SECTION-I : ARITHMETICAL ABILITY

1. OPERATIONS ON NUMBERS

1. NUMBERS: In Hindu- Arabic system, we have ten **digits**, namely 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 called zero, one two, three, four, five, six, seven, eight and nine respectively.

A number is denoted by a group of digits, called **numeral.**

For denoting a numeral, we use the place-value chart, given below.

Ex. 1. *Write each of the following numerals in words.*

	Ten-Crores	*Crores*	*Ten-Lacs*	*Lacs*	*Ten-Thousands*	*Thousands*	*Hundreds*	*Ten*	*Units*
(i)				6	3	8	5	4	9
(ii)			2	3	8	0	9	1	7
(iii)		8	5	4	1	6	0	0	8
(iv)	5	6	1	3	0	7	0	9	0

Sol. The given numerals in words are:

(i) Six lac thirty-eight thousand five hundred forty-nine.

(ii) Twenty-three lac eighty thousand nine hundred seventeen.

(iii) Eight crore fifty-four lac sixteen thousand eight.

(iv) Fifty-six crore thirteen lac seven thousand ninety.

Ex. 2. *Write each of the following numbers in figures:*

(i) Nine crore four lac six thousand two

(ii) Twelve crore seven lac nine thousand two hundred seven.

(iii) Four lac four thousand forty.

(iv) Twenty-one crore sixty lac five thousand fourteen.

Sol. Using the place value chart, we may write

	Ten-Crores	Crores	Ten-Lacs	Lacs	Ten-Thousands	Thousands	Hundreds	Tens	Ones
(i)		9	0	4	0	6	0	0	2
(ii)	1	2	0	7	0	9	2	0	7
(iii)				4	0	4	0	4	0
(iv)	2	1	6	0	0	5	0	1	4

2. Face value and Place value (or Local Value) of a Digit In a Numeral

(i) The face value of a digit in a numeral is its own value, at whatever place it may be

Ex. In the numeral 6872, the face value of 2 is 2, the face value of 7 is 7, the face value of 8 is 8 and the face value of 6 is 6.

(ii) In a given numeral:

Place value of unit digit = (unit digit) × 1,

Place value of tens digit = (tens digit) × 10,

Place value of hundred's digit = (hundred's digit) × 100 and so on.

Ex. In the numeral 70984, we have

Place value of 4 = (4 × 1) = 4

Place value of 8 = (8 × 10) = 80,
Place value of 9 = (9 × 100) = 900,
Place value of 7 = (7 × 10000) = 70000.

Note: Place value of 0 in a given numeral is 0, at whatever place it may be.

Ex. 3. *In the numeral 8734925, write down:*

(i) *Face value of 7* (ii) *Face value of 9* (iii) *Place value of 4*
(iv) *Place value of 3* (iv) *Place value of 8* (v) *Place value of 5*

Sol. Writing the given numeral in place-value chart, we get

Ten-Lacs	Lacs	Ten-thousands	Thousands	Hundreds	Tens	Ones
8	7	3	4	9	2	5

(i) Face value of 7 is 7
(ii) Face value of 9 is 9
(iii) Place value of 4 = (4 × 1000) = 4000
(iv) Place value of 3 = (3 × 10000) = 30000
(v) Place value of 8 = (8 × 1000000) = 8000000
(vi) Place value of 5 = (5 × 1) = 5

3. **Various Types of Numbers:**

(i) **Natural Numbers:** *Counting numbers are called natural numbers.*
Thus 1, 2, 3, 4, 5, 6, ... are all natural numbers.

(ii) **Whole Numbers:** *All counting numbers and 0 form the set of whole numbers.*
Thus 0, 1, 2, 3, 4, 5, ... etc. are whose numbers.
Clearly, every natural number is whole number and 0 is a whole number which is not a natural number.

(iii) **Integers:** All counting numbers, zero and negatives of counting numbers form the set of integers.
Thus, ..., –3, –2, –1, 0, 1 , 2, 3, ... are all integers.
Set of positive integers = {1, 2, 3, 4, 5, 6, ...}
Set of negative integers = {–1, –2, –3, –4, ...}
Set of all non-negative integers = {0, 1, 2, 3, 4, 5, ...}.

*4. **Even And Odd Numbers:**

(i) **Even Numbers:** *A counting number divisible by 2 is called an even number.*
Thus 0, 2, 4, 6, 8, 10, 12, ... etc. are all even numbers.

(ii) **Odd Numbers:** *A counting number not divisible by 2 is called an odd number.*
Thus 1, 3, 5, 7, 9, 11, 13, 15, ... etc. are all odd numbers.

5. **Prime Numbers:** *A counting number is called a prime number if it has exactly two factors, namely itself and 1.*

Ex. 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

Test For a Number To be Prime:

Let p be a given number and let n be the smallest counting number such that $n^2 \geq p$.
Now, test whether p is divisible by any of the prime numbers less than or equal to n.
If yes, the p is not prime otherwise, p is prime.

Ex. 4. *Test, which of the following are prime numbers ?*
(i) 137 (ii) 173 (iii) 319 (iv) 437 (v) 811

Sol. (*i*) We know that $(12)^2 > 137$.

Prime numbers less than 2 are 2, 3, 5, 7, 11

Clearly, none of them divides 137.

$\therefore$ 137 is a prime number.

(*ii*) We known that $(14)^2 > 173$

Prime numbers less than 14 are 2, 3, 5, 7, 11, 13.

Clearly, none of them divides 173.

$\therefore$ 173 is a prime number.

(*iii*) We know that $(18)^2 > 319$.

Prime numbers less than 18 are 2, 3, 5, 7, 11, 13, 17.

Out of these prime numbers, 11 divides 319 completely.

$\therefore$ 319 is not a prime number.

(*iv*) We know that $(21)^2 > 437$.

Prime numbers less than 21 are 2, 3, 5, 7, 11, 13, 17, 19

Clearly, 437 is divisible by 19.

$\therefore$ 437 is not a prime number.

(*v*) We know that $(30)^2 > 811$.

Prime numbers less than 30 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

Clearly, none of these numbers divides 811.

$\therefore$ 811 is a prime number.

Composite Numbers: *The natural numbers which are not prime, are called composite numbers.*

6. Co Primes: Two natural numbers a and b are said to be co-prime if their HCF is 1.

Ex. (2, 3), (4, 5), (7, 9), (8, 11) etc. are pairs of co-primes.

TESTS OF DIVISIBILITY

I. Divisibility By 2:

A number is divisible by 2 if its unit digit is any of 0, 2, 4, 6, 8.

Ex. 58694 is divisible by 2, while 86945 is not divisible by 2.

II. Divisibility By 3:

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

Ex. (*i*) In the number 695421, the sum of digits = 27, which is divisible by 3.

$\therefore$ 695421 is divisible by 3.

(*ii*) In the number 948653, the sum of digits = 35, which is not divisible by 3.

$\therefore$ 948653 is not divisible by 3.

III. Divisibility BY 9:

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

Ex. (*i*) In the number 246591, the sum of digits = 27, which is divisible by 9.

$\therefore$ 246591 is divisible by 9.

(*ii*) In the number 734519, the sum of digits = 29, which is not divisible by 9.

$\therefore$ 734519 is not divisible by 9.

IV. Divisibllity By 4:

A number is divisible by 4 is the sum of its last two digits is divisible by 4.

Ex. (*i*) 6879376 is divisible by 4, since 76 is divisible by 4.

(*ii*) 496138 is not divisible by 4, since 38 is not divisible by 4.

V. Divisibility By 8:

A number is divisible by 8 if the number formed by hundred's ten's and unit's digit of the given number is divisible by 8.

Ex. (*i*) In the number 16789352, the number formed by last 3 digits, namely 352 is divisible by 8.

$\therefore$ 16789352 is divisible by 8.

(*ii*) In the number 576484, the number formed by last 3 digits, namely 484 is not divisible by 8.

$\therefore$ 576484 is not divisible by 8.

VI. Divisibility By 10:

A number is divisible by 10 only when its unit digit is 0.

Ex. (*i*) 7849320 is divisible by 10, since its unit digits is 0.

(*ii*) 678405 is not divisible by 10, since its unit digit is not 0.

VII. Divisibility By 5:

A number is divisible by 5 only when its unit digit is 0 or 5.

Ex. Each of the numbers 76895 and 68790 is divisible by 5.

VIII. Divisibility By 11:

A number is divisible by 11 if the difference between the sum of its digits at odd places and the sum of its digits at even places is either 0 or a number divisible by 11.

Ex. (*i*) Consider the number 29435417

(Sum of its digits at odd places) – (Sum of its digits at even places)

$= (7 + 4 + 3 + 9) - (1 + 5 + 4 + 2) = (23 - 12) = 11$, which is divisible by 11.

$\therefore$ 29435417 is divisible by 11.

(*ii*) Consider the number 57463822.

(Sum of its digits at odd places) – (Sum of its digits at even places)

$= (2 + 8 + 6 + 7) - (2 + 3 + 4 + 5) = (23 - 14) = 9$, which is not divisible by 11.

$\therefore$ 57463822 is not divisible by 11.

SOLVED EXAMPLES

Ex. 1. *9587 – ? = 7429 – 4358.*

Sol. Let $9587 - x = 7429 - 4358$. Then,

$9587 - x = 3071 \Rightarrow x = 9587 - 3071 = \mathbf{6516}$

$$\begin{array}{r} 7429 \\ -\ 4358 \\ \hline 3071 \end{array}$$

Ex. 2. *5793405 × 9999 = ?*

Sol. $5793405 \times 9999 = 5793405 \times (10000 - 1)$

$= 57934050000 - 5793405$

$= 57928256595$

$$\begin{array}{r} 57934050000 \\ -5793405 \\ \hline 57928256595 \end{array}$$

Ex. 3. *839478 × 625 = ?*

Sol. $839478 \times 625 = 839478 \times 5^4$

$$= 839478 \times \left(\frac{10}{2}\right)^4 = \frac{839478 \times 10^4}{2^4}$$

$$= \frac{8394780000}{16} = 524673750$$

Ex. 4. *976 × 237 + 976 × 763 = ?*

Sol. Using distributive law, we get:

$976 \times 237 + 976 \times 763 = 976 \times (237 + 763)$
$= 976 \times 1000 = 976000.$

Ex. 5. *986 × 307 – 986 × 207 = ?*

Sol. By distributive law, we get

$986 \times 307 - 986 \times 207 = 986 \times (307 - 207)$
$= 986 \times 100 = 98600$

Ex. 6. *1607 × 1607 = ?*

Sol. $1607 \times 1607 = (1607)^2$
$= (1600 + 7)^2 = (1600)^2 + 7^2 + 2 \times 1600 \times 7$
$= 2560000 + 49 + 22400 = 2582449.$

2560000
+ 49
+ 22400
2582449

Ex. 7. *1396 × 1396 = ?*

Sol. $1396 \times 1396 = (1396)^2$
$= (1400 - 4)^2 = (1400)^2 + 4^2 - 2 \times 1400 \times 4$
$= 1960000 + 16 - 11200 = 1948816$

1960016
–11200
1948816

Ex. 8. *(475 × 475 + 125 × 125) = ?*

Sol. We have $(a^2 + b^2) = \frac{1}{2}\left[(a+b)^2 + (a-b)^2\right]$

$$\therefore\ (475)^2 + (125)^2 = \frac{1}{2}\cdot\left[(475+125)^2 + (475-125)^2\right]$$

$$= \frac{1}{2}\cdot\left[(600)^2 + (350)^2\right] = \frac{1}{2}\cdot[360000 + 122500]$$

$$= \frac{1}{2} \times 482500 = 241250.$$

Ex. 9. *(796 × 796 – 204 × 204) = ?*

Sol. $796 + 796 - 204 \times 204 = (796)^2 - (204)^2$
$= (796 + 204)(796 - 204)$ $\boxed{[\because (a^2 - b^2) = (a+b)(a-b)]}$
$= (1000 \times 593) = 592000.$

Ex. 10. *(387 × 387 + 113 × 113 + 2 × 387 × 113) = ?*

Sol. Given Exp. $= (387)^2 + (113)^2 + 2 \times 387 + 113$
$= (a^2 + b^2 + 2ab)$, where $a = 387$ and $b = 113$
$= (a + b)^2 = (387 + 113)^2 = (500)^2 = 250000$

Ex. 11. *(87 × 87 + 61 × 61 – 2 × 87 × 61) = ?*

Sol. Given Exp. $= (87)^2 + (61)^2 - 2 \times 87 \times 61$
$= (a^2 + b^2 - 2ab)$, where $a = 87$ and $b = 61$
$= (a - b)^2 = (87 - 61)^2 = (26)^2 = (20 + 6)^2$
$= (20)^2 + 6^2 + 2 \times 20 \times 6 = (400 + 36 - 240)$
$= (436 - 240) = 196.$

Ex. 12. *Find the least value of * for which 5967 * 13 is divisible by 3.*

Sol. Let the required value be x. Then,

$(5 + 9 + 6 + 7 + x + 1 + 3) = (31 + x)$ is divisible by 3.

$\therefore$ Least value of x is 2.

Ex. 13. *Find the least value of * for which 7*5462 is divisible by 9.*

Sol. Let the required value be x. Then.

$(7 + x + 5 + 4 + 6 + 2) = (24 + x)$ is divisible by 9.

Ex. 14. *Find the least value of * for which 4832 * 18 is divisible by 11.*

Sol. (Sum of digits at odd places) – (Sum of digits at even places)

$= (8 + x + 3 + 4) - (1 + 2 + 8) = (4 + x)$, which should be divisible by 11.

$\therefore \quad x = 7.$

Ex. 15. *Show that 52563744 is divisible by 24.*

Sol. $24 = 3 \times 8$, where 3 and 8 are co-prime.

Sum of digits = 36, which is divisible by 3.

So, the given number is divisible by 3.

The number formed by last 3 digits = 744, which is divisible by 8.

So, the given number is divisible by 8.

Hence, it is divisible by (3×8), *i.e.*, 24.

Ex. 16. *What least number must be subtracted from 1672 to obtain a number which is completely divisible by 17 ?*

Sol. 17) 1672 (98
153
142
136
6

Number to be subtracted = 6.

Ex. 17. *What least number must be added to 2010 to obtain a number which is completely divisible by 19?*

Sol. 19) 2010 (105
19
110
95
15

Number to be added = (19 – 15) = 4

Ex. 19. *On dividing 12401 by a certain number, we get 76 as quotient and 13 as remainder. What is the divisor ?*

Sol. [(Divisor) × (Quotient)] + Remainder = Dividend

$$\therefore \quad \text{Divisor} = \frac{(\text{Dividend}) - (\text{Remainder})}{\text{Quotient}}$$

$$= \frac{(12401 - 13)}{76} = \frac{\cancel{12388}\ \cancel{3097}^{163}}{\cancel{76}\ \cancel{19}_{1}} = 163.$$

Ex. 20. *On dividing a certain number by 342, we get 47 as remainder. If the same number is divided by 18, what will be the remainder ?*

Sol. Suppose that the on dividing the given number by 342, we get quotient = k and remainder = 47. Then,

$$\text{Number} = 342\,k + 47$$

$$= (18 \times 19\,k) + (18 \times 2) + 11$$

$$= 18 + (19\,k + 2) + 11.$$

So, the number when divided by 18 gives remainder = 11.

Ex. 21. *Simplify:*

$$\frac{789\times789\times789+211\times211\times211}{789\times789-789\times211+211\times211}=?$$

Sol. Given Ex.p. $=\dfrac{(789)^3+(211)^3}{(789)^2-(789\times211)+(211)^2}$

$=\dfrac{(a^3+b^3)}{(a^2-ab+b^2)}$, where $a = 789$ and $b = 211$

$= (a + b) = (789 + 211) = 1000.$

Ex. 22. *Simplify:*

$$\frac{658\times658\times658-328\times328\times328}{658\times658+658\times328+328\times328}=?$$

Sol. Given Exp. $=\dfrac{(658)^3-(328)^3}{(658)^2+658\times328+(328)^2}$

$=\dfrac{(a^3-b^3)}{(a^2+ab+b^2)}$, where $a = 658$ and $b = 328$

$= (a - b) = (658 - 328) = 330.$

Ex. 23. *Simplify:*

$$\frac{(893+786)^2-(893-786)^2}{(893\times786)}=?$$

Sol. Given Exp. $=\dfrac{(a+b)^2-(a-b)^2}{ab}$, where $a = 893$ and $b = 786$

$=\dfrac{4ab}{ab}=4$

Ex. 24. *What is the unit digit in the product (684 × 759 × 413 × 676) ?*

Sol. Unit digit in the given product

= Unit digit in the product $(4 \times 9 \times 3 \times 6) = 8$.

Ex. 25. *What is the unit digit in the product* $(3547)^{153} \times (251)^{72}$?

Sol. Required digit = unit digit in $(7^{153} \times 1^{72})$

Now, 7^4 gives unit digit 1 and $1^{72} = 1$.

$(7^{153} \times 1^{72}) = [(7^4)^{38} \times 7 \times 1]$

$\therefore$ Required unit digit $= (1 \times 7 \times 1) = 7$.

Ex. 26. *What is the unit digit in* $[(264)^{102} + (264)^{103}]$?

Sol. $(264)^{102} + (264)^{103} = (264)^{102}\ \{1 + 264\} = (264)^{102} + 265$.

Required unit digit = unit digit in $[(4)^{102} \times 5]$

= unit digit in $[(4^4)^{25} + 4^2 \times 5]$

= unit digit in $(6 \times 6 \times 5) = 0$.

Ex. 27. *Find the total number of prime factors in the product* $[(4)^{11} \times 7^5 \times (11)^2]$.

Sol. $\{(4)^{11} \times 7^5 \times (11)^2\} = (2 \times 2)^{11} \times 7^5 \times (11)^2 = (2^2)^{11} \times 7^5 + (11)^2$

$= (2^{22} \times 7^5 \times 11^2)$

Required number of factors $= (22 + 5 + 2) = 29$.

Ex. 28. *Find the remainder when 2^{31} is divided by 5.*

Sol. $2^{31} = (2^{10} \times 2^{10} \times 2^{10}) \times 2 = (2^{10})^3 \times 2 = (1024)^3 \times 2$

Unit digit in 2^{31} = Unit digit in $\{(1024)^3 \times 2\} = (4 \times 2) = 8$.

Now, 8 when divided by 5 gives 3 as remainder

$\therefore$ 2^{31} when divided by 5 gives remainder = 3.

Ex. 29. *A number when successively divided by 3, 5 and 8 leaves remainders 1, 4 and 7 respectively. Find the respective remainders if the order of divisors be reversed.*

Sol.

$$\begin{array}{r|l} 3 & x \\ \hline 5 & y - 1 \\ \hline 8 & z - 4 \\ \hline & 1 - 7 \end{array}$$

$\therefore z = (8 \times 1 + 7) = 15,\ y = (5 \times z + 4) = (5 \times 15 + 4) = 79$

$x = (3y + 1) = (3 \times 79 + 1) = (237 + 1) = 238.$

$$\begin{array}{r|l} 8 & 238 \\ \hline 5 & 29 - 6 \\ \hline 3 & 5 - 4 \\ \hline & 1 - 2 \end{array}$$

Hence, the respective remainders are 6, 4, 2.

Results On Some Series (Formulae)

(*i*) $(1 + 2 + 3 + \ldots + n) = \frac{1}{2} n(n+1)$

(*ii*) $(1^2 + 2^2 + 3^2 + \ldots + n^2) = \frac{1}{6} n(n+1)(2n+1)$

(*iii*) $(1^3 + 2^3 + 3^3 + \ldots + n^3) = \frac{1}{4} n^2(n+1)^2$

(*iv*) **Arithmetic Progression (A.P.)**

$a, a + d, a + 2d, a + 3d, \ldots$ are said to be in A.P. in which first term = a and common difference = d.

Let the nth term be t_n and let last term = $t_n = l$. Then

I. nth term = $a + (n - 1)d$

II. Sum of n terms $= \frac{n}{2}[2a + (n-1)d]$

III. Sum of n terms $= \frac{n}{2}(a + l)$, where l is the last term.

(*v*) **Geometric Progression (G.P)**

$a, ar, ar^2, ar^3, \ldots$ are said to be in G.P. in which first term = a and common ratio = r

I. nth term = ar^{n-1}

II. Sum of n terms $= \begin{cases} \dfrac{a(1-r^n)}{(1-r)}, & \text{when } r < 1 \\ \dfrac{a(r^n - 1)}{(r-1)}, & \text{when } r > 1 \end{cases}$

Ex. 30. *How many natural numbers between 17 and 80 are divisible by 6?*

Sol. These numbers are 18, 24, 30, 36, ..., 78.

This is an A.P. in which $a = 18$, $d = (24 - 18) = 6$ and $l = 78$.

Let the number of these terms be n. Then,

$t_n = 78 \Rightarrow a + (n - 1)d = 78$

$\Rightarrow 18 + (n - 1) \times 6 = 78 \Rightarrow (n - 1) \times 6 = 60 \Rightarrow (n - 1) = 10 \Rightarrow n = 11$

Required number of numbers = 11.

Ex. 31. *Find the sum of all even natural numbers less than 75.*

Sol. Required sum = 2 + 4 + 6 + ...+ 74

This is an A.P. in which $a = 2$, $d = (4 - 2) = 2$, $l = 74$

Clearly, $n = 37$.

$$\therefore \quad \text{Required sum} = \frac{n}{2}(a+l) = \frac{37}{2} \times (2+74) = (37 \times 38)$$
$$= 37 \times (40 - 2) = (37 \times 40) - (37 \times 2)$$
$$= (1480 - 74) = 1406.$$

Ex. 32. *(6 + 15 + 24 + 33 + ... + 105) = ?*

Sol. Given series in an A.P. in which $a = 6$, $d = (15 - 6) = 9$ and $l = 105$

Let the number of terms in it be n. Then,

$$a + (n - 1)\,d = 105 \Rightarrow 6 + (n - 1) \times 9 = 105$$
$$\Rightarrow \quad (n - 1) \times 9 = 99 \Rightarrow (n - 1) = 11 \Rightarrow n = 12$$

$$\text{Required sum} = \frac{n}{2}(a+l) = \frac{12}{2} \times (6+105) = (6 \times 111) = 666.$$

Ex. 33. *Find the sum* $(2 + 2^2 + 2^3 + 2^4 + ... + 2^{10})$

Sol. This is a G.P. in which $a = 2$, $r = \frac{2^2}{2} = \frac{4}{2} = 2$.

$$\text{Required sum} = \frac{a(r^n - 1)}{(r-1)} = \frac{2 \times (2^{10} - 1)}{(2-1)} = (2 \times 1023) = 2046$$

EXERCISE

Mark (✔) against the correct answer in each of the following:

1. The difference between the place value and the face value of 6 in the numeral 856973 is
(*a*) 973 (*b*) 6973 (*c*) 5994 (*d*) none of these

2. The difference between the local value and the face value of 7 in the numeral 32675149 is
(*a*) 75142 (*b*) 64851 (*c*) 5149 (*d*) 69993
(*e*) none of these

3. The difference between the place values of two sevens in the numeral 69758472 is
(*a*) 0 (*b*) 6993 (*c*) 699930 (*d*) none of these

4. The unit digit in the product (784 × 618 × 917 × 463) is:
(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5
(S.S.C. 2005)

5. What is the unit digit in 7^{105}?
(*a*) 1 (*b*) 5 (*c*) 7 (*d*) 9
(L.I.C. 2003)

6. What is the unit digit in the product $(3^{65} \times 6^{59} \times 7^{71})$?
(*a*) 1 (*b*) 2 (*c*) 4 (*d*) 6

7. What is the unit digit in $(7^{95} - 3^{58})$?
(*a*) 0 (*b*) 4 (*c*) 6 (*d*) 7

8. What is the unit digit in $(4137)^{754}$?
(*a*) 1 (*b*) 3 (*c*) 7 (*d*) 9

9. What is the unit digit in $\{(6374)^{1793} \times (625)^{317} \times (341)^{491}\}$?
(*a*) 0 (*b*) 2 (*c*) 3 (*d*) 5
(Bank P.O. 2003)

10. 7589 – ? = 3434
(*a*) 4242 (*b*) 4155 (*c*) 1123 (*d*) 11023
(*e*) none of these

11. 8597 – ? = 7429 – 4358
(*a*) 5426 (*b*) 5706 (*c*) 5526 (*d*) 5476
(*e*) none of these
(Bank P.O. 2007)

12. 3251 + 587 + 369 – ? = 3007
(*a*) 1250 (*b*) 1300 (*c*) 1375 (*d*) 1200
(*e*) none of these

13. (4300731) − ? = 2535618 (Bank P.O. 2007)
(a) 1865113 (b) 1775123 (c) 1765113 (d) 1675123
(e) none of these

14. (?) − 19657 − 33994 = 9999
(a) 63650 (b) 53760 (c) 59640 (d) 61560
(e) none of these

15. 3 + 33 + 333 + 3.33 = ?
(a) 362.3 (b) 372.33 (c) 702.33 (d) 702
(e) none of these

16. $9\frac{3}{4}+7\frac{2}{17}-9\frac{1}{15}=?$ (Bank P.O. 2006)
(a) $7\frac{719}{1020}$ (b) $9\frac{817}{1020}$ (c) $9\frac{719}{1020}$ (d) $7\frac{817}{1020}$
(e) none of these

17. −84 × 29 + 365 = ? (Bank P.O. 2007)
(a) 2436 (b) 2801 (c) −2801 (d) −2071
(e) none of these

18. (35423 + 7164 + 41720) − (317 × 89) = ?
(a) 28213 (b) 84307 (c) 50694 (d) 54094
(e) none of these

19. 9548 + 7314 − 8362 = ?
(a) 8230 (b) 8410 (c) 8500 (d) 8600
(e) none of these

20. (?) + 3699 + 1985 − 2047 = 31111
(a) 34748 (b) 27474 (c) 30154 (d) 27574
(e) none of these

21. 4500 × ? = 3375 (Bank P.O. 2007)
(a) $\frac{2}{5}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) $\frac{3}{5}$
(e) none of these

22. If 1400 × x = 1050. Then, x = ?
(a) $\frac{1}{4}$ (b) $\frac{3}{5}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$
(e) none of these

23. $(1000)^9 \div 10^{24} = ?$ (Bank P.O. 2006)
(a) 10000 (b) 1000 (c) 100 (d) 10
(e) none of these

24. 8988 ÷ 8 ÷ 4 = ? (Bank P.O. 2007)
(a) 4494 (b) 561.75 (c) 2247 (d) 280.875
(e) none of these

25. 666 ÷ 6 ÷ 3 = ? (Bank P.O. 2006)
(a) 37 (b) 333 (c) 111 (d) 84
(e) none of these

26. (800 ÷ 64) × (1296 ÷ 36) = ? (Bank P.O. 2007)
(a) 420 (b) 460 (c) 500 (d) 540
(e) none of these

27. $(12)^3 \times 6^4 \div 432 = ?$ (Bank P.O. 2007)
(a) 5184 (b) 5060 (c) 5148 (d) 5084
(e) none of these

28. 35 + 15 × 1.5 = ? (Bank P.O. 2006)
(a) 75 (b) 51.5 (c) 57.5 (d) 5.25
(e) none of these

29. $5358 \times 51 = ?$ (R.B.I. 2003)
(*a*) 273258 (*b*) 273268 (*c*) 273348 (*d*) 273358

30. $587 \times 999 = ?$
(*a*) 586413 (*b*) 587523 (*c*) 614823 (*d*) 615173

31. $3897 \times 999 = ?$
(*a*) 3883203 (*b*) 3893103 (*c*) 3639403 (*d*) 3791203
(*e*) none of these

32. $72519 \times 9999 = ?$
(*a*) 725117481 (*b*) 674217481 (*c*) 685126481 (*d*) 696217481
(*e*) none of these

33. $2056 \times 987 = ?$
(*a*) 1936372 (*b*) 2029272 (*c*) 1896172 (*d*) 1923472
(*e*) none of these

34. $1904 \times 1904 = ?$
(*a*) 3654316 (*b*) 3632646 (*c*) 3625216 (*d*) 3623436
(*e*) none of these

35. $1397 \times 1397 = ?$
(*a*) 1951609 (*b*) 1981709 (*c*) 18362619 (*d*) 2031719
(*e*) none of these

36. $107 \times 107 + 93 \times 93 = ?$
(*a*) 19578 (*b*) 19418 (*c*) 20098 (*d*) 21908
(*e*) none of these

37. $217 \times 217 + 183 \times 183 = ?$ (Hotel Management 2002)
(*a*) 79698 (*b*) 80578 (*c*) 80698 (*d*) 81268

38. $106 \times 106 - 94 \times 94 = ?$ (R.R.B. 2006)
(*a*) 2400 (*b*) 2000 (*c*) 1904 (*d*) 1906
(*e*) none of these

39. $8796 \times 223 + 8796 \times 77 = ?$
(*a*) 2736900 (*b*) 2638800 (*c*) 2658560 (*d*) 2716740
(*e*) none of these

40. $287 \times 287 + 269 \times 269 - 2 \times 287 \times 269 = ?$
(*a*) 534 (*b*) 446 (*c*) 354 (*d*) 324
(*e*) none of these

41. $\{(476 + 424)^2 - 4 \times 476 \times 424\} = ?$
(*a*) 2906 (*b*) 3116 (*c*) 2704 (*d*) 2904
(*e*) none of these

42. $(112 \times 5^4) = ?$ (M.B.A. 2002)
(*a*) 67000 (*b*) 70000 (*c*) 76500 (*d*) 77200

43. $(935421 \times 625) = ?$
(*a*) 575648125 (*b*) 584638125 (*c*) 584649125 (*d*) 585628125

44. $(12345679 \times 72) = ?$
(*a*) 88888888 (*b*) 888888888 (*c*) 898989898 (*d*) 9999999998

45. $397 \times 397 + 104 \times 104 + 2 \times 397 \times 104 = ?$
(*a*) 250001 (*b*) 251001 (*c*) 260101 (*d*) 261001

46. If $(64)^2 - (36)^2 = 20 \times x$, then $x = ?$
(*a*) 70 (*b*) 120 (*c*) 180 (*d*) 140
(*e*) none of these

47. $\dfrac{(489+375)^2-(489-375)^2}{(489 \times 375)} = ?$
(*a*) 144 (*b*) 864 (*c*) 2 (*d*) 4
(*e*) none of these

48. $\dfrac{(963+476)^2+(963-476)^2}{(963 \times 963+476 \times 476)} = ?$

(a) 1449 (b) 497 (c) 2 (d) 4
(e) none of these

49. $\dfrac{768\times768\times768+232\times232\times232}{768\times768-768\times232+232\times232}=?$

(a) 1000 (b) 536 (c) 500 (d) 268
(e) none of these

50. $\dfrac{854\times854\times854-276\times276\times276}{854\times854+854\times276+276\times276}=?$

(a) 1130 (b) 578 (c) 565 (d) 1156
(e) none of these

51. $\dfrac{753\times753+247\times247-753\times247}{753\times753\times753+247\times247\times247}=?$

(a) $\dfrac{1}{1000}$ (b) $\dfrac{1}{506}$ (c) $\dfrac{253}{500}$ (d) none of these

52. If the number 517 * 324 is completely divisible by 3, then the smallest whole number in place of * will be
(a) 0 (b) 1 (c) 2 (d) none of these

53. If the number 481 * 673 is completely divisible by 9, then the smallest whole number in place of * will be:
(a) 2 (b) 5 (c) 6 (d) 7
(e) none of these

54. If the number 97215 * 6 is completely divisible by 11, then the smallest whole number in place of * will be:
(a) 3 (b) 2 (c) 1 (d) 5
(e) none of these

55. If the number 91876 * 2 is completely divisible by 8, then the smallest whole number in place of * will be:
(a) 1 (b) 2 (c) 3 (d) 4
(e) none of these

56. Which one of the following numbers is completely divisible by 45 ?
(a) 181560 (b) 331145 (c) 202860 (d) 2033550
(e) none of these

57. Which one of the following numbers is completely divisible by 99 ?
(a) 3572404 (b) 135792 (c) 913464 (d) 114345
(e) none of these

58. If the number 42573 * is exactly divisible by 72, then the minimum value of * is:
(a) 4 (b) 5 (c) 6 (d) 7 (e) 8

59. If x and y are the two digits of the number 653 xy such that this number is divisible by 80, then $x + y = ?$
(a) 2 (b) 3 (c) 4 (d) 6
(e) none of these

60. If the product 4864 × 9 P 2 is divisible by 12, the value of P is:
(a) 2 (b) 5 (c) 6 (d) 8
(e) none of these

61. If the number 5 * 2 is divisible by 6, then * = ?
(a) 2 (b) 3 (c) 6 (d) 7

62. Which of the following numbers is divisible by 24 ?
(a) 35718 (b) 63810 (c) 537804 (d) 3125736

63. How many of the following numbers are divisible by 132 ?
264, 396, 462, 792, 968, 2178, 5184, 6336
(a) 4 (b) 5 (c) 6 (d) 7

(Hotel Management, 2002)

64. 476 ** 0 is divisible by both 3 and 11. The non-zero digits in the hundred's and ten's places are respectively:
(a) 7 and 4 (b) 7 and 5 (c) 8 and 5 (d) none of these

65. Which one of the following numbers is exactly divisible by 11 ? (C.D.S. 2003)
(a) 235641 (b) 245642 (c) 315624 (d) 415624

66. How many 3 digit numbers are divisible by 6 in all ?
(a) 149 (b) 150 (c) 151 (d) 166

67. The sum of fist 45 natural numbers is :
(a) 1035 (b) 1280 (c) 2070 (d) 2140

68. The sum of even numbers between 1 and 31 is :
(a) 6 (b) 128 (c) 240 (d) 512

69. (51 + 52 + 53 + ... + 100) = ?
(a) 2525 (b) 2975 (c) 3225 (d) 3775

70. The smallest prime number is:
(a) 0 (b) 1 (c) 2 (d) 3

71. The sum of first five prime numbers is :
(a) 11 (b) 18 (c) 26 (d) 28

72. How many prime numbers are less than 50 ?
(a) 16 (b) 15 (c) 14 (d) 18

73. Which of the following is a prime number ?
(a) 33 (b) 81 (c) 93 (d) 97

74. Which one of the following is not a prime number ?
(a) 31 (b) 61 (c) 71 (d) 91

75. Which one of the following is a prime number ?
(a) 161 (b) 221 (c) 373 (d) 437
(e) none of these

76. Which one of the following is a prime number ?
(a) 119 (b) 187 (c) 247 (d) 551
(e) none of these

77. The smallest 3-digit prime number is:
(a) 103 (b) 107 (c) 109 (d) 113
(e) none of these

78. If a and b are odd numbers, then which of the following is even ?
(a) $a + b$ (b) $a + b + 1$ (c) ab (d) $ab + 2$
(e) none of these

79. Which one of the following cannot be the square of a natural number ?
(a) 30976 (b) 75625 (c) 28561 (d) 143642
(e) none of these

80. Which one of the following cannot be the square of a natural number ?
(a) 32761 (b) 81225 (c) 42437 (d) 20164
(e) none of these

81. What smallest number should be added to 4456 so that the sum is completely divisible by 6 ?
(a) 4 (b) 3 (c) 2 (d) 1
(e) none of these

82. Which natural number is nearest to 9217, which is completely divisible by 88 ?
(a) 9152 (b) 9240 (c) 9064 (d) 9184
(e) none of these

83. Which natural number is nearest to 8485, which is completely divisible by 75 ?
(a) 8475 (b) 8500 (c) 8550 (d) 8525
(e) none of these

84. The largest 4-digit number exactly divisible by 88 is
(a) 9944 (b) 9768 (c) 9988 (d) 8888
(e) none of these

85. The largest 5-digit number exactly divisible by 91 is
(a) 99921 (b) 99918 (c) 99981 (d) 99971
(e) none of these

86. What least number must be subtracted from 13601, so that the remainder is divisible by 87 ?
(a) 23 (b) 31 (c) 29 (d) 37
(e) 49

87. What least number must be added to 1056, so that the sum is completely divisible by 23 ?
(a) 2 (b) 3 (c) 18 (d) 21
(e) none of these

88. The smallest 5-digit number exactly divisible by 41 is :
(a) 10041 (b) 10004 (c) 10045 (d) 10025
(e) none of these

89. The smallest 6-digit number exactly divisible by 111 is :
(a) 111111 (b) 110011 (c) 100011 (d) 110101
(e) none of these

90. In a division sum, the divisor is 10 times the quotient and 5 times the remainder. If the remainder is 46, what is the dividend ?
(a) 4236 (b) 4306 (c) 4336 (d) 5336
(e) none of these

91. On dividing a number by 68, we get 269 as ~~dividend~~ Quotient and 0 as remainder. On dividing the same number by 67, what will be the remainder ? (S.S.C. 2005)
(a) 0 (b) 1 (c) 2 (d) 3

92. On dividing a number by 56, we get 29 as remainder. On dividing the same number by 8, what will be the remainder ? (S.S.C 2007)
4
(a) 4 (b) 5 (c) 6 (d) 7

93. On dividing a number by 357, we get 39 as remainder. On dividing the same number by 17, what will be the remainder ? (S.S.C. 2005)
(a) 0 (b) 3 (c) 5 (d) 11

94. On dividing a number by 5, we get 3 as remainder. What will be the remainder when the square of this number is divided by 5 ? (S.S.C. 2005)
4 1
(a) 0 (b) 1 (c) 2 (d) 4

95. The difference of two numbers is 1365. On dividing the larger number by the smaller, we get 6 as quotient and 15 as remainder. What is the smaller number ? (L.I.C. 2003)
(a) 240 (b) 270 (c) 295 (d) 360

96. In a division sum, the remainder is 0. As student mistook the divisor by 12 instead of 21 and obtained 35 as quotient. What is the correct quotient ? (S.S.C. 2003)
(a) 0 (b) 12 (c) 13 (d) 20

97. The sum of the two numbers is 12 and their product is 35. What is the sum of the reciprocals of these numbers ? (S.S.C. 2007)
(a) $\frac{12}{35}$ (b) $\frac{1}{35}$ (c) $\frac{35}{8}$ (d) $\frac{7}{32}$

98. If 60% of $\frac{3}{5}$ of a number is 36, then the number is :
(a) 80 (b) 100 (c) 75 (d) 90

99. The difference between a positive proper fraction and its reciprocal is $\frac{9}{20}$. The fraction is : (S.S.C. 2006)
(a) $\frac{3}{5}$ (b) $\frac{3}{10}$ (c) $\frac{4}{5}$ (d) $\frac{5}{4}$

100. On dividing 2272 as well as 875 by 3-digit number N, we get the same remainder. The sum of the digits of N is : (S.S.C. 2007)
(a) 10 (b) 11 (c) 12 (d) 13

101. On multiplying a number by 7, the product is a number each of whose digits is 3. The smallest such number is : (S.S.C. 2006)
(a) 47619 (b) 47719 (c) 48619 (d) 47649

102. The difference of the squares of two consecutive even integers is divisible by which of the following integers ? (M.B.A. 2003)
(a) 3 (b) 4 (c) 6 (d) 7

103. The difference of the squares of two consecutive odd integers is divisible by which of the following integers ? (M.B.A. 2003)
(a) 3 (b) 6 (c) 7 (d) 8

104. If n is a natural number, then $(6n^2 + 6n)$ is always divisible by : (*M.B.A. 2005*)
(*a*) 6 only (*b*) 6 and 12 both (*c*) 12 only (*d*) by 18 only

105. n is a whole number which when divided by 4 gives 3 as remainder. What will be the remainder when $2n$ is divided by 4 ?
(*a*) 3 (*b*) 2 (*c*) 1 (*d*) 0

106. What will be the remainder when $(67^{67} + 67)$ is divided by 68 ?
(*a*) 1 (*b*) 63 (*c*) 66 (*d*) 67

107. Which of the following numbers will completely divide $(49^{15} - 1)$?
(*a*) 8 (*b*) 14 (*c*) 48 (*d*) 50

108. $(x^n - a^n)$ is completely divisible by $(x - a)$, when
(*a*) n is any natural number (*b*) n is an even natural number
(*c*) n is an odd natural number (*d*) n is prime

109. What will be the remainder when 17^{200} is divided by 18 ? (*S.S.C. 2006*)
(*a*) 17 (*b*) 16 (*c*) 1 (*d*) 2

110. Which one of the following is the common factor of $(47^{43} + 43^{43})$ and $(47^{47} + 43^{47})$?
(*a*) $(47 - 43)$ (*b*) $(47 + 43)$ (*c*) $(47^{43} + 43^{43})$ (*d*) none of these

111. It is being given that $(2^{32} + 1)$ is completely divisible by a whole number. Which of the following numbers is completely divisible by this number ? (*S.S.C. 2007*)
(*a*) $(2^{16} + 1)$ (*b*) $(2^{16} - 1)$ (*c*) 7×2^{33} (*d*) $(2^{96} + 1)$

112. Which one of the following numbers will completely divide $(4^{61} + 4^{62} + 4^{63} + 4^{64})$?
(*a*) 3 (*b*) 10 (*c*) 11 (*d*) 13

113. Which one of the following numbers will completely divide $(3^{25} + 3^{26} + 3^{27} + 3^{28})$?
(*a*) 11 (*b*) 16 (*c*) 25 (*d*) 30

114. 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, $(a + b) = ?$
(*a*) 10 (*b*) 11 (*c*) 12 (*d*) 15

115. If x and y are positive integers such that $(3x + 7y)$ is a multiple of 11, then which of the following will be divisible by 11 ?
(*a*) $4x + 6y$ (*b*) $x + y + 4$ (*c*) $9x + 4y$ (*d*) $4x - 9y$

116. If the number 653 xy is divisible by 90, then $(x + y) = ?$
(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 6

117. How many of the following numbers are divisible by 3 but not by 9 ?
2133, 2343, 3474, 4131, 5286, 5340, 6336, 7347, 8115, 9276
(*a*) 5 (*b*) 6 (*c*) 7 (*d*) none of these

118. Which of the following numbers is divisible by each one of 3, 7, 9 and 11 ?
(*a*) 639 (*b*) 2079 (*c*) 3791 (*d*) 37911
(*e*) none of these

119. How many of the following numbers are divisible by 132 ? (*Hotel Management, 2002*)
264, 396, 462, 792, 968, 2178, 5184, 6336
(*a*) 4 (*b*) 5 (*c*) 6 (*d*) 7

120. A number when divided by 6 leaves a remainder 3. When the square of the number is divided by 6, the remainder is :
(*a*) 0 (*b*) 1 (*c*) 2 (*d*) 3

121. A number when divided successively by 4 and 5 leaves remainders 1 and 4 respectively. When it is successively divided by 5 and 4, then the respective remainders will be (*S.S.C. 2003*)
(*a*) 1, 2 (*b*) 2, 3 (*c*) 3, 2 (*d*) 4, 1

122. 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

123. In dividing a number by 585, a student employed the method of short division. He divided the number successively by 5, 9 and 13 (factors of 585) and got the remainders 4, 8, 12 respectively. If he had divided the number by 585, the remainder would have been
(*a*) 24 (*b*) 144 (*c*) 292 (*d*) 584

124. When a number is divided by 13, the remainder is 11. When the same number is divided by 17, the remainder is 9. What is the number ?

(a) 339 (b) 349 (c) 369 (d) data inadequate

125. A number when divided by 296 leaves 75 as remainder. When the same number is divided by 37, the remainder will be : (C.B.I. 2003)

(a) 1 (b) 2 (c) 8 (d) 11

126. A boy multiplied 987 by a certain number and obtained 559981 as his answer. If in the answer both 98 are wrong and the other digits are correct, then the correct answer would be :

(a) 553681 (b) 555181 (c) 555681 (d) 556581

127. How many of the following numbers are completely divisible by 132 ?
264, 396, 462, 792, 968, 2178, 5184, 6336

(a) 4 (b) 5 (c) 6 (d) 7

128. How many 3-digit numbers are completely divisible by 6 ?

(a) 149 (b) 150 (c) 151 (d) 166

129. The sum of first 45 natural numbers is :

(a) 1035 (b) 1280 (c) 2070 (d) 2140

130. The sum of all even natural numbers between 1 and 31 is

(a) 16 (b) 128 (c) 240 (d) 512

131. $(51 + 52 + 53 + \ldots + 100) = ?$

(a) 2525 (b) 2975 (c) 3225 (d) 3775

132. $\left(1-\frac{1}{n}\right)+\left(1-\frac{2}{n}\right)+\left(1-\frac{3}{n}\right)+\ldots$ upto n terms = ?

(a) $\frac{1}{2}n$ (b) $\frac{1}{2}(n-1)$ (c) $\frac{1}{2}n(n-1)$ (d) none of these

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

(a) 8 (b) 11 (c) 12 (d) 13 (e) none of these

134. The sum of all two digit numbers divisible by 5 is

(a) 1035 (b) 1245 (c) 1230 (d) 945 (e) none of these

135. The sum of how many terms of the series 6 + 12 + 18 + 24 + ... is 1800 ?

(a) 16 (b) 24 (c) 20 (d) 18 (e) 22

136. How many terms are there in the G.P. 3, 6, 12, 24, ..., 384 ?

(a) 8 (b) 9 (c) 10 (d) 11 (e) 7

137. $2 + 2^2 + 2^3 + \ldots + 2^9 = ?$

(a) 2044 (b) 1022 (c) 1056 (d) none of these

138. $(1^2 + 2^2 + 3^2 + \ldots + 10^2) = ?$

(a) 330 (b) 345 (c) 365 (d) 385

139. $(2^2 + 4^2 + 6^2 + \ldots + 20^2) = ?$

(a) 770 (b) 1155 (c) 1540 (d) 385×385

140. $(11^2 + 12^2 + 13^2 + \ldots + 20^2) = ?$

(a) 385 (b) 2485 (c) 2870 (d) 3255

ANSWERS

1. (c)	**2.** (d)	**3.** (c)	**4.** (a)	**5.** (c)	**6.** (c)	**7.** (b)	**8.** (d)
9. (a)	**10.** (b)	**11.** (c)	**12.** (d)	**13.** (c)	**14.** (a)	**15.** (b)	**16.** (d)
17. (d)	**18.** (c)	**19.** (c)	**20.** (b)	**21.** (b)	**22.** (d)	**23.** (b)	**24.** (d)
25. (a)	**26.** (e)	**27.** (e)	**28.** (c)	**29.** (a)	**30.** (a)	**31.** (b)	**32.** (a)
33. (b)	**34.** (c)	**35.** (a)	**36.** (c)	**37.** (b)	**38.** (a)	**39.** (b)	**40.** (d)
41. (c)	**42.** (b)	**43.** (b)	**44.** (b)	**45.** (b)	**46.** (d)	**47.** (d)	**48.** (c)
49. (a)	**50.** (b)	**51.** (a)	**52.** (c)	**53.** (d)	**54.** (a)	**55.** (c)	**56.** (c)
57. (d)	**58.** (c)	**59.** (a)	**60.** (e)	**61.** (a)	**62.** (d)	**63.** (a)	**64.** (c)
65. (d)	**66.** (b)	**67.** (a)	**68.** (c)	**69.** (d)	**70.** (c)	**71.** (d)	**72.** (b)
73. (d)	**74.** (d)	**75.** (c)	**76.** (e)	**77.** (e)	**78.** (a)	**79.** (d)	**80.** (c)
81. (c)	**82.** (b)	**83.** (a)	**84.** (a)	**85.** (b)	**86.** (c)	**87.** (a)	**88.** (b)
89. (c)	**90.** (d)	**91.** (b)	**92.** (b)	**93.** (c)	**94.** (d)	**95.** (b)	**96.** (d)
97. (a)	**98.** (b)	**99.** (c)	**100.** (a)	**101.** (a)	**102.** (b)	**103.** (d)	**104.** (b)
105. (b)	**106.** (c)	**107.** (a)	**108.** (a)	**109.** (c)	**110.** (b)	**111.** (a)	**112.** (b)
113. (d)	**114.** (a)	**115.** (d)	**116.** (c)	**117.** (b)	**118.** (b)	**119.** (a)	**120.** (d)
121. (b)	**122.** (a)	**123.** (d)	**124.** (b)	**125.** (a)	**126.** (b)	**127.** (a)	**128.** (b)
129. (a)	**130.** (c)	**131.** (d)	**132.** (b)	**133.** (d)	**134.** (d)	**135.** (b)	**136.** (a)
137. (b)	**138.** (d)	**139.** (c)	**140.** (b)				

SOLUTION

1. (Place value of 6) – (Face vlaue of 6)

$= (6000 - 6) = 5994.$

2. (Local value of 7) – (Face value of 7)

$= (70000 - 7) = 69993.$

3. Required difference $= (700000 - 70) = 699930.$

4. Unit digit in the given product = Unit digit in $(4 \times 8 \times 7 \times 3) = 2$

5. Unit digit in 7^{105} = Unit digit in $[(7^4)^{26} \times 7]$

But, unit digit in $(7^4)^{26} = 1.$

$\therefore$ Unit digit in $7^{105} = (1 \times 7) = 7.$

6. Unit digit in $3^4 = 1 \Rightarrow$ Unit digit in $(3^4)^{16} = 1$

$\therefore$ Unit digit in 3^{65} = Unit digit in $[(3^4)^{16} \times 3] = (1 \times 3) = 3$

Unit digit in $6^{59} = 6$

Unit digit in $7^4 = 1 \Rightarrow$ Unit digit in $(7^4)^{17}$ is 1.

Unit digit in 7^{71} = Unit digit in $[(7^4)^{17} \times 7^3] = (1 \times 3) = 3$

$\therefore$ Required digit = Unit digit in $(3 \times 6 \times 3) = 4.$

7. Unit digit n 7^{95} = Unit digit in $[(7^4)^{23} \times 7^3] = (1 \times 3) = 3$

Unit digit in 3^{58} = Unit digit in $[(3^4)^{14} \times 3^2] = (1 \times 9) = 9.$

Unit digit in $(7^{95} - 3^{58}) = (13 - 9) = 4.$

8. Unit digit in $(4137)^{754}$ = Unit digit in $\left\{\left\{(4137)^4\right\}^{188} \times (4137)^2\right\} = (1 \times 9) = 9$

9. Unit digit in $(6374)^{1793}$ = Unit digit in $(4)^{1793}$

= Unit digit in $[(4^2)^{896} \times 4]$

= Unit digit in $(6 \times 4) = 4.$

Unit digit in $(625)^{317}$ = Unit digit in $(5)^{317} = 5.$

Unit digit in $(341)^{491}$ = Unit digit in $(1)^{491} = 1$

Required digit = Unit digit in $(4 \times 5 \times 1) = 0.$

10. Let $7589 - x = 3434$.

Then, $x = 7589 - 3434$

$= 4155$

$$\begin{array}{r} 7589 \\ -\ 3434 \\ \hline 4155 \\ \hline \end{array}$$

11. $$\begin{array}{r} 7429 \\ -4358 \\ \hline 3071 \\ \hline \end{array}$$

Let $8597 - x = 3071$

Then, $x = 8597 - 3071$

$$\begin{array}{r} 8597 \\ -\ 3071 \\ \hline 5526 \\ \hline \end{array}$$

12. $$\begin{array}{r} 3251 \\ +\ 587 \\ +\ 369 \\ \hline 4207 \\ \hline \end{array}$$

Let $4207 - x = 3007$

Then, $x = 4207 - 3007 = 1200$.

13. Let $4300731 - x = 2535618$

Then, $x = 4300731 - 2535618$

$$\begin{array}{r} 4300731 \\ -2535618 \\ \hline 1765113 \\ \hline \end{array}$$

14. $$\begin{array}{r} 19657 \\ 33994 \\ \hline 53651 \\ \hline \end{array}$$

Let $x - 53651 = 9999$

Then, $x = 9999 + 53651 = 9999 + 1 + 53650$

$= 10000 + 53650 = 63650$.

15. $$\begin{array}{r} 3 \\ +\ \ 33 \\ +\ 333 \\ +\ \ \ 3.33 \\ \hline 372.33 \\ \hline \end{array}$$

16. Given sum $= 9+\frac{3}{4}+7+\frac{2}{17}-\left(9+\frac{1}{15}\right)$

$$=(9+7-9)+\left(\frac{3}{4}+\frac{2}{17}-\frac{1}{15}\right)$$

$$=7+\frac{765+120-68}{1020}=7\frac{817}{1020}$$

17. Given Exp. $= -84 \times (30 - 1) + 365$

$= -(84 \times 30) + 84 + 365$

$= -2520 + 449 = -2071$

$$\begin{array}{r} -\ 2520 \\ +\ \ \ 449 \\ \hline -\ 2071 \\ \hline \end{array}$$

18. $$\begin{array}{r} 35423 \\ +\ 7164 \\ +\ 41720 \\ \hline 84307 \\ -\ 28213 \\ \hline 54094 \\ \hline \end{array}$$

$317 \times 89 = 317 \times (90 - 1)$

$= (317 \times 90 - 317)$

$= (28530 - 317) = 28213$

9. $$\begin{array}{r} 9548 \\ +\ 7314 \\ \hline 16862 \\ \hline \end{array}$$

$16862 = 8362 + x \Rightarrow x = 16862 - 8362 = 8500$.

20. $x + 3699 + 1985 - 2047 = 31111$

$\Rightarrow \quad x + 3699 + 1985 = 31111 + 2047$

$\Rightarrow \quad x + 5684 = 33158$

$\Rightarrow \quad x = 33158 - 5684 = 27474.$

$$\begin{array}{r} 33158 \\ -5684 \\ \hline 27474 \end{array}$$

21. $4500 \times x = 3375 \quad \Rightarrow \quad x = \frac{\cancel{3375}^{75}}{\cancel{4500}_{100}} = \frac{3}{4}$

45)3375(75
315
225
225
×

22. $1400 \times x = 1050 \Rightarrow x = \frac{1050}{1400} = \frac{3}{4}.$

23. Given Exp. $= \frac{(1000)^9}{10^{24}} = \frac{(10^3)^9}{10^{24}} = \frac{10^{27}}{10^{24}} = 10^{(27-24)} = 10^3 = 1000.$

24. Given Exp. $8988 \times \frac{1}{8} \times \frac{1}{4} = \frac{2247}{8} = 280.875.$

25. Given Exp. $= 666 \times \frac{1}{6} \times \frac{1}{3} = 37.$

26. Given Exp. $= \frac{300^{\,50}}{64_{\,4}} \times \frac{\cancel{1296}^{\,\cancel{216}\,\cancel{36}\,9}}{36_{\,\cancel{6}\,4}} = 450.$

27. Given Exp. $= \frac{(12)^3 \times 6^4}{432} = \frac{(12)^3 \times 6^4}{12 \times 6^2} = (12)^2 \times 6^2 = (72)^2 = 70.$

28. Given Exp. $= 35 + 15 \times \frac{3}{2} = 35 + \frac{45}{2} = 35 + 22.5 = 57.5.$

29. $5358 \times 51 = 5358 \times (50 + 1)$

$= 5358 \times 50 + 5358 \times 1$

$= 267900 + 5358 = 273258.$

$$\begin{array}{r} 267900 \\ +\ 5358 \\ \hline 273258 \end{array}$$

30. $587 \times 999 = 587 \times (1000 - 1)$

$= 587 \times 1000 - 587 - 1 = 587000 - 587 = 586413$

31. $3897 \times 999 = 3897 \times (1000 - 1)$

$= 3897 \times 1000 - 3897 \times 1$

$= 3897000 - 3897 = 3893103$

$$\begin{array}{r} 3897000 \\ -\ 3897 \\ \hline 3893103 \end{array}$$

32. $7259 \times 9999 = 72519 \times (10000 - 1)$

$= 72519 \times 10000 - 72519 \times 1$

$= 725190000 - 72519 = 725117481$

$$\begin{array}{r} 725190000 \\ -72519 \\ \hline 725117481 \end{array}$$

33. $2056 \times 987 = 2056 \times (1000 - 13)$

$= 2056 \times 1000 - 2056 \times 13$

$= 2056000 - 26728 = 2029272$

$$\begin{array}{r} 2056000 \\ -26728 \\ \hline 2029272 \end{array}$$

34. $1904 \times 1904 = (1904)^2 = (1900 + 4)^2$

$= (1900)^2 + 4^2 + 2 \times 1900 \times 4 = 3610000 + 16 + 15200$

$3610016 + 15200 = 3625216.$

35. $1397 \times 1397 = (1397)^2 = (1400 - 3)^2$
$= (1400)^2 + 3^2 - 2 \times 1400 \times 3 = 1960000 + 9 - 8400$
$= 1960009 - 8400 = 1951609.$

$$\begin{array}{r} 1960009 \\ -8400 \\ \hline 1951609 \\ \hline \end{array}$$

36. $107 \times 107 + 93 \times 93 = (107)^2 + (93)^2 = (100 + 7)^2 + (100 - 7)^2$
$= 2 \times [(100)^2 + 7^2]$ $\quad [\because (a + b)^2 + (a - b)^2 = 2(a^2 + b^2)]$

37. $(217)^2 + (183)^2 = (200 + 17)^2 + (200 - 17)^2$
$= 2[(200)^2 + (17)^2]$ $\quad [(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)]$
$= 2[40000 + 289] = (2 \times 40289) = 80578.$

38. $106 \times 106 - 94 \times 94 = (106)^2 - (94)^2 = (106 + 94)(106 - 94)$ $\quad [(a^2 - b^2) = (a + b)(a - b)]$
$= (200 \times 12) = 2400.$

39. $8796 \times 223 + 8796 \times 77 = 8796 \times (223 + 77)$ [*by distributive law*]
$= (8796 \times 300) = 2638800.$

40. Given Exp. $= a^2 + b^2 - 2ab$, where $a = 287$ and $b = 269$
$= (a - b)^2 = (287 - 269)^2 = (18)^2 = 324.$

41. Given Exp. $= [(a + b)^2 - 4ab]$, where $a = 476$ and $b = 424$
$= [(476 + 424)^2 - 4 \times 476 \times 424]$
$= [(900)^2 - 807296] = 810000 - 807296 = 2704$

42. $$(112 \times 5^4) = 112 \times \left(\frac{10}{2}\right)^4 = \frac{112 \times 10^4}{2^4} = \frac{1120000}{16} = 70000.$$

43. $$935421 \times 625 = 935421 \times 5^4 = 935421 \times \left(\frac{10}{2}\right)^4$$

$$\frac{935421 \times 10^4}{2^4} = \frac{9354210000}{16}$$

$= 584638125$

44. $12345679 \times 72 = 12345679 \times (70 + 2)$
$= 12345679 \times 70 + 12345679 \times 2$
$= 864197530 + 24691358$
$= 888888888$

$$\begin{array}{r} 864197530 \\ 24691358 \\ \hline 888888888 \\ \hline \end{array}$$

45. Given Exp. $= (397)^2 + (104)^2 + 2 \times 397 \times 104$
$= (397 + 104)^2 = (501)^2 = (500 + 1)^2$
$= (500)^2 + 1^2 + 2 \times 500 \times 1 = 250000 + 1 + 1000$
$= 251001$

46. $20 \times x = (64 + 36)(64 - 36) = 100 \times 28$

$$\Rightarrow \qquad x = \frac{100 \times 28}{20} = 140.$$

47. Given Exp. $$= \frac{(a+b)^2 - (a-b)^2}{ab} = \frac{4ab}{ab} = 4.$$

48. Given Exp. $$= \frac{(a+b)^2 + (a-b)^2}{(a^2+b^2)} = \frac{2(a^2+b^2)}{(a^2+b^2)} = 2.$$

49. Given Exp. $$\frac{(a^3+b^3)}{(a^2-ab+b^2)} = (a+b) = (768+232) = 1000.$$

50. Given Exp. $\dfrac{(a^3-b^3)}{(a^2+ab+b^2)}=(a-b)=(854-276)=578.$

51. Given Exp. $=\dfrac{(a^2+b^2-ab)}{(a^3-b^3)}=\dfrac{1}{(a+b)}=\dfrac{1}{(753+247)}=\dfrac{1}{1000}.$

52. Sum of digits = (5 + 1 + 7 + x + 3 + 2 + 4) = (22 + x), which must be divisible by 3.
$\therefore$ $x = 2$.

53. Sum of digits = (4 + 8 + 1 + x + 6 + 7 + 3) = (29 + x), which must be divisible by 9.
$\therefore$ $x = 7$.

54. Given number = 97215x6
(6 + 5 + 2 + 9) − (x + 1 + 7) = (14 − x), which must be divisible by 11.
$\therefore$ $x = 3$.

55. The number 6x2 must be divisible by 8.
$\therefore$ $x = 3$, as 632 is divisible by 8.

56. 45 = 5 × 9, where 5 and 9 are co-primes.
Unit digit must be 0 or 5 and sum of digits must be divisible by 9.
Among given numbers, such number is 202860.

57. 99 = 11 × 9, where 11 and 9 are co-prime
By hit and trial, we find that 114345 is divisible by 11 as well as 9. So, it is divisible by 99.

58. 72 = 9 × 8, where 9 and 8 are co-prime.
The minimum value of x for which 73x is divisible by 8 is, $x = 6$.
Sum of digits in 425736 = (4 + 2 + 5 + 7 + 3 + 6) = 27, which is divisible by 9.
$\therefore$ Required value of * is 6.

59. 80 = 2 × 5 × 8.
Since 653 xy is divisible by 2 and 5 both, so $y = 0$.
Now, 653 x0 is divisible by 8, so 3x0 should be divisible by 8. This happens when $x = 2$.
$\therefore$ $x + y = (2 + 0) = 2$.

60. Clearly, 4864 is divisible by 4.
So, 9P2 must be divisible by 3. So, (9 + P + 2) must be divisible by 3.
$\therefore$ P = 1.

61. 6 = 3 × 2. Clearly, 5 * 2 is divisible by 2. Replace * by x.
Then, (5 + x + 2) must be divisible by 3. So, $x = 2$

62. 24 = 3 × 8, where 3 and 8 are co-prime
Clearly, 35718 is not divisible by 8, as 718 is not divisible by 8
Similarly, 63810 is not divisible by 8 and 537804 is not divisible by 8.
Consider part (d).
Sum of digits = (3 + 1 + 2 + 5 + 7 + 3 + 6) = 27, which is divisible by 3.
Also, 736 is divisible by 8
$\therefore$ 3125736 is divisible by (3 × 8), *i.e.*, 24.

63. 132 = 11 × 3 × 4.
Clearly, 968 is not divisible by 3
None of 462 and 2178 is divisible by 4.
And, 5184 is not divisible by 11.
Each one of the remaining four numbers is divisible by each one of 4, 3 and 11. So, there are 4 such numbers.

64. Let the given number be 476 xy 0.

Then $(4 + 7 + 6 + x + y + 0) = (17 + x + y)$ must be divisible by 3.

And, $(0 + x + 7) - (y + 6 + 4) = (x - y - 3)$ must be either 0 or 11.

$x - y - 3 = 0 \quad \Rightarrow \quad y = x - 3$

$(17 + x + y) = (17 + x + x - 3) = (2x + 14) \Rightarrow x = 2$ or $x = 8$.

$\therefore x = 8$ and $y = 5$.

65. $(4 + 5 + 2) - (1 + 6 + 3) = 1$, not divisible by 11.

$(2 + 6 + 4) - (4 + 5 + 2) = 1$, not divisible by 11.

$(4 + 6 + 1) - (2 + 5 + 3) = 1$, not divisible by 11.

$(4 + 6 + 1) - (2 + 5 + 4) = 0$, So, 415624 is divisible by 11.

66. Required numbers are 102, 108, 114, ..., 996

This is an A.P. in which $a = 102$, $d = 6$ and $l = 996$

Let the number of terms be n. Then,

$a + (n - 1)d = 996 \quad \Rightarrow \quad 102 + (n - 1) \times 6 = 996$

$\Rightarrow 6 \times (n - 1) = 894 \quad \Rightarrow \quad (n - 1) = 149 \Rightarrow n = 150$

Required number of terms = 150.

67. Let $S_n = (1 + 2 + 3 + ... + 45)$. This is an A.P. in which $a = 1$, $d = 1$, $n = 45$.

$$S_n = \frac{n}{2}[2a + (n-1)d] = \frac{45}{2} \times [2 \times 1 + (45-1) \times 1] = \left(\frac{45}{2} \times 46\right) = (45 \times 23)$$

$= 45 \times (20 + 3) = (45 \times 20 + 45 \times 3) = (900 + 135) = 1035.$

68. Let $S_n = (2 + 4 + 6 + ... + 30)$. This is an A.P. in which $a = 2$, $d = 2$ and $l = 30$

Let the number of terms be n. Then.

$a + (n - 1)d = 30 \Rightarrow 2 + (n - 1) \times 2 = 30 \Rightarrow n = 15.$

$$\therefore \; S_n = \frac{n}{2}(a + l) = \frac{15}{2} \times (2 + 30) = (15 \times 16) = 240.$$

69. $S_n = (1 + 2 + 3 + ... + 50 + 51 + 52 + ... + 100) - (1 + 2 + 3 + ... + 50)$

$$= \frac{100}{2} \times (1 + 100) - \frac{50}{2} \times (1 + 50) = (50 \times 101) - (25 \times 51) = (5050 - 1275) = 3775.$$

70. The smallest prime number is 2.

71. Required sum = $(2 + 3 + 5 + 7 + 11) = 28$.

72. Prime numbers less than 50 are :

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47

Their number is 15.

73. Clearly, 97 is a prime number.

74. 91 is divisible by 7. So, it is not a prime number.

75. $\sqrt{437} > 22$

All prime numbers less than 22 are 2, 3, 5, 7, 11, 13, 17, 19.

161 is divisible by 7, and 221 is divisible by 13.

373 is not divisible by any of the above prime numbers.

$\therefore$ 373 is prime.

76. $\sqrt{551} > 24$

All prime numbers less than 24 are 2, 3, 5, 7, 11, 13, 17, 19.

119 is divisible by 7; 187 is divisible by 11; 247 is divisible by 13 and 551 is divisible by 19.

So, none of the given numbers is prime.

77. The smallest 3-digit number is 100, which is divisible by 2.

$\therefore$ 100 is not a prime number.

$\sqrt{101} < 11$ and 101 is not divisible by any of the prime numbers 2, 3, 5, 7, 11.

$\therefore$ 101 is a prime number

Hence 101 is the smallest 3-digit prime number.

78. The sum of two odd number is even. So, $a + b$ is even.

79. The square of a natural number never ends in 2.

$\therefore$ 143642 is not the square of a natural number.

80. The square of a natural number never ends in 7.

$\therefore$ 42437 is not the square of a natural number

81. 6) 4456 (742
42
25
24
16
12
4

Required number = (6 – 4) = 2

82. On dividing, we get

88) 9217 (104
88
417
352
65

$\therefore$ Required number = 9217 + (88 – 65) = 9217 + 23 = 9240

83. On dividing, we get: 75) 8485 (113
75
98
75
235
225
10

$\therefore$ Required number = (8485 – 10) = 8475.

84. Largest 4-digit number = 9999

88) 9999 (113
88
119
88
319
264
55

Required number = (9999 – 55) = 9944

119 is divisible by 7; 187 is divisible by 11; 247 is divisible by 13 and 551 is divisible by 19.

So, none of the given numbers is prime.

77. The smallest 3-digit number is 100, which is divisible by 2.

$\therefore$ 100 is not a prime number.

$\sqrt{101} < 11$ and 101 is not divisible by any of the prime numbers 2, 3, 5, 7, 11.

$\therefore$ 101 is a prime number

Hence 101 is the smallest 3-digit prime number.

78. The sum of two odd number is even. So, $a + b$ is even.

79. The square of a natural number never ends in 2.

$\therefore$ 143642 is not the square of a natural number.

80. The square of a natural number never ends in 7.

$\therefore$ 42437 is not the square of a natural number

81. 6) 4456 (742

42
25
24
16
12
4

Required number = (6 – 4) = 2

82. On dividing, we get

88) 9217 (104

88
417
352
65

$\therefore$ Required number = 9217 + (88 – 65) = 9217 + 23 = 9240

83. On dividing, we get: 75) 8485 (113

75
98
75
235
225
10

$\therefore$ Required number = (8485 – 10) = 8475.

84. Largest 4-digit number = 9999

88) 9999 (113

88
119
88
319
264
55

Required number = (9999 – 55) = 9944

85. Largest 5-digit number = 99999

```
91 ) 99999 ( 1098
     91
     ---
      899
      819
      ---
       809
       728
       ---
        81
```

Required number = (99999 − 81) = 99918.

86.

```
87 ) 13601( 156
     87
     ---
     490
     435
     ---
      551
      522
      ---
       29
```

∴ Required number = 29

87.

```
23 ) 1056 ( 45
     92
     ---
     136
     115
     ---
      21
```

Required number = (23 − 21) = 2

88. The smallest 5-digit number = 10000.

```
41 ) 10000 ( 243
     82
     ---
     180
     164
     ---
      160
      123
      ---
       37
```

Required number = 10000 + (41 − 37) = 10004

89. The smallest 6-digit number = 100000.

```
111 ) 100000 ( 900
      999
      ---
       100
```

Required number = 100000 + (111 − 100) = 100011.

90. Divisor = (5 × 46) = 230

$\therefore$ 10 × quotient = 230 ⇒ Quotient $= \frac{230}{10} = 23$.

Dividend = (Divisor × Quotient) + Remainder
= (230 × 23) + 46 = (5290 + 46) = 5336.

91. Number = 269 × 68 + 0 = 18292

```
  269
 × 68
 ----
 2152
1614
-----
18292
```

```
67 ) 18292 ( 273
     134
     ---
      489
      469
      ---
       202
       201
       ---
         1
```

∴ Required remainder = 1

93. Let x be the number and y be the quotient. Then,

$$x = 357 \times y + 39$$
$$= (17 \times 21 \times y) + (17 \times 2) + 5$$
$$= 17 \times (21y + 2) + 5.$$

$\therefore$ Required remainder = 5.

94. Let the number be x and on dividing x by 5, we get k as quotient and 3 as remainder.

$\therefore$ $x = 5k + 3 \Rightarrow x^2 = (5k + 3)^2 = (25k^2 + 30k + 9)$
$= 5\,(5k^2 + 6k + 1) + 4$

$\therefore$ On dividing x^2 by 5, we get 4 as remainder.

95. Let the smaller number be x. Then larger number = $(x + 1365)$.

$\therefore$ $x + 1365 = 6x + 15 \Rightarrow 5x = 1350 \Rightarrow x = 270$

$\therefore$ Smaller number = 270.

96. Number = $(12 \times 35) = 420$.

Correct Quotient = $420 \div 21 = 20$.

97. Let the numbers be a and b. Then, $a + b = 12$ and $ab = 35$.

$$\therefore \frac{a+b}{ab} = \frac{12}{35} \Rightarrow \left(\frac{1}{b} + \frac{1}{a}\right) = \frac{12}{35}$$

$\therefore$ Sum of reciprocals of given numbers $= \dfrac{12}{35}$

98. Let the number be x. Then

$$60\% \text{ of } \frac{3}{5} \text{ of } x = 36 \Rightarrow \frac{60}{100} \times \frac{3}{5} \times x = 36 \Rightarrow x = \left(36 \times \frac{25}{9}\right) = 100.$$

$\therefore$ Required number = 100.

99. Let the required fraction be x. Then, $\dfrac{1}{x} - x = \dfrac{9}{20}$

$$\therefore \frac{1 - x^2}{x} = \frac{9}{20} \Rightarrow 20 - 20x^2 = 9x \Rightarrow 20x^2 + 9x - 20 = 0$$

$$\Rightarrow 20x^2 + 25x - 16x - 20 = 0 \Rightarrow 5x\,(4x + 5) - 4(4x + 5) = 0$$

$$\Rightarrow (4x + 5)\,(5x - 4) = 0 \Rightarrow x = \frac{4}{5}.$$

100. Clearly, $(2272 - 875) = 1397$, is exactly divisible by N.

Now , $1397 = 11 \times 127$

$\therefore$ The required 3-digit number is 127, the sum of whose digits is 10

101. By hit and trial, we find that

$47619 \times 7 = 333333$.

```
7 ) 333333 ( 47619
    28
     53
     49
      43
      42
       13
        7
        63
        63
         ×
```

102. Let the two consecutive even integers be $2n$ and $(2n + 2)$. Then,
$(2n + 2)^2 - (2n)^2 = (2n + 2 + 2n)(2n + 2 - 2n)$
$= 2(4n + 2) = 4(2n + 1)$, which is divisible by 4.

103. Let the two consecutive odd integers be $(2n + 1)$ and $(2n + 3)$. Then,
$(2n + 3)^2 - (2n + 1)^2 = (2n + 3 + 2n + 1)(2n + 3 - 2n - 1)$
$= (4n + 4) \times 2 = 8(n + 1)$, which is divisible by 8.

104. $(6n^2 + 6n) = 6n(n + 1)$, which is always divisible by 6 and 12 both, since $n(n + 1)$ is always even.

105. Let $n = 4q + 3$. Then, $2n = 8q + 6 = 4(2q + 1) + 2$.
Thus, when 2n is divided by 4, the remainder is 2.

106. $(x^n + 1)$ will be divisible by $(x + 1)$ only when n is odd.
$\therefore$ $(67^{67} + 1)$ will be divisible by $(67 + 1)$
$\therefore$ $(67^{67} + 1) + 66$, when divided by 68 will give 66 as remainder.

107. $(x^n - 1)$ will be divisible by $(x + 1)$ only when n is even.
$(49^{15} - 1) = \{(7^2)^{15} - 1\} = (7^{30} - 1)$, which is divisible by $(7 + 1)$, *i.e.*, 8.

108. For every natural number n, $(x^n - a^n)$ is always divisible by $(x - a)$.

109. When n is even, $(x^n - a^n)$ is completely divisible by $(x + a)$
$(17^{200} - 1^{200})$ is completely divisible by $(17 + 1)$, *i.e.*, 18.
$\Rightarrow$ $(17^{200} - 1)$ is completely divisible by 18.
$\Rightarrow$ On dividing 17^{200} by 18, we get 1 as remainder.

110. When n is odd, $(x^n + a^n)$ is always divisible by $(x + a)$.
$\therefore$ Each one of $(47^{43} + 43^{43})$ and $(47^{47} + 43^{43})$ is divisible by $(47 + 43)$.

111. Let $2^{32} = x$. Then, $(2^{32} + 1) = (x + 1)$.
Let $(x + 1)$ be completely divisible by the natural number N. Then,
$(2^{96} + 1) = [(2^{32})^3 + 1] = (x^3 + 1) = (x + 1)(x^2 - x + 1)$, which is completely divisible by N, since $(x + 1)$ is divisible by N.

112. $(4^{61} + 4^{62} + 4^{63} + 4^{64}) = 4^{61} \times (1 + 4 + 4^2 + 4^3) = 4^{61} \times 85$
$= 4^{60} \times (4 \times 85) = (4^{60} \times 340)$, which is divisible by 10.

113. $(3^{25} + 3^{26} + 3^{27} + 3^{28}) = 3^{25} \times (1 + 3 + 3^2 + 3^3) = 3^{25} \times 40$
$= 3^{24} \times 3 \times 4 \times 10 = (3^{24} \times 4 \times 30)$, which is divisible by 30.

114. $\left.\begin{matrix} 4 & a & 3 \\ 9 & 8 & 4 \\ 13 & b & 7 \end{matrix}\right\} \Rightarrow a + 8 = b \Rightarrow b - a = 8$

Also, $13\,b7$ is divisible by 11 $\Rightarrow (7 + 3) - (b + 1) = (9 - b) \Rightarrow (9 - b) = 0 \Rightarrow b = 9$
$\therefore$ $(b = 9$ and $a = 1) \Rightarrow (a + b) = 10$.

115. By hit and trial, we put $x = 5$ and $y = 1$ so that $(3x + 7y) = (3 \times 5 + 7 \times 1) = 22$, which is divisible by 11.
$\therefore$ $(4x + 6y) = (4 \times 5 + 6 \times 1) = 26$, which is not divisible by 11;
$(x + y + 4) = (5 + 1 + 4) = 10$, which is not divisible by 11;
$(9x + 4y) = (9 \times 5 + 4 \times 1) = 49$, which is not divisible by 11;
$(4x - 9y) = (4 \times 5 - 9 \times 1) = 11$, which is divisible by 11.

116. $90 = 10 \times 9$
Clearly, $653xy$ is divisible by 10, so $y = 0$
Now, $653x0$ is divisible by 9. So, $(6 + 5 + 3 + x + 0) = (14 + x)$ is divisible by 9. So, $x = 4$.
Hence, $(x + y) = (4 + 0) = 4$.

117. Marking (✓) those which are divisible by 3 but not by 9 and the others by (5), by taking

the sum of digits, we get:

2133 → 9 (✗), 2343 → 12 (✓), 3474 → 18 (✗) 4131 → 9 (✗), 5286 → 21 (✓)
5340 → 12 (✓), 6336 → 18 (✗) 7347 → 21 (✓) 8115 → 15 (✓) 9276 → 24 (✓)

Required number of numbers = 6

118. 639 is not divisible by 7.

2079 is divisible by each one of 3, 7, 9, 11.

119. $132 = 4 \times 3 \times 11$

264 → 11,3,4 (✓); 396 → 11,3,4 (✓); 462 → 11,3 (✓); 792 → 11,3,4 (✓)

968 → 11,4 (✗); 2178 → 11,3 (✗); 5184 → 3,4 (✗); 6336 → 11,3,4 (✓)

Required number of numbers = 4.

120. Let $x = 6q + 3$. Then, $x^2 = (6q + 3)^2 = 36q^2 + 36q + 9 = 6(6q^2 + 6q + 1) + 3$

Thus, when x^2 is divided by 6, then remainder = 3.

121.

4	x
5	$y - 1$
	$1 - 4$

$\therefore y = (5 \times 1 + 4) = 9$

$x = (4 \times y + 1) = (4 \times 9 + 1) = 37$

Now, 37 when divided successively by 5 and 4, we get

5	37
4	$7 - 2$
	$1 - 3$

Respective remainders are 2 and 3

122.

4	x
5	$y - 2$
6	$z - 3$
	$1 - 4$

$\therefore z = 6 \times 1 + 4 = 10$

$y = 5 \times z + 3 = 5 \times 10 + 3 = 53$

$x = 4 \times y + 2 = 4 \times 53 + 2 = 212 + 2 = 214.$

Hence, required number = 214.

123.

5	x
9	$y - 4$
13	$z - 8$
	$1 - 12$

$\therefore z = 13 \times 1 + 12 = 25,$

$y = 9 \times z + 8 = 9 \times 25 + 8 = 233$

$x = 5 \times y + 4 = 5 \times 233 + 4 = 1169$

585) 1169 (1
585
584 $\therefore$ On dividing the number by 585, remainder = 584.

124. $x = 13p + 11$ and $x = 17q + 9$

$$\therefore 13p + 11 = 17q + 9 \Rightarrow 17q - 13p = 2 \Rightarrow q = \frac{2 + 13p}{17}$$

The least value of p for which $q = \frac{2+13p}{17}$ is a whole number is $p = 26$

$\therefore x = (13 \times 26 + 11) = (338 + 11) = 349.$

125. Let $x = 296\,q + 75 = (37 + 8q + 37 \times 2) + 1$

$= 37 + (8q + 2) + 1$

Thus, when the number is divided by 37, the remainder is 1

126. $987 = 3 \times 7 \times 47.$

So, the required number must be divisible by each one of 3, 7, 47

553681 → (Sum of digits = 28, not divisible by 3)

555181 → (Sum of digts = 25, not divisible by 3)

555681 is divisible by each one of 3, 7, 47.

127. $132 = 3 \times 4 \times 11$

264 → 3, 4, 11 (✓); 396 → 3, 4, 11 (✓); 462 → 3, 11 (X); 792 → 3, 4, 11 (✓)

968 → 4, 11 (X); 2178 → 3, 11 (X); 5184 → 3, 4 (X); 6336 → 3, 4, 11 (✓)

Required number of numbers = 4

128. 3-digit numbers divisible by 6 are:

102, 108, 114, ..., 996

This is an A.P. in which $a = 102$, $d = 6$ and $l = 996$

Let the number of terms be n. Then $t_n = 996$.

$\therefore a + (n-1)d = 996 \Rightarrow 102 + (n-1) \times 6 = 996$

$\Rightarrow 6 \times (n-1) = 894 \Rightarrow (n-1) = 149 \Rightarrow n = 150$

$\therefore$ Number of terms = 150.

129. Let $S_n = (1 + 2 + 3 + ... + 45)$

This is an A.P. in which $a = 1$, $d = 1$, $n = 45$ and $l = 45$

$$\therefore\ S_n = \frac{2}{2}(a+l) = \frac{45}{2} \times (1+45) = (45 \times 23) = 45 \times (20+3)$$

$$= (45 \times 20) + (45 \times 3) = 900 + 135 = 1035.$$

Required sum = 1035.

130. Required sum = $(2 + 4 + 6 + ... + 30)$

This is an A.P. in which $a = 2$; $d = (4-2) = 2$ and $l = 30$.

Let the number of terms be n. Then

$t_n = 30 \Rightarrow a + (n-1)d = 30$

$\Rightarrow 2 + (n-1) \times 2 = 30 \Rightarrow n - 1 = 14 \Rightarrow n = 15$

$$\therefore\ S_n = \frac{n}{2}(a+l) = \frac{15}{2} \cdot (2+30) = 240.$$

131. This is an A.P. in which $a = 51$, $l = 100$ and $n = 50$

$$\therefore\ Sum = \frac{n}{2}(a+l) = \frac{50}{2} \times (51+100) = (25 \times 151) = 3775.$$

132. Given sum = $(1 + 1 + 1 + ...\text{ to } n \text{ terms}) - \left(\frac{1}{n} + \frac{2}{n} + \frac{3}{n} + ...\text{ to } n \text{ terms}\right)$

$$= n - \frac{n}{2}\left(\frac{1}{n} + 1\right) \qquad \left[\because\ l = n\text{th terms } = \frac{n}{n} = 1\right]$$

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

133. Required numbers are 24, 30, 36, 42 ..., 96

This is an A.P. in which $a = 24$, $d = 6$ and $l = 96$

Let the number of terms in it be n.

Then, $t_n = 96 \Rightarrow a + (n-1)d = 96$

$\Rightarrow\ 24 + (n-1) \times 6 = 96 \Rightarrow (n-1) \times 6 = 72 \Rightarrow (n-1) = 12 \Rightarrow n = 13$

Required number of numbers = 13.

134. Required numbers are 10, 15, 20, 25, ..., 95

This is an A.P. in which $a = 10$, $d = 5$ and $l = 95$.

Let the number of terms in it be n. Then

$t_n = 95 \Rightarrow a + (n-1)d = 95$

$\Rightarrow 10 + (n-1) \times 5 = 95 \Rightarrow (n-1) \times 5 = 85 \Rightarrow (n-1) = 17 \Rightarrow n = 18$

Required sum $= \frac{n}{2}(a+l) = \frac{18}{2} \cdot (10+95) = (9 \times 105) = 945$

135. This is an A.P. in which $a = 6$, $d = 6$ and $S_n = 1800$

Then, $\frac{n}{2}[2a+(n-1)d] = 1800 \Rightarrow \frac{n}{2} \cdot [2 \times 6 + (n-1) \times 6] = 1800$

$\Rightarrow 3n(n+1) = 1800 \Rightarrow n(n+1) = 600$

$\Rightarrow n^2 + n - 600 = 0 \Rightarrow n^2 + 25n - 24n - 600 = 0$

$\Rightarrow n(n+25) - 24(n+25) = 0 \Rightarrow (n+25)(n-24) = 0 \Rightarrow n = 24$

Number of terms = 24

136. Here $a = 3$ and $r = \frac{6}{3} = 2$. Let the number of terms be n.

Then, $t_n = 384 \Rightarrow ar^{n-1} = 384$

$\Rightarrow \quad 3 \times 2^{n-1} = 384 \Rightarrow 2^{n-1} = 128 = 2^7$

$\Rightarrow \quad n - 1 = 7 \Rightarrow n = 8$

$\therefore$ Number of terms = 8

137. This is a G.P. in which $a = 2$, $r = \frac{2^2}{2} = 2$ and $n = 9$

$$S_n = \frac{a(r^n-1)}{(r-1)} = \frac{2 \times (2^9 - 1)}{(2-1)} = 2 \times (512-1) = 2 \times 511 = 1022.$$

138. We know that $(1^2 + 2^2 + 3^2 + \ldots + n^2) = \frac{1}{6}n(n+1)(2n+1)$

Putting $n = 10$, required sum $= \left(\frac{1}{6} \times 10 \times 11 \times 21\right) = 385$

139. $(2^2 + 4^2 + 6^2 + \ldots + 20^2) = (1 \times 2)^2 + (2 \times 2)^2 + (2 \times 3)^2 + \ldots + (2 \times 10)^2$

$= (2^2 \times 1^2) + (2^2 \times 2^2) + (2^2 \times 3^2) + \ldots + (2 \times 10)^2$

$= 2^2 \times [1^2 + 2^2 + 3^2 + \ldots + 10^2]$

$= \left(4 \times \frac{1}{6} \times 10 \times 11 \times 21\right) \quad \left[\because (1^2 + 2^2 + 3^2 + \ldots + n^2) = \frac{1}{6}n(n+1)(2n+1)\right]$

$= (4 \times 5 \times 77) = 1540.$

140. $(11^2 + 11^2 + 13^2 + \ldots + 20^2) = (1^2 + 2^2 + \ldots + 30^2) - (1^2 + 2^2 + \ldots + 10^2)$

$= \left\{\frac{20 \times 21 \times 41}{6} - \frac{10 \times 11 \times 21}{6}\right\} \quad \left[\because (1^2 + 2^2 + \ldots + n^2) = \frac{1}{6}n(n+1)(2n+1)\right]$

$= (2870 - 385) = 2485.$