and 7 digits respectively. So, total no. of numbers, when all digits are different = $9 \times 8 \times 7 = 504$.
Hence, total no. of numbers, where atleast two digit are same = total numbers – numbers where digits are different
$= 1000 - 504 = 496$

2. (b) Four integers next lower than 81 are 80, 79, 78, 77
Four integers next higher then 81 are 82, 83, 84, 85
Sum = (80 + 82) + (79 + 83) + (78 + 84) + (77 + 85)
= [81 + 81 + 81 + 81] × 2 = 4 × 81 × 2
Sum is divisible by 81, hence it is divisible by 9.

3. (c) For number between 600 to 700 :
Number of 6 at the units place = 10
Number of 6 at the tens place = 10
Number of 6 at the hundredth place = 100
For number between 501 to 599 :
Number of 6 at the units place = 10
Number of 6 at the tens place = 10
Hence, total number of 6 between (501 – 700)
= 10 + 10 + 100 + 10 + 10 = 140

4. (c) Term divisible by 15 are 15, 30, ... 300
Let n be the total terms $300 = 15 + (n - 1) \times 15$
$\Rightarrow n = \frac{300}{15} = 20$

5. (c) Given : Divisor = 2 × remainder
$\therefore$ Divisor = $2 \times 75 = 150$
Also, Divisor $= \frac{2}{3} \times$ dividend
$\Rightarrow$ dividend $= 150 \times \frac{3}{2} = 225$

6. (c) Numbers from (0 – 999) divisible by 7,
$\frac{999}{7} = 142\frac{5}{7} \approx 142$
Numbers from (0 – 999) divisible by 5,
$\frac{999}{5} = 199\frac{4}{5} \approx 199$
There are few numbers which are divisible by both 5 and 7, i.e., by 35.
Numbers from (0 – 999) divisible by 35,
$\frac{999}{35} = 28\frac{19}{35} \simeq 28$
Numbers divisible by 5 or 7 = 142 + 199 – 28 = 313
Hence, total numbers between (0 – 999) not divisible by 5 or 7 = 999 – 313 = 686

7. (d) Let the number be 5q + 3, where q is quotient
Now, $(5q+3)^2 = 25q^2 + 30q + 9 = 25q^2 + 30q + 5 + 4$
$= 5[5q^2 + 6q + 1] + 4$
Hence, remainder is 4.

8. (b) $\frac{1}{8}$th Part is black. Half of the remaing. i.e. $\frac{1}{2} \times \frac{7}{8} = \frac{7}{16}$ is yellow
Therefore, the part left = $\frac{7}{16}$
Which is equal to $3\frac{1}{2}\text{cm} = 3.5\text{cm}$
Hence, length of Pencil = $\frac{3.5}{\frac{7}{16}} = 8\text{cm}$

9. (c) A number is divisible by 9 if the sum of its digits is divisible by 9.
Here 5 + 4 + 3 + 2 + * + 7 = 21 + *
So, the digit in place of * is 6.

10. (a) Here $44 = 11 \times 4$
$\therefore$ the number must be divisible by 4 and 11 respectively.
Test of 4 says that 9y must be divisible by 4 and since y > 5, so y = 6
Again , x 9596 is divisible by 11, so $x + 5 + 6 = 9 + 9 \Rightarrow x = 7$
Thus x = 7, y = 6

11. (a) $24162 = 89x + 43$
$\Rightarrow x = (24162 - 43) \div 89 = 271$

12. (c) By actual division, we find that 999999 is exactly divisible by 13. The quotient 76923 is the required number.

13. (d) Complete remainder = $d_1d_2r_3 + d_1r_2 + r_1$
$= 5 \times 6 \times 7 + 5 \times 4 + 3 = 233.$
Dividing 233, by reversing the divisors i.e. by 8, 6, 5; respective remainders are 1, 5, 4.

14. (a) Let the number be z. Now $385 = 5 \times 7 \times 11$

5	z	Remainders
7	y	4
11	x	6
	102	10

$x = 11 \times 102 + 10 = 1132$
$y = 7x + 6 = 7 \times 1132 + 6 = 7930$
$z = 5y + 4 = 5 \times 7930 + 4 = 39654$

15. (d) Sum of digits = 35 and so it is not divisible by 3.
Now, (Sum of digits at odd places)
– (Sum of digits at even places)
= (19 – 16) = 3, not divisible by 11.
So, the given number is neither divisible by 3 nor by 11.

16. (c) Since 111111 is divisible by each one of 7, 11 and 13, so each one of given type of numbers is divisible by each one of 7, 11, and 13. as we may write, 222222 = 2×111111, $333333 = 3 \times 111111$, etc.

17. (c) On dividing 803642 by 11, we get remainder = 4.
$\therefore$ Required number to be added = (11 – 4) = 7.

18. (a) Number = (296 × Q) + 75 = (37 × 8Q) + (37 × 2) + 1
$= 37 \times (8Q + 2) + 1.$
$\therefore$ Remainder = 1.

19. (a)

4	x	Remainders
5	y	2
6	z	3
	1	4

$z = 6 \times 1 + 4 = 10$
$y = 5 \times 10 + 3 = 53$
$x = 4 \times 53 + 2 = 214$

20. (a) On dividing 427398 by 15, we get remainder = 3.
$\therefore$ Required number to be subtracted = 3.

21. (c) Let x be the number of times, then
$79x + 43759 = 50{,}000$
$\Rightarrow x = (50000 - 43759) \div 79 = 79$

22. (b) Unit digit in 7^4 is 1. So, unit digit in 7^{92} is 1.
$\therefore$ Unit digit in 7^{95} is 3.
Unit digit in 3^4 is 1.
$\therefore$ Unit digit in 3^{56} is 1.
$\therefore$ Unit digit in 3^{58} is 9.
$\therefore$ Unit digit in $(7^{95} - 3^{58}) = (13 - 9) = 4$.

23. (b) The number is divisible by 18 i.e., it has to be divisible by 2 and 9.
$\therefore$ B may be 0, 2, 4, 6, 8.
$A + 4 + 5 + 7 + 1 + 2 + 0 + 3 + B$
$= A + B + 22$.
A + B could be 5, 14 (as the sum can't exceed 18, since A and B are each less than 10).
So, A and B can take the values of 6, 8.

24. (d) x is prime say 7
y is not prime but composite no. say 8, 9, 21
(a) $9 - 7 = 2$ (b) $7 \times 8 = 56$ (c) $\frac{21+7}{7} = 4$
Put x = 2 and y = 6 and check for the options.
By hit and trial all the 3 options can be proved wrong

25. (d) Let n = 6
Therefore $\sqrt{n} = \sqrt{6} \approx 2.4$
Now, the divisor of 6 are 1, 2, 3
If we take 2 as divisor then $\sqrt{n} > 2 > 1$.
Statement I is true.
If we take 3 as divisor then $6 > 3 > 2.4$, i.e. $n > \sqrt{n}$
Therefore statement II is true.

26. (d) Given $a = 6b = 12c = 27d = 36e$
Multiplied and Divide by 108 in whole expression
$$\frac{108a}{108} = \frac{108b}{18} = \frac{108c}{9} = \frac{108d}{4} = \frac{108e}{3}$$
$$\frac{1}{108}a = \frac{1}{18}b = \frac{1}{9}c = \frac{1}{4}d = \frac{1}{3}e = k \text{ (say)}$$
$\Rightarrow$ $a = 108k$, $b = 18k$, $c = 9k$, $d = 4k$, $e = 3k$
So it is clear that $\left(\frac{a}{6}, \frac{c}{d}\right)$ contains a number $\frac{c}{d} = \left(\frac{9}{4}\right)$ which is not an integer

27. (a) a, a + 2, a + 4 are prime numbers.
Put value of 'a' starting from 3, we will have 3, 5 and 7 as the only set of prime numbers satisfying the given relationships.

28. (d) $\frac{29}{12} + \frac{15}{16} = \frac{116+45}{48} = \frac{161}{48}$
Therefore, $\frac{161}{48} + \frac{31}{48} = \frac{192}{48} = 4$ = a whole number
And $\frac{161}{48} - \frac{17}{48} = 3 =$ whole number
Between $\frac{31}{48}$ and $\frac{17}{48}$; $\frac{17}{48}$ is the least fraction.
Clearly, the least fraction among the given fractions in options is $\frac{17}{48}$.

29. (a) Let us take a proper fraction, such as $\frac{1}{2}$.
Now, the new fraction = $\frac{1+2}{2+2} = \frac{3}{4}$
Thus, $\frac{3}{4} > \frac{1}{2}$

30. (b) Putting the value of x = – 0.5 in all the options.
(a) $2^{1/-0.5} = 2^{-2} = \frac{1}{4}$ (b) $\frac{1}{-0.5} = -2$
(c) $\frac{1}{(-0.5)^2} = 4$ (d) $2^{-0.5} = \frac{1}{\sqrt{2}}$
So, clearly (b) is smallest.

31. (a) $\frac{1}{m} + \frac{4}{n} = \frac{1}{12}$
$\Rightarrow 12n + 48m - mn - 576 = -576$
$$m - 12 = \frac{576}{n - 48} \quad \text{...(i)}$$
Since n is an odd, therefore, $(n - 48)$ is an odd.
Also – 576 is an even, therefore $(m - 12)$ is definitely even.
Now n is an odd integer less than 60. Hence, on checking, we get all possible value of n are 49, 51 and 57.
Therefore, there are three value of n

32. (c) $\left.\begin{matrix} 4 & a & 3 \\ 9 & 8 & 4 \\ 13 & b & 7 \end{matrix}\right\} \Rightarrow a + 8 = b \Rightarrow b - a = 8$
Also, 13b7 is divisible by 11 $\Rightarrow 7 + 3 - (b + 1) = 9 - b$
$\Rightarrow 9 - b = 0 \quad \Rightarrow b = 9$
$\therefore$ (b = 9 and a = 1) $\Rightarrow$ (a + b) = 10

33. (c) For maximum value $|3x - 7|$ should be minimum and $|3x - 7|$ min. = 0
$\therefore$ maximum value = 17.

34. (a) $|3x - 11| = 14 \Rightarrow 3x - 11 = \pm 14$.
$\Rightarrow 3x - 11 = 14$ or $3x - 11 = -14 \Rightarrow x = \frac{25}{3}$ or $x = -1$

35. (b) For minimum value $|7x^2 - 9|$ Should be minimum i.e. 0.
$\therefore$ Minimum value = 0 + 8 = 8.

36. (b) $|\frac{2}{3}x + \frac{5}{9}| = \frac{4}{9} \Rightarrow \frac{2}{3}x + \frac{5}{9} = \pm\frac{4}{9}$
$\Rightarrow \frac{2}{3}x + \frac{5}{9} = \frac{4}{9}$ or, $\frac{2}{3}x + \frac{5}{9} = -\frac{4}{9}$
$\Rightarrow \frac{2}{3}x = \frac{-1}{9}$ or, $\frac{2}{3}x = -1$
$\Rightarrow x = -\frac{1}{6}$ $x = \frac{-3}{2}$

37. (a) Let the square root of $28-\sqrt{300}$ is $p-\sqrt{q}$, then by squaring both the sides

$p^2+q-2p\sqrt{q}=28-\sqrt{300},$

equating rational and irrational parts $p^2+q=28$ and

$2p\sqrt{q}=\sqrt{300}$

$=10\sqrt{3}=2\times5\times\sqrt{3}$

Hence we can assume that $p=5$ and $q=3$. so required square roots are $\pm\left(5-\sqrt{3}\right)$

38. (d) Multiply the numerator and denominator by conjugate of denominator i.e., $8\sqrt{7}+7\sqrt{8}$

$$=\frac{8\sqrt{7}+7\sqrt{8}}{8\sqrt{7}-7\sqrt{8}}\times\frac{8\sqrt{7}+7\sqrt{8}}{8\sqrt{7}+7\sqrt{8}}$$

$$=\frac{448+392+112\sqrt{56}}{448-392}=\frac{\left(840+112\sqrt{56}\right)}{56}$$

$=15+2\sqrt{56}$

39. (d) From the given information we can say that

$\left(\sqrt{x}\right)^9=9=3^2$ hence $\sqrt{x}=3^{\frac{2}{9}}$ *or* $x=3^{\frac{4}{9}}$

40. (a) $x=3^{1/3}+3^{1/3}=2.3^{1/3}$

$3x^3-9x=3\left(2.3^{1/3}\right)^3-9.2.3^{1/3}$

[Just put the value of x]

$=3.\left(2^3.3\right)-18.3^{1/3}=72-18.3^{1/3}=72-18\sqrt[3]{3}$

41. (c) The L.C.M. of given numbers = $2^2\times3^2\times11\times7$
So, required number = $2^2\times3^2\times11^2\times7^2$
$=213444$

42. (c) Only one value p can assume, which is 2.
At p = 2, $p^2+3=7$, which is also prime.
Again at p = 3, 5, 7, 11, ...
p^2+3 = an even number which can not be a prime number.

43. (c) As per the given condition N must be divisible by 12, so N must be in the form of 12k where k is not divisible by 3 (As N is not divisible by 9). Hence N/18 cannot be an integer.

44. (b) $(50^2-1)=(50+1)(50-1)$
$=(17\times3)\times(7\times7)$
hence divisible by 17.
and $(729)^5-729=729\,(729^4-1)$
$=729\,(729^2-1)\,(729^2+1)$
$=(729)(729-1)(729+1)(729^2+1)$
$=729\times728\times730\times(729^2+1)$
Hence it is divisible by 5.

45. (a) Product of first sixty consecutive integers = 60!
$8=2\times2\times2=2^3$
highest power of 2 is 60!

$$=\left[\frac{60}{2}\right]+\left[\frac{60}{2^2}\right]+\left[\frac{60}{2^3}\right]+\left[\frac{60}{2^4}\right]+\left[\frac{60}{2^5}\right]$$

$=30+15+7+3+1=56$

highest power of 8 or $(2^3)=\left[\frac{56}{3}\right]=18$

46. (a) Since the given number is divisible by 5, so 0 or 5 must come in place of $. But, a number ending with 5 is never divisible by 8. So, 0 will replace $.
Now, the number formed by the last three digits is 4*0, which becomes divisible by 8, if * is replaced by 4.
Hence, digits in place of * and $ are 4 and 0 respectively.

47. (b) Divisor = [Sum of remainders]
– [Remainder when sum is divided]
$=11+21-4=28$

48. (a) $\because\ 56=d_1\times d_2$
$\therefore$ required remainder = $d_1r_2+r_1$ where $d_1=7$ and $r_1=3$ and $r_2=5$
$=7\times5+3=38$, No. = $56+38=94$
$94\div56$, Remainder = 38

49. (b) He wants to write from 1 to 999. He has to write 9 numbers of one digit, 90 numbers of two digits and 900 numbers of three digits.
Total number of times = $1\times9+2\times90+3\times900=2889$

50. (b) By division Algorithm,
$49471=246\times D+25$
$\Rightarrow$ D = 201

51. (b) Required Divisor = (sum of remainders)
– Remainder when sum is divided
= [4375 + 2986] – 2361 = 5000

52. (c) $987=3\times7\times47$
So, required number must be divisible by each one of 3, 7, 47.
None of the numbers in (a) and (b) are divisible by 3, while (d) is not divisible by 7.
$\therefore$ Correct answer is (c).

53. (d) The required no. is $3[4(7x+4)+1]+2=84x+53$
So the remainder is 53, when divided by 84.

54. (a) Let total number of seats in the stadium be p; number of seats in the lower deck be x and number of seats in upper deck be y.
$\therefore$ $p=x+y$, $x=p/4$, $y=3p/4$
Now in the lower deck, 4x/5 seats were sold and x/5 seats were unsold.
No. of total seats sold in the stadium = 2p/3.
No. of unsold seats in the lower deck = x/5 = p/20
No. of unsold seats in the stadium = p/3

$\therefore$ Required fraction = $\frac{p/20}{p/3}=\frac{3}{20}$

55. (a) Let the number be x. Then, as per the operation undertook by the student, we have

$\frac{x+12}{6}=112\ \Rightarrow\ x=660$

Hence, the correct answer = $\frac{660}{6}+12=122$

56. (b) Let the 3 digits of number A be x, y and z
Hence A = 100x + 10y + z
On reversing the digits of number A, we get the number B i.e., z y x.
$\therefore$ B = 100z + 10y + x

As $B > A \Rightarrow z > x$ ...(i)

$B - A = 99z - 99x = 99(z - x)$

As 99 is not divisible by 7

so $(z - x)$ has to be divisible by 7. ...(ii)

Using (i) & (ii), the only possible values of z and x are (8, 1) and (9, 2)

So the minimum and maximum range of A are 108 and 299, which $\in 106 < A < 305$

57. (d) Let x be the no of eggs already present in the basket.
Then, no. of eggs on each successive days:
$x, 2x, 4x, 8x, \ldots\ldots\ldots$ upto 24 days.
From here, we can see that number of eggs are getting doubled on each successive days.
On 24th day basket was filled completely.

$\therefore$ On 23rd day basket was filled = $\frac{1}{2}$

Hence, on 22nd day basket was filled = $\frac{1}{2}\left(\frac{1}{2}\right) = \frac{1}{4}$

58. (d) Let the no. of ₹ 1 coins = x
and the no. of ₹ 2 coins = y
According to the question:
$x + y = 50$ ... (i)
$x.1 + 2.y = 75$ ... (ii)
on solving (i) and (ii), we get
$2y - y = 75 - 50$
$\Rightarrow y = 25$
put value of y in equation (i), we get
$x = 50 - y$
$= 50 - 25 = 25$
Hence, number of ₹1 and ₹2 coins are 25 and 25 respectively.

59. (b) Let number of rabbit and pigeons are a and b respectively

ATQ, $a + b = 200$ ...(i)

$4a + 2 \times b = 580$

$2a + b = 290$ ...(ii)

From (i) and (ii) $a = 90, b = 110$.

$\therefore$ Number of Pigeons = 110

60. (a) Sum of the digits of the 'super' number
$= 1 + 2 + 3 + \ldots\ldots\ldots\ldots + 29$

$$\frac{29(29+1)}{2} = \frac{29 \times 30}{2} = 29 \times 15 = 435$$

Now, sum of digits in the number $435 = 4 + 3 + 5 = 12$ which gives a remainder of 3 when divided by 9.

61. (d) $\left[\frac{81}{7}\right] + \left[\frac{81}{49}\right]$

$\Rightarrow 11 + 1 = 12$

62. (c) Unit digit in $(3127)^{173}$ = Unit digit in $(7)^{173}$. Now, 7^4 gives unit digit 1.
$\therefore (7)^{173} = (7^4)^{43} \times 7^1$. Thus, $(7)^{173}$ gives unit digit 7.

63. (c) Unit digit in 7^4 is 1.
Unit digit in 7^{68} is 1.
$\therefore$ Unit digit in $7^{71} = 1 \times 7^3 = 3$
Again, every power of 6 will give unit digit 6.
$\therefore$ Unit digit in 6^{59} is 6.
Unit digit in 3^4 is 1.
$\therefore$ Unit digit in 3^{64} is 1. Unit digit in 3^{65} is 3.
$\therefore$ Unit digit in $(7^{71} \times 6^{59} \times 3^{65})$
= Unit digit in $(3 \times 6 \times 3) = 4$.

64. (c) $a^3 + b^3 + c^3 = 3abc$
When $a + b + c = 0$
here $a = 55, b = 17, c = -72$
$a + b + c = 0$
$\because 55^3 + 17^3 - 72^3 = -3 \times 55 \times 17 \times 72$
Hence it is divisible by 3 & 17.

65. (d) $(217)^{413} \times (819)^{547} \times (414)^{624} \times (342)^{812}$
$\because$ The unit place of the given expression will be equal to
Step 1

$4\overline{)413}(103$ $4\overline{)547}(139$ $4\overline{)624}(156$ $4\overline{)812}(203$

40 4 60 8

13 14 24 12

12 12 24 12

1 37 0 0

36

1

Step 2 : (Unit place of the bar)$^{\text{Remainder}}$, but in cart when remainder is zero, (unit palce of bar)^4
So $(7)^1 \times (9)^1 \times (4)^4 \times (2)^4$
after solving the unit place of the expression will be

$7 \times 9 \times 4 \times 4 \times 4 \times 4 \times 2 \times 2 \times 2 \times 2$

$6\,(3) \times 1\,(6) \times 1\,(6) \times (4) \times (4)$

$3 \times 6 \times 6 \times 4 \times 4$

$1\,(8) \times 2\,(4) \times 4$

$3\,(2) \times 4$

So the unit place is $\boxed{8}$

66. (c) Taking $\sqrt[3]{12}$, $\sqrt[4]{29}$ and $\sqrt{5}$ from the given expression
LCM of 3, 4 and 2 = 12
(n^{th} root of the given expression)

So $(12)^{12/3}$, $(29)^{12/4}$, $(5)^{12/2}$

$\downarrow$ $\downarrow$ $\downarrow$

12^4 29^3 5^6

$12^4 \longrightarrow 20736, 29^3 \longrightarrow 24389, 5^6 \longrightarrow 15625$
So the right descending order is

$$\frac{1}{\sqrt{5}} > \frac{1}{\sqrt[3]{12}} > \frac{1}{\sqrt[4]{29}}$$

67. (c) Taking $\sqrt[3]{11}, \sqrt[2]{7}, \sqrt[4]{45}$ from the given expression.
The LCM of 3, 2, 4 = 12

$(11)^{\frac{1}{3}\times 12}$ $(7)^{\frac{1}{2}\times 12}$ $(45)^{\frac{1}{4}\times 12}$

$\downarrow$ $\downarrow$ $\downarrow$

$(11)^4$ $(7)^6$ $(45)^3$

$\downarrow$ $\downarrow$ $\downarrow$

14641 117649 91125

So the order of descending numbers is

$\sqrt[2]{7} > \sqrt[4]{45} > \sqrt[3]{11}$

68. (c) Given $A + B + AB = 65$
Let $A = 10, B = 5$ $(\because B \le 15)$
$\therefore$ $A - B = 10 - 5 = 5$

69. (d) $14^3 + 16^3 + 18^3 + ... + 30^3$
We can take common
$2^3[7^3 + 8^3 + 9^3 + ... + 15^3]$
$2^3[(1^3 + 2^3 + 3^3 + ... + 15^3) - (1^3 + 2^3 + 3^{3+} ... + 6^3)]$
$\because$ The sum of cube of n natural number.

$$1^3 + 2^3 + 3^3 + 4^3 + ... n^3 = \left(\frac{n \times (n+1)}{2}\right)^2$$

$$\text{So } 2^3\left[\underbrace{(1^3 + 2^3 + ... + 15^3)}_{n=15} - \underbrace{(1^3 + 2^3 + ... + 6^3)}_{n=6}\right]$$

$$= 2^3\left[\left(\frac{15 \times 16}{2}\right)^2 - \left(\frac{6 \times 7}{2}\right)^2\right]$$

$= 2^3[(120)^2 - (21)^2]$
$= 8[14400 - 441] = 8 \times 13959 = 111672$

70. (d) Let $6A = 4B = 9C = k \times LCM(6, 4, 9)$
$6A = 4B = 9C = k \times 36$
$\Rightarrow$ $A = 6k$
$B = 9k$
$C = 4k$
$A : B : C = 6k : 9k : 4k$
$\Rightarrow$ $A : B : C = 6 : 9 : 4$

71. (d) $22.\overline{4} + 11.5\overline{67} - 33.\overline{59}$

$$= 22 + \frac{4}{9} + 11 + \frac{567 - 5}{990} - 33 - \frac{59}{99}$$

$$= \frac{4}{9} + \frac{562}{990} - \frac{59}{99}$$

$$= \frac{440 + 562 - 590}{990} = \frac{412}{990}$$

$= 0.4161616$ or $0.4\overline{16}$

72. (d) Ratio of $\frac{c}{a} = \frac{5}{2}$ ... (i)
According to question

$$b = \frac{5}{2} - \frac{7}{4} = \frac{3}{4}$$

so, $a + c = \frac{23}{12} - \frac{9}{12} = \frac{14}{12} \Rightarrow a + c = \frac{7}{6}$ ... (ii)
from (i) and (ii)

$$a + \frac{5}{2}a = \frac{7}{6} \Rightarrow \frac{7a}{2} = \frac{7}{6}$$

$$a = \frac{1}{3}$$

$$c = \frac{5}{2} \times \frac{1}{3} = \frac{5}{6} \qquad \therefore\ c - a = \frac{5}{6} - \frac{1}{3} = \frac{1}{2}$$

73. (d) $x = (633)^{24} - (277)^{38} + (266)^{54}$
for unit digit

Step I : $4\overline{)24}\ (6$ $4\overline{)38}\ (9$ $4\overline{)54}\ (13$
$\underline{24}$ $\underline{36}$ $\underline{52}$
0 2 Remainder $\textcircled{2}$ Remainder

Step II: (base unit place)$^{\text{Remainder}}$
[Note down when remainder equals is 0 exponend equal to 4]
so $3^4 - 7^2 + 6^3$
taking unit place $1 - 9 + 6 = 7 - 9$
or $17 - 9$ or $17 - 9 = 8$

74. (b) Any number which divisible by 44, must be divisible by 11 also is
And for any number divisible by 11 the difference of sum of its digits at odd and even places be divisible by 11.
For the given number $15x\,1y2$
$(x + y + 1) - (5 + 1 + 2) = 0$
$x + y = 7$

75. (c) 20% of $(x + y)$ = 50% of $(x - y)$
$2(x + y) = 5(x - y)$
$2x + 2y = 5x - 5y$
$7y = 3x$

$$\frac{x}{y} = \frac{7}{3}$$

i.e $x : y$ is 7 : 3

76. (b) Let two numbers are a and b
then, $(a + b) : (a - b) : (a \times b) = 5 : 1 : 18$
$\Rightarrow (a + b) = 5k$, $(a - b) = k$ and $ab = 18k$
$\therefore$ $a = 3k$, $b = 2k$
Product $ab = 3k*2k = 18k$
$6k^2 - 18k = 0$
$6k(k - 3) = 0 \Rightarrow k = 3$.
Now, $a^2 - b^2 = (3k)^2 - (2k)^2 = k^2(9 - 4) = 9 \times 5 = 45$

77. (a) Let one prime number is a then other prime number is a + 24.
ATQ, third prime number = $100 - (a + a + 24) = 76 - 2a$.
For a = 2, 76 – 4 = 72 Not a prime number
a = 3, 76 – 6 = 70 Not a prime number
a = 5, 76 – 10 = 66 Not a prime number
a = 7, 76 – 14 = 59 This is a prime number
Hence, prime number (a) = 7.

78. (b) Number divisible by 7 and 3 = 21.
Number between 11 and 50, that is divisible by 7 are 14, 21, 28, 35, 42 and 49 out of which 21 and 42 are divisible by 3.
Hence, only 4 numbers 14, 28, 35 and 49 are between 11 and 50 which is divisible by 7 but not by 3.