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Compiled & Edited by
Arihant 'Expert Team'

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PREFACE

Institute of Banking Personnel Selection , often known as IBPS is an autonomous agency in India. It is envisioned as a self governed academic and research oriented institute with a mission of enhancing human resource through personnel assessment. From 2011 onwards a common written examination (CWE) is organised by the IBPS for the post of Probationary Officers. The examination is held every year. This CWEconducted by IBPS is now mandatory for anyone who seeks an employement in 20 public sector banks and some private banks also. IBPS periodically accepts the examination applications from the candidates at their website and the exams are organised at various locations throughout the country in online mode.

Quantitative Aptitude is an equally weighted section in the examination. Quantitative Aptitude tests your calculation and mental ability. Importance of Quantitative Aptitude is constantly getting the center stage in today's competitive environment. Quantitative Aptitude, thus forms an integral part of the Banking examination and it can be a hard nut to crack, if the students are not familiar with the nuances of the subject.

The book in your hand helps in cracking this hard nut by gradually building up the core mathematical concepts, starting from a very basic level. Examination papers of the past 20 years have been fully solved and a fine topical division ensures that no section has been left uncovered. Each chapter begins with an overview of the key concepts/formulae that would be used in the chapter. The book doesn't require the reader to have advanced mathematical abilities, instead helps the reader to develop such abilities in due course. The language used is kept simple and intricacies have been avoided as far as possible. Alternate solutions, wherever possible have been provided.

A thorough study this book would not only pave the way for you in this era of cut-throat competition but would also help you untangle the intricacies of Quantitative Aptitude.

Author

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Topicwise Distribution of Questions asked in the

PREVIOUS YEARS' EXAMS

Held in 2019, 2018 and 2017

S. NO.	TOPIC / EXAMS	IBPS (PO) Mains 2019	IBPS (PO) Pre. 2019	SBI (PO) Mains 2019	SBI (PO) Pre. 2019	IBPS (PO/MT) Pre. 2018
1.	Number System					
2.	Simplification					
3.	Approximation					
4.	Number Series	1	6	2	5	6
5.	Average					2
6.	Percentage		1			
7.	Ratio and Proportion					
8.	Mixture and Alligation		1		1	1
9.	Partnership		2		1	
10.	Profit, Loss and Discount				1	1
11.	Time and Work		1		1	1
12.	Time, Speed and Distance		2		2	1
13.	Simple Interest				1	1
14.	Compound Interest		1			
15.	Problem Based on Ages		1		1	1
16.	Inequalities		5		5	6
17.	Permutation, Combination & Probability			3		
18.	Mensuration			3	2	
19.	Data Sufficiency			5		5
20.	Data Interpretation	34	15	22	15	10
	Total	**35**	**35**	**35**	**35**	**35**

Topicwise Distribution of Questions asked in the

PREVIOUS YEARS' EXAMS

Held in 2019, 2018 and 2017

S. NO.	TOPIC / EXAMS	CANARA BANK (PO) 2018	IBPS (SO) PRE 2017	SBI (PO) PRE 2017	SBI (PO) MAINS 2017	IBPS RRB (PO) PRE 2017
1.	Number System					
2.	Simplification	6	4			
3.	Approximation			5		5
4.	Number Series	6	5	5		5
5.	Average	1				1
6.	Percentage	1	1	1		
7.	Ratio and Proportion					
8.	Mixture and Alligation	1	1	1	1	1
9.	Partnership	1				1
10.	Profit, Loss and Discount			1		1
11.	Time and Work	1		1		1
12.	Time, Speed and Distance	2	1	2	1	2
13.	Simple Interest	1	1			
14.	Compound Interest			1		
15.	Problem Based on Ages	1		1		1
16.	Inequalities	6	10	5	5	5
17.	Permutation, Combination & Probability	1		1	2	1
18.	Mensuration	1		1		1
19.	Data Sufficiency	5	12		4	
20.	Data Interpretation	16	15	10	22	15
	Total	**50**	**50**	**35**	**35**	**40**

1

Number System

This chapter acts as the base for the other chapters of the Mathematics. By understanding each and every topic of this chapter, we can solve different types of questions from this chapter as well as from other chapters also.

So, start this chapter with the definition of numbers and their types.

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.

Numerals

A mathematical symbol representing a number is called a numeral represented by a set of digits.

How to write a number?

To write a number, we put digits from right to left at the places designated as units, tens, hundreds, thousands, ten thousands, lakh, ten lakhs, crore, ten crores.

Let us see how the number 308761436 is denoted

Ten Crores	Crores	Ten Lakhs	Lakh	Ten Thousands	Thousands	Hundreds	Tens	Units
10^8	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
3	0	8	7	6	1	4	3	6

It is read as thirty crore eighty seven lakh sixty one thousand four hundred and thirty six.

Face Value and Place Value of the Digits in a Number

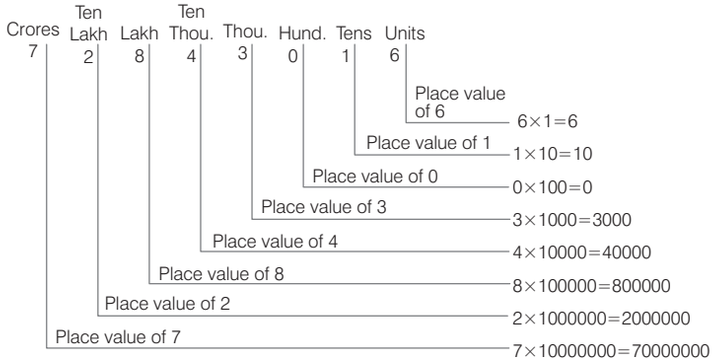
Face Value

In a numeral, the face value of a digit is the value of the digit itself irrespective of its place in the numeral.

For example, in the numeral 486729, the face value of 8 is 8; the face value of 7 is 7; the face value of 6 is 6; the face value of 4 is 4 and so on.

Place Value (Or Local Value)

In a numeral, the place value of a digit changes according to the change of its place. Look at the following to get the idea of place value of digits in 72843016.



It is clear from the above presentation that to obtain the place value of a digit in a numeral, we multiply the digit with the value of its place in the given numeral.

Types of Numbers

Natural Numbers

Counting numbers 1, 2, 3, 4, 5, ..., are known as natural numbers. The set of natural numbers can be represented by $N = \{1, 2, 3, 4, 5, ...\}$

Whole Numbers

If we include 0 among the natural numbers, then the numbers 0, 1, 2, 3, 4, 5 etc., are called whole numbers.

The set of whole numbers, $W = \{0, 1, 2, 3, 4, 5, ...\}$

Note Clearly, every natural number is a whole number but 0 is the only whole number which is not a natural number.

Integers

All counting numbers and their negatives including zero are known as integers.

The set of integers, $I = \{..., -3, -2, -1, 0, 1, 2, 3, 4, ...\}$

Positive Integers

The set {1, 2, 3, 4, 5, ...} is a set of all positive integers.

Positive integers and natural numbers are synonyms.

Negative Integers

The set {..., – 3, – 2, – 1} is a set of all negative integers.

Note 0 is neither a positive integer nor a negative integer.

Rational Numbers

The numbers of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$ are known as rational numbers.

e.g. $\frac{2}{3}, \frac{5}{7}, \frac{-4}{9}$, etc.

Irrational Numbers

Those numbers which when expressed in decimal form are neither terminating nor repeating decimals, are known as irrational numbers. e.g. $\sqrt{2}, \sqrt{3}, \sqrt{5}, \pi$, etc.

Note The exact value of π is not $\frac{22}{7}$. $\frac{22}{7}$ is a rational number while π is an irrational number. Sometimes π is also considered equivalent to $\frac{355}{113}$. This value is also an approximate value of π and not the exact value. Similarly, 3.14 is not an exact value of π.

Real Numbers

The rational and irrational numbers combined together are called real numbers.

e.g. $\frac{12}{19}, \sqrt{5}, 4 + \sqrt{2}, 6 + \sqrt{5}$, etc., are all real numbers.

The set of all real numbers is denoted by R.

Even Numbers

All those numbers which are exactly divisible by 2 are called even numbers. e.g. 2, 4, 6, 8, 10, etc.

Odd Numbers

All those numbers which are not exactly divisible by 2 are called odd numbers. e.g. 1, 3, 5, 7, 9, etc.

Prime Numbers

Numbers divisible by 1 and itself and not divisible by any other number are called prime numbers.

e.g. 2, 3, 5, 7, 11, etc.

Note 2 is the only prime number which is even. Rest all are odd prime numbers.

Prime numbers between 1 to 100

1-10	2, 3, 5, 7
11-20	11, 13, 17, 19
21-30	23, 29
31-40	31, 37
41-50	41, 43, 47
51-60	53, 59
61-70	61, 67
71-80	71, 73, 79
81-90	83, 89
91-100	97

Composite Numbers

Natural numbers greater than 1 which are not prime are composite numbers. e.g. 4, 6, 9, 15, etc.

Coprime Numbers

Two numbers which have only 1 as the common factor are called coprimes or relatively prime to each others.

e.g. (3, 7) (8, 9) (36, 25) etc.

Note Here, 8 and 9 are not prime numbers but since they have only one common factor, i.e. 1, so they are coprime numbers. (6, 15) are not coprime numbers because they have two common factors, i.e. 1 and 3.

Operations on Numbers

Addition

When two or more numbers are combined together, then it is called addition. Addition is denoted by '+' sign.

e.g. $24 + 23 + 26 = 73$

Subtraction

When one or more numbers are taken out from a larger number, then it is called subtraction.

Subtraction is denoted by '–' sign.

e.g. $100 - 4 - 13 = 100 - 17 = 83$

Division

When D and d are two numbers, then $\frac{D}{d}$ is called the operation of division, where D is the dividend and d is the divisor. A number which tells how many times a divisor (d) exists in dividend D is called the quotient Q.

If dividend D is not a multiple of divisor d, then D is not exactly divisible by d and in this case remainder R is obtained. e.g. Let $D = 17$, $d = 3$

Then, $$\frac{D}{d} = \frac{17}{3} = 5\frac{2}{3}$$

Here, 5 = Quotient (Q), 3 = Divisor (d), 2 = Remainder (R)

3 (Divisor) $\times 5$ (Quotient) $+ 2$ (Remainder) $= 17$ (Dividend)

Hence, we can write a formula

$$\boxed{\text{Dividend} = (\text{Divisor} \times \text{Quotient}) + \text{Remainder}}$$

Multiplication

When a is multiplied by b, then a is added b times or b is added a times. It is denoted by x.

Let us see the following operation on multiplication

e.g. If $a = 2$ and $b = 4$, then, $2 \times 4 = 8$ or $(2 + 2 + 2 + 2) = 8$

Here, a is added b times or in other words 2 is added 4 times.

Similarly, $4 \times 2 = 8$ or $(4 + 4) = 8$

In this case, b is added a times or in other words 4 is added 2 times.

Divisibility Tests

Divisibility by 2 A number is divisible by 2, if its unit digit is zero or divisible by 2. e.g. 10, 22, 42, 84, 3872, etc.

Divisibility by 3 A number is divisible by 3, if the sum of digits in the number is divisible by 3. e.g. 2553, here $2 + 5 + 5 + 3 = 15$, which is divisible by 3. Hence, 2553 is divisible by 3.

Divisibility by 4 A number is divisible by 4, if its last two digits are divisible by 4. e.g. 2652, here 52 is divisible by 4. So, 2652 is divisible by 4.

Divisibility by 5 A number is divisible by 5, if the unit digit in number is 0 or 5. e.g. 50, 505, 405, etc.

Divisibility by 6 A number is divisible by 6, if the number is even and sum of digits is divisible by 3. e.g. 4536 is an even number and sum of digit $4 + 5 + 3 + 6 = 18$ is divisible by 3.

Divisibility by 8 A number is divisible by 8, if last three digits of it are divisible by 8. e.g. 47472, here 472 is divisible by 8. Hence, the number 47472 is divisible by 8.

Divisibility by 9 A number is divisible by 9, if the sum of its digit is divisible by 9. e.g. 108936, here $1 + 0 + 8 + 9 + 3 + 6$ is 27, which is divisible by 9. Hence, 108936 is divisible by 9.

Divisibility by 10 A number is divisible by 10, if its unit digit is 0. e.g. 90, 900, 740, 34920, etc.

Divisibility by 11 A number is divisible by 11, if the difference of sum of digits at odd places and sum of digits at even places is either 0 or divisible by 11. e.g. 1331, the sum of digits at odd places is $1 + 3$ and sum of digits at even places is $3 + 1$ and their difference is $4 - 4 = 0$. So, 1331 is divisible by 11.

Divisibility by 12 A number which is divisible by both 4 and 3 is also divisible by 12. e.g. 2244 is divisible by both 3 and 4. Therefore, it is divisible by 12 also.

Divisibility by 14 A number which is divisible by both 7 and 2 is also divisible by 14. e.g. 1232 is divisible by both 7 and 2. Therefore, it is divisible by 14 also.

Divisibility by 15 A number which is divisible by both 5 and 3 is divisible by 15 also. e.g. 1275 is divisible by both 5 and 3. Therefore, it is divisible by 15 also.

Techniques for Fast Calculation

Technique I

Multiplying the numbers which are nearer to 100.

e.g. (i) 96×98

$$\overset{-4}{96} \quad \overset{-2}{98} = \begin{matrix} 98-4 \\ \text{or} \\ 96-2 \end{matrix} \Bigg| -4 \times -2 = 9408$$

(ii) 102×105

$$\overset{+2}{102} \times \overset{+5}{105} = \begin{matrix} 102+5 \\ \text{or} \\ 105+2 \end{matrix} \Bigg| 5 \times 2 = 10710$$

(iii) $102 \times 98 = (100+2)(100-2)$

$= (100)^2 - (2)^2 = 1000 - (4) = 9996$

Technique II

When a number (N) is multiplied by 9, 99, 999, ... or $(10^n - 1)$.

In such cases, number of zeroes equal to number of 9s in $(10^n - 1)$ are put at extreme right of N to make a new number M and then N is subtracted from this new number to get the result. Clearly, $(M - N)$ is the result of multiplication.

Ex. 1 Multiply 3428 with 999.

Sol. Here, $N = 3428$, $(10^n - 1) = (10^3 - 1) = 999$

According to the rule,

$$\underset{(N)}{3428} \times 999 = \underset{(M)}{3428000} - \underset{(N)}{3428}$$

999 has three 9s and hence three zeroes are put at the right end of N to make M.

N is subtracted from M to get the result of multiplication.

$\therefore \quad (M - N) = 3424572$

Technique III

When a number (N) is multiplied by 11, 101, ... or $(10^n + 1)$.

In such cases, n zeroes are put at the right end of N to make a new number M and then N is added to this new number to get the result. Clearly, $M + N$ is the result of multiplication.

Ex. 2 Multiply 8482 with 101.

Sol. Here, $N = 8482$, $(10^n + 1) = (10^2 + 1) = 101$

According to the rule,

$$\underset{(N)}{8482} \times 101 = \underset{(M)}{848200} + \underset{(N)}{8482}$$

$n = 2$, hence 2 zeroes are put at the right end of N to make M.

N is added to M to get the result of multiplication.

$\therefore \quad (M + N) = 848200 + 8482 = 856682$

Ex. 3 Multiply 276 by 1001.

Sol. Here, $N = 276$, $(10^n + 1) = (10^3 + 1) = 1001$

According to the rule, $276 \times 1001 = 276000 + 276 = 276276$

Technique IV

When a number (N) is multiplied by 5, 25, 125, 625, ... or 5^n.

In such cases, n zeroes are put at the right end of N to get a new number M and then M is divided by 2^n to find the required result of multiplication.

Ex. 4 Find the value of 9482×25.

Sol. Here, $N = 9482$

$5^n = 25 = 5^2$

Now, $n = 2$

According to the rule,

$$\underset{(N)}{9482} \times \underset{(5^n)}{25} = \frac{\underset{(M)}{948200}}{2^2}$$

[$n = 2$, hence 2 zeroes are put. Also, M has been divided by 2^2 as $n = 2$]

$$= \frac{948200}{4} = 237050$$

Technique V

Finding the square of a number ending with 5.

In such cases, number coming before 5, say n is multiplied with $n + 1$ and 25 is put at the right end of the result obtained from $n(n + 1)$.

Ex. 5 Find the square of 35.

Sol. Here, $n = 3$

According to the rule, $n(n + 1) = 3(3 + 1)$

$= 3 \times 4 = 12$

$\therefore$ Required square = 12 25

Here, $n(n + 1)$, 25 is put at the right end of $n(n + 1)$ or 12 to get the required square of 35.

Ex. 6 Find the square of 135.

Sol. Here, $n = 13$

According to the rule,

$n(n + 1) = 13(13 + 1) = 13 \times 14 = 182$

Here, $n(n + 1)$, 25 is put at the right end of $n(n + 1)$ or 182 to get the required square of 135.

$\therefore$ Required square = 18225

Ex. 7 Find the square of 75.

Sol. Here, $n = 7$

According to the rule, $n(n + 1) = 7(7 + 1) = 7 \times 8 = 56$

Here, $n(n + 1)$, 25 is put at the right end of $n(n + 1)$ or 56 to get the required square of 75.

$\therefore$ Required square = 56 25

Important Algebraic Formulae

1. $(a+b)^2 = a^2 + 2ab + b^2$
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $(a-b)(a+b) = a^2 - b^2$
4. $(a+b)^2 + (a-b)^2 = 2(a^2 + b^2)$
5. $(a+b)^2 - (a-b^2) = 4ab$
6. $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
   $= a^3 + b^3 + 3ab(a+b)$
7. $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
   $= a^3 - b^3 - 3ab(a-b)$
8. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
9. $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
10. $\dfrac{a^3 + b^3 + c^3 - 3abc}{a^2 + b^2 + c^2 - ab - bc - ca} = (a+b+c)$

Conditions of Divisibility for Algebraic Function

1. **$a^n + b^n$ is exactly divisible by $a + b$,** only when **n is odd.**
   e.g. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$ is divisible by $a + b$, also $a^5 + b^5$ is divisible by $a + b$.

2. **$a^n + b^n$ is never divisible by $a - b$**
   (whether n is odd or even).
   e.g. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$, is not divisible by $(a-b)$.
   $a^7 + b^7$ is also not divisible by $(a-b)$.

3. **$a^n - b^n$ is exactly divisible by $(a-b)$**
   (whether n is odd or even).
   e.g. $a^2 - b^2 = (a-b)(a+b)$, so it is divisible by $(a-b)$.
   $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$, so it is divisible by $(a-b)$.
   $a^4 - b^4 = (a^2) - (b^2)$
   $= (a^2 - b^2)(a^2 + b^2)$
   $= (a-b)(a+b)(a^2 + b^2)$, so it is divisible by $(a-b)$.

Similarly, $a^9 - b^9$ is exactly divisible by $(a-b)$
also $a^{12} - b^{12}$ is also exactly divisible by $(a-b)$.

Cyclicity

Cyclicity of a number is used mainly for finding unit digits.

Cyclicity of 1

In 1^n, unit digit will always be 1.

Cyclicity of 2

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

After every fourth interval, 2, 4, 8, 6 are repeated. So, cycle of 2 is 2, 4, 8, 6.

Ex. 8 Find the unit digit of 2^{54}.

Sol. Here, unit digits 2, 4, 8, 6 are repeated at after every fourth interval till 52. Next 53 will be 2 and 54 will be 4. So, unit digit will be 4.

Ex. 9 Find unit digit of 2^{323}.

Sol. Here, $2^{323} = 2^{4\times 80 + 3} = (2)^3$ [after every 4 times, it repeats itself] = 8

Ex. 10 Find the unit digit of $12^{14} \times 22^{26}$.

Sol. Here, in $(12)^{14} \times (22)^{26}$

2 repeats itself after every 4 times.
$\therefore \quad (12)^{4\times 3 + 2} \times (22)^{4\times 6 + 2} \Rightarrow (2)^2 \times (2)^2 \Rightarrow 4 \times 4 = 16$

So, unit digit is 6.

Cyclicity of 3

$3^1 = 3$ $\quad 3^2 = 9$ $\quad 3^3 = 27$ $\quad 3^4 = 81$
$3^5 = 243$ $\quad 3^6 = 729$ $\quad 3^7 = 2187$ $\quad 3^8 = 6561$

After every fourth interval, 3, 9, 7 and 1 are repeated. So, cycle of 3 is 3, 9, 7, 1.

Ex. 11 Find unit digit of 3^{81}.

Sol. Cycle of 3 is 3, 9, 7, 1 which repeats after every fourth interval till 3^{80}. So, the next unit digit will be 3.

Ex. 12 Find unit digit of 133^{133}.

Sol. Cycle of 3 is 3, 9, 7, 1 which repeats after every fourth interval till 133^{132}. So, the next unit digit will be 3.

Ex. 13 Find unit digit of $963^{63} \times 73^{73}$.

Sol. Unit digit of 963^{63} will be 7 and unit digit of 73^{73} will be 3. So, unit digit of $963^{63} \times 73^{73}$ will be unit digit of $7 \times 3 = 21$, i.e. 1.

Ex. 14 Find unit digit of $122^{122} \times 133^{133}$.

Sol. Unit digit of 122^{122} will be 4 because cycle of 2 is 2, 4, 8, 6 and unit digit of 133^{133} will be 3. So, unit digit of $122^{122} \times 133^{133}$ will be unit digit of $4 \times 3 = 12$, i.e. 2.

Cyclicity of 4

$4^1 = 4 \quad 4^2 = 16 \quad 4^3 = 64 \quad 4^4 = 256$

Cycle is 4, 6, i.e. unit digit of 4^n depends on value of n. If n is odd, then unit digit is 4 and if n is even, then unit digit is 6.

Ex. 15 Find unit digit of 4^{425}.

Sol. Since, 425 is an odd number, therefore unit digit will be 4.

Ex. 16 Find unit digit of 4^{1024}.

Sol. Since, 1024 is an even number, therefore unit digit will be 6.

Ex. 17 Find unit digit of $133^{63} \times 4^{49}$.

Sol. Unit digit of 133^{63} is 7 and unit digit of 4^{49} is 4. So, unit digit of $133^{63} \times 4^{49}$ will be unit digit of $7 \times 4 = 28$, i.e. 8.

Cyclicity of 5

$5^1 = 5 \quad 5^2 = 25 \quad 5^3 = 125 \quad 5^4 = 625$

Unit digit will always be 5.

Cyclicity of 6

$6^1 = 6 \quad 6^2 = 36 \quad 6^3 = 216 \quad 6^4 = 1296$

Unit digit will always be 6.

Ex. 18 Find unit digit of $4^{69} \times 6^5$.

Sol. Unit digit of 4^{69} is 4 and unit digit of 6^5 is 6. So, unit digit of $4^{69} \times 6^5$ will be unit digit of $4 \times 6 = 24$, i.e. 4.

Ex. 19 Find unit digit of $144^{144} \times 126^{126}$.

Sol. Unit digit of 144^{144} is 6 and unit digit of 126^{126} is 6. So, unit digit of $144^{144} \times 126^{126}$ will be unit digit of $6 \times 6 = 36$, i.e. 6.

Cyclicity of 7

$7^1 = 7 \quad 7^2 = 49 \quad 7^3 = 343$
$7^4 = 2401 \quad 7^5 = 16807 \quad 7^6 = 117649$
$7^7 = 823543 \quad 7^8 = 5764801$

Cycle of 7 is 7, 9, 3, 1.

Ex. 20 Find unit digit of 17^{17}.

Sol. Cycle of 7 repeats 7, 9, 3, 1 till 17^{16} next digit will be 7. So, unit digit of 17^{17} is 7.

Ex. 21 Find unit digit of $17^{17} \times 27^{27}$.

Sol. Unit digit of 17^{17} is 7 and unit digit of 27^{27} is 3. So, unit digit of $17^{17} \times 27^{27}$ will be unit digit of $7 \times 3 = 21$, i.e. 1.

Ex. 22 Find unit digit of $17^{17} \times 27^{27} \times 37^{37}$.

Sol. Unit digit of 17^{17} is 7 and unit digit of 27^{27} is 3 and unit digit of 37^{37} is 7. So, unit digit of $17^{17} \times 27^{27} \times 37^{37}$ will be unit digit of $7 \times 3 \times 7 = 147$, i.e. 7.

Cyclicity of 8

$8^1 = 8 \quad 8^2 = 64 \quad 8^3 = 512 \quad 8^4 = 4096 \quad 8^5 = 32768$

So, cycle of 8 is 8, 4, 2, 6.

Ex. 23 Find unit digit of 18^{18}.

Sol. Cycle of 8 repeats 8, 4, 2, 6 after every fourth interval till 18^{16}. Next digits will be 8 and 4. So, unit digit of 18^{18} will be 4.

Ex. 24 Find unit digit of $18^{18} \times 28^{28} \times 288^{288}$.

Sol. Unit digit of 18^{18} is 4, unit digit of 28^{28} is 6 and unit digit of 288^{288} is 6. So, unit digit of $18^{18} \times 28^{28} \times 288^{288}$ will be unit digit of $4 \times 6 \times 6 = 144$, i.e. 4.

Cyclicity of 9

$9^1 = 9 \quad 9^2 = 81 \quad 9^3 = 729 \quad 9^4 = 6561$

Cycle of 9 is 9, 1.In 9^n, unit digit will be 9, if n is odd and unit digit will be 1, if n is even.

Ex. 25 Find unit digit of

$11^{11} + 12^{12} + 13^{13} + 14^{14} + 15^{15}$.

Sol. Unit digit of 11^{11} is 1. Unit digit of 12^{12} is 6.
Unit digit of 13^{13} is 3. Unit digit of 14^{14} is 6.
Unit digit of 15^{15} is 5.
So, unit digit of given sum will be unit digit of $1 + 6 + 3 + 6 + 5 = 21$, i.e. 1.

Ex. 26 Find unit digit of

$21^{21} \times 22^{22} \times 23^{23} \times 24^{24} \times 25^{25}$.

Sol. 25^{25} will give 5 in unit place, when multiplied by any even number, i.e. 0, 2, 4, 6, 8, it will given zero at unit place. So, zero will be the unit digit of given question.

Remainder Theorem

Remainder of expression $\frac{a \times b \times c}{n}$ [i.e. $a \times b \times c$, when divided by n] is equal to the remainder of expression $\frac{a_r \times b_r \times c_r}{n}$ [i.e. $a_r \times b_r \times c_r$, when divided by n], where
a_r is remainder, when a is divided by n,
b_r is remainder, when b is divided by n
and c_r is remainder, when c is divided by n.

Ex. 27 Remainder of $15 \times 17 \times 19$, when divided by 7.

Sol. Remainder of expression $\frac{15 \times 17 \times 19}{7}$

will be equal to $\frac{1 \times 3 \times 5}{7} \Rightarrow \frac{15}{7} \Rightarrow \frac{1}{7}$, i.e. 1.

On dividing 15 by 7, we get 1 as remainder.
On dividing 17 by 7, we get 3 as remainder.
On dividing 19 by 7, we get 5 as remainder and combined remainder will be equal to remainder of $\frac{15}{7}$, i.e. 1.

Ex. 28 Find the remainder of expression $\frac{19 \times 20 \times 21}{9}$.

Sol. Remainder will be equal to remainder of expression $\frac{1 \times 2 \times 3}{9}$, which is equal to 6.

Polynomial Theorem

This is very useful theorem to find the remainder.

According to polynomial theorem,

$$(x + a)^n = x^n + {}^nC_1 x^{n-1}a^1 + {}^nC_2 x^{n-2}a^2 + {}^nC_3 x^{n-3}a^3 + \ldots + {}^nC_{n-1}x^1 a^{n-1} + a^n. \quad \ldots (i)$$

$$\therefore \quad \frac{(x + a)^n}{x} = \frac{\left(\begin{matrix} x^n + {}^nC_1 x^{n-1}a^1 + {}^nC_2 x^{n-2}a^2 \\ + {}^nC_3 x^{n-3}a^3 + \ldots + {}^nC_{n-1}x^1 a^{n-1} + a^n \end{matrix}\right)}{x} \quad \ldots (ii)$$

Remainder of expression (ii) will be equal to remainder of $\frac{a^n}{x}$ because rest of the terms which contains x are completely divisible by x.

Ex. 29 Find the remainder of $\frac{9^{99}}{8}$.

Sol. $\frac{9^{99}}{8} = \frac{(8 + 1)^{99}}{8}$

According to polynomial theorem, remainder will be equal to remainder of the expression $\frac{1^{99}}{8}$ which is equal to 1.

Ex. 30 Find the remainder of $\frac{8^{99}}{7}$.

Sol. $\frac{8^{99}}{7} = \frac{(7 + 1)^{99}}{7}$

$= \frac{1^{99}}{7}$, i.e. 1.

Ex. 31 Find the remainder of $\frac{11 \times 13 \times 17}{6}$.

Sol. $\frac{11 \times 13 \times 17}{6} = \frac{5 \times 1 \times 5}{6}$

$= \frac{1}{6} = 1$ [according to remainder theorem]

Ex. 32 Find the remainder of $\frac{9^{100}}{7}$.

Sol. $\frac{9^{100}}{7} = \frac{[7 + 2]^{100}}{7} = \frac{2^{100}}{7}$

$= \frac{2^{99} \times 2}{7} = \frac{(2^3)^{33} \times 2}{7}$

$= \frac{(7 + 1)^{33} \times 2}{7} = \frac{1 \times 2}{7} = 2$

Ex. 33 Find the remainder of $\frac{9^{50}}{7}$.

Sol $\frac{9^{50}}{7} = \frac{(7 + 2)^{50}}{7} = \frac{2^{50}}{7}$

$= \frac{(2^3)^{16} \times 2^2}{7}$

$= \frac{(7 + 1)^{16} \times 4}{7}$

$= \frac{1 \times 4}{7}$, i.e. 4

Ex. 34 Find the remainder of $\frac{5^{100}}{7}$.

Sol. $\frac{5^{100}}{7} = \left[\frac{3 \times 7 + 4}{7}\right]^{50}$

$= \frac{(4)^{50}}{7} = \frac{2^{100}}{7}$

$= \frac{(2^3)^{33} \times 2}{7} = \frac{(7 + 1)^{33}}{7} \times 2$

$= \frac{1 \times 2}{7}$

$\Rightarrow$ Remainder is 2.

Ex. 35 Find remainder of $\frac{3^{50}}{7}$.

Sol. $\frac{3^{50}}{7} = \frac{(3^2)^{25}}{7}$

$= \frac{(7 + 2)^{25}}{7}$

$= \frac{2^{25}}{7}$

$= \frac{(2^3)^8 \times 2}{7} = \frac{(7 + 1)^8 \times 2}{7}$

$= \frac{1 \times 2}{7}$

$\Rightarrow$ Remainder is 2.

HCF and LCM of Numbers

HCF

Highest Common Factor of two or more numbers is the greatest number that divides each one of them exactly. e.g. 8 is the highest common factor of 16 and 40. HCF is also called Greatest Common Divisor (GCD) or GCM, i.e. Greatest Common Measure.

LCM

Least Common Multiple of two or more numbers is the least or a lowest number which is exactly divisible by each of them. e.g. LCM of 8 and 12 is 24 because it is the first number which is multiple of both 8 and 12.

LCM and HCF of Fractions

Fractions are written in form of $\frac{\text{Numerator}}{\text{Denominator}}$, where denominator is not equal to zero.

$$\text{HCF of fraction} = \frac{(\text{HCF of Numerators})}{(\text{LCM of Denominators})}$$

$$\text{LCM of fraction} = \frac{(\text{LCM of Numerators})}{(\text{HCF of Denominators})}$$

e.g. Find HCF and LCM of $\frac{1}{2}, \frac{2}{3}$ and $\frac{3}{7}$.

$$\text{HCF} = \frac{\text{HCF of } (1, 2, 3)}{\text{LCM of } (2, 3, 7)}$$

$$= \frac{1}{42}$$

$$\text{LCM} = \frac{\text{LCM of } (1, 2, 3)}{\text{HCF of } (2, 3, 7)}$$

$$= \frac{6}{1} = 6$$

Arithmetic Series

$a, (a + d), (a + 2d), (a + 3d), \ldots$

a = 1st term

d = common difference. Then,

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

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

(c) Sum of n terms $= \frac{n}{2}(a + l)$,

where l = last term

Ex.36 In series 359, 365, 371, …, what will be the 10th term?

Sol. The given series is in the form of AP. Since, common difference i.e. d is same.

$\therefore$ 10th term $= a + (n - 1)d$

$= 359 + (10 - 1)6$

$= 359 + (9 \times 6)$

$= 413$

Geometric Series

$a, ar, ar^2, ar^3, \ldots$

a = 1st term, r = common ratio. Then,

(a) nth term $= ar^{n-1}$

(b) Sum of n terms $= \frac{a(1 - r^n)}{(1 - r)}$, when $r < 1$

(c) Sum of n terms $= \frac{a(r^n - 1)}{(r - 1)}$, when $r > 1$

Ex.37 In the series 7, 14, 28, …, what will be the 10th term?

Sol. The given series is in the form of GP. Since, common ratio i.e. r is same.

Here, $a = 7$ and $r = 2$

$\therefore$ 10th term $= ar^{n-1} = 7(2)^{(10-1)} = 7 \times 2^9 = 3584$

Some Important Points

- Square of every even number is an even number while square of every odd number is an odd number.
- A number obtained by squaring a number does not have 2, 3, 7 or 8 at its unit place.
- Sum of first n natural numbers $= \frac{n(n + 1)}{2}$
- Sum of first n odd numbers $= n^2$
- Sum of first n even numbers $= n(n + 1)$
- Sum of square of first n natural numbers $= \frac{n(n + 1)(2n + 1)}{6}$
- Sum of cubes of first n natural numbers $= \left[\frac{n(n + 1)}{2}\right]^2$
- Every prime number greater than 3 can be written in the form of $(6k + 1)$ or $(6k - 1)$, where k is an integer.
- There are 15 prime numbers between 1 and 50 and 10 prime numbers between 50 and 100.
- If p divides q and r, then p divided their sum and difference also. e.g. If 4 divides 12 and 20, then 20 + 12 = 32 and 20 − 12 = 8 are also divisible by 4.
- For any natural number n, $(n^3 - n)$ is divisible by 6.
- The product of three consecutive natural numbers is always divisible by 6.
- $(x^m - a^m)$ is divisible by $(x - a)$, for all values of m.
- $(x^m - a^m)$ is divisible by $(x + a)$, for even values of m.
- $(x^m + a^m)$ is divisible by $(x + a)$, for odd values of m.

QUESTIONS *with* Detailed Explanation

Type 1 Interchanging the Position of the Digit of a Number

In this type of questions, a two digit number is supposed as $10y + x$ or $10x + y$ and then we operate according to the question.

1. When 9 is subtracted from a two-digit number, the number so formed is reverse of the original number. Also, the average of the digits of the original number is 7.5. What is definitely the original number?
[IBPS RRB PO (Pre) 2016]

(a) 87 *(b)* 92 *(c)* 90 *(d)* 69
(e) 96

(a) Let a two-digit number = $10x + y$

$\Rightarrow \quad 10x + y - 9 = 10y + x$

$\Rightarrow \quad 9x - 9y = 9$

$\Rightarrow \quad x - y = 1 \quad \ldots(i)$

Also, $\frac{x + y}{2} = 7.5 \Rightarrow x + y = 15 \quad \ldots(ii)$

From Eqs. (i) and (ii),

$x = 8$ and $y = 7$

$\therefore$ Required number = $10x + y$

$= 10 \times 8 + 7 = 87$

2. Let d be a two digit number. If half of d exceeds one third of d by the sum of the digits in d, then the sum of the digits in d is
[United India Insurance (AAO) 2012]

(a) 6 *(b)* 8
(c) 9 *(d)* 15
(e) None of these

(c) Here, let d be $10x + y$.

According to the question,

$$\frac{10x + y}{2} - \frac{10x + y}{3} = x + y$$

or $3(10x + y) - 2(10x + y) = 6(x + y)$

$\Rightarrow \quad 30x + 3y - 20x - 2y = 6(x + y)$

$\Rightarrow \quad 10x + y = 6(x + y)$

$\Rightarrow \quad 4x = 5y$

$\Rightarrow \quad \frac{x}{y} = \frac{5}{4}$

Then, sum of digits can be 9 as $(x + y)$ is in the multiple of $(5 + 4 = 9)$.

3. If a number of two digits is k times the sum of its digits, then the number formed by interchanging the digits is the sum of the digits multiplied by
[General Insurance Corporation (AAO) 2011]

(a) $9 + k$ *(b)* $10 + k$
(c) $11 - k$ *(d)* $k - 1$
(e) None of these

(c) Here, let the number be $10x + y$.

Then, $10x + y = k \cdot (x + y)$

Now, by interchanging the digits,

we get the number $10y + x$.

Now, $10y + x = 11y + 11x - 10x - y$

$= 11(x + y) - k(x + y)$

$= (11 - k)(x + y)$

$\therefore$ Correct option is $(11 - k)$.

4. The difference between a two digit number and the number obtained by interchanging the two digits of the number is 9. What is the difference between the two digits of the number?
[IBPS (PO) 2011]

(a) 3 *(b)* 2 *(c)* 1
(d) Cannot be determined
(e) None of these

(c) Let the number be $10x + y$.

The number by interchanging the position of the digit = $10y + x$

Now, $(10x + y) - (10y + x) = 9$

$9x - 9y = 9$

$\Rightarrow \quad 9(x - y) = 9$

$\Rightarrow \quad (x - y) = 1$

5. If the positions of the digits of a two digit number are interchanged, the number obtained is smaller than the original number by 27. If the digits of the number are in the ratio of 1 : 2, what is the original number?
[United Bank of India (PO) 2009]

(a) 36 *(b)* 63 *(c)* 48
(d) Cannot be determined
(e) None of the above

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

Now, by interchanging the position of the digits of the number, we get $10y + x$.

Now, $(10x + y) - (10y + x) = 27$

$\Rightarrow \quad 9x - 9y = 27 \Rightarrow x - y = 3$

$\Rightarrow \quad \frac{y}{x} = \frac{1}{2} \Rightarrow x = 2y$

If $y = 3$

$x = 6$

Then, number = $10 \times 6 + 3 = 63$

Alternate Method

Difference of two numbers is always multiple of 9 and sum of two numbers is always multiple of 11.

So, here, difference = $9(x - y)$

or $9(x - y) = 27 \Rightarrow (x - y) = 3$

And $\frac{x}{y} = \frac{2}{1}$

$\therefore \quad x = 6$ and $y = 3$

So, number = $10 \times 6 + 3 = 63$

Hit and Trial Method

We can solve this question by eliminating options also.

(i) Option *(a)* is 36, the number after interchanging the position of the digits is 63. Hence, this is not possible as number obtained > original number.

(ii) Option (b), 48 is also not possible.

(iii) 63 is the right choice, as it fulfills all the conditions.

6. The sum of the digits of a two-digit numbers is 15 and the difference between the two digits of the two digit numbers is 3. What is the product of the two digits of the two digit number?
[PNB Management Trainee 2009]

(a) 56 *(b)* 63 *(c)* 42
(d) Cannot be determined
(e) None of these

(e) Here, let the two digits of the number be x and y.

$\therefore \quad x + y = 15 \quad \ldots(i)$

$x - y = 3 \quad \ldots(ii)$

On solving Eqs. (i) and (ii), we get

$2x = 18 \Rightarrow x = 9$

and $y = 6$

$\therefore \quad x \times y = 9 \times 6 = 54$

Hit and Trial Method

By going through options, sum of the digits is not 15. Hence, no option is correct.

7. The difference between a two digit number and the number obtained by interchanging the two digits of the number is 9. If the sum of the two digits of the number is 15, then what is the original number? **[Punjab National Bank 2009]**

(a) 89 *(b)* 67 *(c)* 87
(d) Cannot be determined
(e) None of these

(c) Here, difference = $9x - 9y$

Now, $9(x - y) = 9 \; ; \; x - y = 1$

And $x + y = 15$

Now, $x + y = 15$

$x - y = 1$

$2x = 16$

$x = 8$

$y = 7$

$\therefore$ Number = 87

Hit and Trial Method

By options, we see that, sum of the digits is not 15 of any option except 87.

And difference between the number and number got by interchanging the position of the digits is 9. Hence, 87 is right option.

8. In a two digit positive number, the digit at the units place is equal to the square of the digit in ten's place and the difference between the number and the number obtained by interchanging the digits is 54. What is 40% of the original number? **[IOB (PO) 2008]**

(a) 15.6 *(b)* 39 *(c)* 37.2 *(d)* 24
(e) None of these

(a) Let the number be $10x + y$.

And, $y = x^2$

Now, $10x + y - (10y + x) = 54$

$\Rightarrow \quad 9x - 9y = 54$

$\Rightarrow \quad x - y = 6$

$\Rightarrow \quad x - x^2 = 6$

$\Rightarrow \quad x^2 - x - 6 = 0$

$\Rightarrow \quad x^2 - 3x - 2x - 6 = 0$

$\Rightarrow \quad x(x - 3) - 2(x - 3) = 0$

$\Rightarrow \quad (x - 2)(x - 3) = 0$

$\Rightarrow \quad x = 2$ or $x = 3$

$\therefore \quad y = x^2$

or $y = 4, 9$

Number is either 24 or 39.

Here, 24 is not possible, so 39 is the number.

Now, $39 \times \frac{40}{100} = 3.9 \times 4 = 15.6$

9. The number obtained by interchanging the digits of a two digit number is less than the original number by 63. If the sum of the digits of the number is 11, what is the original number? **[SBI (PO) 2008]**

(a) 29
(b) 92
(c) 74
(d) Cannot be determined
(e) None of the above

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

and difference = 63

$9(x - y) = 63$

$\Rightarrow \quad x - y = 7$

Now, $x + y = 11$

$x - y = 7$

$2x = 18$

$x = 9$

$y = 2$

Original number is 92.

Hit and Trial Method

We can also use elimination method, to find out the answer.

Sum of digits of all the given options is 11 but difference between original and the number obtained after interchanging the position of digits is not 63 except 92. Hence, correct option is 92.

10. In a three digit number, the digit in the unit's place is twice the digit in the ten's place and 1.5 times the digit in the hundred's place. If the sum of all the three digits of the number is 13, what is the number? **[SBI (PO) Preliminary 2008]**

(a) 364 *(b)* 436
(c) 238 *(d)* 634
(e) None of these

(b) Let the three digit number be

$100a + 10b + c$

And $c = 2b$

Now, $c = 1.5 \times a$

$a + b + c = 13$

$\therefore \quad \frac{c}{1.5} + \frac{c}{2} + c = 13$

$\Rightarrow \; 2c + 1.5c + 3c = 39$

$\Rightarrow \quad 6.5c = 39$

$\Rightarrow \quad c = \frac{39}{6.5}$

Now, $c = 6$

$b = 3$

$a = 4$

So, number is $100 \times 4 + 10 \times 3 + 6$

$= 400 + 30 + 6 = 436$

11. The sum of the two digits of a two digit number is 12 and the difference between the two digits of the two digit number is 6. What is the two digit number? **[SBI (PO) Preliminary 2008]**

(a) 39 *(b)* 84
(c) 93
(d) Cannot be determined
(e) None of the above

(c) Let the twodigit number be $10x + y$.

And $x + y = 12$

$x - y = 6$

$2x = 18$

$x = 9$

$y = 3$

Hence, number = $10 \times 9 + 3$

$= 93$

12. A certain number of two digits is three times the sum of its digits. If 45 is added to it, the digits are reversed. The number is **[United India Insurance Corporation (AAO) 2007]**

(a) 72 *(b)* 32
(c) 27 *(d)* 23
(e) None of these

(c) Let the number be $10x + y$.

Then, $10x + y = 3(x + y)$

$\Rightarrow \quad 10x - 3x + y - 3y = 0$

$\Rightarrow \quad 7x - 2y = 0 \quad \ldots(i)$

and $10x + y + 45 = 10y + x$

$\Rightarrow \quad 9x - 9y = -45$

$\Rightarrow \quad 9y - 9x = 45$

$\Rightarrow \quad y - x = 5 \quad \ldots(ii)$

Now, $7x - 2y = 0$

$-x + y = 5$ [multiply by 2]

So, $7x - 2y = 0$

$-2x + 2y = 5 \times 2$

$5x = 10$

$x = 2$

$y = 7$

$\therefore$ Number is $10 \times 2 + 7 = 27$

13. In a two digit number, the digit in the unit's place is twice the digit in the ten's place and the number obtained by interchanging the digits is more than the original number by 27. What is 50% of the original number? **[SBI (PO) 2005]**

(a) 36 *(b)* 63
(c) 48 *(d)* 18
(e) None of these

› ***(d)*** Let the original number be $10x + y$ and $y = 2x$

The number obtained by interchanging the position of the digits = $10y + x$

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

$\Rightarrow \quad 9x - 9y = -27$

$\Rightarrow \quad y - x = 3$ or $2x - x = 3$

$\Rightarrow \quad x = 3$

$\Rightarrow \quad y = 3 \times 2 = 6$

$\therefore$ Numbers $= 36$

So, 50% of this number is 18.

14. The number obtained by interchanging the two digits of a two digit number is less than the original number by 27. If the difference between the two digits of the number is 3, then what is the original number?

[Union Bank of India (PO) 2005]

(a) 74 *(b)* 63 *(c)* 85
(d) Cannot be determined
(e) None of these

› ***(d)*** Let the original number be $10x + y$.

The number obtained by interchanging the position of the digits = $10y + x$

Again, difference = $9x - 9y$

Now, $9x - 9y = 27$

$\Rightarrow \quad x - y = 3$

But, here all the given options fulfill this condition. Hence, we cannot determine an exact answer.

15. In a two digit number, the digit in ten's place is four times the digit in Unit place and sum of the digits is equal to ten. What is the number?

[LIC Assistant Administrative Officer (AAO) 2005]

(a) 14
(b) 41
(c) 82
(d) Data inadequate
(e) None of the above

› ***(c)*** Here, by going through the options, we see that 82 is the correct option.

16. The difference between a two digit number and the number obtained by interchanging the positions of its digits is 36.
What is the difference between the two digits of that number?

[Canara Bank (PO) 2003]

(a) 4 *(b)* 9 *(c)* 3
(d) Cannot be determined
(e) None of these

› ***(a)*** Here, let the two digit number be $10x + y$ and the number by interchanging the position of the digits = $10y + x$.

Now,

$10x + y - (10y + x) = 36$

$\Rightarrow \quad 9x - 9y = 36 \Rightarrow x - y = 4$

Alternate Method

As we know, difference between original number and number obtained by interchanging the position of the digits is multiple of 9.

i.e. $9(x - y) = 36$

$\Rightarrow \quad (x - y) = 4$

Type ❷ Operations on Two Different Numbers

In this type of questions, an equation can be formed from the given question, then solve the equation to find the unknown number.

17. Twice the square of a number is six times the other number. What is the ratio of the first number to the second? **[IOB (PO) 2010]**

(a) 1 : 4
(b) 2 : 5
(c) 1 : 3
(d) Cannot be determined
(e) None of the above

› ***(d)*** Here, let the first number be x and second number be y.

Then, $2(x^2) = 6y$

$\Rightarrow \quad x^2 = 3y$

$\therefore$ We cannot determine the ratio between these two numbers.

18. The sum of twice of a number and thrice of 42 is 238. What will be the sum of thrice of that number and twice of 42?

[Syndicate Bank (PO) 2009]

(a) 245 *(b)* 250
(c) 264 *(d)* 252
(e) None of these

› ***(d)*** Here, let the number be x.

Then, $2 \times x + 3 \times 42 = 238$

or $2x = 238 - 126$

$\Rightarrow \quad 2x = 112$

$\Rightarrow \quad x = 56$

Now, $3 \times 56 + 2 \times 42 = 168 + 84 = 252$

19. Three-fourth of one number is equal to five-sixth of another number. What is the respective ratio of the first number to the second number?

[Haryana Grammen Bank (PO) 2009]

(a) 12 : 11 *(b)* 11 : 9 *(c)* 9 : 10
(d) Cannot be determined
(e) None of these

› ***(e)*** Here, let the two numbers be x and y.

Then, $\frac{3}{4} \times x = \frac{5}{6} \times y$

$\Rightarrow \quad \frac{x}{y} = \frac{5}{6} \times \frac{4}{3} = \frac{20}{18} = 10 : 9$

20. There are two numbers such that the sum of twice the first number and thrice the second number is 100 and the sum of thrice the sum first number and twice the second number is 120. Which is the larger number? **[Corporation Bank (PO) 2009]**

(a) 32 *(b)* 12
(c) 14 *(d)* 35
(e) None of these

› ***(a)*** Here, let the two numbers be x and y.

And, $2 \times x + 3 \times y = 100$

Again, $3 \times x + 2 \times y = 120$

$2x + 3y = 100 \quad \ldots \times 2 \quad \ldots(i)$

$3x + 2y = 120 \quad \ldots \times 3 \quad \ldots(ii)$

And subtracting Eq. (ii) from Eq. (i), we get

$4x + 6y = 200$

$9x + 6y = 360$

$- \quad - \quad -$

$-5x = -160$

$x = 32$

$y = 12$

Hence, larger number is 32.

21. The sum of five numbers is 290. The average of the first two numbers is 48.5 and the average of last two numbers is 53.5. What is the third number? **[IOB (PO) 2009]**

(a) 72 *(b)* 84
(c) 96 *(d)* 108
(e) None of these

› ***(e)*** Here, let the five numbers be a, b, c, d and e.

And $a + b + c + d + e = 290$

Again, $a + b = 2 \times 48.5 = 97$

And $d + e = 2 \times 53.5 = 107$

So, $a + b + d + e = 97 + 107 = 204$

$\therefore$ Third number $= 290 - 204 = 86$

22. The difference between the $\frac{3}{4}$th of $\frac{4}{5}$th of a number and $\frac{1}{6}$th of $\frac{2}{5}$th of the same number is 648. What is the number? **[IOB (PO) 2009]**

(a) 1110 *(b)* 1215
(c) 1325 *(d)* 1440
(e) None of these

➲ ***(b)*** Here, let the number be x.

Hence, $\frac{3}{4} \times \frac{4}{5} \times x - \frac{1}{6} \times \frac{2}{5} \times x = 648$

$\Rightarrow \quad \frac{3x}{5} - \frac{x}{15} = 648$

$\Rightarrow \quad \frac{9x - x}{15} = 648$

$\Rightarrow \quad 8x = 648 \times 15$

$\Rightarrow \quad x = \frac{648 \times 15}{8}$

$= 81 \times 15 = 1215$

23. A number when subtracted by $\frac{1}{7}$ of itself gives the same value as the sum of all the angles of a triangle. What is the number? **[Corporation Bank (PO) 2009]**

(a) 224 *(b)* 210
(c) 140 *(d)* 350
(e) 187

➲ ***(b)*** Here, let the number be x.

Then, $x - \frac{x}{7} = 180°$

[$\because$ sum of all the angles of triangle is 180°]

$\Rightarrow \quad \frac{6x}{7} = 180$

$\Rightarrow \quad x = 210$

Type ❸ Operations on Even Numbers

In this type of questions, an equation between two or more than two even numbers is given and we have to find out the required even number.

24. The sum of two even numbers is 6 more than twice of the smaller number. If the difference between these two numbers is 6, which is definitely the smaller number? **[IBPS RRB (PO) 2014]**

(a) 18
(b) 20
(c) Data provided are not adequate to answer the question
(d) 12
(e) 24

➲ ***(c)*** Here, let the first even number be x.

Then, second even number is $x + 6$.

Now, $x + x + 6 = 2x + 6$

or $2x + 6 = 2x + 6$

Hence, data provided is not sufficient.

25. The product of two consecutive even numbers is 3248. Which is the larger number? **[IBPS (PO) 2013]**

(a) 58
(b) 62
(c) 56
(d) 60
(e) None of the above

➲ ***(a)*** Here, let the one even number be x.

Then, another even number is $(x + 2)$.

Now, $x(x + 2) = 3248$

or $x^2 + 2x - 3248 = 0$

$\Rightarrow \quad x^2 + 58x - 56x - 3248 = 0]$

[by splitting the middle term]

$\Rightarrow \quad x(x - 56) + 58(x - 56) = 0$

$\Rightarrow \quad (x + 58)(x - 56) = 0$

$\Rightarrow \quad x = 56$

$\therefore$ Larger number is $x + 2$ or $56 + 2 = 58$

26. The sum of the squares of two consecutive even numbers is 6500. Which is the smaller number? **[IOB (PO) 2008]**

(a) 54 *(b)* 52 *(c)* 48 *(d)* 56
(e) None of these

➲ ***(d)*** Here,

Let the first even number be x.

Then, second number is $x + 2$.

Again, $x^2 + (x + 2)^2 = 6500$

or $x^2 + x^2 + 4 + 4x = 6500$

$\Rightarrow \quad 2x^2 + 4x + 4 = 6500$

$\Rightarrow \quad x^2 + 2x + 2 = 3250$

$\Rightarrow \quad x^2 + 2x - 3248 = 0$

$\Rightarrow \quad x^2 + 58x - 56x - 3248 = 0$

[by splitting the middle term]

$\Rightarrow \quad x(x - 56) + 58\,(x - 56) = 0$

$\Rightarrow \quad x = 56$

$\therefore$ Smaller number is 56.

27. The product of two consecutive even numbers is 9408. Which is the greater of the two numbers? **[Andhra Bank (PO) 2008]**

(a) 96 *(b)* 98 *(c)* 94 *(d)* 92
(e) None of these

➲ ***(b)*** Here, let the first even number be x.

Then, second even number is $x + 2$.

And, $x(x + 2) = 9408$

or $x^2 + 2x = 9408$

$\Rightarrow \quad x^2 + 2x - 9408 = 0$

[by splitting the middle term]

$\Rightarrow \quad x^2 + 98x - 96x - 9408 = 0$

$\Rightarrow \quad x(x - 96) + 98(x - 9408) = 0$

$\Rightarrow \quad (x + 98)(x - 96) = 0$

$\Rightarrow \quad x = 96$

Hence, the greater number is 98.

28. The product of two successive even numbers is 6888. Which is the greater of the two numbers? **[UK GBO 2007]**

(a) 78 *(b)* 82
(c) 86 *(d)* 90
(e) None of these

➲ ***(e)*** Here, let the first even number be x.

Then, second even number is $(x + 2)$.

And $x(x + 2) = 6888$

or $x^2 + 2x = 6888$

$\Rightarrow \quad x^2 + 2x - 6888 = 0$

$\Rightarrow \quad x^2 + 84x - 82x - 6888 = 0$

[by splitting the middle term]

$\Rightarrow \quad x(x - 82) + 84\,(x - 82) = 0$

$\Rightarrow \quad (x + 84)\,(x - 82) = 0$

$\Rightarrow \quad x = 82$

and second number is 84.

$\therefore$ Greater number is 84.

Type 4 Operations on Odd Numbers

In this type of questions, an equation between two odd numbers is given and we have to find out the required number.

29. The sum of two odd numbers is 38 and their product is 325. What is three times the larger number? **[IBPS (SO) 2014]**

(a) 42 *(b)* 39
(c) 75 *(d)* 72
(e) 78

› ***(c)*** Here, let the first odd number be x.
Then, second odd number is y.
Then, $x + y = 38$ ...(i)
And $x \times y = 325$
$(x - y)^2 = (x + y)^2 - 4xy$
$= (38)^2 - 4 \times 325$
$= 1444 - 1300$
$x - y = \sqrt{144}$
or $x - y = 12$ ...(ii)
By solving Eqs. (i) and (ii), we get
$2x = 50$
$\Rightarrow x = 25$
and $y = 13$
$\therefore$ Required number $= 3 \times 25 = 75$

Alternate Method
We can directly do it through eliminating options as
(a) $1.3 \times x = 42, x = 14$
$y = 24$
$24 \times 14 \neq 325$
(b) $2.3 \times x = 39, x = 13$
$y = 25$
(c) $3 \times x = 75$
$x = 25$
Larger number = 25
$\therefore$ Correct option is 75.
Its product is 325 but larger number is 25 here.

30. The average of four consecutive odd numbers is 36. What is the smallest of these numbers? **[Haryana Grameen Bank (PO) 2009]**

(a) 31 *(b)* 35
(c) 43 *(d)* 47
(e) None of these

› ***(e)*** Here, let the first odd number be x.
Second odd number is $x + 2$.
Third odd number is $x - 2$.
Fourth odd number is $x + 4$.
Now,
$x + x + 2 + x - 2 + x + 4 = 4 \times 36$
or $4x + 4 = 4 \times 36$
$\Rightarrow x + 1 = 36$
$\Rightarrow x = 35$
Hence, smallest odd number
$= 35 - 2 = 33$

31. The sum of five consecutive odd numbers is 575. What is the sum of the next set of the consecutive odd numbers? **[NABARD (PO) 2009]**

(a) 615 *(b)* 635
(c) 595
(d) Cannot be determined
(e) None of these

› ***(d)*** Here, let the five consecutive odd numbers be $x, x - 2, x - 4, x + 2$ and $x + 4$.
And
$x + x + 2 + x - 2 + x + 4 + x - 4 = 575$
$\Rightarrow 5x = 575$
$\Rightarrow x = 115$
So, from this, five odd numbers are 111, 113, 115, 117, 119.
By this, we cannot determine the next set of odd numbers

Type 5 Operations on Fractions

Fractions are the part of a whole number. e.g. $\frac{3}{5}$ is a fraction in which 3 is numerator and 5 is denominator. Here, questions are asked by increasing or decreasing the value of fractions and we have to find out the original fraction.

32. If the numerator of a fraction is increased by 240% and the denominator of the fraction is decreased by 50%, the resultant fraction is $2\frac{5}{6}$. What is the original fraction? **[NABARD (PO) 2009]**

(a) $\frac{1}{4}$ *(b)* $\frac{2}{3}$
(c) $\frac{5}{12}$ *(d)* $\frac{4}{11}$
(e) None of these

› ***(c)*** Here, let the original fraction be $\frac{x}{y}$.
Then, $\frac{x + x \times \frac{240}{100}}{y - y \times \frac{50}{100}} = \frac{17}{6}$
Then, $\frac{x + \frac{12x}{5}}{y - \frac{y}{2}} = \frac{17}{6}$
or $\frac{\frac{17x}{5}}{\frac{y}{2}} = \frac{17}{6}$
$\Rightarrow \frac{17x}{5} \times \frac{2}{y} = \frac{17}{6}$
$\Rightarrow \frac{34x}{5y} = \frac{17}{6}$
$\Rightarrow 204x = 85y$
$\Rightarrow \frac{x}{y} = \frac{85}{204}$
$= \frac{5}{12}$

33. If the numerator of a fraction is increased by 200% and the denominator is increased by 350%. The resultant fraction is $\frac{5}{12}$. What was the original fraction? **[IOB (PO) 2009]**

(a) $\frac{5}{9}$ *(b)* $\frac{5}{8}$ *(c)* $\frac{7}{12}$ *(d)* $\frac{11}{12}$
(e) None of these

› ***(b)*** Here, let the original fraction be $\frac{x}{y}$.
Then, numerator $= x + x \times \frac{200}{100} = 3x$
And denominator $= y + y \times \frac{350}{100}$
or $\frac{450y}{100}$
So, fraction $= \frac{\text{Numerator}}{\text{Denominator}} = \frac{3x \times 100}{450y}$
$= \frac{2x}{3y}$
Now, $\frac{2x}{3y} = \frac{5}{12}$, $\frac{x}{y} = \frac{15}{24} = \frac{5}{8}$

Alternate Method
We can do it directly as add 100 in the increasing value and multiply it with numerator and denominator.

Here, original fraction is $\frac{x}{y}$.

So, $\frac{x \times 300}{y \times 450} = \frac{5}{12}$ or $\frac{x}{y} = \frac{15}{24}$

$\Rightarrow \frac{x}{y} = \frac{5}{8}$

34. If the numerator of a fraction is increased by 400% and the denominator is increased by 500%. The resultant fraction is $\frac{20}{27}$. What was the original fraction? **[New India Insurance 2009]**

(a) $\frac{9}{8}$ *(b)* $\frac{11}{12}$ *(c)* $\frac{3}{4}$
(d) Cannot be determined
(e) None of these

(e) Here, let the original fraction be $\frac{x}{y}$.

Then, $\frac{x \times 500}{y \times 600} = \frac{20}{27}$

$\Rightarrow \frac{x}{y} = \frac{120}{135} \Rightarrow \frac{x}{y} = \frac{8}{9}$

35. If the numerator of a fraction is increased by 500% and the denominator is increased by 300%. The resultant fraction is $2\frac{4}{7}$. What was the original fraction? **[IOB (PO) 2009]**

(a) $\frac{4}{7}$ *(b)* $\frac{12}{7}$ *(c)* $\frac{15}{4}$ *(d)* $\frac{6}{5}$
(e) None of these

(b) Here, let the original fraction be $\frac{x}{y}$.

Then, $\frac{x \times 600}{y \times 400} = \frac{18}{7}$

$\Rightarrow \frac{x}{y} = \frac{72}{42} \Rightarrow \frac{x}{y} = \frac{12}{7}$

36. If the numerator of a fraction is increased by 200% and the denominator of the fraction is increased by 150%, the resultant fraction is $\frac{7}{10}$. What is the original fraction? **[Bank of Maharashtra (PO) 2008]**

(a) $\frac{3}{4}$ *(b)* $\frac{7}{12}$ *(c)* $\frac{7}{11}$ *(d)* $\frac{9}{11}$
(e) None of these

(b) Let the original fraction be $\frac{x}{y}$.

Then, $\frac{x \times 300}{y \times 250} = \frac{7}{10}$

$\Rightarrow \frac{x}{y} = \frac{7 \times 5}{10 \times 6}$

$\Rightarrow \frac{x}{y} = \frac{7}{12}$

37. If the numerator of a fraction is increased by 20% and its denominator by 25%, then the fraction so obtained is $\frac{3}{5}$. What is the original fraction? **[Syndicate Bank (PO) Exam 2004]**

(a) $\frac{3}{5}$ *(b)* $\frac{3}{8}$ *(c)* $\frac{5}{8}$
(d) Cannot be determined
(e) None of these

(c) Here, let the original fraction be $\frac{x}{y}$.

Then, $\frac{x \times 120}{y \times 125} = \frac{3}{5}$

Required answer is

$\Rightarrow \frac{x}{y} = \frac{3 \times 25}{5 \times 24} \Rightarrow \frac{x}{y} = \frac{5}{8}$

Type 6 Concept of LCM and HCF

38. The HCF and LCM of two natural numbers are 12 and 72 respectively. What is the difference between two numbers, if one of the numbers is 24? **[IBPS PO (Pre) 2017]**

(a) 12 *(b)* 18 *(c)* 21 *(d)* 24
(e) 27

(a) We know that, First number × Second number = LCM × HCF

$\Rightarrow$ 24 × Second number = 72 × 12

$\Rightarrow$ Second number = $\frac{72 \times 12}{24}$

$\Rightarrow$ Second number = 36

$\therefore$ Difference between the two numbers
= 36 – 24 = 12

39. The HCF and LCM of two natural numbers are 12 and 72 respectively. What is the difference between the two numbers, if one of the numbers is 24? **[IBPS PO (Pre) 2017]**

(a) 12 *(b)* 18
(c) 21 *(d)* 24
(e) 27

(a) We know that,
First number × Second number
= LCM × HCF

$\Rightarrow$ 24 × Second number = 72 × 12

$\Rightarrow$ Second number = $\frac{72 \times 12}{24}$ = 36

$\therefore$ Difference between the two numbers
= 36 – 24
= 12

40. The difference between two numbers is 18 and their HCF and LCM are 6 and 168, respectively. What is the sum of squares of the two numbers? **[RBI 2015]**

(a) 2280 *(b)* 2260
(c) 2420 *(d)* 2340
(e) 2380

(d) Let one number be x.
Then, another number is $x + 18$.
Now, product of two numbers
= HCF × LCM

$\Rightarrow x \times (x + 18) = 6 \times 168$
$\Rightarrow x^2 + 18x = 1008$
$\Rightarrow x^2 + 18x - 1008 = 0$
$\Rightarrow x^2 + 42x - 24x - 1008 = 0$
$\Rightarrow x(x - 24) + 42(x - 24) = 0$
$\Rightarrow x = 24$

$\therefore$ Another number is 42.
Required sum = $(24)^2 + (42)^2$
= 576 + 1764 = 2340

41. LCM of two numbers is 120 and their HCF is 10. Which of the following can be the sum of those two numbers? **[NICL (GIC) AO (Finance) 2013]**

(a) 140 *(b)* 80
(c) 60 *(d)* 70
(e) None of these

(d) Here, LCM of two numbers = 120
HCF of these two numbers = 10
Let the two numbers be $10x$ and $10y$.
Then, LCM of $10x$ and $10y$ = 120
$10xy = 120 \Rightarrow xy = 12$
Here, xy can be (3, 4).
So, numbers are 10 × 3 and 10 × 4.
Sum of these two numbers = 30 + 40 = 70

Alternate Method
We can solve it directly as
Divide the LCM by HCF
i.e. 120 ÷ 10 = 12
and prime factors of 12 is 3 and 4.
$\therefore$ Sum of the numbers = 10 × (3 + 4) = 70

42. Find the maximum number of girls, among whom 2923 bags and 3239 eyeliners can be distributed in such a way that each girl gets the same number of bags and eyeliners. **[NICL (GIC) AO (Finance) 2013]**

(a) 80 *(b)* 79
(c) 78 *(d)* 81
(e) None of the above

(b) Here, we have to find maximum number. Hence, here we have to find out the HCF of 2923 and 3239.

So, find the HCF of these two numbers by factorisation method.

i.e. 2923 = 1, 37, 79

3239 = 1, 41, 79

∴ HCF = 79

Hence, maximum number of girls = 79

43. The sum of two numbers is 45 and their product is 500. Their HCF is **[NICL (GIC) AO 2013]**

(a) 5 *(b)* 9 *(c)* 10 *(d)* 15
(e) None of these

(a) Here, the sum of two numbers = 45

or $x + y = 45$

And $x \times y = 500$

So, going through the options 5 is the only common factor which satisfies both the equations.

44. LCM of two numbers is 28 times their HCF. The sum of HCF and LCM is 1740. If one of these numbers is 240, the sum of digits of the other number is **[United India Insurance (AAO) 2012]**

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

(c) Here, let LCM of the two numbers = x

Then, HCF of the two numbers = $\frac{x}{28}$

Now, $x + \frac{x}{28} = 1740$

$\Rightarrow \frac{29x}{28} = 1740$

$\Rightarrow x = \frac{1740 \times 28}{29} = 1680$

So, LCM of these two numbers = 1680

Again, $240 \times y = 1680 \times 60$

[First number × Second number] = [LCM × HCF]

or $y = 7 \times 60$ $y = 420$

Hence, other number is 420

or sum of digits = 4 + 2 + 0 = 6

45. HCF of three numbers 3240, 3600 and p is 36. If their LCM is $2^4 \times 3^5 \times 5^2 \times 7^2$, then the number p is **[Oriental Insurance Companay (AAO) 2012]**

(a) $2^2 \times 5^3 \times 7^2$
(b) $3^5 \times 5^2 \times 7^2$
(c) $2^2 \times 3^5 \times 7^2$
(d) $2^3 \times 3^5 \times 7^3$
(e) None of the above

(c) Here, HCF of three numbers 3240, 3600 and p is 36.

LCM of these three numbers

$= 2^4 \times 3^5 \times 5^2 \times 7^2$

Now, prime factor of 36

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

Prime factors of 3600

$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5$

$= 2^4 \times 3^2 \times 5^2$

Prime factors of 3240

$= 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5$

$= 2^3 \times 3^4 \times 5$

Hence, $p = 2^2 \times 3^5 \times 7^2$

46. HCF of two numbers each of 4 digits is 103 and their LCM is 19261. Sum of the numbers is **[New India Insurance (AAO) 2011]**

(a) 2884
(b) 2488
(c) 4288
(d) 4882
(e) None of these

(a) Here, HCF of two 4-digits numbers = 103

∴ Let the numbers be 103*a* and 103*b*.

And LCM of 103*a* and 103*b* = 19261

or $103(a \times b) = 19261$

$\Rightarrow a \times b = 187$

or $a = 11$ or 17 and $b = 11$ or 17

∴ Numbers = 103 × 11 = 1133

= 103 × 17 = 1751

∴ Sum of these two numbers = 2884

47. When a number is divided by 2, 3, 4, 5 or 6, remainder in each case is 1. But the number is exactly divisible by 7. If the number lies between 250 and 350, the sum of digits of the number will be **[New India Insurance (AAO) 2011]**

(a) 4 *(b)* 5
(c) 7 *(d)* 10
(e) None of these

(a) Here, first of all we have to find the LCM of 2, 3, 4, 5 and 6 = 60

Now, $60 \times 5 + 1 = 7k$

or $7k = 301$

$k = 43$

So, sum of the digits of 301 = 3 + 0 + 1 = 4

48. Amit, Sucheta and Neeti start running around a circular track and complete one round in 18 s, 24 s and 32 s, respectively.
In how many seconds, will the three meet again at the starting point as they all have started running at the same time?

(a) 196 s
(b) 288 s
(c) 324 s
(d) Cannot be determined
(e) None of the above

(b) Here, to find out the time after which they meet again at the starting point

= LCM of 18, 24 and 32

= 288 s

∴ After 288 s they will meet with one another.

49. The LCM of $\frac{1}{3}, \frac{5}{6}, \frac{2}{9}, \frac{4}{27}$ is **[LIC Assistant Administrative Officer (AAO) 2009]**

(a) $\frac{1}{54}$ *(b)* $\frac{10}{27}$
(c) $\frac{20}{3}$ *(d)* $\frac{27}{3}$
(e) None of these

(c) Here, to find the LCM of fractions, we find the LCM of numerators and HCF of denominators.

So, $\frac{\text{LCM of 1, 5, 2 and 4}}{\text{HCF of 3, 6, 9 and 27}} = \frac{20}{3}$

50. Punit, Vinit and Ajit begin to jog around a stadium. They complete their revolutions in 45 s, 54 s and 36 s respectively. After how many seconds, will they be together at the starting point? **[RBI Grade B Officer 2008]**

(a) 360 s *(b)* 600 s *(c)* 540 s *(d)* 450 s
(e) None of these

(c) Here, to find out the time after which they will meet one another at the starting point, we have to find LCM of 45s, 36 s and 54s.

So, LCM of 45, 36 and 54 = 540 s

Type 7 Miscellaneous

In this type, questions which are not based on any single concept but have multiple concepts, are put under this section.

51. *A*, *B* and *C* have a certain amount of money with themselves. *C* has 3/4 of what *A* has and *B* has ₹50 less than *C*. If *A*, *B* and *C* together have ₹250, then how much does *A* alone have?
[IBPS RRB PO (Pre) 2016]
(a) ₹75 *(b)* ₹160 *(c)* ₹80 *(d)* ₹120
(e) ₹140

(d) Let *A* has ₹ *x*.
Then, *C* has $\frac{3}{4}x$ and *B* has $\frac{3x}{4} - 50$
Now, $x + \frac{3x}{4} + \frac{3x}{4} - 50 = 250$
$\Rightarrow 10x - 200 = 1000$
$\Rightarrow 10x = 1200$
$\Rightarrow x = 120$
$\therefore$ *A* has ₹ 120.

52. The sum of 8 consecutive odd numbers is 656. Also, average of four consecutive even numbers is 87. What is the sum of the smallest odd number and second largest even number? **[Bank of Baroda (PO) 2011]**
(a) 165 *(b)* 175
(c) 163
(d) Cannot be determined
(e) None of the above

(e) Here, let the first odd number be x.
Then, 8 consecutive odd numbers are as
$x - 8, x - 6, x - 4, x - 2, x,$
$x + 2, x + 4, x + 6$
Now, $x - 8 + x - 6 + x - 4 + x - 2 + x + x + 2 + x + 4 + x + 6 = 656$
$\Rightarrow 8x - 8 = 656$
$\Rightarrow 8x = 656 + 8$
$\Rightarrow 8x = 664$
$\Rightarrow x = 83$
Now, let four consecutive even numbers be $y - 2$, y, $y + 2$ and $y + 4$.
Now, $4y + 4 = 87 \times 4$
$\Rightarrow 4y + 4 = 348$
$\Rightarrow 4y = 344$
$\Rightarrow y = 86$
Now, smallest even number
$= 86 - 8$
$= 78$
Second largest even number = 88
$\therefore$ Sum of both the numbers = 88 + 78
= 166

53. The sum of three consecutive odd numbers and three consecutive even numbers together is 231. Also, the smallest odd number is 11 less than the smallest even number. What is the sum of the largest odd number and the largest even number?
[IOB 2010]
(a) 82
(b) 83
(c) 74
(d) Cannot be determined
(e) None of these

(e) Here, let the three consecutive odd numbers be $x - 2$, x and $x + 2$ and three even numbers be $y - 2$, y and $y + 2$.
Now,
$x - 2 + x + x + 2 + y - 2 + y + y + 2 = 231$
$\Rightarrow 3x + 3y = 231$
$\Rightarrow x + y = 77$
Again, $y - 2 - (x - 2) = 11$
$\Rightarrow y - 2 - x + 2 = 11$
$\Rightarrow y - x = 11$
$x + y = 77$
$\underline{y - x = 11}$
$2y = 88$
$y = 44$
and $x = 33$
$\therefore$ Largest odd number = 35
And largest even number = 46
$\therefore$ Sum of these two numbers = 81

54. The sum of five consecutive numbers is 270. What is the sum of the second and the fifth number?
[IOB 2010]
(a) 108 *(b)* 107 *(c)* 110
(d) Cannot be determined
(e) None of these

(e) Here, let the five consecutive numbers be
$x - 2, x - 1, x, x + 1, x + 2$
Again,
$x - 2 + x - 1 + x + x + 1 + x + 2 = 270$
$\Rightarrow 5x = 270$
$\Rightarrow x = 54$
Second number = 54 – 1 = 53
and fifth number = 54 + 2
= 56
$\therefore$ Required sum = 56 + 53 = 109

55. If the numerator of a fraction is increased by $\frac{1}{4}$ and the denominator is decreased by $\frac{1}{3}$, the new fraction obtained is $\frac{33}{64}$. What was the original fraction? **[IOB 2010]**
(a) $\frac{9}{11}$ *(b)* $\frac{5}{7}$ *(c)* $\frac{3}{7}$ *(d)* $\frac{7}{9}$
(e) None of these

(e) Here, let the original fraction be $\frac{x}{y}$.
Then, $\frac{x + \frac{x}{4}}{y - \frac{y}{3}} = \frac{33}{64}$
$\Rightarrow \frac{\frac{4x + x}{4}}{\frac{2y}{3}} = \frac{33}{64}$
$\Rightarrow \frac{x}{y} = \frac{33 \times 8}{320 \times 3}$
$\Rightarrow \frac{x}{y} = \frac{11}{40}$

Practice Questions

Prelims

1. What is true about prime numbers?
(a) Prime numbers are not counting numbers
(b) Prime numbers are greater than 1
(c) Prime numbers are not natural numbers
(d) Prime numbers are less than 2
(e) None of the above

2. Find the positive integer for which the sum of the number and its reciprocal is $\frac{17}{4}$.
(a) 6 *(b)* 8
(c) 4 *(d)* 2
(e) None of these

3. The sum of a number and its reciprocal is one-fifth of 26. What is the sum of that number and its square?
(a) 3 *(b)* 4
(c) 5 *(d)* 6
(e) None of these

4. A number of two-digit has 3 for its unit digit and the sum of the digit is $\frac{2}{11}$ of the number itself. The number is
(a) 13 *(b)* 23
(c) 43 *(d)* 33
(e) None of these

5. The difference between the two numbers is $\frac{1}{3}$ of the larger number. If the smaller one is 48, then the larger one is
(a) 72 *(b)* 60
(c) 32 *(d)* 96
(e) None of these

6. The difference between the number and its three-fifth is 40, what is the number?
(a) 80 *(b)* 100
(c) 90 *(d)* 120
(e) None of these

7. A number whose one-fourth part is increased by 5 is equal to the third part diminished by 5 is
(a) 100 *(b)* 80 *(c)* 60 *(d)* 120
(e) None of these

8. A number is tripled and added 3, if the resultant is doubled, it becomes 30. What is the number?
(a) 3 *(b)* 5 *(c)* 4 *(d)* 7
(e) None of these

9. The sum of the two numbers is 18. If four times of one is five times the other number. Then, the bigger of the two numbers is
(a) 7 *(b)* 8 *(c)* 10 *(d)* 9
(e) None of these

10. The sum of the four consecutive even numbers is 284. What would be the smallest number?
(a) 72 *(b)* 74 *(c)* 68 *(d)* 66
(e) None of these

Mains

1. Two numbers are such that the square of greater, one is 504 less than 8 times the square of the other. If the numbers are in the ratio 3 : 4, then find the number.
(a) 15 and 20 *(b)* 6 and 8
(c) 12 and 16 *(d)* 9 and 12
(e) None of these

2. The sum of the numerator and denominator of a fraction is 11. If 1 is added to the numerator and 2 is subtracted from the denominator, it becomes $\frac{3}{2}$. The fraction is
(a) $\frac{3}{8}$ *(b)* $\frac{5}{6}$
(c) $\frac{7}{4}$ *(d)* $\frac{9}{2}$
(e) None of these

3. There are two numbers such that the sum of twice the first number and thrice the second number is 141 and sum of thrice the first number and twice the second number is 174. Which is the largest number?
(a) 52 *(b)* 36
(c) 48 *(d)* 24
(e) None of these

4. The sum of the digits of a two-digit number is 14 and the difference between the two digits of the number is 2. What is the product of the two digits of the two digit number?
(a) 56 *(b)* 48
(c) 45
(d) Cannot be determined
(e) None of these

5. A number consists of 3 digits whose sum is 10. The middle digit is equal to the sum of the other two and the number will be increased by 99. If its digits are reversed, then find the number.
(a) 352 *(b)* 253
(c) 145
(d) 350
(e) None of these

6. If the number obtained on the interchanging the digits of two digit number is 18 more than the original number and the sum of the digits is 8, then what is the original number?
(a) 50 *(b)* 51
(c) 52
(d) 53
(e) None of these

7. In a two digit number, if it is known that its unit digit exceeds its tenth's place digit by 3 and product of the given number and sum of the digit is equal to 175, then the number is
(a) 14 *(b)* 25
(c) 36 *(d)* 47
(e) None of these

8. The difference between a two digit and the number obtained by interchanging the positions of its digit is 36. What is the difference between the two digit number?
(a) 4 *(b)* 5 *(c)* 6 *(d)* 7
(e) None of these

9. The difference between the two digit number and the number obtained by interchanging the two digits is 45. Which is the smaller of the two?
(a) 5 *(b)* 10
(c) 15
(d) Data inadequate
(e) None of these

10. J, K, L, M are four consecutive odd integers and their average is 42. What is the product of K and M?
(a) 1900 *(b)* 1890 *(c)* 1895 *(d)* 1845
(e) None of these

11. The sum of 5 consecutive even numbers A, B, C, D and E is 130. What is the product of A and E?
(a) 720 *(b)* 616 *(c)* 660 *(d)* 672
(e) None of these

12. The sum of the five consecutive numbers is equal to 170. What is the product of largest and the smallest numbers?
(a) 1512 *(b)* 1102 *(c)* 1152 *(d)* 1210
(e) None of these

13. Which of the following numbers always divides the difference between the square of two consecutive odd integers?
(a) 7 *(b)* 3 *(c)* 8 *(d)* 6
(e) None of these

14. The difference between the sum of four consecutive odd numbers and three consecutive even numbers together is 20. Also, the largest even number is 5 more than the largest odd number. What is the sum of the smallest odd number and the smallest even number?
(a) 75
(b) 77
(c) 85
(d) Cannot be determined
(e) None of the above

15. The product of three consecutive even numbers is 4032. The product of the first and the third number is 252. What is five times the second number?
(a) 80
(b) 100
(c) 60
(d) 70
(e) 90

Answers

Prelims

1. (b) **2.** (c) **3.** (c) **4.** (d) **5.** (a) **6.** (b) **7.** (d) **8.** (c) **9.** (c) **10.** (c)

Mains

1. (d) **2.** (b) **3.** (c) **4.** (b) **5.** (b) **6.** (d) **7.** (b) **8.** (a) **9.** (d) **10.** (d)
11. (c) **12.** (c) **13.** (c) **14.** (b) **15.** (a)

2

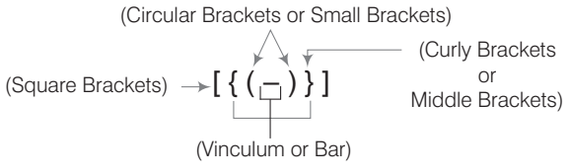
Simplification

In Mathematics, we have to solve different types of expressions to get the final value. So, to solve the expression, we require various techniques and simplification is one of those techniques. So, simplification is the process by which we solve a complex expression into a simple one.

'VBODMAS' Rule

To simplify arithmetic expressions, which involve various operations like brackets, multiplication, addition, etc; a particular sequence of the operations has to be followed.

The operations have to be carried out in the order, in which they appear in the word **VBODMAS**, where different letters of the word stand for following operations.



V = Vinculum or Bar '–'
B = Brackets

Order of removing brackets

First Small brackets (Circular brackets) '( )'
Second Middle brackets (Curly brackets)'{ }'
Third Square brackets (Big brackets) '[ ]'

O = Of
D = Division
M = Multiplication
A = Addition
S = Subtraction

Order of above mentioned operations is same as the order of letters in the 'VBODMAS' from left to right as

QUESTIONS *with* Detailed Explanation

Type 1 Questions Based on VBODMAS Rule

In this type of expressions, we have to follow the VBODMAS rule strictly to get the correct answer.

Directions (Q. Nos. 1-34) *What will come in place of the question mark (?) in the following questions?*

1. $24\times144\div19-?=312\div13$ **[SBI (PO) 2015]**

(a) 130 *(b)* 122 *(c)* 124 *(d)* 112 *(e)* 120

(e) Here, $24\times114\div19-x=312\div13$

We apply the BODMAS rule to solve this expression.

$\Rightarrow \quad 24\times6-x=24$

$\Rightarrow \quad 24\times6-24=x$

$\Rightarrow \quad 24(6-1)=x$

$\Rightarrow \quad 24\times5=x$

$\Rightarrow \quad x=120$

2. $\dfrac{5^2\times14+1450}{5}=1998\div?$ **[SBI (PO) 2015]**

(a) 5.55 (b) 55.5 (c) 50.5 (d) 5.05 (e) 50.05

(a) Here, $\dfrac{5^2\times14+1450}{5}=1998\div x$

We apply the BODMAS rule to solve this expression.

$\Rightarrow \quad \dfrac{350+1450}{5}=1998\div x$

$\Rightarrow \quad \dfrac{1800}{5}=1998\div x$

$\therefore \quad x=5.55$

3. $1\frac{1}{3}+2\frac{1}{6}-3\frac{1}{9}=1\div?$ **[RBI 2015]**

(a) $2\frac{4}{7}$ (b) $5\frac{2}{7}$ (c) $2\frac{1}{3}$ (d) $3\frac{1}{3}$ (e) $3\frac{1}{7}$

(a) Here, $1\frac{1}{3}+2\frac{1}{6}-3\frac{1}{9}=1\div x$

$\Rightarrow \quad \dfrac{4}{3}+\dfrac{13}{6}-\dfrac{28}{9}=1\div x$

$\Rightarrow \quad \dfrac{24+39-56}{18}=1\div x$

$\Rightarrow \quad \dfrac{7}{18}=1\div x$

$\Rightarrow \quad x=\dfrac{18}{7}=2\dfrac{4}{7}$

4. $1246+\sqrt[4]{(256)}=\left(?^2+19\dfrac{1}{3}\right)\times15$ **[RBI 2015]**

(a) 16 *(b)* 24 *(c)* 32 *(d)* 8 *(e)* 64

(d) Here,

$\Rightarrow \quad 1246+\sqrt[4]{256}=\left(x^2+19\dfrac{1}{3}\right)\times15$

$\Rightarrow \quad 1246+4=\left(x^2+\dfrac{58}{8}\right)\times15$

$\Rightarrow \quad \dfrac{1250}{15}=x^2+\dfrac{58}{3}$

$\Rightarrow \quad \dfrac{250}{3}-\dfrac{58}{3}=x^2$

$\Rightarrow \quad \dfrac{192}{3}=x^2$

$\Rightarrow \quad x=\sqrt{64}=8$

5. $\dfrac{9}{13}$ of $221+1\dfrac{4}{9}$ of $378=241+?$ **[RBI 2015]**

(a) 450 *(b)* 410 *(c)* 458 *(d)* 350 *(e)* 358

(d) Here,

$\dfrac{9}{13}$ of $221+1\dfrac{4}{9}$ of $378=241+?$

$\Rightarrow \quad 9\times17+13\times42=241+?$

$\Rightarrow \quad 153+546=241+?$

$\Rightarrow \quad x=458$

6. $104-21\times448\div16+1013=?^2$ **[RBI 2015]**

(a) 17 *(b)* 21 *(c)* 33 *(d)* 23 *(e)* 19

(d) Here,

$104-21\times448\div16+1013=?^2$

$\Rightarrow \quad 104-21\times28+1013=?^2$

$\Rightarrow \quad 104-588+1013=?^2$

$\Rightarrow \quad 529=x^2$

$\Rightarrow \quad \sqrt{x^2}=\sqrt{529}$

$x=23$

7. $4003\times77-21015=?\times116$ **[IBPS CWE (PO) 2012]**

(a) 2477 *(b)* 2478 *(c)* 2467 *(d)* 2476 *(e)* None of these

(d) Here, we apply the BODMAS rule to solve the question.

$4003\times77-21015=?\times116$

$\Rightarrow \quad 308231-21015=?\times116$

$\Rightarrow \quad 287216=?\times116$

$\Rightarrow \quad ?=\dfrac{287216}{116}=2476$

8. $(4444\div40)+(645\div25)+(3991\div26)=?$ **[IBPS CWE 2012]**

(a) 280.4 *(b)* 290.4 *(c)* 295.4 *(d)* 285.4 *(e)* None of these

(b) Here, we apply the BODMAS rule as follows

$(4444\div40)+(645\div25)+(3991\div26)=?$

$=111.1+25.8+153.5=290.4$

9. $118963-107958-9589=?$ **[PNB (PO) 2010]**

(a) 1420 *(b)* 1404 *(c)* 1416 *(d)* 1412 *(e)* None of these

(c) Here, $118963-107958-9589=?$

$=118963-(107958+9589)$

$=118963-(117547)=1416$

10. $(5696\div4-?)\times5=1020$ **[PNB (PO) 2010]**

(a) 1180 *(b)* 1200 *(c)* 1240 *(d)* 1220 *(e)* None of these

(d) Here,

$(5696\div4-?)\times5=1020$

$\Rightarrow \quad (1424-?)\times5=1020$

$\Rightarrow \quad 1424-?=204$

$\Rightarrow \quad ?=1424-204$

$\Rightarrow \quad ?=1220$

11. $7960+2956-8050+4028=?$ **[PNB (PO) 2010]**

(a) 6984 *(b)* 6884 *(c)* 6894 *(d)* 6954 *(e)* None of these

(c) Here, $7960+2956-8050+4028=?$

$\Rightarrow \quad 7960+2956+4028-8050=6894$

12. $4848 \div 24 \times 11 - 222 = ?$ **[Allahabad Bank (PO) 2010]**

(a) 200 *(b)* 244
(c) 2000 *(d)* $115\frac{3}{8}$
(e) None of these

(c) Here, $4848 \div 24 \times 11 - 222 = ?$
$\Rightarrow 202 \times 11 - 222 = ?$
$\Rightarrow 2222 - 222 = ?$
$\Rightarrow ? = 2000$

13. $653 \times 749 = ?$ **[PNB (PO) 2010]**

(a) 489907 *(b)* 488348
(c) 488444 *(d)* 490403
(e) None of these

(e) Here, $? = 653 \times 749$
$= (701 - 48) \times (701 + 48)$
$= (701)^2 - (48)^2$
$[\because a^2 - b^2 = (a + b)(a - b)]$
$= 491401 - 2304 = 489097$

14. $460 \times 15 - 5 \times 20 = ?$ **[Allahabad Bank (PO) 2010]**

(a) 92000 *(b)* 4600
(c) 137800 *(d)* 7000
(e) None of these

(e) Here, $460 \times 15 - 5 \times 20 = ?$
$\Rightarrow 6900 - 100 = 6800$

15. $5163 - 4018 + 3209 = ?$ **[Allahabad Bank (PO) 2010]**

(a) 4174 *(b)* 4264
(c) 4804 *(d)* 4354
(e) None of these

(d) Here, $5163 - 4018 + 3209 = ?$
$\Rightarrow ? = 5163 + 3209 - 4018$
$\Rightarrow ? = 8372 - 4018 = 4354$

16. $36 \times 15 - 56 \times 784 \div 112 = ?$ **[BOI (PO) 2010]**

(a) 138 *(b)* 238
(c) 158 *(d)* 258
(e) None of these

(e) Here, $36 \times 15 - 56 \times 784 \div 112$
$\Rightarrow 36 \times 15 - 56 \times 7$
$\Rightarrow 540 - 392 = 148$

17. $23 \times 15 - 60 + ? \div 31 = 292$ **[Indian Bank (PO) 2010]**

(a) 218 *(b)* 186
(c) 217 *(d)* 201
(e) None of these

(c) Here, we apply the BODMAS rule to solve this expression.
So, $23 \times 15 - 60 + ? \div 31 = 292$
$\Rightarrow 345 - 60 + ? \div 31 = 292$
$\Rightarrow 285 + ? \div 31 = 292$
$\Rightarrow ? \div 31 = 7$
$\Rightarrow ? = 7 \times 31$
$= 217$

18. $16 \times 12 - 672 \div 21 = ? - 211$ **[Central Bank of India (PO) 2010]**

(a) 381 *(b)* 347
(c) 372 *(d)* 311
(e) None of these

(e) Here, $16 \times 12 - 672 \div 21 = ? - 211$
We apply the BODMAS rule to solve this expression.
So, $192 - 672 \div 21 = ? - 211$
$\Rightarrow 192 - 32 = ? - 211$
$\Rightarrow 160 = ? - 211$
$\Rightarrow ? = 160 + 211$
$\Rightarrow ? = 371$

19. $1268 \div 8 \div 2 = ?$ **[OBC (PO) 2009]**

(a) 71.75 *(b)* 317
(c) 268 *(d)* 79.25
(e) None of these

(d) Here, $1268 \div 8 \div 2 = ?$
So, it can also be written as
$1268 \times \frac{1}{8} \times \frac{1}{2} = 79.25$

20. $88 \div 5 \div 4 = ?$ **[OBC (PO) 2009]**

(a) 65.4 *(b)* 8.4
(c) 70.4 *(d)* 4.4
(e) None of these

(d) It can also be written as
$88 \times \frac{1}{5} \times \frac{1}{4}$
$88 \times \frac{1}{20} = 4.4$

21. $216 \times 5 + 102 \times 4 = ?$ **[Haryana Grameen Bank (PO) 2009]**

(a) 94228 *(b)* 1488
(c) 1848 *(d)* 92448
(e) None of these

(b) Here, we apply the BODMAS rule to solve this expression, which is as follows
$= 216 \times 5 + 102 \times 4$
$= 1080 + 408$
$= 1488$

22. $-76 \times 33 + 221 = ?$ **[NABARD (PO) 2009]**

(a) – 2287 *(b)* – 19304
(c) 2287 *(d)* 19304
(e) None of these

(a) Here, we apply the BODMAS rule to solve this expression.
So, $(-76 \times 33) + 221$
$= -2508 + 221$
$= -2287$
[here, sign is negative as $2508 > 221$]

23. $2115 \div ? = 94 \times 15$ **[Dena Bank (PO) 2008]**

(a) 1.25 *(b)* 2.75
(c) 1.5 *(d)* 3
(e) None of these

(c) Here, $2115 \div ? = 94 \times 15$
We follow the rule of BODMAS to solve this expression, so we get
$\frac{2115}{?} = 94 \times 15$
$\Rightarrow ? = \frac{2115}{95 \times 15} = 1.5$

24. $518 \times ? \times 9 = 303030$ **[Dena Bank 2008]**

(a) 75 *(b)* 65
(c) 85 *(d)* 55
(e) None of these

(b) Here, we follow the rule of BODMAS to solve this expression.
So, $518 \times ? \times 9 = 303030$
$? = \frac{303030}{518 \times 9}$
$= \frac{303030}{4662}$
$= 65$

25. $5982 + 1345 + 736 - ? = 4588 + 992$ **[Dena Bank (PO) 2008]**

(a) 2485 *(b)* 2480
(c) 2473 *(d)* 2467
(e) None of these

(e) Here, we follow the rule of BODMAS to solve this expression.
So, $5982 + 1345 + 736 - ? = 4588 + 992$
$\Rightarrow 9063 - ? = 5580$
$\Rightarrow ? = 9063 - 5580$
$\Rightarrow ? = 3483$

26. $1485 \times ? = 594$ **[IOB (PO) 2008]**

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

(a) Here, $1485 \times ? = 594$
To simplify this expression, we follow the rule of BODMAS.
So, $1485 \times ? = 594$
$? = \frac{594}{1485}$
$\Rightarrow = \frac{2}{5}$

27. $24336 \div ? = 78 \times 24$ **[SBI (PO) 2008]**

(a) 6 *(b)* 13 *(c)* 11 *(d)* 17
(e) None of these

(b) Here, to solve this expression, we follow the rule of BODMAS as follows
$24336 \div ? = 78 \times 24$
$\Rightarrow \frac{24336}{?} = 78 \times 24$
$\Rightarrow ? = \frac{24336}{78 \times 24}$
$= \frac{24336}{1872}$
$= 13$

28. $2116 + 692 - ? = 1111$ **[Andhra Bank (PO) 2008]**

(a) 1667 *(b)* 1677
(c) 1687 *(d)* 1697
(e) None of these

(d) Here, to simplify the expression, we follow the rule of BODMAS.

So, $2116 + 692 - ? = 1111$

$\Rightarrow \quad 2808 - ? = 1111$

$\Rightarrow \quad ? = 2808 - 1111$

$= 1697$

29. $361 \times ? \times 11 = 428868$ **[UK GBO 2007]**

(a) 105 *(b)* 107 *(c)* 109 *(d)* 111
(e) None of these

(e) Here, we follow the rule of the BODMAS as

$361 \times ? \times 11 = 428868$

$\Rightarrow \quad ? = \frac{428868}{361 \times 11}$

$= \frac{428868}{3971} = 108$

30. $8226 \div 15 \div 5 = ?$ **[Bank of Maharashtra (PO) 2007]**

(a) 2156 *(b)* 109.68
(c) 185.56 *(d)* 2742
(e) None of these

(b) Here, we follow the rule of BODMAS, so this expression can be written as

$8226 \times \frac{1}{15} \times \frac{1}{5}$

$= \frac{8226}{75}$

$= 109.68$

31. $1802 \div 34 \div 5 = \sqrt{?}$ **[UK GBO 2007]**

(a) 10.6 *(b)* 114.49
(c) 11.14 *(d)* 110.4
(e) None of these

(e) Here, we follow the rule of BODMAS.

So, it can also be written as

$1802 \times \frac{1}{34} \times \frac{1}{5}$

$= \frac{1802}{170} = 10.6$

$= \sqrt{?}$

$\Rightarrow \quad ? = (10.6)^2$

$= 112.36$

32. $2817 \times ? = 626$ **[UK GBO 2007]**

(a) $\frac{1}{2}$ *(b)* $\frac{3}{4}$
(c) $\frac{2}{9}$ *(d)* $\frac{3}{5}$
(e) None of these

(c) Here, we follow the rule of BODMAS to solve this expression.

So, $2817 \times ? = 626$

$\Rightarrow \quad ? = \frac{626}{2817} = \frac{2}{9}$

33. $4172 + 593 - ? = 3069$ **[UK GBO 2007]**

(a) 1666 *(b)* 1669
(c) 1996 *(d)* 1969
(e) None of these

(e) Here, we follow the rule of BODMAS to solve this expression.

So, $4172 + 593 - ? = 3069$

$\Rightarrow \quad 4765 - ? = 3069$

$\Rightarrow \quad ? = 4765 - 3069$

$\Rightarrow \quad ? = 1693$

34. $(8792 - 4136) \div ? = 145.5$ **[Bank of Maharashtra (PO) 2007]**

(a) 38 *(b)* 32
(c) 42 *(d)* 36
(e) None of these

(b) Here, we follow the rule of BODMAS to solve this expression.

So, $(8792 - 4136) \div ? = 145.5$

$\Rightarrow \quad (4656) \div ? = 145.5$

$\Rightarrow \quad ? = \frac{4656}{145.5} = 32$

Type 2 Questions Based on Decimal

OPERATIONS ON DECIMALS

Addition and Subtraction of Decimals

To add or subtract decimals, the given numbers are written under each other such that the decimal points lie in one column and the numbers so arranged can now be added or subtracted as per the conventional method of addition and subtraction.

e.g. 353.5 + 2.32 + 43.23 = ?

Sol.
$$\begin{array}{r} 353.50 \\ 2.32 \\ +\ 43.23 \\ \hline 399.05 \end{array}$$

Multiplication of Two or More Decimals

Given numbers are multiplied without considering the decimal points and then in the product, decimal point is marked from the right hand side to as many places of decimal as the sum of the numbers of decimal places in the multiplier and the multiplicand together.

e.g. $4.3 \times 0.13 = ?$

Sol. $43 \times 13 = 559$

Sum of the decimal places = (1 + 2) = 3

$\therefore$ Required product = 0.559

Division of Decimals

In such divisions, dividend and divisor both are multiplied first by a suitable multiple of 10 to convert divisor into a whole number and then above mentioned rule of division is followed.

e.g. Divide the following.

(i) $42 \div 0.007$

(ii) $0.00048 \div 0.8$

Sol. (i) $\frac{42}{0.007} = \frac{42}{0.007} \times \frac{1000}{1000}$

$= \frac{42000}{7} 3$

$= 6000$

(ii) $\frac{0.00048}{0.8} = \frac{0.00048}{0.8} \times \frac{10}{10}$

$= \frac{0.0048}{8}$

$= 0.0006$

Note Order of the VBODMAS is same for the decimals

Directions (Q. Nos. 35-69) *What should come in place of the question mark (?) in the following questions?* **[RBI 2015]**

35. $85.6 \div 12 \times ?^2 = 69.5 \times 8$

(a) 5 *(b)* 9
(c) 2 *(d)* 4
(e) 6

(b) Here,

$85.6 \div 12 \times ?^2 = 69.5 \times 8$

$?^2 = \frac{69.5 \times 8 \times 12}{85.6}$

$?^2 = 77.94$

$? = 8.82 \approx 9$

36. $[(15.5 \times 28) \div 16 - 1230 \div 240] = ? \times 5$ **[RBI 2015]**

(a) 4.4 *(b)* 4
(c) 5 *(d)* 4.2
(e) 2.4

› ***(a)*** Here,

$[(15.5\times28)\div16-1230\div240]=?\times5$

$\Rightarrow 434\div16-5.125=?\times5$

$\Rightarrow 27.125-5.125=?\times5$

$\Rightarrow 22=?\times5$

$\Rightarrow ?=\frac{22}{5}$

$=4.4$

37. $37.5\div\left[\frac{1}{2}\text{ of }(24+33)-13\frac{1}{2}\right]=?$ **[RBI 2015]**

(a) 2.75 *(b)* 2.5
(c) 1.75 *(d)* 2.25
(e) 1.5

› ***(b)*** Here,

$37.5\div\left[\frac{1}{2}\text{ of }(24+33)-13\frac{1}{2}\right]=?$

$\Rightarrow 37.5\div\left[\frac{1}{2}\times57-\frac{27}{2}\right]$

$\Rightarrow 37.5\div\left[\frac{57-27}{2}\right]$

$\Rightarrow 37.5\div15$

$\Rightarrow ?=2.5$

38. $1111.1+111.11+11.111=?$ **[UBI (PO) 2011]**

(a) 1232.231 *(b)* 1233.123
(c) 1332.331 *(d)* 1323.132
(e) None of these

› ***(e)*** Here, we add this according to the rule of decimals.

So,
1111.100
111.110
+ 11.111
1233.321

39. $12.4\times?\times16.5=2905.32$ **[UBI (PO) 2011]**

(a) 13.4 *(b)* 15.2 *(c)* 16.2 *(d)* 14.2
(e) None of these

› ***(d)*** Here, we multiply this according to the rule of decimals.

So, $12.4\times?\times16.5=2905.32$

$?=\frac{2905.32}{204.6}=14.2$

40. $28.314-31.427+113.928=?+29.114$ **[BOI (PO) 2010]**

(a) 81.711 *(b)* 80.701
(c) 71.711 *(d)* 81.701
(e) None of these

› ***(d)*** Here, we apply the rule of BODMAS and then solve according to the rule of decimals.

So, $28.314+113.928-31.427=?+29.114$

$\Rightarrow 142.242-31.427=?+29.114$

$\Rightarrow 110.815=?+29.114$

$\Rightarrow 110.815-29.114=?$

$\Rightarrow ?=81.701$

41. $25\times3.25+50.4\div24=?$ **[BOI (PO) 2010]**

(a) 84.50 *(b)* 83.35
(c) 83.53 *(d)* 82.45
(e) None of these

› ***(b)*** Here, we follow the rule of the BODMAS and then apply the rule of decimals.

So, $25\times3.25+50.4\div24$

$\Rightarrow ?=25\times3.25+2.1$

$\Rightarrow ?=81.25+2.10$

$\Rightarrow ?=81.25+2.10$

$?=83.35$

42. $34.596+61.472-496.708=?+27.271$ **[CBI (PO) 2010]**

(a) 126.631 *(b)* 62.069
(c) 72.089 *(d)* 132.788
(e) None of these

› ***(e)*** Here, we have to follow the rule of BODMAS and then apply the rule of decimals.

So, $34.596+61.472-496.708$

$=?+27.271$

$\Rightarrow 96.068-496.708=?+27.271$

$\Rightarrow ?=27.271+496.708-96.068$

$\Rightarrow ?=523.979-96.068=427.911$

43. $15.4\times13.5\times?=2598.75$ **[BOI (PO) 2010]**

(a) 13.4 *(b)* 10.5
(c) 11.4 *(d)* 12.5
(e) None of these

› ***(d)*** Here, we apply the rule of decimals

So, $?=\frac{2598.75}{15.4\times13.5}$

$=\frac{2598.75}{207.9}=12.5$

44. $6435.9+7546.4+1203.5=?$ **[BOI (PO) 2010]**

(a) 15188.5 *(b)* 15185.8
(c) 15155.5 *(d)* 15815.8
(e) None of these

› ***(b)*** Here,
6435.9
7546.4
+ 1203.5
15185.8

45. $4.5\times437\div19=?$ **[BOI (PO) 2010]**

(a) 103.5 *(b)* 115.3
(c) 105.3 *(d)* 113.5
(e) None of these

› ***(a)*** Here, we follow the rule of BODMAS and then apply the rule of decimals.

So, $4.5\times437\div19$

$=4.5\times23=103.5$

46. $0.3+3+3.33+3.3+3.03+333=?$ **[NABARD (PO) 2009]**

(a) 375.66 *(b)* 345.99
(c) 375.93 *(d)* 355.96
(e) None of these

› ***(e)*** Here, to add this, we have to follow the rule of decimals.

So,
0.30
3.00
3.33
3.30
3.03
+ 333.00
345.96

47. $0.01\times0.1-0.001\div10+0.01=?$ **[Corporation Bank (PO) 2009]**

(a) 0.01009 *(b)* 0.0101
(c) 0.19 *(d)* 0.109
(e) 0.0109

› ***(e)*** Here, we apply the rule of decimals to get the final value.

So, $0.01\times0.1-(0.001\div10)+0.01$

$\Rightarrow 0.001-(0.001\div10)+0.01$

$\Rightarrow 0.001-0.0001+0.01$

$\Rightarrow ?=0.011-0.0001$

$=0.0110-0.0001=0.0109$

48. $28.217-14.241+6.873-2.434=?$ **[JIA (PO) 2009]**

(a) 9.419 *(b)* 18.545
(c) 16.275 *(d)* 4.669
(e) None of these

› ***(e)*** Here, we follow the rule of BODMAS and then solve according to the rule of the decimals.

So, $28.217-14.241+6.873-2.434=?$

$\Rightarrow 28.217+6.873-14.241-2.434=?$

$\Rightarrow 35.09-16.675=?$

$\Rightarrow 18.415=?$

49. $712+92\times0.50-83=?$ **[NIA (PO) 2009]**

(a) 685 *(b)* 625 *(c)* 635 *(d)* 675
(e) None of these

› ***(d)*** Here, we follow the rule of BODMAS and then solve according to the rule of decimals.

So, $712+92\times\frac{1}{2}-83=712+46-83$

$=758-83=675$

50. $416\times38\times0.4=?$ **[NIA (PO) 2009]**

(a) 6424.2 *(b)* 6323.2
(c) 6601.2 *(d)* 6182.2
(e) None of these

› ***(b)*** Here, we solve this sum according to the rules of decimals.

So, $416\times38\times0.4=?$

$\Rightarrow =?\,15808\times0.4=6323.2$

51. $36.15+71.58+6.33+2.71=?$ **[Haryana Grameen Bank (PO) 2009]**

(a) 126.87 *(b)* 108.67
(c) 116.77 *(d)* 131.57
(e) None of these

› ***(c)*** Here, to add this, we follow the rule of the decimals.

So,
36.15
71.58
6.33
+ 2.71
116.77

52. $4 + 4.44 + 0.4 + 44.04 + 444 = ?$ **[IOB (PO) 2008]**

(a) 497.24 *(b)* 487.66
(c) 496.88 *(d)* 469.88
(e) None of these

› ***(c)*** Here, to add this, we follow the rule of the decimals.

So,
4.00
4.44
0.40
44.04
444.00
496.88

53. $22.5 \times 0.05 = ?$ **[BOB (PO) 2008]**

(a) 11.25 *(b)* 1.125
(c) 22.55 *(d)* 112.5
(e) None of these

› ***(b)*** Here, to multiply this, we apply the rule of decimals.

$22.5 \times 0.05 = 225 \times 5$
$= 1.125$

[$\because$ in multiplication, we add the place of the decimals after multiplication]

54. $666.66 + 66.66 + 6.66 + 6 + 0.66 = ?$ **[Dena Bank (PO) 2008]**

(a) 746.64 *(b)* 764.64
(c) 766.64 *(d)* 744.64
(e) None of these

› ***(a)*** Here, add this according to the rule of decimals.

666.66
66.66
6.66
6.00
+ .66
746.64

55. $56 + 12 \times 0.45 - 3 = ?$ **[Dena Bank (PO) 2008]**

(a) 28.5 *(b)* 47.6 *(c)* 86.6 *(d)* 58.4
(e) None of these

› ***(d)*** Here, we follow the rule of BODMAS and then apply the rules of decimals.

So, $56 + 12 \times 0.45 - 3 = ?$

$\Rightarrow ? = 56 + 5.40 - 3 = 61.40 - 3 = 58.4$

56. $15.593 - 9.214 - 3.452 - 2.191 = ?$ **[Dena Bank (PO) 2008]**

(a) 1.874 *(b)* 0.686
(c) 2.342 *(d)* 0.736
(e) None of these

› ***(d)*** Here, to solve this, we apply BODMAS rule as well as rule of decimals simultaneously.

So, $15.593 - (9.214 + 3.452 + 2.191)$
$= 15.593 - (14.857)$
$= 15.593 - 14.857 = 0.736$

57. $999 + 111 \times 0.5 = ?$ **[BOB (PO) 2008]**

(a) 555 *(b)* 500
(c) 1054.5 *(d)* 1110.5
(e) None of these

› ***(c)*** Here, we follow the rule of BODMAS and then solve according to the rule of decimals.

So, $999 + 111 \times 0.5$

$= 999 + 111 \times \frac{1}{2} \quad \left[\because 0.5 = \frac{1}{2}\right]$

$= 999 + 55.50$

$= 1054.50$

58. $52.901 - 17.563 - 7.731 - 0.690 = ?$ **[Andhra Bank (PO) 2008]**

(a) 23.971 *(b)* 26.917
(c) 28.971 *(d)* 31.917
(e) None of these

› ***(b)*** Here, we follow the rule of BODMAS, and then apply the rule of decimals.

So, $52.901 - (17.563 + 7.731 + 0.690)$
$= 52.901 - (25.984)$
$= 26.917$

59. $345 + 25 \times 0.80 - 11 = ?$

(a) 354 *(b)* 666
(c) 324 *(d)* 600
(e) None of these **[Andhra Bank (PO) 2008]**

› ***(a)*** Here, we follow the order of BODMAS and then solve according to the rules of decimals.

So, $345 + 25 \times 0.80 - 11$
$= 345 + 20.00 - 11$
$= 365 - 11 = 354$

60. $(833.25 - 384.45) \div 24 = ?$ **[IOB (PO) 2008]**

(a) 1.87 *(b)* 20.1
(c) 2.01 *(d)* 18.7
(e) None of these

› ***(d)*** Here, we follow the order of BODMAS and then solve according to the rule of decimals.

So, $(448.8) \div 24 = 18.7$

61. $38 + 16 \times 0.8 = ?$ **[Andhra Bank (PO) 2008]**

(a) 43.2 *(b)* 50.8
(c) 44.8 *(d)* 1.9
(e) None of these

› ***(b)*** Here, we follow the order of BODMAS and then solve this according to the rule of decimals.

So, $38 + 16 \times 0.8 = 38 + 12.8$
$= 50.8$

62. $12.28 \times 1.5 - 36 \div 24 = ?$ **[IOB (PO) 2007]**

(a) 3.24 *(b)* 7.325 *(c)* 6.42 *(d)* 4.32
(e) None of these

› ***(e)*** Here, we follow the order of BODMAS and then solve this according to the rules of decimals.

So, $12.28 \times 1.5 - 36 \div 2.4$
$= 12.28 \times 1.5 - 15$
$= 15\ (12.28 \times 0.1 - 1)$
$= 15 \times (1.228 - 1)$
$= 15 \times 0.228 = 3.42$

63. $(562.038 + 838.734) \div 3 = ?$ **[IOB (PO) 2007]**

(a) 466.924 *(b)* 654.843
(c) 546.897 *(d)* 386.124
(e) None of these

› ***(a)*** Here, we follow the order of BODMAS and then solve according to the rules of decimals.

So, $(562.038 + 838.734) \div 3$
$= (1400.772) \div 3 = 466.924$

64. $9.348 - 2.563 + 3.884 + 1.673 = ?$ **[Corporation Bank (PO) 2007]**

(a) 18.454 *(b)* 16.786
(c) 14.560 *(d)* 12.342
(e) None of these

› ***(d)*** Here, we follow the rule of BODMAS and then solve according to the rule of decimals.

So, $9.348 - 2.563 + 3.884 + 1.673$
$= 9.348 + 3.884 + 1.673 - 2.563$
$= 14.905 - 2.563 = 12.342$

65. $99.9 + 9.99 + 0.99 + 99.09 + 9.09 + 999 = ?$ **[Andhra Bank (PO) 2007]**

(a) 1123.06 *(b)* 1218.06
(c) 1345.06 *(d)* 144.06
(e) None of these

› ***(b)*** Here, to add this, we apply the rule of decimals.

So,
99.90
9.99
.99
99.09
9.09
+ 999.00
1218.06

66. $9.348 - 2.563 + 3.884 + 1.673 = ?$ **[UK GBO 2007]**

(a) 18.454 *(b)* 16.786
(c) 14.560 *(d)* 12.342
(e) None of these

› ***(d)*** Here, we follow the order of BODMAS and then apply the rule of decimals.

So, $9.348 + 3.884 + 1.673 - 2.563$
$= 14.905 - 2.563$
$= 12.342$

67. $53 + 27 \times 0.35 = ?$ **[UK GBO 2007]**

(a) 62.45 *(b)* 78.90
(c) 45.67 *(d)* 83.43
(e) None of these

(a) Here, we follow the order of BODMAS and then solve according to the rules of decimals.

So, $53 + 27 \times 0.35$

$= 53 + 9.45 = 62.45$

68. $3 + 33 + 333 + 3.33 = ?$ **[Corporation Bank (PO) 2006]**

(a) 362.3 *(b)* 372.33
(c) 702.33 *(d)* 702
(e) None of these

(b) Here, $3 + 33 + 333 + 3.33$

We follow the rule of the decimals and add this as

$36 + 333 + 3.33$

$= 369 + 3.33 = 372.33$

69. $35 + 15 \times 1.5 = ?$ **[Corporation Bank (PO) 2006]**

(a) 75 *(b)* 25.25
(c) 57.5 *(d)* 5.15
(e) None of these

(c) Here, $35 + 15 \times 1.5$

We follow the rule of BODMAS as well as the rule of decimals.

So, $35 + 15 \times 1.5$

$= 35 + 22.5 = 57.5$

70. How many times is the number 11.11 that of 11.1? **[United India Insurance (AAO) 2002]**

(a) 1 *(b)* 10 *(c)* 11 *(d)* 111
(e) None of these

(a) Here, 11.11 is x times of 11.1.

So, $x \times 11.1 = 11.11$

or $x = \frac{11.11}{11.1} = 1.0009009 \approx 1$

71. What will come in place of the question mark (?) in the following equation? **[RBI Grade B Officer 2002]**

$\sqrt{625.04} \times 16.96 + 136.001 \div 17 = ?$

(a) 4.18
(b) 4.41
(c) 425
(d) 433
(e) None of the above

(d) Here,

$\sqrt{625.04} \times 16.96 + 136.001 \div 17 = ?$

To solve this, we follow the rule of BODMAS as well as rule of decimals.

So, $\sqrt{625.04} \times 16.96 + 136.001 \div 17$

$= \sqrt{625.04} \times 16.96 + 8$

$= 25 \times 16.96 + 8$

$= 424.013 + 8$

$= 432.013 \approx 433$

Type 3 Simplification of Fractions

As we know that, fractions are the part of a whole number.

e.g. $\frac{4}{5}, \frac{6}{5}, \frac{7}{5}$

Here, in fraction $\frac{4}{5}$, 4 is called numerator and 5 is called denominator. Again, fraction may contain integral as well as fractional part.

So, fraction $2\frac{3}{5}$ can also be written as

$2 + \frac{3}{5}$ or $\frac{2}{1} + \frac{3}{5}$

or $\frac{10 + 3}{5} = \frac{13}{5}$

Again $2\frac{3}{5}$ can also be written as

$3 - \frac{2}{5}$ or $\frac{3}{1} - \frac{2}{5}$

or $\frac{15 - 2}{5} = \frac{13}{5}$

Directions (Q. Nos. 72-85) *What should be come in the place of question mark (?) in the following questions?*

72. $3\frac{1}{4} + 2\frac{1}{2} - 1\frac{5}{6} = \frac{(?)^2}{10} + 1\frac{5}{12}$ **[Corporation Bank (PO) 2011]**

(a) 25 *(b)* $\sqrt{5}$
(c) 625 *(d)* 15
(e) 5

(e) Here, we solve this according to the rule of BODMAS.

So,

$3 + \frac{1}{4} + 2 + \frac{1}{2} - \left(1 + \frac{5}{6}\right) = \frac{(?)^2}{10} + 1 + \frac{5}{12}$

or, add the integral part and fractional part separately.

So, $(3 + 2 - 1) + \left(\frac{1}{4} + \frac{1}{2} - \frac{5}{6}\right)$

$= \frac{(?)^2}{10} + 1 + \frac{5}{12}$

$\Rightarrow (4) + \left(\frac{3 + 6 - 10}{12}\right) = \frac{(?)^2}{10} + 1 + \frac{5}{12}$

$\Rightarrow (4 - 1) + \left(-\frac{1}{12} - \frac{5}{12}\right) = \frac{(?)^2}{10}$

$\Rightarrow 3 - \frac{6}{12} = \frac{(?)^2}{10}$

$\Rightarrow 3 - \frac{1}{2} = \frac{(?)^2}{10}$

$\Rightarrow \frac{5}{2} \times 10 = (?)^2$

$\Rightarrow 25 = (?)^2$

$\Rightarrow \sqrt{25} = ?$

$\Rightarrow ? = 5$

73. $1\frac{1}{4} + 1\frac{1}{6} - 1\frac{1}{8} = ? + 1\frac{1}{12}$ **[Corporation Bank (PO) 2011]**

(a) $\frac{5}{24}$ *(b)* $\frac{7}{24}$ *(c)* $\frac{5}{12}$ *(d)* $\frac{7}{12}$
(e) None of these

(a) Here, we add fractional and integral part separately.

$= 1 + \frac{1}{4} + 1 + \frac{1}{6} - \left(1 + \frac{1}{8}\right) = ? + 1 + \frac{1}{12}$

$(1 + 1 - 1 - 1) + \left(\frac{1}{4} + \frac{1}{6} - \frac{1}{8} - \frac{1}{12}\right) = ?$

$? = 0 + \frac{6 + 4 - 3 - 2}{24}$

$\Rightarrow ? = \frac{5}{24}$

74. $4\frac{1}{2} - 2\frac{5}{6} = ? - 1\frac{7}{12}$ **[Punjab and Sindh Bank (PO) 2010]**

(a) $3\frac{1}{4}$ *(b)* $3\frac{5}{12}$ *(c)* $2\frac{7}{12}$ *(d)* $3\frac{3}{4}$
(e) None of these

(a) Here, we add the integral and fractional part separately and follow the order of BODMAS.

So, $4 + \frac{1}{2} - \left(2 + \frac{5}{6}\right) + 1 + \frac{7}{12} = ?$

$\Rightarrow (4 - 2 + 1) + \left(\frac{-5}{6} + \frac{7}{12} + \frac{1}{2}\right) = ?$

$\Rightarrow ? = 3 + \left(\frac{-10 + 7 + 6}{12}\right) = 3 + \frac{1}{4} = \frac{13}{4}$

$= 3\frac{1}{4}$

75. $\frac{3}{8}$ th of $\frac{4}{9}$ th of $1092 = ?$ **[Punjab and Sindh Bank (PO) 2010]**

(a) 182 *(b)* 728 *(c)* 364 *(d)* 218
(e) None of these

(a) Here, $\frac{3}{8}\times\frac{4}{9}\times 1092$

$\Rightarrow \quad \frac{12}{72}\times 1092 = 12\times 15.16$

$= 181.92 = 182$

76. $3\frac{3}{4}+4\frac{2}{5}-3\frac{1}{8}=?$ **[BOB (PO) 2010]**

(a) $4\frac{1}{40}$ *(b)* $5\frac{1}{40}$

(c) $6\frac{1}{40}$ *(d)* $5\frac{3}{40}$

(e) None of these

(b) Here, we add the integral part and fractional part separately.

$\Rightarrow \quad ? = 3+\frac{3}{4}+4+\frac{2}{5}-\left(3+\frac{1}{8}\right)$

$\Rightarrow \quad ? = (3+4-3)+\left(\frac{3}{4}+\frac{2}{5}-\frac{1}{8}\right)$

$\Rightarrow \quad ? = 4+\left(\frac{30+16-5}{40}\right)=\frac{160+41}{40}$

$= 5\frac{1}{40}$

77. $5\frac{17}{37}\times 4\frac{51}{52}\times 11\frac{1}{7}+2\frac{3}{4}=?$

[Punjab and Sind Bank (PO) 2009]

(a) 303.75 *(b)* 305.75

(c) $303\frac{3}{4}$ *(d)* $305\frac{1}{4}$

(e) None of these

(b) Here, $5\frac{17}{37}\times 4\frac{51}{52}\times 11\frac{1}{7}+2\frac{3}{4}$

$=\frac{202}{37}\times\frac{259}{52}\times\frac{78}{7}+\frac{11}{4}$

Here, we follow the order of BODMAS.

$? = \frac{202\times 7}{52}\times\frac{78}{7}+\frac{11}{4}$

$\Rightarrow \quad ? = \frac{101\times 6}{2}+\frac{11}{4}$

$? = \frac{1212+11}{4}=\frac{1223}{4}$

$= 305.75$

78. $\frac{3}{8}\text{ of }\frac{4}{5}\text{ of }\frac{2}{3}\text{ of }730=?$

[Andhra Bank (PO) 2009]

(a) 86 *(b)* 146

(c) 156 *(d)* 93

(e) None of these

(b) Here, $\frac{3}{8}\times\frac{4}{5}\times\frac{2}{3}\times 730$

$\Rightarrow \quad \frac{24}{120}\times 730 = 146$

79. $1\frac{1}{4}+1\frac{5}{9}\times 1\frac{5}{8}\div 6\frac{1}{2}=?$

[Corporation Bank (PO) 2009]

(a) 17 *(b)* 27

(c) 42 *(d)*18

(e) None of these

(e) Here, to solve this expression, we follow the order of BODMAS and then solve.

So, $\frac{5}{4}+\frac{14}{9}\times\frac{13}{8}\div\frac{13}{2}=?$

$\Rightarrow \quad ? = \frac{5}{4}+\frac{14}{9}\times\frac{13}{8}\times\frac{2}{13}$

$=\frac{5}{4}+\frac{7}{18}$

$=\frac{45+14}{36}=\frac{59}{36}$

80. $3\frac{2}{7}-2\frac{1}{14}-1\frac{1}{14}-1\frac{1}{7}=?+2\frac{1}{13}$

[Andhra Bank (PO) 2009]

(a) $1\frac{1}{7}$ *(b)* $1\frac{2}{7}$

(c) $\frac{1}{7}$ *(d)* $\frac{3}{7}$

(e) None of these

(e) Here,

$3\frac{2}{7}-2\frac{1}{14}-1\frac{1}{14}-1\frac{1}{7}-2\frac{1}{13}=?$

Solve the integral part and fractional part separately.

$\Rightarrow 3\frac{2}{7}-\left(2\frac{1}{14}+1\frac{1}{14}+1\frac{1}{7}+2\frac{1}{13}\right)=?$

$\Rightarrow 3\frac{2}{7}$

$-\left\{(2+1+1+2)+\left(\frac{1}{14}+\frac{1}{14}+\frac{1}{7}+\frac{1}{13}\right)\right\}=?$

$\Rightarrow \quad 3\frac{2}{7}-\left\{6+\left(\frac{1}{7}+\frac{1}{7}+\frac{1}{13}\right)\right\}=?$

$\Rightarrow \quad 3\frac{2}{7}-\left\{6+\left(\frac{2}{7}+\frac{1}{13}\right)\right\}=?$

$\Rightarrow \quad \frac{23}{7}-\left\{6+\frac{26+7}{91}\right\}=?$

$\Rightarrow \quad \frac{23}{7}-\left\{\frac{546+33}{91}\right\}=?$

$\Rightarrow \quad ? = \frac{299-579}{91}=\frac{-280}{91}$

81. $6\frac{2}{3}+3\frac{3}{5}+3\frac{5}{6}=?$ **[Andhra Bank (PO) 2008]**

(a) 15 *(b)* $15\frac{11}{20}$ *(c)* $14\frac{1}{10}$ *(d)* 14

(e) None of these

(c) Here, add this by separating integral part and fractional part.

So, $(6+3+3)+\left(\frac{2}{3}+\frac{3}{5}+\frac{5}{6}\right)$

$=(12)+\left(\frac{20+18+25}{30}\right)$

$=12+\left(\frac{63}{30}\right)$

$=12\frac{21}{10}$

or $14\frac{1}{10}$

82. $5\frac{17}{18}\times 2\frac{10}{11}\div\frac{8}{33}=?$ **[UK GBO 2008]**

(a) $34\frac{3}{11}$ *(b)* $12\frac{49}{66}$

(c) $71\frac{1}{3}$ *(d)* $55\frac{7}{8}$

(e) None of these

(c) Here, follow the rule of BODMAS to solve the expression.

So, $\frac{107}{18}\times\frac{32}{11}\div\frac{8}{33}$

$=\frac{107}{18}\times\frac{32}{11}\times\frac{33}{8}$

$=\frac{107}{18}\times 12=\frac{214}{3}=71\frac{1}{3}$

83. $\frac{1}{2}+\frac{1}{4}+\frac{3}{4}+\frac{2}{3}=?$

[Bank of Baroda (PO) 2008]

(a) $2\frac{1}{5}$ *(b)* $\frac{1}{16}$

(c) $2\frac{1}{16}$ *(d)* $2\frac{1}{6}$

(e) None of these

(d) Here, to add this, we take LCM of 2, 4, 4 and 3 which is 12.

So, $\frac{6+3+9+8}{12}=\frac{26}{12}=2\frac{1}{6}$

84. $5\frac{1}{4}+6\frac{2}{3}+7\frac{1}{6}=?$ **[SBI (PO) 2008]**

(a) 19.5 *(b)* $19\frac{11}{12}$

(c) $19\frac{1}{12}$ *(d)* 19

(e) None of these

(c) To add this, we separate the integral part and fractional part.

So, $(5+6+7)+\left(\frac{1}{4}+\frac{2}{3}+\frac{1}{6}\right)$

$=(18)+\left(\frac{3+4\times 2+2}{12}\right)$

$=18+\frac{13}{12}$

$=18+1\frac{1}{12}=19\frac{1}{12}$

85. $4\frac{5}{6}-5\frac{5}{9}=?-2\frac{1}{3}+\frac{11}{18}$ **[UBI (PO) 2001]**

(a) $\frac{3}{4}$ *(b)* $2\frac{1}{18}$

(c) $1\frac{7}{9}$ *(d)* $1\frac{11}{18}$

(e) None of these

(e) Here, $\frac{29}{6}-\frac{50}{9}=?-\frac{7}{3}+\frac{11}{18}$

$\Rightarrow \quad \frac{87-100}{18}=?-\frac{42+11}{18}$

$\Rightarrow \quad \frac{-13}{18}+\frac{31}{18}=?$

$\Rightarrow \quad \frac{18}{18}=?\ \text{ or }\ 1=?$

Type 4 Questions Based on Square, Square Root, Cube and Cube Root

SQUARE

If the number is multiplied with itself, then the result of this multiplication is called the square of that number. e.g.

(i) Square of $6 = 6 \times 6 = 36$
(ii) Square of $12 = 12 \times 12 = 144$
(iii) Square of $100 = 100 \times 100 = 10000$

Square Root

The square root of a number is the number, the square of which is equal to the given number. It is denoted by the sign '$\sqrt{\ }$'.

e.g. $\sqrt{49} = \sqrt{7 \times 7}$
$= 7$

How to Calculate the Square Root?

Prime Factorisation Method

This method has the following steps:

Step I Express the given number as the product of prime factors.

Step II Keep these factors in pairs.

Step III Take the product of these prime factors taking one out of every pair of the same primes. This product gives us the square root of the given number.

e.g. **Find the square root of 1089.**

Sol. Prime factors of

11	1089
11	99
3	9
3	3
	1

$1089 = 11 \times 11 \times 3 \times 3$

$\Rightarrow \sqrt{1089} = \sqrt{11 \times 11 \times 3 \times 3}$

Now, taking one number from each pair and multiplying them, we get

$\sqrt{1089} = 11 \times 3$
$= 33$

How to Calculate the Square Root of a Decimal Number?

If in a given decimal number, the number of digits after decimal are not even, then we put a 0 (zero) at the extreme right. Now, we mark off the periods and try to calculate the square root applying the division method.

e.g. **Find the square root of 147.1369.**

Sol.

	12. 13
1	11 47 . 13 69 1
22	47 44
241	313 241
242	7269
3	7269
	×

$\therefore$ Required square root = 12.13

How to Calculate the Square Root of a Fraction?

To find square root of a fraction, we have to find the square roots of numerators and denominators, separately.

e.g. $\sqrt{\frac{2704}{81}} = ?$

Sol. $\sqrt{\frac{2704}{81}} = \frac{\sqrt{2704}}{\sqrt{81}}$

	52
5	2704 25
102	204 204
	×

$= \frac{52}{9}$

Multiplication of Rationalisation Factor

If the number is given in the form of $\frac{1}{\sqrt{a} \pm \sqrt{b}}$, we multiply by its rationalisation factor $\sqrt{a} \mp \sqrt{b}$ in both the numerator and denominator.

e.g. $\sqrt{2} = 1.414$, find the value of $\frac{1}{\sqrt{9} - \sqrt{8}}$.

Sol. $\frac{1}{\sqrt{9} - \sqrt{8}} = \frac{1}{\sqrt{9} - \sqrt{8}} \times \frac{\sqrt{9} + \sqrt{8}}{\sqrt{9} + \sqrt{8}}$

$= \frac{\sqrt{9} + \sqrt{8}}{(\sqrt{9})^2 - (\sqrt{8})^2}$

$= \frac{\sqrt{9} + \sqrt{8}}{9 - 8} = \frac{3 + 2\sqrt{2}}{1}$

$= 3 + 2\ (1.414)$
$= 3 + 2.828$
$= 5.828$

CUBE

If the number is multiplied two times with itself, then the result of this multiplication is called the cube of that number.

e.g.

(i) Cube of $6 = 6 \times 6 \times 6 = 216$
(ii) Cube of $8 = 8 \times 8 \times 8 = 512$

Cube Root

The cube root of a given number is the number whose cube is the given number. The cube root is denoted by the sign '$\sqrt[3]{\ }$'.

If n is a given number, then the cube root of n is the number whose cube is n and it will be denoted as $\sqrt[3]{n}$.

e.g.

(i) $\sqrt[3]{8} = \sqrt[3]{2 \times 2 \times 2} = 2$
(ii) $\sqrt[3]{512} = \sqrt[3]{8 \times 8 \times 8} = 8$

How to Calculate the Cube Root?

Prime Factorisation Method

This method has following steps

Step I Express the given number as the product of prime factors.

Step II Keep these factors in a group of three.

Step III Take the product of these prime factors picking one out of every group (group of three) of the same primes. This product gives us the cube root of given number.

e.g. **Find the cube root of 9261.**

Sol. Prime factors of 9261

3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

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

$\sqrt[3]{9261} = \sqrt[3]{3 \times 3 \times 3 \times 7 \times 7 \times 7}$

Now, taking one number from each group of three, we get

$\sqrt[3]{9261} = 3 \times 7$
$= 21$

Directions (Q. Nos. 86-118)*What will come in place of the question mark (?) in the following questions?*

86. $784 \times \sqrt{(256)} \times 343 = 4^4 \times 7^?$ **[RBI 2015]**

(a) 3 *(b)* 11 *(c)* 9 *(d)* 5
(e) 7

(d) Here,

$784 \times \sqrt{256} \times 843 = 4^4 \times 7^x$

$\Rightarrow 784 \times 16 \times 343 = 4^4 \times 7^x$

$\Rightarrow (28)^2 \times 16 \times 7^3 = 4^4 \times 7^x$

$\Rightarrow 7^5 \times 4^4 = 4^4 \times 7^x$

$\Rightarrow x = 5$

87. $\sqrt{(5) \times \sqrt{(1600) \times \sqrt{(1024)}}} = 28 \div 7 \times x$ **[RBI 2015]**

(a) 16 *(b)* 40 *(c)* 8 *(d)* 20
(e) 80

(d) Here,

$\Rightarrow (\sqrt{5 \times (\sqrt{1600 \times 1024})}) = 28 \div 7 \times x$

$\Rightarrow \sqrt{5 \times \sqrt{1600 \times 1024}} = 4x$

$\Rightarrow \sqrt{5 \times 1280} = 4x$

$\Rightarrow 8 \times 10 = 4x \Rightarrow x = 20$

88. $\sqrt{(625)} \times 12 - 864 \div 24 = ? + 71$ **[RBI 2015]**

(a) 193 *(b)* 183 *(c)* 181 *(d)* 190
(e) 187

(a) Here,

$\Rightarrow \sqrt{625} \times 12 - 864 \div 24 = x + 71$

$\Rightarrow 25 \times 12 - 36 = x + 71$

$\Rightarrow 300 - 36 = x + 71$

$\Rightarrow x = 193$

89. $216^{1/3} \times 26^4 \times 39^4 \div [12^4 \times 3 \times 2^{-3}] = 13^?$ **[RBI 2015]**

(a) 8 *(b)* 12 *(c)* 4 *(d)* 10
(e) 16

(a) Here,

$$\frac{(216)^{1/3} \times 26^4 \times (39)^4}{(12)^4 \times 3 \times 2^{-3}} = 13^x$$

$$\Rightarrow \frac{6 \times 2^4 \times 3^4 \times 13^8}{(2 \times 6)^4 \times 3 \times 2^{-3}} = 13^x$$

$$\Rightarrow \frac{6 \times 6^4 \times 13^8}{6 \times 6^4} = 13^x$$

$\Rightarrow 13^8 = 13^x \Rightarrow x = 8$

90. What is the least number that can be added to the number 1020 to make it a perfect square? **[IBPS (PO) 2014]**

(a) 59 *(b)* 65 *(c)* 4 *(d)* 12
(e) None of these

(c) Here, we can do it directly by adding least number from the option.

So, 1020 + 4 = 1024 and 1024 is a perfect square.

91. $\sqrt{360 - 225 \times 2 + 379} = ?$ **[IBPS (PO) 2012]**

(a) 17 *(b)* 19 *(c)* $\sqrt{279}$ *(d)* 289
(e) None of these

(a) Here, $\sqrt{360 - 225 \times 2 + 379}$

We follow the order of BODMAS, to solve this expression.

So, $\sqrt{360 - 450 + 379}$

$= \sqrt{360 + 379 - 450}$

$= \sqrt{739 - 450}$

$= \sqrt{289} = 17$

92. $(?)^2 \times (12)^2 \div (48)^2 = 81$ **[PNB (PO) 2011]**

(a) 26 *(b)* 32 *(c)* 9 *(d)* 15
(e) None of these

(e) Here, $(?)^2 \times (12)^2 \div (48)^2 = 81$

It can also be written as

$$(?)^2 \times \left(\frac{12}{48}\right)^2 = 81 \Rightarrow (?)^2 = 81 \times 16$$

$\Rightarrow ? = \sqrt{81 \times 16} \Rightarrow = 9 \times 4 = 36$

93. $(72)^2 + (61)^2 = (199)^2 - (?)^2 - 420$ **[Bank of India (PO) 2010]**

(a) 165 *(b)* 198 *(c)* 182 *(d)* 171
(e) None of these

(e) Here, we can write it as

$?^2 + 420 = (199)^2 - \{(72)^2 + (61)^2\}$

$?^2 + 420 = 39601 - \{5184 + 3721\}$

$?^2 + 420 = 39601 - \{8905\}$

$?^2 + 420 = 30696$

$?^2 = 30696 - 420$

$?^2 = 30276$

$? = \sqrt{30246} = 174$

94. $[(144)^2 \div 48 \times ?] \div 22 = 216$ **[PNB (PO) 2009]**

(a) 23 *(b)* 16 *(c)* 11 *(d)* 32
(e) None of these

(c) Here, $[(144)^2 \div 48 \times ?] \div 22 = 216$

We follow the BODMAS rule.

So, $\left[\frac{144 \times 144}{48} \times ?\right] \div 22 = 216$

$\Rightarrow (432 \times ?) \div 22 = 216$

$\Rightarrow (432 \times ?) = 216 \times 22$

$$\Rightarrow ? = \frac{216 \times 22}{432} = 11$$

95. $92 \times 576 \div 2\sqrt{1296} + (?)^3 + \sqrt{49}$ **[PNB (PO) 2009]**

(a) 3 *(b)* $(9)^2$ *(c)* 9 *(d)* 27
(e) None of these

(c) Here,

$92 \times 576 \div 2\sqrt{1296} = (?)^3 + \sqrt{49}$

We can also write it as

$92 \times 576 \div 2 \times 36 = (?)^3 + \sqrt{49}$

$\Rightarrow 92 \times 576 \div 72 = (?)^3 + \sqrt{49}$

Here, we apply the BODMAS rule.

So, $92 \times 8 = (?)^3 + 7$

$\Rightarrow 736 - 7 = (?)^3$

$\Rightarrow (?) = \sqrt[3]{729} = 9$

96. $68 \times \sqrt{?} - 3421 = 591$ **[Bank of India (PO) 2010]**

(a) 3249 *(b)* 3481
(c) 3364 *(d)* 3136
(e) None of these

(b) Here, $68 \times \sqrt{?} = 591 + 3421 = 4012$

$$\sqrt{?} = \frac{4012}{68} = 59$$

$\Rightarrow ? = 59 \times 59 = 3481$

97. $\frac{343 \times 49}{216 \times 16 \times 81} = ?$ **[Bank of Baroda (PO) 2010]**

(a) $\frac{7^5}{6^7}$ *(b)* $\frac{7^5}{6^8}$ *(c)* $\frac{7^6}{6^7}$ *(d)* $\frac{7^4}{6^8}$
(e) None of these

(a) Here, $\frac{7^3 \times 7^2}{6^3 \times 4^2 \times 9^2}$

$[\because 343 = 7^3, 49 = 7^2, 216 = 6^3, 16 = 4^2, 81 = 9^2]$

$$\Rightarrow \frac{7^5}{6^3 \times (4 \times 9)^2} = \frac{7^5}{6^3 \times (6)^4}$$

$$= \frac{7^5}{6^3 \times 6^4} = \frac{7^5}{6^7}$$

98. $(35)^2 \div \sqrt[3]{125} + (25)^2 \div 125 = ?$ **[Bank of Maharashtra (PO) 2009]**

(a) 200 *(b)* 250 *(c)* 50 *(d)* 100
(e) None of these

(b) Here, $(35)^2 \div \sqrt[3]{125} + (25)^2 \div 125 = ?$

$\Rightarrow 1225 \div 5 + 625 \div 125 = ?$

Applying the BODMAS rule to solve the expression, we get

$1225 \div 5 + 5 = ?$

$\Rightarrow 245 + 5 = ? \Rightarrow ? = 250$

99. $(?)^3 = 4913$ **[Bank of Maharashtra (PO) 2009]**

(a) 27 *(b)* 19 *(c)* 17 *(d)* 29
(e) None of these

(c) Here, $(?)^3 = 4913 \Rightarrow ? = \sqrt[3]{4913} = 17$

100. $1802 \div 34 \div 5 = \sqrt{?}$ **[PNB (PO) 2009]**

(a) 10.6 *(b)* 114.49 *(c)* 11.4 *(d)* 110.25
(e) None of these

(e) Here, $\sqrt{?} = 1802 \div 34 \div 5$

By applying BODMAS rule, we get

$$\sqrt{?} = 1802 \times \frac{1}{34} \times \frac{1}{5} = 10 \cdot 6$$

$\Rightarrow ? = 10.6 \times 10.6 = 112.36$

101. $\sqrt[3]{804357} = ?$ **[Bank of Baroda (PO) 2009]**

(a) 39 *(b)* 76
(c) 83 *(d)* 86
(e) None of these

(e) Here, $? = \sqrt[3]{804357} = 93$

102. $(12)^2 + (?)^2 + (7)^2 = 274$ **[IOB (PO) 2009]**

(a) 81 *(b)* 28 *(c)* 11 *(d)* 9
(e) None of these

(d) Here,

$(12)^2 + (?)^2 + (7)^2 = 274$

$\Rightarrow 144 + (?)^2 + 49 = 274$

$\Rightarrow (?)^2 + 193 = 274$

$\Rightarrow (?)^2 = 274 - 193$

$\Rightarrow (?)^2 = 81$

[on taking square root both sides]

$\Rightarrow ? = \sqrt{81} = 9$

103. $(?)^2 + (65)^2 = (160)^2 - (90)^2 - 7191$ **[IOB (PO) 2009]**

(a) 75 *(b)* 77 *(c)* 49 *(d)* 81
(e) None of these

(e) Here,

$(?)^2 + (65)^2 = (160)^2 - (90)^2 - 7191$

$\Rightarrow (?)^2 = (160)^2 - (90)^2 - 7191 - (65)^2$

$\Rightarrow (?)^2 = 25600 - (8100 + 7191 + 4225)$

$\Rightarrow (?)^2 = 25600 - 19516$

$\Rightarrow (?)^2 = 6084 \Rightarrow (?) = \sqrt{6084} = 78$

104. $\sqrt{(8)^2 \times 7 \times (5)^2 - 175} = ?$ **[Union Bank of India (PO) 2009]**

(a) 105 *(b)* 95
(c) 115 *(d)* 125
(e) None of these

(a) Here, $\sqrt{(8)^2 \times 7 \times (5)^2 - 175} = ?$

$\Rightarrow \sqrt{64 \times 7 \times 25 - 175} = ?$

$\Rightarrow \sqrt{11200 - 175} = ?$

$\Rightarrow = \sqrt{11025} = 105$

105. $\sqrt{1225} = ?$ **[Haryana Grameen Bank (PO) 2009]**

(a) 25 *(b)* 45 *(c)* 55 *(d)* 15
(e) None of these

(e) Here, to solve this, we use factorisation method.

So, $? = 1225 = 5 \times 5 \times 7 \times 7$

$\Rightarrow ? = \sqrt{1225} = \sqrt{\overline{5 \times 5} \times \overline{7 \times 7}}$

$\Rightarrow ? = 5 \times 7$ [$\because$ in square root, to remove root, we take pairs of two]

$\Rightarrow ? = 5 \times 7 = 35$

106. $(2\sqrt{392} - 21) + (\sqrt{8} - 7)^2 = (?)^2$ **[Corporation Bank (PO) 2009]**

(a) 4 *(b)* –4 *(c)* 12 *(d)* 2
(e) 6

(e) Here, $2\sqrt{392} - 21 + (\sqrt{8} - 7)^2 = (?)^2$

$\Rightarrow 2\sqrt{392} - 21 + 8 + 49 - 14\sqrt{8} = (?)^2$

$\Rightarrow \sqrt{4 \times 392} - 21 + 8 + 49 - \sqrt{196 \times 8} = (?)^2$

$\Rightarrow \sqrt{1568} - 21 + 8 + 49 - \sqrt{1568} = (?)^2$

$\Rightarrow (?)^2 = 36 \Rightarrow ? = 6$

107. $(94)^2 + (?)^2 = (145)^2 - (56)^2 - 3869$ **[UBI (PO) 2009]**

(a) 5184 *(b)* 72 *(c)* 84 *(d)* 7056
(e) None of these

(b) Here,

$(?)^2 = (145)^2 - (56)^2 - 3869 - (94)^2$

$= (145)^2 - \{56^2 + 3869 + (94)^2\}$

$= (145)^2 - \{3136 + 3869 + 8836\}$

$= 21025 - \{15841\} = 5184$

or $? = \sqrt{5184} = 72$

108. $(?)^3 = 729$ **[BOI (PO) 2009]**

(a) 14 *(b)* 7 *(c)* 19 *(d)* 11
(e) None of these

(e) Here, $(?)^3 = 729 \Rightarrow (?)^3 = 9 \times 9 \times 9$

$\Rightarrow ? = 9$ [taking cube root on both sides]

109. $[(165)^2 \div 75 \times 12] \div 36 = (?)^2$ **[Andhra Bank (PO) 2008]**

(a) 13 *(b)* 169 *(c)* 121 *(d)* 11
(e) None of these

(d) Here, $(?)^2 = [(165)^2 \div 75 \times 12] \div 36$

Applying the BODMAS rule, we get

$\left[\frac{165 \times 165}{75} \times 12\right] \div 36 = ?$

$\Rightarrow [363 \times 12] \div 36 = (?)^2$

$\Rightarrow (?)^2 = \frac{363 \times 12}{36} = 121$

$\Rightarrow ? = \sqrt{121} = 11$

110. $\sqrt{\sqrt{44944} + \sqrt{52441}} = ?$ **[UBI (PO) 2008]**

(a) 312 *(b)* 441
(c) 485 *(d)* 17
(e) None of these

(e) Here, $\sqrt{\sqrt{449944} + \sqrt{52441}} = ?$

or $? = \sqrt{212 + 229} = \sqrt{441}$

111. $(4)^? = 1024$ **[Bank of Baroda (PO) 2008]**

(a) 1 *(b)* 2 *(c)* 4 *(d)* 3
(e) None of these

(e) Here, $(4)^? = 1024$

$\Rightarrow (4)^4 = 2^{10}$

[1024 = 2 × 2 × 2 .... 10 times]

Now, $(2^2)^? = 2^{10}$

$\Rightarrow 2^{2\times ?} = 2^{10}$ [$\because (2^2)^? = 2^{2\times ?}$]

$\Rightarrow 2 \times ? = 10 \Rightarrow ? = 5$

112. $\{(45)^3 + (65)^2\} \div ? = 1907$ **[Andhra Bank (PO) 2008]**

(a) 80 *(b)* 70 *(c)* 60 *(d)* 50
(e) None of these

(d) Here, $\{(45)^3 + (65)^2\} \div ? = 1907$

$\Rightarrow \{91125 + 4225\} \div ? = 1907$

$\Rightarrow ? = \frac{95350}{1907} = 50$

113. $[(144)^2 \div 48 \times 18] \div 36 = \sqrt{?}$

(a) 23328 *(b)* 36 **[SBI (PO) 2008]**
(c) 216 *(d)* 46656
(e) None of these

(d) Here, $\left[\frac{144 \times 144}{48} \times 18\right] \div 36 = \sqrt{?}$

$\Rightarrow [144 \times 3 \times 18] \div 36 = \sqrt{?}$

$? = 7776 \div 36 = (216)^2 = 46656$

114. $\sqrt{5^2 \times 14 - 6 \times 7 + (4)^?} = 18$ **[UK GBO 2007]**

(a) 1 *(b)* 3 *(c)* 4 *(d)* 5
(e) None of these

(e) Here, $\sqrt{25 \times 14 - 6 \times 7 + (4)^?} = 18$

$\Rightarrow \sqrt{350 - 42 + (4)^?} = 18$

$\Rightarrow \sqrt{350 - 42 + (4)^?} = 18$

On taking squares both sides, we get

$350 - 42 + (4)^? = 324$

$\Rightarrow (4)^? = 16 \Rightarrow (4)^? = (4)^2 \Rightarrow ? = 2$

115. $\sqrt{24^4} + 224 = ? \times 20^2$ **[UK GBO 2007]**

(a) 20 *(b)* 4
(c) 2 *(d)* 16
(e) None of these

(c) Here, $(24^4)^{1/2} + 224 = ? \times (20)^2$

$\Rightarrow (24)^{4 \times 1/2} + 224 = ? \times (20)^2$

$\Rightarrow 576 + 224 = (?) \times 400$

$\Rightarrow ? = \frac{800}{400} = 2$

116. $\sqrt[3]{19683} = ? \times 3$ **[Corporation Bank (PO) 2006]**

(a) 90 *(b)* 27 *(c)* 3 *(d)* 18
(e) None of these

(e) Here, $\sqrt[3]{19683} = ? \times 3$

$\Rightarrow \sqrt[3]{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3} = ? \times 3$

[$\because 19683 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$]

$\Rightarrow (3^9)^{\times \frac{1}{3}} = ? \times 3$

$\Rightarrow 3^3 = 3 \times ? \Rightarrow ? = \frac{27}{3} = 9$

117. If $\sqrt{80656} = 284$, then $\sqrt{8.0656} = ?$ **[United India Insurance Co (AAO) 2002]**

(a) 28.4 *(b)* 2.84
(c) 0.0284 *(d)* 0.284
(e) None of these

(b) Here, $\sqrt{80656} = 284$

$\Rightarrow \sqrt{8.0656} = \sqrt{\frac{80656}{10000}} = \frac{284}{100} = 2.84$

118. $\sqrt{8^2 \times 7 \times (5)^2 - 175} = ?$ **[UBI (PO) 2001]**

(a) 105 *(b)* 95 *(c)* 115 *(d)* 125
(e) None of these

(a) Here, $\sqrt{64 \times 7 \times 25 - 175}$

$\Rightarrow \sqrt{11200 - 175} = \sqrt{11025} = 105$

Type 5 Simplification of Surds and Indices

SURDS

Surds are the roots of those quantities which cannot be exactly obtained.

e.g. $\sqrt{2}$, $\sqrt{5}$, $3\sqrt{8}$, $a + \sqrt{b}$, $5\sqrt{a^3}$, etc.

Order of surds

Let P be a rational number and m be a positive integer such that

$P^{1/m} = \sqrt[m]{P}$ is irrational.

Then, $\sqrt[m]{P}$ is called a surd of mth order.

Similarly, $7^{1/2} = \sqrt{7}$ = Surd of 2nd order.

$6^{1/5} = \sqrt[5]{6}$ = Surd of 5th order.

Rules of Surds

1. $\sqrt[m]{P} = P^{1/m}$
2. $\sqrt[m]{PQ} = \sqrt[m]{P} \times \sqrt[m]{Q}$
3. $\sqrt[m]{\frac{P}{Q}} = \frac{\sqrt[m]{P}}{\sqrt[m]{Q}}$
4. $(\sqrt[m]{P})^m = P$
5. $(\sqrt[m]{P})^n = (P^{1/m})^n = P^{n/m}$

INDICES

When a number P is multiplied by itself n times, then the product is called nth power of P and is written as P^n. Here, P is called the base and n is known as the index of the power.

Rules of Indices

1. $P^m \times P^n = P^{m+n}$
2. $\frac{P^m}{P^n} = P^{m-n}$
3. $(P^m)^n = P^{mn}$
4. $(PQ)^n = P^n \times Q^n$
5. $\left(\frac{P}{Q}\right)^n = \frac{P^n}{Q^n}$
6. $P^0 = 1$
7. $P^{-n} = \frac{1}{P^n}$

To arrange the surds in increasing or decreasing order

Suppose given surds are $p^{1/a}, q^{1/b}, r^{1/c}$

First of all, take the LCM of a, b and c and use it to make the denominator of the powers same.

Then, easily we can find the required order.

e.g. Arrange $\sqrt[4]{3}$, $\sqrt[3]{2}$, and $\sqrt[6]{5}$ in the decreasing order.

Sol. LCM of 4, 3 and 6 = 12

Now, $\sqrt[4]{3} = (3)^{1/4} = 3^{3/12} = \sqrt[12]{27}$

$\sqrt[3]{2} = (2)^{1/3} = 2^{4/12} = \sqrt[12]{16}$

and $\sqrt[6]{5} = (5)^{1/6} = (5)^{2/12} = \sqrt[12]{25}$

Thus, $\sqrt[12]{27} > \sqrt[12]{25} > \sqrt[12]{16}$

Hence, $\sqrt[4]{3} > \sqrt[6]{5} > \sqrt[3]{2}$

Addition and Subtraction of Surds

First make the possible factors of the terms, then add or subtract the equivalent surds.

e.g. Find the value of

$\sqrt{80} + 3\sqrt{245} - \sqrt{125}$

Sol. Here, $3\sqrt{245} = \sqrt{49 \times 5} = 21\sqrt{5}$

and $\sqrt{125} = \sqrt{25 \times 5} = 5\sqrt{5}$

$\therefore \sqrt{80} + 3\sqrt{245} - \sqrt{125}$

$= 4\sqrt{5} + 21\sqrt{5} - 5\sqrt{5} = 20\sqrt{5}$

Multiplication and Division of Surds

To multiply or divide the surds, we make the denominators of the power same as we did while arranging them in increasing or decreasing order. Then, multiply or divide as usual.

e.g. Find the value of $\sqrt{5}$, $\sqrt[6]{6}$ and $\sqrt[3]{4}$.

Sol. LCM of 2, 6 and 3 = 6

$\therefore \sqrt{5} = 5^{1/2} = 5^{3/6} = (125)^{1/6}$

$\sqrt[6]{6} = 6^{1/6} = (6)^{1/6}$

$\sqrt[3]{4} = 4^{1/3} = 4^{2/6} = (16)^{1/6}$

$\therefore$ Required product

$= (125 \times 6 \times 10)^{1/6} = (1200)^{1/6}$

e.g. Divide $12 \times 4^{1/3}$ by $3\sqrt{2}$.

Sol. $\frac{12 \times 4^{1/3}}{3 \times 2^{1/2}} = \frac{4 \times 4^{2/6}}{1 \times 2^{3/6}} = \frac{4 \times (16)^{1/6}}{(8)^{1/6}}$

$= 4\left(\frac{16}{8}\right)^{1/6} = 4(2)^{1/6} = 4\sqrt[6]{2}$

Techniques for Fast Calculation

Technique 1

To find the value of $\sqrt{x + \sqrt{x + \sqrt{x + \ldots}}}$,

factorise x. If $x = m(m+1)$, then $(m+1)$ is your answer.

e.g. Find the value of

$\sqrt{6 + \sqrt{6 + \sqrt{6 + \ldots}}}$

Sol. We know that, $6 = 2 \times 3 = 2(2+1)$

$\therefore \sqrt{6 + \sqrt{6 + \sqrt{6 + \ldots}}} = 3$

Technique 2

To find the value of $\sqrt{x - \sqrt{x - \sqrt{x - \ldots}}}$,

factorise x. If $x = m(m+1)$, then m is your answer.

e.g. Find the value of

$\sqrt{12 - \sqrt{12 - \sqrt{12 - \ldots}}}$

Sol. We know that, $12 = 3 \times 4$

$\therefore \sqrt{12 - \sqrt{12 - \sqrt{12 - \ldots}}} = 3$

Technique 3

$\sqrt{x\sqrt{x\sqrt{x \ldots}}} = x^{\left(\frac{2^n - 1}{2^n}\right)}$

where, n is the number of times that x is repeated.

e.g. Find the value of $\sqrt{7\sqrt{7\sqrt{7}}}$.

119. What will come in place of both the question marks (?) in the following equation? **[IBPS (PO) 2014]**

$$\frac{?^{0.8}}{49} = \frac{189}{?^{2.2}}$$

(a) 18 *(b)* 23 *(c)* 24 *(d)* 21 *(e)* 28

(d) Here, put x at the place of ?

i.e. $\frac{x^{0.8}}{49} = \frac{189}{x^{2.2}}$

$\Rightarrow x^{0.8 + 2.2} = 189 \times 49$

[add the power in multiplication]

$\Rightarrow x^3 = 189 \times 49$

$= 27 \times 7 \times 49$

$= \overline{3 \times 3 \times 3} \times \overline{7 \times 7 \times 7}$

$\Rightarrow x = 3 \times 7 = 21$

Directions (Q. Nos. 120-144) *What will come in place of the question mark (?) in the following questions?*

120. $[(5\sqrt{7} + \sqrt{7}) \times (4\sqrt{7} + 8\sqrt{7})] - (19)^2 = ?$ **[IBPS (PO) 2012]**

(a) 143 *(b)* $72\sqrt{7}$

(c) 134 *(d)* $70\sqrt{7}$

(e) None of these

(a) Here,

$[(5\sqrt{7} + \sqrt{7}) \times (4\sqrt{7} + 8\sqrt{7})] - (19)^2 = ?$

$\Rightarrow [20 \times 7 + 280 + 28 + 56] - 361 = ?$

$\Rightarrow [420 + 84] - 361 = ?$

$\Rightarrow 504 - 361 = ?$

$\Rightarrow ? = 143$

121. $(15 \times 0.4)^4 \div (1080 \div 30)^4 \times (27 \times 8)^4 = (3 \times 2)^{? + 5}$ **[Punjab and Sindh Bank (PO) 2011]**

(a) 8 *(b)* 3 *(c)* 12 *(d)* 16 *(e)* None of these

(b) Here,

$(15 \times 0.40)^4 \div (1080 \div 30)^4 \times (27 \times 8)^4 = (3 \times 2)^{? + 5}$

$\Rightarrow (6.00)^4 \div (36)^4 \times (216)^4 = (6)^{? + 5}$

$\Rightarrow (6)^4 \div (6^2)^4 \times (6^3)^4 = (6)^{? + 5}$

$\Rightarrow 6^4 \div 6^8 \times 6^{12} = (6)^{? + 5}$

$\Rightarrow 6^{4-8} \times 6^{12} = 6^{? + 5}$

$\Rightarrow 6^{-4} \times 6^{12} = 6^{? + 5}$

$\Rightarrow 6^{-4 + 12} = 6^{? + 5}$

$\Rightarrow 6^8 = 6^{? + 5}$

$\Rightarrow ? + 5 = 8$

$? = 8 - 5 = 3$

122. $(\sqrt{8}\times\sqrt{8})^{1/2}+(9)^{1/2}=(?)^3+\sqrt{8}-340$

[Union Bank of India (PO) 2011]

(a) 7 *(b)* 19
(c) 18 *(d)* 9
(e) None of these

(a) Here,
$(\sqrt{8}\times\sqrt{8})^{1/2}+9^{1/2}=(?)^3+\sqrt{8}-340$
$\Rightarrow (8)^{1/2}+9^{1/2}=(?)^3+\sqrt{8}-340$
$\Rightarrow \sqrt{8}+\sqrt{9}-\sqrt{8}+340=(?)^3$
$\Rightarrow ?^3=343$
[taking cube root on both sides]
$? = \sqrt[3]{343}=7$

123. $(0.125)^3\div(0.25)^2\times(0.5)^2=(0.5)^{7-?}$

[Union Bank of India (PO) 2011]

(a) 2 *(b)* 8
(c) 4 *(d)* 0
(e) None of these

(d) Here, $(0.125)^3\div(0.25)^2\times(0.5)^2=(0.5)^{7-?}$
$\Rightarrow \{(0.5)^3\}^3\div(0.5)^{2\times2}\times(0.5)^2=(0.5)^{7-?}$
$\Rightarrow \{(0.5)\}^9\div(0.5)^4\times(0.5)^2=(0.5)^{7-?}$
$\Rightarrow (0.5)^{9-4}\times(0.5)^2=(0.5)^{7-?}$
$\Rightarrow (0.5)^5\times(0.5)^2=(0.5)^{7-?}$
$\Rightarrow (0.5)^7=(0.5)^{7-?}$
$\Rightarrow 7-?=7$
$? = 0$

124. $3^3\times81^2\div27^3=(3)^?$

[United Bank of India (PO) 2011]

(a) 3 *(b)* 4 *(c)* 5 *(d)* 6
(e) None of these

(e) Here, $3^3\times81^2\div27^3=(3)^?$
$\Rightarrow 3^3\times(3^4)^2\div(3^3)^3=(3)^?$
$\Rightarrow 3^3\times3^8\div3^9=(3)^?$
$\Rightarrow 3^{3+8}\div3^9=(3)^?$
$\Rightarrow 3^{11-9}=(3)^?$
$\Rightarrow ?=2$

125. $572\div26\times12-200=(2)^?$ **[IOB (PO) 2010]**

(a) 5 *(b)* 6
(c) 8 *(d)* 7
(e) None of these

(b) Here, $572\div26\times12-200=(2)^?$
Applying the BODMAS rule to solve, we get
$\Rightarrow 22\times12-200=(2)^?$
$\Rightarrow 264-200=(2)^?$
$\Rightarrow (2)^?=64$
$(2)^?=(2)^6$
$\Rightarrow ?=6$

126. $(\sqrt{9})^3\times(\sqrt{81})^5\div(27)^2=(3)^{(?)}$

[IOB (PO) 2010]

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

(e) Here, applying the rules of surds and indices, we get
$(9)^{3/2}\times(9)^{5/2}\div(27)^2=(3)^?$
$\Rightarrow (3)^{2\times3/2}\times(3)^{2\times5/2}\div(3^3)^{\times2}=(3)^?$
$\Rightarrow 3^{3+5-6}=(3)^?$
$\Rightarrow ?=2$

127. $\dfrac{16\times32}{9\times27\times81}=?$ **[Corporation Bank (PO) 2009]**

(a) $\left(\frac{2}{3}\right)^{12}$ *(b)* $\left(\frac{2}{3}\right)^{11}$
(c) $\left(\frac{2}{3}\right)^{13}$ *(d)* $\left(\frac{2}{3}\right)^{9}$
(e) None of these

(d) Here, $\dfrac{2^4\times2^5}{3^2\times3^3\times3^4}$
$\left[\because 16=2^4,\ 32=2^5;\ 9=3^2,\ 27=3^3;\ 81=3^4\right]$
By applying the rule of indices,
$\dfrac{2^9}{3^9}=\left(\dfrac{2}{3}\right)^9$

128. $(49)^3\div(7)^2=?$

[New India Insurance (PO) 2009]

(a) 2401 *(b)* 49 *(c)* 343 *(d)* 7
(e) None of these

(a) Here, $(7^2)^3\div(7)^2=?$
$\Rightarrow (7)^6\div7^2=?$
$\Rightarrow 7^{6-2}=?\ [\because 7^6\div7^2=7^{6-2}]$
$\Rightarrow ?=7^4=7\times7\times7\times7$
$=2401$

129. $64^{3.1}\times8^{4.3}=8^?$

[Corporation Bank (PO) 2009]

(a) 10.5 *(b)* 7.4 *(c)* 1.2 *(d)* 13.3
(e) None of these

(a) Here, $(64)^{3.1}\times(8)^{4.3}=8^?$
By applying the rule of indices, we get
$(8^2)^{3.1}\times(8)^{4.3}=8^?$
$8^?=8^{6.2+4.3}$
$=8^{10.5}$
$\Rightarrow ?=10.5$

130. $8^7\times2^6\div8^{2.4}=8^?$ **[OBC (PO) 2009]**

(a) 10.6 *(b)* 9.6
(c) 8.6 *(d)* 6.6
(e) None of these

(d) Here, $8^7\times(2^3)^2\div8^{2.4}=8^?$
Applying the rule of indices, we get
$8^7\times8^2\div8^{2.4}=8^?$
$\Rightarrow 8^{7+2-2.4}=8^?$
$\Rightarrow 8^?=8^{9-2.4}=8^{6.6}$
$\Rightarrow ?=6.6$

131. $\sqrt[3]{1331}=?$ **[OBC (PO) 2009]**

(a) 27 *(b)* 21 *(c)* 17 *(d)* 9
(e) None of these

(e) Here, $\sqrt[3]{1331}$
$=\sqrt[3]{11\times11\times11}$
$=(11^3)^{1/3}=11^{3\times\frac{1}{3}}$
$=11$

132. $8^{1.1}\times4^{2.7}\times2^{3.3}=2^?$

[Indian Bank (PO) 2009]

(a) 7.1 *(b)* 14 *(c)* 0.5 *(d)* 9
(e) None of these

(e) Here, $(2^3)^{1.1}\times(2^2)^{2.7}\times2^{3.3}=2^?$
$\Rightarrow 2^{3\times1.1}\times2^{2\times2.7}\times2^{3.3}=2^?$
$\Rightarrow 2^{3.3+5.4+3.3}=2^?$
$\Rightarrow 2^{12}=2^?$
$\Rightarrow ?=12$

133. If $289=17^{x\frac{1}{5}}$, then $x=?$ **[OBC (PO) 2009]**

(a) 16 *(b)* 83 *(c)* 32 *(d)* $\frac{2}{5}$
(e) None of these

(e) Here, $17^{x\frac{1}{5}}=289$
$\Rightarrow (17)^{x+\frac{1}{5}}=(17)^2\quad[\because 289=17^2]$
$\Rightarrow x+\dfrac{1}{5}=2$
$\Rightarrow x=2-\dfrac{1}{5}=\dfrac{9}{5}$

134. $348\div29\times15+156=(?)^3+120$

[OBC (PO) 2009]

(a) 12 *(b)* 6 *(c)* 36 *(d)* 9
(e) None of these

(b) Here,
$348\div29\times15+156=(?)^3+120$
Applying the BODMAS rule, we get
$12\times15+156=(?)^3+120$
$\Rightarrow 336-120=(?)^3$
$\Rightarrow (?)^3=216$
$\Rightarrow ?=\sqrt[3]{216}=6$

135. $(4\times4)^3\div(512\div8)^4\times(32\times8)^4=(2\times2)^{?+4}$

[Corporation Bank 2009]

(a) 8 *(b)* 12 *(c)* 6 *(d)* 14
(e) None of these

› ***(c)*** Here, $(4 \times 4)^3 \div (512 \div 8)^4 \times (32 \times 8)^4 = (2 \times 2)^{?+4}$

$\Rightarrow (16)^3 \div (64)^4 \times (256)^4 = (4)^{?+4}$

$\Rightarrow (4)^{2\times 3} \div (4^4)^4 \times (4^5)^4 = (4)^{?+4}$

$\Rightarrow 4^{6-16+20} = (4)^{?+4}$

$\Rightarrow ? + 4 = 10$

$\Rightarrow ? = 6$

136. $(98)^{45} \times (98)^{-35} = ?$ **[OBC (PO) 2008]**

(a) 98 *(b)* $(98)^2$
(c) $(98)^{-5}$ *(d)* $(98)^{10}$
(e) None of these

› ***(d)*** Here, $(98)^{45} \times (98)^{-35}$

By the rule of indices, we get

$98^{45-35} = (98)^{10}$

137. $(31)^3 \times (31)^{-27} = ?$ **[Andhra Bank (PO) 2008]**

(a) $(961)^2$ *(b)* 4
(c) $(31)^2$ *(d)* 29791
(e) None of these

› ***(a)*** Here,

$(31)^3 \times (31)^{-27}$

By the rule of indices, we get

$(33)^{31-27} = (31)^4$

$= (961)^2$ $[\because 31^2 = 961]$

138. $(32)^{20} \div (32)^5 = ?$ **[Andhra Bank (PO) 2008]**

(a) $(32)^{100}$ *(b)* $(32)^2$
(c) $(32)^{25}$ *(d)* $(32)^{15}$
(e) None of these

› ***(d)*** Here, applying the rule of indices, we get

$? = (32)^{20} \div (32)^5$

$? = (32)^{20-5} = (32)^{15}$

139. $(27)^{18} \div (27)^3$ **[Andhra Bank (PO) 2008]**

(a) $(27)^{54}$ *(b)* $(27)^{21}$
(c) $(27)^{15}$ *(d)* $(27)^6$
(e) None of these

› ***(c)*** Here,

$(27)^{18} \div (27)^3$ $[\because a^m \div a^n = a^{m-n}]$

$\Rightarrow (27)^{18-3} = (27)^{15}$

140. $(19)^{29} \times (19)^{-27} = ?$ **[Union Bank of India (PO) 2007]**

(a) 6 *(b)* 361
(c) 19 *(d)* 6859
(e) None of these

› ***(b)*** Here, $(19)^{29} \times (19)^{-27}$ $[\because a^m \times a^n = a^{m+n}]$

$= (19)^{29-27} = (19)^2 = 361$

141. $(3^?)^? = 19683$

(a) 6 *(b)* 9
(c) 4 *(d)* 8
(e) None of these

› ***(e)*** Here, $(3^?)^? = 19683$

Putting x at the place of (?).

So, $3^{x\times x} = (27)^3$ $[\because 19683 = 27^3]$

$\Rightarrow 3^{x^2} = 3^9 \Rightarrow x^2 = 9$

$\Rightarrow x = \sqrt{9} = 3$

142. $8^{1.3} \times 4^{0.6} \times 16^{0.2} = 2^?$ **[Bank of India (PO) 2007]**

(a) 2.1 *(b)* 3.8
(c) 5.9 *(d)* 4.7
(e) None of these

› ***(c)*** Here, $2^{3\times 1.3} \times (2^2)^{\times 0.6} \times 2^{4\times 0.2} = 2^?$

$\Rightarrow 2^{3.9 + 1.2 + 0.8} = 2^?$

$[\because m^x \times m^y \times m^z = m^{x+y+z}]$

$\Rightarrow 2^{5.9} = 2^?$

$\Rightarrow ? = 5.9$

143. $7^{2.3} \times 49^{4.7} \times 63^{3.4} \times 81^{5.85} = 63^?$ **[Union Bank of India (PO) 2005]**

(a) 16.25 *(b)* 15.1
(c) 13.4 *(d)* 18.9
(e) None of these

› ***(b)*** Here,

$7^{2.3} \times 7^{2\times 4.7} \times (7 \times 9)^{3.4} \times (9^2)^{5.85} = 63^?$

$\Rightarrow 7^{2.3 + 9.4 + 3.4} \times 9^{3.4 + 11.70} = (63)^?$

$\Rightarrow 7^{1.51} \times 9^{15.1} = (63)^?$

$\Rightarrow (63)^{15.1} = (63)^?$

$\Rightarrow ? = 15.1$

144. $27^{15} \times 27^{3.5} = 27^?$ **[Syndicate Bank (PO) 2004]**

(a) 5 *(b)* 7 *(c)* 3 *(d)* 2
(e) None of these

› ***(a)*** Here, $27^{1.5+3.5} = 27^?$

$[\because m^x \times m^y = m^{x+y}]$

$\Rightarrow 27^5 = 27^?$

$\Rightarrow ? = 5$

Type 6 Simplification of Percentage Based Questions

Here, first of all, we know about the percentage. Percentage means per hundred or for every hundred. It is denoted by '%'.
Or we solve the percentage value as

$$x\% \text{ of } y = \frac{x}{100} \times y$$

Directions (Q. Nos. 145-176) *What will come in place of question mark (?) in the following questions?*

145. $\sqrt{(2704} + 78) \div 13 + ?\% \text{ of } 70 = 31$ **[RBI 2015]**

(a) 40 *(b)* 25 *(c)* 45 *(d)* 30
(e) 20

› ***(d)*** Here,

$(\sqrt{2704} + 78) \div 13 + x\% \text{ of } 70 = 31$

$\Rightarrow (52 + 78) \div 13 + \frac{70x}{100} = 31$

$\Rightarrow 130 \div 13 + \frac{70}{100}x = 31$

$\Rightarrow 10 + \frac{7}{10}x = 31$

$\Rightarrow \frac{7}{10}x = 31 - 10$

$\Rightarrow x = \frac{21\times 10}{7}$

$= 30$

146. $(25\% \text{ of } 780 + 35\% \text{ of } 640) \div 4 = ?$ **[RBI 2015]**

(a) 108.25 *(b)* 104.75
(c) 120.75 *(d)* 114.25
(e) 110.75

› ***(b)*** Here, $(25\% \text{ of } 780 + 35\% \text{ of } 640) \div 4 = ?$

$\Rightarrow (25 \times 7.80 + 35 \times 6.4) \div 4 = ?$

$\Rightarrow (195 + 224) \div 4$

$\Rightarrow ? = 419 \div 4 = 104.75$

147. $64.5\% \text{ of } 800 + 36.4\% \text{ of } 1500 = (?)^2 + 38$ **[Union Bank of India (PO) 2014]**

(a) 32 *(b)* 38
(c) 42 *(d)* 48
(e) 84

› ***(a)*** Here, 64.5% of $800 + 36.4\%$ of $1500 = (?)^2 + 38$

$\Rightarrow \frac{64.5}{100} \times 800 + \frac{36.4}{100} \times 1500 = (?)^2 + 38$

$\Rightarrow 64.5 \times 8 + 36.4 \times 15 = (?)^2 + 38$

$\Rightarrow 516 + 546 = (?)^2 + 38$

$\Rightarrow ?^2 = 516 + 546 - 38 = 1062 - 38$

$? = \sqrt{1024}$

$= 32$

148. $\frac{1}{6}$ of (92)% of $1\frac{1}{23}$ of (650) = 85 + ?

[Bank of Boroda (PO) 2011]

(a) 18 *(b)* 21
(c) 19 *(d)* 28
(e) None of these

(c) Here, $\frac{1}{6}$ of (92)% of $1\frac{1}{2^3}$ of (650) = 85 + ?

$\Rightarrow \frac{1}{6} \times \frac{92}{100} \times \frac{24}{23} \times 650 = 85 + ?$

$\Rightarrow 16 \times 6.5 = 85 + ?$

$\Rightarrow ? = 16 \times 6.5 - 85$

$= 104 - 85 = 19$

149. 76% of 1285 = 35% of 1256 + ?

[Corporation Bank (PO) 2011]

(a) 543 *(b)* 537
(c) 547 *(d)* 533
(e) None of these

(b) Here, 76% of 1285 = 35% of 1256 + ?

$\Rightarrow$? = 76% of 1285 − 35% of 1256

$\Rightarrow ? = 1285 \times \frac{76}{100} - \frac{35}{100} \times 1256$

$\Rightarrow$? = 976.60 − 439.60

$\Rightarrow$? = 537

150. 14.2% of 5500 + 15.6% of ? = 1795

[Corporation Bank (PO) 2011]

(a) 6500 *(b)* 6200
(c) 5600 *(d)* 5800
(e) None of these

(a) Here, 14.2% of 5500 + 15.6% of ? = 1795

$\Rightarrow \frac{14.2}{100} \times 5500 + 15.6\% \text{ of } ? = 1795$

$\Rightarrow$ 15.6% of ? = 1795 − 14.2 × 55

= 1795 − 781

$\Rightarrow$ 15.6% of ? = 1014

$\Rightarrow ? = \frac{1014 \times 100}{15.6}$

= 65 × 100

= 6500

151. 25% of 84 × 24% of 85 = ?

[Union Bank of India (PO) 2011]

(a) 424.2 *(b)* 488.4
(c) 482.8 *(d)* 428.4
(e) None of these

(d) Here, 25% of 84 × 24% of 85 = ?

$\Rightarrow \frac{25}{100} \times 84 \times \frac{24}{100} \times 85 = ?$

$\Rightarrow 21 \times 20.40 = ?$

$\Rightarrow 21 \times 20.4 = ?$

$\Rightarrow ? = 428.4$

152. 64% of ? ÷ 14 = 176

[Rajasthan Grameen Bank (PO) 2011]

(a) 3800 *(b)* 3950
(c) 3850 *(d)* 3900
(e) None of these

(c) Here,

64% of ? ÷ 14 = 176

$\Rightarrow$ 64% of ? = 176 × 14

$\Rightarrow ? = \frac{176 \times 14}{64} \times 100$

$\Rightarrow ? = \frac{2464 \times 100}{64} \Rightarrow ? = 38.5 \times 100$

$\Rightarrow ? = 3850$

153. 40% of 265 + 35% of 180 = 50% of ?

[Allahabad Bank (PO) 2010]

(a) 338 *(b)* 84.5 *(c)* 253.5 *(d)* 169
(e) None of these

(a) Here,

40% of 265 + 35% of 180 = 50% of ?

It can also be written as

$\frac{40}{100} \times 265 + \frac{35}{100} \times 180 = \frac{50}{100} \times ?$

$\Rightarrow 40 \times 2.65 + 35 \times 1.8 = \frac{50}{100} \times ?$

$\Rightarrow 106 + 63 = \frac{1}{2} \times ? \left[50\% = \frac{1}{2}\right]$

$\Rightarrow ? = 169 \times 2 = 338$

154. $4\frac{1}{5} \times 3\frac{1}{3} + ? = 20\% \text{ of } 120$

[Allahabad Bank (PO) 2010]

(a) $10\frac{1}{15}$ *(b)* 10 *(c)* 5 *(d)* 15
(e) None of these

(b) Here,

$4\frac{1}{5} \times 3\frac{1}{3} + ? = 20\% \text{ of } 120$

It can also be written as

$\frac{21}{5} \times \frac{10}{3} + ? = \frac{1}{5} \times 120 \left[\because 20\% = \frac{1}{5}\right]$

$\Rightarrow \frac{21}{5} \times \frac{10}{3} + ? = 24 \Rightarrow 7 \times 2 + ? = 24$

$\Rightarrow ? = 24 - 14 = 10$

155. $\frac{2}{3}$ of $1\frac{2}{5}$ of 75% of 540 = ?

[Allahabad Bank (PO) 2010]

(a) 378 *(b)* 756 *(c)* 252 *(d)* 332
(e) None of these

(a) Here, $\frac{2}{3}$ of $1\frac{2}{5}$ of 75% of 540 = ?

It can be simplified as

$\Rightarrow \frac{2}{3} \times \frac{7}{5} \times \frac{75}{100} \times 540 = ?$

$\Rightarrow \frac{14}{15} \times \frac{75}{100} \times 540 = ?$

$\Rightarrow \frac{14 \times 5}{100} \times 540 = ?$

$\Rightarrow 7 \times 54 = ?$

$\Rightarrow ? = 54 \times 7 = 378$

156. 36% of 420 − 56% of 350 = ? − 94

[BOI (PO) 2010]

(a) 48.2 *(b)* 49.2 *(c)* − 138.8 *(d)* − 158.8
(e) None of these

(b) 36% of 420 − 56% of 350 = ? − 94

$\Rightarrow \frac{36}{100} \times 420 - \frac{56}{100} \times 350 = ? - 94$

$\Rightarrow \frac{15120}{100} - \frac{19600}{100} = ? - 94$

$\Rightarrow$ 151.20 − 196 + 94 = ?

$\Rightarrow$? = 151.20 + 94 − 196

= 245.2 − 196 = 49.2

157. 14% of 250 × ?% of 150 = 840

[BOI (PO) 2009]

(a) 15 *(b)* 18 *(c)* 16 *(d)* 12
(e) None of these

(c) Here, 14% of 250 × ? % of 150 = 840

It can also be simplified as

$\Rightarrow \frac{14}{100} \times 250 \times x\% \text{ of } 150 = 840$

[taking x at the place of ?]

$\Rightarrow \frac{14}{100} \times 250 \times \frac{x}{100} \times 150 = 840$

$\Rightarrow \frac{3500}{100} \times \frac{x}{100} \times 150 = 840$

$\Rightarrow x = \frac{840 \times 100}{150 \times 35} = \frac{24 \times 100}{150} = 16$

158. 350% of ? ÷ 50 + 248 = 591

[BOI (PO) 2009]

(a) 4806 *(b)* 4890 *(c)* 4850 *(d)* 4950
(e) None of these

(e) Here, 350% of ? ÷ 50 + 248 = 591

It can also be written as

$\frac{350}{100} \times ? \div 50 + 248 = 591$

By putting x at the place of ?

$\Rightarrow 3.5 \times x \div 50 + 248 = 591$

$\Rightarrow \frac{3.5x}{50} + 248 = 591$

$\Rightarrow \frac{3.5x}{50} = 591 - 248 = 343$

$\Rightarrow 3.5x = 343 \times 50$

$\Rightarrow x = \frac{343 \times 50}{3.5} = 98 \times 50 = 4900$

159. $\frac{1}{2}$ of 3842 + 15% of ? = 2449

[BOI (PO) 2009]

(a) 3520 *(b)* 3250 *(c)* 3350 *(d)* 3540
(e) None of these

(a) Here, $\frac{1}{2}$ of 3842 + 15% of ? = 2449

$\Rightarrow \frac{1}{2} \times 3842 + \frac{15}{100} \times ? = 2449$

$1921 + \frac{15}{100} \times x = 2449$ [put x = ?]

$\Rightarrow 1921 + \frac{15}{100} \times x = 2449$

$\Rightarrow \frac{15x}{100} = 2449 - 1921 \Rightarrow \frac{15x}{100} = 528$

$\Rightarrow x = \frac{528 \times 100}{15} = 35.2 \times 100 = 3520$

160. If $x\%$ of 500 = $y\%$ of 300 and $x\%$ of $y\%$ of 200 = 60, then x = ?
[Corporation Bank (PO) 2009]
(a) $10\sqrt{2}$ *(b)* $20\sqrt{2}$
(c) $15\sqrt{2}$ *(d)* $30\sqrt{2}$
(e) None of these

(d) Here, $x\%$ of 500 = $y\%$ of 300
It can also be written as
$$\frac{x}{100}\times 500 = \frac{y}{100}\times 300 \Rightarrow 5x = 3y$$
$$\Rightarrow \quad 5x - 3y = 0 \qquad \ldots(i)$$
$$\Rightarrow \quad x = \frac{3}{5}y$$
Again, $x\%$ of $y\%$ of 200 = 60
$$\Rightarrow \quad \frac{x}{100}\times\frac{y}{100}\times 200 = 60$$
$$xy = \frac{60\times 100}{2}$$
$$xy = 3000$$
Putting $x = \frac{3}{5}y \Rightarrow \frac{3}{5}y \times y = 3000$
$$\Rightarrow \quad y^2 = 1000\times 5 \Rightarrow y = 50\sqrt{2}$$
and $$x = \frac{3}{5}\times 50\sqrt{2} = 30\sqrt{2}$$

161. 160% of 250 + ? = 120% of 400
[Andhra Bank (PO) 2009]
(a) 160 *(b)* 40 *(c)* 80 *(d)* 120
(e) None of these

(c) Here, 160% of 250 + ? = 120% of 400
? = 120% of 400 − 160% of 250
$$= \frac{120}{100}\times 400 - \frac{160}{100}\times 250$$
$$= 120\times 4 - 16\times 25$$
$$= 480 - 400 = 80$$

162. 18.5% of 220 + 12.4%680 = ?
[Andhra Bank (PO) 2009]
(a) 132.05 *(b)* 125.02
(c) 142.07 *(d)* 118.07
(e) None of these

(b) Here, 18.5% of 220 + 12.4% of 680 = ?
It can also be written as
$$\frac{18.5}{100}\times 220 + \frac{12.4}{100}\times 680 = ?$$
$$\Rightarrow \quad 18.5\times 2.2 + 12.4\times 6.8 = ?$$
$$\Rightarrow \quad 40.7 + 84.32 = ? = 125.02$$

163. $2.8\times 1.5 + 8\%$ of 250 = ? **[BOB (PO) 2009]**
(a) 24.2 *(b)* 24.02 *(c)* 242.2 *(d)* 2.42
(e) None of these

(a) Here, it can also be written as
$2.8\times 1.5 + 8\%$ of 250
$$= 2.8\times 1.5 + \frac{8}{100}\times 250$$
$$= 2.8\times 1.5 + 8\times 2.5 \qquad \left[\because \frac{250}{100} = 2.5\right]$$
$$= 4.2 + 20 = 24.2$$

164. ?% of 555 + 28% of 444 = 202.02
[NIA (PO) 2009]
(a) 18 *(b)* 12 *(c)* 14 *(d)* 16
(e) None of these

(c) Here, ?% of 555 + 28% of 444 = 202.02
It can also be written as
$$\frac{x}{100}\times 555 + \frac{28}{100}\times 444 = 202.02$$
$$\Rightarrow \quad 5.55x + 28\times 4.44 = 202.02$$
$$\Rightarrow \quad 5.55x = 202.02 - 124.32$$
$$\Rightarrow \quad 5.55x = 77.7$$
$$\Rightarrow \quad x = \frac{77.7}{5.55} = 14$$

165. (825% of 330) ÷ 507 = ? **[NIA (PO) 2009]**
(a) 5.36 *(b)* 11.54 *(c)* 17.08 *(d)* 23.04
(e) 27.18

(a) Here, (825% of 330) ÷ 507 = ?
It can also be written as
$$\left(\frac{825}{100}\times 330\right) \div 507 = ?$$
Here, applying the order of BODMAS, we get
$825\times 3.30 \div 507 = ?$
$$\Rightarrow \quad ? = \frac{825\times 3.30}{507} = \frac{2722.5}{507}$$
$$= 5.36$$

166. (9.11% of 936) − (12.5% of 498) = ?
[Dena Bank (PO) 2008]
(a) 22.0176 *(b)* 21.0186
(c) 23.0196 *(d)* 19.0206
(e) None of these

(c) Here, we can simplify this as
(9.11% of 936) − (12.5% of 498) = ?
$$\Rightarrow \left(\frac{9.11}{100}\times 936\right) - \left(\frac{12.5}{100}\times 498\right) = ?$$
$$\Rightarrow \quad (9.11\times 9.36) - (12.5\times 4.98) = ?$$
$$\Rightarrow \quad (85.2696) - (62.25) = ?$$
$$\Rightarrow \quad 23.0196 = ?$$

167. 185% of 400 + 35% of 240 = ?% of 1648
[Dena Bank (PO) 2008]
(a) 85 *(b)* 75 *(c)* 125 *(d)* 50
(e) None of these

(d) Here, it can be written as
$$\frac{185}{100}\times 400 + \frac{35}{100}\times 240 = ?\% \text{ of } 1648$$
$$\Rightarrow \quad 185\times 4 + 35\times 2.4 = x\% \text{ of } 1648$$
$$\Rightarrow \quad 740 + 71.40 = \frac{x}{100}\times 1648$$
$$\Rightarrow \quad 811.40 = \frac{x}{100}\times 1648 \Rightarrow x = \frac{81140}{1648}$$
$$= 49.235 \cong 50$$

168. ?% of 762 + 44% of 568 = 524.24
[Corporation Bank (PO) 2008]
(a) 24 *(b)* 36 *(c)* 48 *(d)* 60
(e) None of these

(b) Here, it can also be written as
?% of 762 + 44% of 568 = 524.24
Putting x at the place of ?.
Now, $x\%$ of 762 + $\frac{44}{100}\times 568 = 524.24$
$$\Rightarrow \quad \frac{x}{100}\times 762 + 44\times 5.68 = 524.24$$
$$\Rightarrow \quad 7.62x = 524.24 - 249.92$$
$$\Rightarrow \quad 7.62x = 274.32 \Rightarrow x = \frac{274.32}{7.62} = 36$$

169. (24.8% of 1338) − (15.5% of 945) = ?
[Corporation Bank (PO) 2008]
(a) 187.349 *(b)* 185.349
(c) 183.349 *(d)* 181.349
(e) None of these

(b) Here, we can simplify it as
$$\frac{24.8}{100}\times 1338 - \frac{15.5}{100}\times 945 = ?$$
$$\Rightarrow \quad \frac{24.8}{100}\times 1338 - \frac{15.5}{100}\times 945 = ?$$
$$\Rightarrow \quad 331.824 - 146.475 = ? \Rightarrow 185.349 = ?$$

170. ?% of 762 + 44% of 568 = 524.24
[Corporation Bank (PO) 2008]
(a) 24 *(b)* 36 *(c)* 48 *(d)* 60
(e) None of these

(b) Here, ?% of 762 + 44% of 568 = 524.24
It can also be written as
$$x\% \text{ of } 762 + \frac{44}{100}\times 568 = 524.24$$
[putting x at the place of ?]
$$\Rightarrow \frac{x}{100}\times 762 + 44\times 5.68 = 524.24$$
$$\Rightarrow \quad x\times 7.62 = 524.24 - 44\times 5.68$$
$$\Rightarrow \quad 7.62x = 524.24 - 249.92$$
$$\Rightarrow \quad x = \frac{274.32}{7.62} = 36$$

171. 40% of 250 = 50% of ? **[BOB (PO) 2008]**
(a) 200 *(b)* 100 *(c)* 150 *(d)* 400
(e) None of these

(a) Here, 40% of 250 = 50% of ?
It can be also written as
$$\frac{40}{100}\times 250 = \frac{50}{100}\times x \quad [\because \text{putting } x = ?]$$
$$\Rightarrow \quad 40\times 2.5 = \frac{1}{2}\times x$$
$$\Rightarrow \quad x = 100\times 2 \Rightarrow x = 200$$

172. (23.6% of 1254) − (16.6% of 834) = ?
[Andhra Bank (PO) 2007]
(a) 159.5 *(b)* 157.5 *(c)* 155.5 *(d)* 153.5
(e) None of these

(b) Here, we can simplify it as
(23.6% of 1254) − (16.6% of 834)
$$= \left(\frac{23.6}{100}\times 1254\right) - \left(\frac{16.6}{100}\times 834\right)$$
$$= (23.6\times 12.54) - (16.6\times 8.34)$$
$$= (295.944) - (138.444)$$
$$= 295.944 - 138.444 = 157.5$$

173. 20.3% of 530 + 16.8% of 225 = ?
[Andhra Bank (PO) 2007]
(a) 123.27 *(b)* 145.39
(c) 165.49 *(d)* 186.57
(e) None of these

› ***(b)*** Here, 20.3% of 530 + 16.8% of 225 = ?
It can be further simplified as
$$\frac{20.3}{100} \times 530 + \frac{16.8}{100} \times 225$$
$$= 20.3 \times 5.3 + 16.8 \times 2.25$$
$$= 107.59 + 37.8 = 145.39$$

174. 73% of 8523 + 32% of 6245 = ?
[Uttarakhand GBO 2007]
(a) 8042.21 *(b)* 8136.28
(c) 8625.35 *(d)* 8220.19
(e) None of these

› ***(d)*** Here, we can simplify it as
$$\frac{73}{100} \times 8523 + \frac{32}{100} \times 6245 = ?$$
$$\Rightarrow \quad 73 \times 85.23 + 32 \times 62.45 = ?$$
$$\Rightarrow \quad ? = 6221.79 + 1998.4 \Rightarrow ? = 8220.19$$

175. 56% of 958 + 67% of 1008 = ?% of 2000
[Union Bank of India (PO) 2005]
(a) 60.592 *(b)* 47.622
(c) 42.86 *(d)* 91.455
(e) None of these

› ***(a)*** Here, 56% of 958 + 67% of 1008 = ? % of 2000
It can be further simplified as
$$\frac{56}{100} \times 958 + \frac{67}{100} \times 1008 = ?\ \%\ \text{of}\ 2000$$
$$\Rightarrow 56 \times 9.58 + 67 \times 10.08 = ?\ \%\ \text{of}\ 2000$$
$$\Rightarrow \quad 536.48 + 675.36 = ?\ \%\ \text{of}\ 2000$$
$$\Rightarrow \quad 1211.84 = ?\ \%\ \text{of}\ 2000$$
$$\Rightarrow \quad 2000 \times \frac{x}{100} = 1211.84$$
$$\Rightarrow \quad x = \frac{1211.84}{20} \Rightarrow x = 60.592$$

176. 56% of 450 + ? = 300
[Syndicate Bank (PO) 2004]
(a) 52 *(b)* 48 *(c)* 42 *(d)* 56
(e) None of these

› ***(b)*** Here, 56% of 450 + ? = 300
It can be simplified as
$$\frac{56}{100} \times 450 + ? = 300$$
$$\Rightarrow \quad 56 \times 4.50 + ? = 300$$
$$\Rightarrow \quad 252 + ? = 300$$
$$\Rightarrow \quad ? = 300 - 252 = 48$$

Type 7 Simplification of the Expression Based on Algebraic Formulae and Identities

To solve these type of questions, first of all we find out the algebraic expression on which given expression is based upon and then simplify. Algebraic formulae and identities on which question can be asked upon are as follows

1. $(a+b)^2 = a^2 + 2ab + b^2$
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $(a-b)(a+b) = a^2 - b^2$
4. $(a+b)^2 + (a-b)^2 = 2(a^2 + b^2)$
5. $(a+b)^2 - (a-b)^2 = 4ab$
6. $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
   $= a^3 + b^3 + 3ab(a+b)$
7. $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
   $= a^3 - b^3 - 3ab(a-b)$
8. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
9. $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
10. $\dfrac{a^3 + b^3 + c^3 - 3abc}{a^2 + b^2 + c^2 - ab - bc - ca}$
    $= (a+b+c)$
11. $a^4 - b^4 = (a^2)^2 - (b^2)^2$
    $= (a^2 + b^2)(a^2 - b^2)$
    $= (a^2 + b^2)(a+b)(a-b)$

177. The value of
$$\frac{(1.111)^3 + (2.212)^3 - (3.323)^3}{(1.111)(2.212)(-3.323)}$$
lies between
[New India Insurance (AO) 2011]
(a) – 0.5 and 0 *(b)* 0 and 0.5
(c) 0.5 and 1 *(d)* 2.5 and 3.5
(e) None of these

› ***(d)*** Here, given expression is
$$\frac{(1.111)^3 + (2.212)^3 - (3.323)^3}{(1.111)(2.212)(-3.323)}$$
Here, put $a = 1.111$, $b = 2.112$
and $c = 3.323$
So, given expression can also be written as
$$\frac{a^3 + b^3 + (-c)^3}{-abc}$$
Now, here, $a + b + c = 0$
Hence, $a^3 + b^3 + c^3 = 3abc$
So, $\dfrac{3abc}{abc} = 3$
So, its value lies between 2.5 and 3.5.

178. $\sqrt{43 - 12\sqrt{7}} - \dfrac{2}{\sqrt{16 + 6\sqrt{7}}} = ?$
[United India Insurance 2011]
(a) $2\sqrt{7} - 1$ *(b)* $-2\sqrt{7} + 3$
(c) -3 *(d)* 3
(e) None of these

› ***(d)*** Here, it can also be written as
$$\sqrt{(6)^2 + (\sqrt{7})^2 - 2.6\sqrt{7}} - \frac{2}{\sqrt{(\sqrt{7})^2 + (3)^2 + 2\sqrt{7} \cdot 3}}$$
Apply the formula
$a^2 + b^2 - 2ab = (a-b)^2$
and $a^2 + b^2 + 2ab = (a+b)^2$
So, $\sqrt{(6-\sqrt{7})^2} - \dfrac{2}{\sqrt{(3+\sqrt{7})^2}}$
$$= \sqrt{(6-\sqrt{7})} - \frac{2}{3+\sqrt{7}}$$
$$= (6-\sqrt{7}) - \frac{2}{3+\sqrt{7}}$$
$$= (6-\sqrt{7}) - \frac{2}{(3+\sqrt{7})} \frac{(3-\sqrt{7})}{(3-\sqrt{7})}$$
$$= (6-\sqrt{7}) - \frac{2(3-\sqrt{7})}{(9-7)}$$
$$[\because a^2 - b^2 = (a+b)(a-b)]$$
$$= (6-\sqrt{7}) - (3-\sqrt{7})$$
$$= 6 - \sqrt{7} - 3 + \sqrt{7} = 3$$

179. $66^2 - 34^2 = ?$ **[Union Bank of India (PO) 2009]**
(a) 3600 *(b)* 3200 *(c)* 2146 *(d)* 2466
(e) None of these

› ***(b)*** Here, this expression is based upon
$a^2 - b^2 = (a+b)(a-b)$
So, $66^2 - 34^2 = (66 + 34)(66 - 34)$
$= 100 \times 32 = 3200$

180. $(78.95)^2 - (43.35)^2 = ?$
[Andhra Bank (PO) 2008]
(a) 4353.88 *(b)* 4305 *(c)* 4235.78 *(d)* 4148
(e) None of these

› ***(a)*** Here, this question can be solved as
$(78.95)^2 - (43.35)^2 = (78.95 + 43.35)$
$$(78.95 - 43.35)$$
$$[\because a^2 - b^2 = (a+b)(a-b)]$$
$= (122.3) \times (35.6) = 4353.88$

181. $(76.32)^2 - (28.82)^2 = ?$
[Andhra Bank (PO) 2008]
(a) 5014.25 *(b)* 4975 *(c)* 4994.15 *(d)* 5000
(e) None of these

› ***(c)*** Here, $(76.32)^2 - (28.82)^2 = ?$
We can simplify this as $(76.32)^2 - (28.82)^2$
$= (76.32 + 28.82)(76.32 - 28.82)$
$$[\because a^2 - b^2 = (a+b)(a-b)]$$
$= (105.14)(47.5) = 4994.15$

Type 8 Statement Based Simplification

In this type of questions, questions are given in statement form and we have to first of all formed an expression which is based on question, then we simplify the expression.

182. Abhay gave 30% of his money to Vijay. Vijay gave 2/3rd of what he received to his mother. Vijay's mother gave 5/8th of the money, she received from Vijay to the grocer. Vijay's mother is now left with ₹ 600. How much money did Abhay have initially? **[SBI (PO) 2015]**

(a) ₹ 6200 *(b)* ₹ 8000 *(c)* ₹ 6000 *(d)* ₹ 8200
(e) ₹ 10200

(b) Here,

Vijay's mother is left with ₹ 600.

And $1-\frac{5}{8}=600 \Rightarrow \frac{3}{8}=600$

$\Rightarrow \quad 1=₹1600$

Now, $\frac{2}{3}=1600 \Rightarrow 1=2400$

This is 30% of the total money what Abhay had.

So, $30\%=2400$

$\therefore \quad 100\%=\frac{2400}{30}\times 100=₹8000$

183. In the month of April, Ramu spent ₹ 6000 on paying electricity bill ₹ 750 on paying water bill ₹ 2500 on paying telephone bill and ₹ 300 on paying cable bill. If after paying all these bills, he is left with 60% of his monthly salary, what is Ramu's annual salary? **[RBI 2015]**

(a) ₹ 240700 *(b)* ₹ 270700
(c) ₹ 286500 *(d)* ₹ 263000
(e) ₹ 252800

(c) Here,

Money spent on paying electricity bill = ₹ 6000

Money spent on paying water bill = ₹ 750

Money spent on paying telephone bill = ₹ 2500

Money spent on paying cable bill = ₹ 300

Total amount = ₹ 9550

This is 40% of his monthly salary.

$\therefore \quad 100\%=\frac{9550}{40}\times 100=23875$

$\therefore$ Annual salary $=23875\times 12=₹286500$

184. What is the value of 24% of four-ninth of five times square of twenty seven? **[Allahabad Bank (PO) 2011]**

(a) 388.8 *(b)* 376.8 *(c)* 378.6 *(d)* 346.6
(e) None of these

(a) Here, we can express the given statement as follows

$$24\% \text{ of } \frac{4}{9} \text{ of } 5 \text{ of } (27)^2$$

$$=\frac{24}{100}\times\frac{4}{9}\times 5\times 729 \quad [\because 27^2=729]$$

$$=\frac{24}{100}\times\frac{4}{9}\times 5\times 729$$

$$=\frac{24\times 4\times 5\times 81}{100}=\frac{24\times 81}{5}$$

$$=81\times 4.8=388.8$$

185. Call rate of a Sim company A is 1 paisa for every 3 s. An other sim company B charges 45 paise per min. A man talked 591 s from Sim company A and 780 s from Sim company B. What would be the total amount he spent? **[Allahabad Bank (PO) 2011]**

(a) ₹ 7.80 *(b)* ₹ 7.40 *(c)* ₹ 7.46 *(d)* ₹ 7.82
(e) ₹ 8.46

(d) Here, total amount spent

$$=\left(\frac{591}{3}+\frac{45}{60}\times 780\right) \text{paise}$$

$$=(197+585) \text{ paise}$$

$$=782 \text{ paise} = ₹ 7.82$$

186. Raman's present age is three times his daughter's present age and nine-thirteenth of his mother's present age. The sum of the present ages of all of them is 125 yr. What is the difference between the Raman's daughter's present age and Raman's mother's present age? **[Allahabad Bank (PO) 2011]**

(a) 45 yr *(b)* 40 yr
(c) 50 yr
(d) Cannot be determined
(e) None of these

(c) Here, Raman's present age $= x$ years

$\therefore$ His daughter's present age $=\frac{x}{3}$ years

His mother's present age $=\frac{13x}{9}$ years

$\therefore \quad x+\frac{x}{3}+\frac{13x}{9}=125$

$\Rightarrow \quad \frac{9x+3x+13x}{9}=125$

$\Rightarrow \quad 25x=125\times 9$

$\Rightarrow \quad x=\frac{125\times 9}{25}=45$

$\therefore$ Required difference

$$=\frac{13x}{9}-\frac{x}{3}$$

$$=\frac{13x-3x}{9}=10\frac{x}{9}$$

$$=\frac{10}{9}\times 45=50 \text{ yr}$$

187. Harshita bought 20 pens, 8 packets of wax colours, 6 calculators and 7 pencil boxes. The price of one pen is ₹ 7. One packet of wax colour is ₹ 22, one calculator is ₹ 175 and one pencil box is ₹ 14 more than the combined price of one pen and one packet of wax colours. How much amount did Harshita pay to the shopkeeper? **[IBPS Bank PO/MT CWE 2011]**

(a) ₹ 1381 *(b)* ₹ 1815
(c) ₹ 1667 *(d)* ₹ 1572
(e) None of these

(c) Here, CP of one pencil box

$= 7 + 22 + 14 = ₹ 43$

$\therefore$ Total amount paid by Harshita

$= ₹ (20\times 7 + 8\times 22 + 6\times 175 + 7\times 43)$

$= ₹ (140 + 176 + 1050 + 301) = ₹ 1667$

188. Raju runs 1250 m on Monday and Friday. Other days, he runs 1500 m except for Sunday (He does not run on Sunday). How many kilometre will he run in 3 weeks (first day starting from Monday)? **[Indian Overseas Bank (PO) 2011]**

(a) 12.5 km *(b)* 20.5 km
(c) 8.5 km *(d)* 25.5 km
(e) None of these

(d) Here, total meters run by Raju in a week.

Days	Monday	Tuesday	Wednesday
Meter	1250	1500	1500
	Thursday	Friday	Saturday
	1500	1250	1500

Total distance covered by him in 1 week

$= 1250\times 2 + 1500\times 4$

$= 2500 + 6000$

$= 8500$ m

Total distance covered by him in 3 weeks

$= 3\times 8500 = 25500$ m

$= 25.5$ km

189. Fifty three per cent of a number is 358 less than the square of 26. What is the value of three fourth of 23 per cent of that number?
[Corporation Bank (PO) 2011]
(a) 101 *(b)* 109.5 *(c)* 113 *(d)* 103.5
(e) None of these

(d) Let the number be x.
Then, 53% of $x = (26)^2 - 358$

$$\Rightarrow \frac{53}{100} \times x = 676 - 358$$

$$\Rightarrow x = \frac{318 \times 100}{53} = 600$$

So, $\frac{3}{4} \times 23\% \times 600 \Rightarrow \frac{3}{4} \times \frac{23}{100} \times 600$

$= 69 \times 1.5 = 103.5$

190. The cost of five chairs and three tables is ₹ 3110. Cost of one chair is ₹ 210 less than cost of one table. What is the cost of two tables and two chairs? **[BOB (PO) 2011]**
(a) ₹ 1660 *(b)* ₹ 1860 *(c)* ₹ 2600
(d) Cannot be determined
(e) None of these

(a) If the CP of 1 chair is ₹ x, then CP of 1 table = ₹ $(x + 210)$

$\therefore \quad 5x + 3(x + 210) = 3110$

$\Rightarrow \quad 5x + 3x + 630 = 3110$

$\Rightarrow \quad 8x = 3110 - 630 = 2480$

$$\therefore \quad x = \frac{2480}{8} = 310$$

$\therefore$ CP of two tables and two chairs

$= 2(x + x + 210) = 4x + 420$

$= 4 \times 310 + 420 = ₹ 1660$

191. Raveena could get equal number of ₹ 55, ₹ 85 and ₹ 105 tickets for a movie. She spent ₹ 2940 for all the tickets. How many of each did she buy? **[IBPS PO/MT CWE 2011]**
(a) 12 *(b)* 18 *(c)* 16
(d) Cannot be determined
(e) None of these

(a) Let the number of tickets of each value be x.

$\therefore \quad 55x + 85x + 105x = 2940$

$\Rightarrow \quad 245x = 2940$

$$\Rightarrow \quad x = \frac{2940}{245} = 12$$

192. There are two numbers such that the sum of twice the first number and thrice the second number is 100 and the sum of thrice the first number and twice the second number is 120. Which is the larger number?
[Corporation Bank (PO) 2010]
(a) 32 *(b)* 12 *(c)* 14 *(d)* 35
(e) None of these

(a) Let the numbers be x and y, where $x > y$.

$\therefore \quad 2x + 3y = 100 \quad \ldots(i)$

$3x + 2y = 120 \quad \ldots(ii)$

From Eq. (ii) × 3 – Eq. (i) × 2, we have

$9x + 6y - 4x - 6y = 360 - 200$

$\Rightarrow \quad 5x = 160$

$$\therefore \quad x = \frac{160}{5} = 32$$

193. There are some parrots and some tigers in a forest. If the total number of animal heads in the forest are 858 and total number of animal legs are 1746, what is the number of parrots in the forest?
[Corporation Bank (PO) 2010]
(a) 845 *(b)* 833
(c) 800
(d) Cannot be determined
(e) None of these

(e) If the number of parrots in the forest is x, then number of tigers = $858 - x$

$\therefore \quad x \times 2 + (858 - x) \times 4 = 1746$

$\Rightarrow \quad 2x = 3432 - 1746 = 1686$

$$\Rightarrow \quad x = \frac{1686}{2}$$

$= 843$

194. On Republic Day, sweets were to be equally distributed among 450 children. But on that particular day, 150 children remained absent. Thus, each child got 3 sweets extra. How many sweets did each child get?
[Bank of India Banking Officer 2010]
(a) 6 *(b)* 12
(c) 9
(d) Cannot be determined
(e) None of these

(c) Here, number of sweets for 150 absent children = 300 × 3 = 900

$\therefore$ Number of sweets each student gets

$$= \frac{900}{150} + 3 = 9$$

195. The bus fare for one person is ₹ 420 from Agra to Aligarh and train fare between the same places for one person is equal to three-fourth the bus fare for two persons between the same places. What is the total fare paid by 2 persons travelling by bus and 4 persons travelling by train between the two places?
[Central Bank of India (PO) 2010]
(a) ₹ 3360 *(b)* ₹ 3460
(c) ₹ 3440 *(d)* ₹ 3406
(e) None of these

(a) Here, bus fare for one person = ₹ 420

Train fare for one person $= \frac{3}{4} \times 840$

$= 3 \times 210 = ₹ 630$

Total fare paid = $2 \times 420 + 4 \times 630$

$= 840 + 2520 = ₹ 3360$

196. Mehul's monthly salary is one and a half times Shailesh's monthly salary. Prashant's monthly salary is five-fourth of Mehul's monthly salary. If the total of the monthly salaries of all the three is ₹ 183750, what is Prashant's monthly salary?
[United Bank of India (PO) 2010]
(a) ₹ 42000 *(b)* ₹ 68500
(c) ₹ 78750 *(d)* ₹ 63000
(e) None of these

(c) Let Shailesh's monthly income be ₹ x.

Mehul's monthly income = ₹ $\frac{3x}{2}$

Prashant's monthly income = ₹ $\frac{15x}{8}$

$$\therefore \quad x + \frac{3x}{2} + \frac{15x}{8} = 183750$$

$$\Rightarrow \quad \frac{8x + 12x + 15x}{8} = 183750$$

$\Rightarrow \quad 35x = 183750 \times 8$

$$\Rightarrow \quad x = \frac{183750 \times 8}{35} = ₹ 42000$$

$\therefore$ Prashant's monthly income

$$= ₹ \left(\frac{15}{8} \times 42000\right) = ₹ 78750$$

197. On the annual day, sweets were to be distributed equally amongst 600 children of the school. But on that particular day, 120 children remained absent. Thus, each child got 2 extra sweets. How many sweets was each child originally supposed to get? **[United Bank of India (PO) 2010]**
(a) 8 *(b)* 14 *(c)* 10 *(d)* 6
(e) None of these

(a) Here, number of extra sweets

$= 2 \times 480 = 960$

These sweets were to be distributed among 120 children.

$\therefore$ Number of sweets to be given to each child originally = $\frac{960}{120} = 8$

198. Deepak has some hens and some goats. If the total number of animal heads is 90 and the total number of animal feet is 248. What is the total number of goats Deepak has?
[PNB Management Trainee 2010]
(a) 32 *(b)* 36 *(c)* 34
(d) Cannot be determined
(e) None of these

➢ ***(c)*** Let the number of hens be x and that of goats be y.

$\therefore \quad x + y = 90 \quad \ldots$ (i)

$2x + 4y = 248$

$\Rightarrow \quad x + 2y = 124$

$\Rightarrow \quad 90 - y + 2y = 124$ [from Eq. (i)]

$\Rightarrow \quad y = 124 - 90 = 34$

199. The cost of 5 kg of apples is ₹ 450. The cost of 12 dozen mangoes is ₹ 4320 and the cost of 4 kg of oranges is ₹ 240. What is the total cost of 8 kg of apples, 8 dozens of mangoes and 8 kg of oranges?

[PNB Management Trainee 2010]

(a) ₹ 4020 *(b)* ₹ 4080
(c) ₹ 4000 *(d)* ₹ 4050
(e) None of these

➢ ***(b)*** Here, cost of 8 kg of apples

$= \frac{450}{5} \times 8 = ₹\ 720$

Cost of 8 dozens of mangoes

$= \frac{4320}{12} \times 8$

$= ₹\ 2880$

Cost of 8 kg of oranges

$= \frac{240}{4} \times 8$

$= ₹\ 480$

$\therefore$ Total cost = ₹ (720 + 2880 + 480)

= ₹ 4080

200. Arun ordered 15 chappattis, 4 plates of rice, 6 plates of mixed vegetables and 5 ice-cream cups. The cost of one chapatti is ₹ 5, one plate of rice is ₹ 50, one plate of mixed vegetables is ₹ 75 and one ice-cream cup is ₹ 20. How much amount did Arun pay to the cashier? **[Syndicate Bank (PO) 2010]**

(a) ₹ 850 *(b)* ₹ 795
(c) ₹ 825 *(d)* ₹ 750
(e) None of these

➢ ***(c)*** Here, total cost of 15 chappattis

$= 15 \times 5 = ₹\ 75$

Total cost of 4 plates of rice

$= 4 \times 50$

$= 200$

Total cost of 6 plates of mixed vegetables

$= 6 \times 75$

$= ₹\ 450$

Total cost of 5 ice-creams

$= 5 \times 20$

$= ₹\ 100$

$\therefore$ Total amount pair by Arun

= 75 + 200 + 450 + 100

= ₹ 825

201. If a number is subtracted by two third of 75% of 600, the value so obtained is 120. What is the number?

[BOB (PO) 2010]

(a) 180 *(b)* 120 *(c)* 160 *(d)* 240
(e) None of these

➢ ***(a)*** Let the number be x.

So, $\frac{2}{3} \times 75\%$ of $600 - x = 120$

$\Rightarrow \quad \frac{2}{3} \times 75\% \times 600 - x = 120$

$\Rightarrow \quad \frac{2}{3} \times \frac{75}{100} \times 600 - x = 120$

$\Rightarrow \quad 300 - x = 120$

$\Rightarrow \quad x = 300 - 120 = 180$

202. When all the students in a school are made to stand in rows of 54, 30 such rows are formed. If the students are made to stand in the rows of 45, how many such rows can be formed?

[Corporation Bank (PO) 2010]

(a) 25 *(b)* 42
(c) 36 *(d)* 32
(e) None of these

➢ ***(c)*** Here, number of students in the school

$= 54 \times 30 = 1620$

$\therefore$ Number of rows of 45 students each

$= \frac{1620}{45} = 36$

203. By how much is 3/4th of 968 less than 7/8th of 1008?

[Corporation Bank (PO) 2010]

(a) 154 *(b)* 146 *(c)* 165 *(d)* 158
(e) None of these

➢ ***(e)*** Here, given expression can be written as

$= \frac{7}{8} \times 1008 - \frac{3}{4} \times 968$

$= 7 \times 126 - 3 \times 242$

$= 882 - 726$

$= 156$

204. Two-third of three-fourth of one-fifth of a number is 15. What is 30% of that number?

[Allahabad Bank (PO) 2010]

(a) 45 *(b)* 60
(c) 75 *(d)* 30
(e) None of these

➢ ***(a)*** Let the number be x.

Then, $\frac{2}{3} \times \frac{3}{4} \times \frac{1}{5} \times x = 15$

$\Rightarrow \quad \frac{1}{10} \times x = 15$

$\Rightarrow \quad x = 150$

So, 30% of $150 = \frac{30}{100} \times 150 = 45$

205. Cost of 8 pens and 4 pencils is ₹ 176 and the cost of 2 pens and 2 pencils is ₹ 48. What is the cost of one pen?

[Andhra Bank (PO) 2009]

(a) ₹ 16 *(b)* ₹ 14
(c) ₹ 12 *(d)* ₹ 18
(e) None of these

➢ ***(e)*** Here, 8 pens + 4 pencils = ₹ 176

2 pens + 2 pencils = ₹ 48

$\Rightarrow$ 1 pens + 1 pencils = ₹ 24

$\Rightarrow$ cost of 1 pen = 24 – 1 pencil

8(24 – 1 pencil) + 4 pencils = ₹ 176

192 – 8 pencils + 4 pencils = ₹ 176

192 – 4 pencils = 176

4 pencils = 16

1 pencils = ₹ 4

$\therefore$ CP of 1 pencil = ₹ 4

and CP of 1 pen = 24 – 4 = ₹ 20

206. On a school's annual Day, sweets were to be equally distributed amongst 112 children. But on that particular day, 32 children were absent. Thus, the remaining children got 6 extra sweets. How many sweets was each child originally supposed to get? **[Indian Overseas Bank (PO) 2009]**

(a) 24 *(b)* 18 *(c)* 15
(d) Cannot be determined
(e) None of these

➢ ***(c)*** Let the total number of sweets be x.

According to the question,

$\frac{x}{112 - 32} - \frac{x}{112} = 6$

$\Rightarrow \quad \frac{x}{80} - \frac{x}{112} = 6$

$\Rightarrow \quad \frac{7x - 5x}{560} = 6$

$\Rightarrow \quad \frac{2x}{560} = 6$

$\Rightarrow \quad x = \frac{560 \times 6}{2} = 1680$

$\therefore$ Required answer $= \frac{1680}{112} = 15$

207. An AC consumes 8 units of electricity in 30 min and a bulb consumes 18 units of electricity in 6 h. How much total unit of electricity will both AC and bulb consume in 8 days, if they run 10 h a day? **[Corporation Bank (PO) 2009]**

(a) 1250 units *(b)* 1528 units
(c) 1248 units *(d)* 1520 units
(e) 1620 units

➢ ***(d)*** Here, total electric consumption

= (10 × 16 × 8) + (3 × 10 × 8) units

= (1280 + 240) = 1520 units

208. $\frac{1}{4}$ of $\frac{3}{5}$ of $\frac{6}{5}$ of a number is 54. What is the number? **[Corporation Bank (PO) 2009]**

(a) 280 *(b)* 250 *(c)* 300 *(d)* 150 *(e)* 160

(c) Let the number be x.

Then, $\frac{1}{4} \times \frac{3}{5} \times \frac{6}{5} \times x = 54$

$\Rightarrow \frac{18}{100} \times x = 54$

$\Rightarrow x = \frac{54 \times 100}{18} = 300$

∴ The number is 300.

209. If the amount in ₹ crores earn marked for Malaria Eradication Programme is 142.51. AIDs Control Programme is 141.00, T B Control Programme is 80.07. Leprosy Eradication Programme is 78.6 and for Control of Blindness is 59.48, how much total amount in ₹ crores is earn marked for all the given programmes together? **[United India Insurance (AAO) 2002]**

(a) ₹ 502.29
(b) ₹ 501.65
(c) ₹ 501.58
(d) ₹ 501.66
(e) None of the above

(d) Here, required answer

= ₹ (142.51 + 141.00 + 80.07 + 78.6 + 59.48) crore

= ₹ 501.66 crore

210. The number of copies circulated for a first-rank newspaper is 2155840 in the world. If the number of copies circulated for the second rank newspaper is less by 860067 of the first rank newspaper, how many copies of second rank newspaper are circulated in the world? **[United India Innsurance (AAO) 2002]**

(a) 129477.3 *(b)* 1295774
(c) 1296773 *(d)* 125973
(e) 1295773

(c) Here, required answer

= 2155840 − 860067

= 1295773

211. Veena's monthly income is equal to the cost of 34 kg of nuts. Cost of 10 kg of nuts is equal to the cost of 20 kg of apples. If cost of 12 kg of apples is ₹ 1500, what is Veena's annual salary? (At some places, annual income and at some place, monthly income are given) **[United Bank of India (PO) 2001]**

(a) ₹ 1 lakh 20 thousand
(b) ₹ 1 lakh 2 thousand
(c) ₹ 2 lakh 20 thousand
(d) Cannot be determined
(e) None of the above

(b) ∵ 12 kg of apples = ₹ 1500

∴ 20 kg of apples = $\frac{1500}{12} \times 20$

= ₹ 2500

∵ 10 kg of nuts = ₹ 2500

∴ 34 kg of nuts = $\frac{2500}{10} \times 34$

= ₹ 8500

∴ Veena's monthly income = ₹ 8500

= 12 × 8500

= ₹ 1 lakh 2 thousand

Practice Questions

Prelims

Directions (Q. Nos. 1-10) *What should come in place of question mark (?) in the following questions?*

1. $38 + 16 \times 0.8 = ?$

(a) 43.2 *(b)* 50.8
(c) 44.8 *(d)* 1.9
(e) None of these

2. $1485 \times ? = 594$

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

3. $2116 + 692 - ? = 1111$

(a) 1667 *(b)* 1677
(c) 1687 *(d)* 1697
(e) None of these

4. $4 + 4.44 + 0.4 + 44.04 + 444 = ?$

(a) 497.24 *(b)* 487.66
(c) 496.88 *(d)* 469.88
(e) None of these

5. $(?)^2 + (65)^2 = (160)^2 - (90)^2 - 7191$

(a) 75 *(b)* 77 *(c)* 79 *(d)* 81
(e) None of these

6. $\frac{\frac{1}{5} + 999\frac{494}{495} \times 99}{4} = ?$

(a) 25000 *(b)* 24225
(c) 24800 *(d)* 24750
(e) None of these

7. $\frac{(m-n)^3 + (n-r)^3 + (r-m)^3}{6(m-n)(n-r)(r-m)} = ?$

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

8. $99 \div 9 \div 3 = ?$

(a) $3\frac{2}{3}$ *(b)* 33 *(c)* 3 *(d)* 1
(e) None of these

9. $13\frac{3}{7} + 18\frac{1}{14} + 8\frac{3}{4} = ?$

(a) $39\frac{1}{2}$
(b) $39\frac{2}{14}$
(c) $40\frac{1}{7}$
(d) $40\frac{1}{4}$
(e) None of the above

10. $756 \text{ of } \frac{2}{3} \text{ of } \frac{4}{9} \text{ of } \frac{3}{7} = ?$

(a) 96 *(b)* 108 *(c)* 88 *(d)* 86
(e) None of these

Mains

1. City *A* has a population of 136000 which is decreasing at the rate of 2400 per year. City *B* has a population of 84000 which is increasing at the rate of 1600 per year. In how many years, will the population of two cities become equal?
(a) 15 *(b)* 18
(c) 13 *(d)* 19
(e) None of these

2. A man had 170 currency notes in all, some of which were of ₹ 100 denominations and some of ₹ 50 denominations. The total amount of all these currency notes was ₹ 10000. How much amount did he have in the denominations of ₹ 50?
(a) ₹ 4000 *(b)* ₹ 9000
(c) ₹ 5000 *(d)* ₹ 6000
(e) None of these

3. Mr Sahni employed a worker for a certain work to be done in some days. He pays ₹ 20 to the worker for each working day and the payment is reduced by ₹ 3 for each non-working day of the worker. For how many days the worker does remain absent from work if at the end of 120 days, he gets ₹ 560 as total remuneration?
(a) 80 *(b)* 60
(c) 70 *(d)* 40
(e) None of these

4. A container of milk was 4/5 full. When 12 bottles of milk were taken out and 8 bottles of milk were poured into it, it was $\frac{3}{4}$ full. How many bottles of milk can the container contain?
(a) 80 *(b)* 40
(c) 90 *(d)* 30
(e) None of these

5. It is required to get 40% marks to quality an exam. A candidate scored 200 marks and failed by 8 marks. What were the maximum marks of that exam?
(a) 520 *(b)* 540
(c) 502
(d) Couldn't be determined
(e) None of these

6. One-third of Rahul's marks in Mathematics exceeds one-half of his marks in Hindi by 30. If he got 480 marks in the two subjects together, how many marks did he get in Hindi?
(a) 200 *(b)* 294 *(c)* 186 *(d)* 196
(e) None of these

7. A man spends $\frac{2}{5}$ of his income on house rent, $\frac{3}{10}$ on food and $\frac{1}{8}$ on conveyance. If he has ₹ 2800 left with him, find his expenditure on food and conveyance together.
(a) ₹ 7000 *(b)* ₹ 5500
(c) ₹ 6700 *(d)* ₹ 6800
(e) None of these

8. Mr Arun is on tour and he has ₹ 360 for his expenses. If he exceeds his tour by 4 days, he must cut down his daily expenses by ₹ 3. For how many days, is Mr Arun out on tour?
(a) 40 *(b)* 20 *(c)* 60 *(d)* 15
(e) None of these

9. From a group of men and women, 15 women leave from it. Then, there are 2 men for each women. After this, 45 men leave. Then, there are 5 women for each men. Find the double of the number of women in the beginning.
(a) 25 *(b)* 23
(c) 35 *(d)* 80
(e) None of these

10. If the fractions 2/5, 3/8, 4/9, 5/13 and 6/11 are arranged in ascending order of their values, which one will be the fourth?
(a) $\frac{4}{9}$ *(b)* $\frac{5}{13}$ *(c)* $\frac{3}{8}$ *(d)* $\frac{2}{5}$
(e) None of these

11. By how much is 5/12 of 516 less than 4/9 of 495?
(a) 5 *(b)* 7
(c) 9 *(d)* 11
(e) None of these

12. The difference between 3/4 of 2/5 of a number and 4/5 of 1/4 of the same number is 5. What is the number?
(a) 25 *(b)* 40
(c) 45 *(d)* 50
(e) None of these

13. In a college, a total number of 27 professors are appointed for all the faculties, i.e. Arts, Commerce and Science. If equal number of professors are appointed for each of the faculties, how many professors are assigned to each faculty?
(a) 9 *(b)* 12
(c) 6 *(d)* 3
(e) None of these

14. By how much is 2/3 of 159 less than 5/8 of 224?
(a) 36 *(b)* 38.75
(c) 32.25 *(d)* 34
(e) None of these

15. On the Independence Day, sweets were to be equally distributed amongst 350 children. But on that particular day, 25 children were absent. Thus, each child got 5 extra sweets. How many sweets did each child get?
(a) 55 *(b)* 70
(c) 50 *(d)* 65
(e) None of these

Answers

Prelims

1. (b) **2.** (a) **3.** (d) **4.** (c) **5.** (e) **6.** (d) **7.** (a) **8.** (a) **9.** (d) **10.** (a)

Mains

1. (c) **2.** (e) **3.** (a) **4.** (a) **5.** (a) **6.** (e) **7.** (d) **8.** (b) **9.** (d) **10.** (a)
11. (a) **12.** (d) **13.** (a) **14.** (d) **15.** (d)

03

Approximation

Approximation is the extension of simplification where we do not require to find out the exact value of expression but to find out the approx value through rounding off the terms of expression. Here, rounding off a number means finding the number which is the closest to that number and by putting it instead of original figure, does not affect the final value of expression. So, in rounding off a number to the nearest hundred means finding the multiple of 100 which is closest to the original number. Rounding off to the nearest tenth means finding the multiple of $\frac{1}{10}$ which is closest to the original number.

Rounding off a Number

Rounding Off to the Nearest 10

Replace the digit at unit's place by 0. If the replaced digit is 5 or more, then add 1 to the digit at tens place, otherwise digit at tens place remains unchanged.

e.g. (i) $47 \xrightarrow[\text{off}]{\text{rounded}} 50$

Here 7 >5, so 1 is added to digit at tens place, i.e. 1 + 4 = 5 (digit at tens place after rounding off)

(ii) $92 \longrightarrow 90$

Here, 2 < 5, so 9 (digit at tens place) remains unchanged.

(iii) $75 \longrightarrow 80$

Here, unit's digit is equal to 5, so 1 is added to 7, i.e. 1 + 7 = 8 becomes the tens place digit.

Rounding Off to the Nearest 100

Replace the digit at unit and tens places by 00. If the replaced digit at tens place is 5 or more, then add 1 to the digit at hundreds place, otherwise the digit at hundreds place remains unchanged.

e.g. (i) $264 \xrightarrow{+1} 300$

Here, 6 > 5, so 1 is added to digit at hundreds place, i.e. 1 + 2 = 3

(ii) 5660 ⟶ 5700, because 660 is rounded off as 700.

Rounding Off to the Nearest 1000

Replace the ones, tens and hundreds digits by 000. If the replaced digit at hundreds place is 5 or more, then add 1 to the digit at thousands place, otherwise not.

e.g. $1973 \longrightarrow 2000$

Note Whether a given number is to be rounded off to the nearest 10, 100 or 1000, it depends on the other numbers involved in the simplification.

Rounding Off a Number to a Decimal Place

To round off a number to the rth decimal place, given steps are to be followed.

***Step* 1** Check the digit immediately, next right to the *r*th place.

***Step* 2** If the next right digit is 5 or more, then add 1 to the digit in the *r*th place, otherwise the digit remains unchanged.

***Step* 3** Delete all the digits in places to the right of the *r*th place.

e.g. (i) $5.792 \xrightarrow[\text{to 2nd place}]{\text{rounded off}} 5.79$

(ii) $5.795 \longrightarrow 5.8$

Ex. 1 What approximate value should come in place of (?) in the following equation

$$9876 \div 24.96 + 215.005 - ? = 309.85$$

Sol. Put x in place of (?), then approximating the terms to the nearest values,

$$9900 \div 25 + 215 - x = 310$$

$$\Rightarrow \quad x = \frac{9900}{25} + 215 - 310$$

$$\Rightarrow \quad x = 396 + 215 - 310$$

$$= 301 \approx 300$$

Therefore, the approximate value in place of (?) is 300.

Techniques For Fast Calculation

Technique I

To solve the complex mathematical expression, take the nearest value of numbers given in the expression.

e.g. 199.03 is approximated to 200; 94.6% is approximated to 95% etc.

Ex. 2 $89\% \text{ of } (599.88 \div 30 \times 400) + 50 = ?$

Sol. $\frac{90}{100} \times (600 \div 30 \times 400) + 50 = ?$

$$? = \frac{9}{10} \times 8000 + 50 = 7200 + 50 = 7250$$

Technique II

To multiply large number, we can take the approximate value (round off) of numbers by increasing one number and decreasing the other accordingly, so that the calculation is eased

e.g. 589×231 is approximated 590×230.

Ex. 3 $393 \times 197 + 5600 \times \frac{5}{4} + 8211.80 = ?$

Sol. $? = 393 \times 197 + 5600 \times \frac{5}{4} + 8211.80$

$$= 390 \times 200 + 5600 \times \frac{5}{4} + 8200$$

$$= 78000 + 7000 + 8200 = 93200$$

Note Numbers are increased or decreased to the nearest value, so that calculation becomes easier like two numbers ending with zero will be much easier to multiply than number with digits other than ending with zero.

Technique III

When we divide large number with decimals, then we can increase or decrease both numbers accordingly.

e.g. $7987.26 \div 38.69$ is approximated as $8000 \div 40$.

Ex. 4 $(9615.36 + 1247.18) \div (2435.72 + 1937.92) = ?$

Sol. $? = (9615.36 + 1247.18) \div (2435.72 + 1937.92)$

$$= 10862.54 \div 4373.64 = 10860 \div 4370 = 2.48 = 2.5$$

Technique IV

To find the percentage of any number, we can use the following shortcut methods

- To calculate 10% of any number, we simply put a decimal after a digit from the right end.
- To calculate 1% of any number, we simply put a decimal after two digits from right end.
- To calculate 25% of any number, we simply divide the number by 4.

Ex. 5 $24\% \text{ of } 3580 + 799.99 \div \frac{1000}{25} = ?$

Sol. $? = 24\% \text{ of } 3580 + 799.99 \div \frac{1000}{25}$

$$= 25\% \text{ of } 3600 + 800 \div 40 = 900 + 20 = 920$$

Ex. 6 $10\% \text{ of } 1350 + ? = 365$

Sol. $10\% \text{ of } 1350 + ? = 365$

$$\Rightarrow \quad 135 + ? = 365$$

$$\Rightarrow \quad ? = 365 - 135 = 230$$

QUESTIONS *with* Detailed Explanation

Type 1 Questions Based on Rounding Off to Integers

In this type, questions are solved by rounding off the integral value to their nearest tenth, hundredth or thousandth and then simplify them to get the final value.

Directions (Q. Nos. 1-48) *What approximate value should come in place of the question mark (?) in the given questions? (You are not expected to calculate the exact value.)*

1. $\sqrt{1230} + \sqrt{4230} = ?$ **[IBPS (PO) 2014]**

(a) 50 *(b)* 200 *(c)* 100 *(d)* 150
(e) 250

(c) Here, we put the exact square root value.

So, $\sqrt{1225} + \sqrt{4225} = ?$

or $35 + 65 = ?$

$[\because \sqrt{1225} = 35 \text{ and } \sqrt{4225} = 65]$

or $100 = ?$

2. $4329 \div 19 + 6464 \div 13 = ?$ **[IBPS (PO) 2014]**

(a) 725 *(b)* 625
(c) 925 *(d)* 525
(e) 825

(a) Here, the given expression can also be written as

$4300 \div 20 + 6500 \div 13 = ?$

or $215 + 500 = ?$

or $? = 715 \approx 725$

3. 40% of $5051 - \frac{3}{7}$th of $999 = ?$ **[IBPS (PO) 2014]**

(a) 2145 *(b)* 2045
(c) 1945 *(d)* 1905
(e) 2165

(b) Here, the given expression can also be written as

50% of $5000 - \frac{3}{7}$ th of $987 = ?$

or $? = \frac{1}{2} \times 5000 - 3 \times 141$

or $? = 2500 - 423$

or $? = 2500 - 423 = 2077 \approx 2045$

4. 23% of $6783 + 57\%$ of $8431 = ?$ **[IBPS (PO) 2013]**

(a) 6460 *(b)* 6420
(c) 6320 *(d)* 6630
(e) 6360

(d) Here, the given expression can also be written as

23% of $6800 + 57\%$ of $8400 = ?$

or $\frac{23 \times 6800}{100} + \frac{57}{100} \times 8400 = ?$

or $23 \times 68 + 57 \times 84 = ?$

or $23 \times 70 + 60 \times 84 = ?$

or $1610 + 5040 = ?$

or $? = 6650 \approx 6630$

5. $\sqrt[3]{54821} \times (303 \div 8) = (?)^2$ **[IBPS (PO) 2013]**

(a) 48 *(b)* 38
(c) 28 *(d)* 18
(e) 58

(b) Here, the given expression can also be written as

$\sqrt[3]{54872} \times (296 \div 8) = (?)^2$

or $38 \times 37 = (?)^2 \quad [\because \sqrt[3]{54872} = 38]$

or $(?)^2 = 38 \times 38$

or $(?) = 38$

6. $8787 \div 343 \times \sqrt{50} = ?$ **[IBPS (PO) 2013]**

(a) 250 *(b)* 140
(c) 180 *(d)* 100
(e) 280

(c) Here, the given expression can also be written as

$8800 \div 350 \times \sqrt{49} = ?$

Now, follow the order of BODMAS, we get

$8800 \div 350 \times 7 = ?$

or $? = 25 \times 7$

$= 175$

$= 180$

7. $\frac{601}{49} \times \frac{399}{81} \div \frac{29}{201} = ?$ **[Corporation Bank (PO) 2011]**

(a) 520 *(b)* 360
(c) 460 *(d)* 500
(e) 420

(e) Here, the given expression can also be written as

$\frac{600}{50} \times \frac{400}{80} \div \frac{30}{200} = ?$

or $\frac{600}{50} \times \frac{400}{80} \times \frac{200}{30} = ?$

[follow the order of BODMAS]

or $? = 20 \times 20 = 400 \approx 420$

8. $\left(\frac{24}{9}\right)^2 \times \frac{399}{39} \div \frac{41}{899} = ?$ **[Bank of Baroda (PO) 2011]**

(a) 1600 *(b)* 1650
(c) 1700 *(d)* 1550
(e) 1750

(e) The given expression can also be written as

$\left(\frac{24}{8}\right)^2 \times \frac{400}{40} \div \frac{40}{900} = ?$

or $? = (3)^2 \times \frac{400}{40} \times \frac{900}{40}$

or $? = 9 \times 10 \times 22.5$

or $? = 9 \times 225$

or $? = 2025 \approx 1750$

9. $7\frac{7}{12} \times 6\frac{7}{19} \div 9\frac{1}{3} = ?$ **[Bank of Baroda (PO) 2011]**

(a) 9 *(b)* 11
(c) 2 *(d)* 5
(e) 13

(d) Here, the given expression can also be written as

$\frac{91}{12} \times \frac{121}{19} \div \frac{28}{3} = ?$

or $\frac{90}{12} \times \frac{120}{20} \times \frac{3}{30} = ?$

or $? = \frac{45}{10}$

or $? = 4.5 \approx 5$

10. $1599 \times 199 \div 49 - 1398 + 3877 = ?$ **[Syndicate Bank (PO) 2011]**

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