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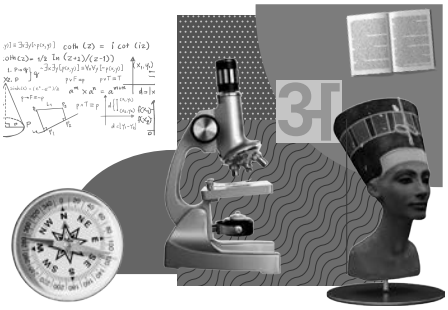

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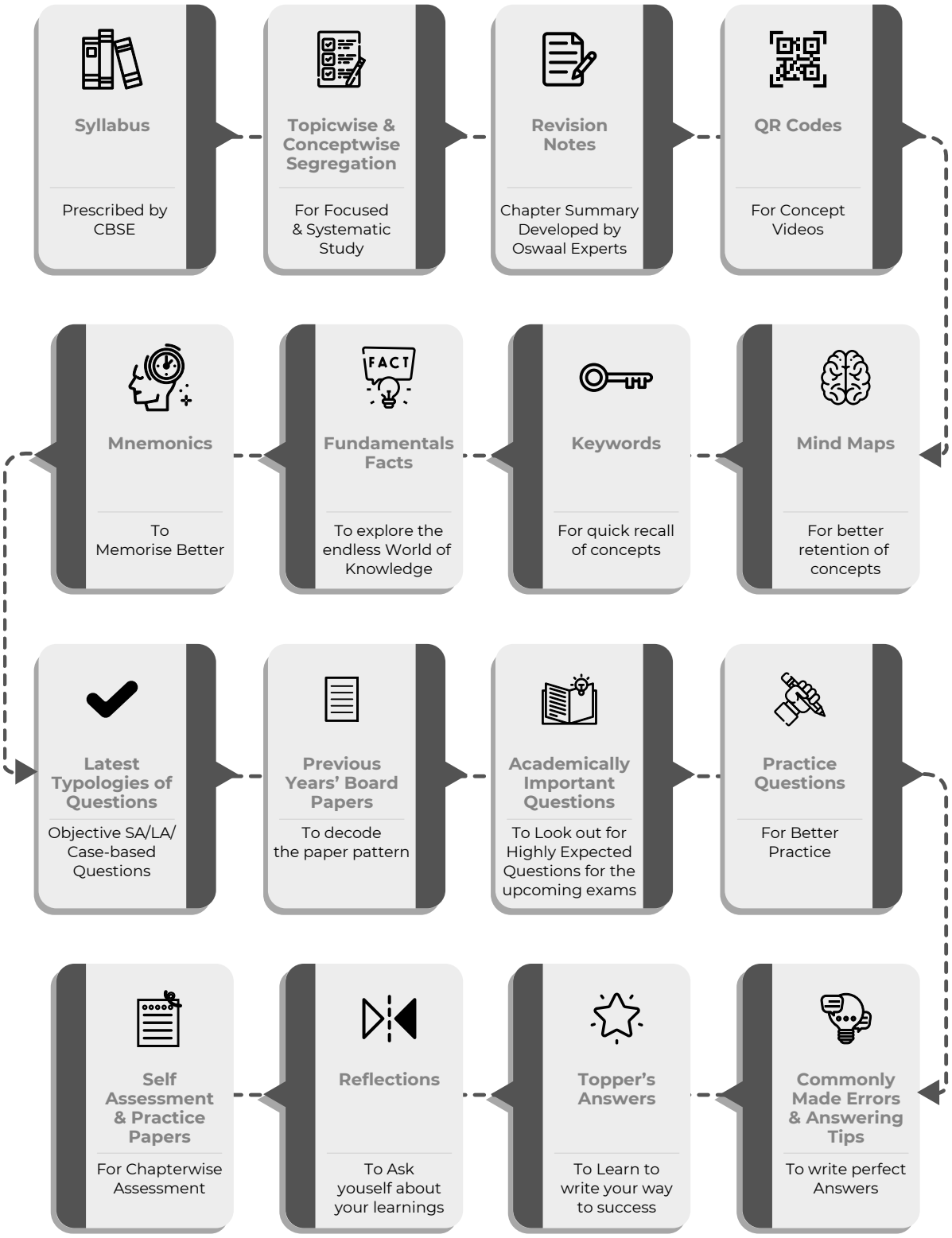

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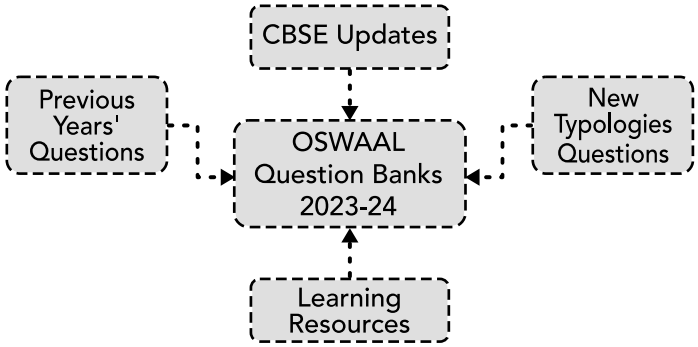

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This Question Bank would not have been made possible without the valuable contributions of the esteemed members of the Oswaal Editorial Board-Authors, Editors, Subject matter experts, Proofreaders & DTP operators who worked day and night to bring this incredible book to you. We are also highly grateful to our dear students for all their valuable and impeccable inputs in the making of this one-of-a-kind exam preparation tool.

All the best Students!! Be the perfectionist that you are!

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Syllabus

MATHEMATICS (Basic)

Course Structure Class - X (Code No. 041)

Latest Syllabus issued by CBSE

Units	Unit Name	Marks
I	Number Systems	06
II	Algebra	20
III	Coordinate Geometry	06
IV	Geometry	15
V	Trigonometry	12
VI	Mensuration	10
VII	Statistics & Probability	11
	Total	**80**

UNIT I: NUMBER SYSTEMS

1. REAL NUMBERS (15) Periods

Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples, Proofs of irrationality of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$.

UNIT II: ALGEBRA

1. POLYNOMIALS (8) Periods

Zeros of a polynomial. Relationship between zeros and coefficients of quadratic polynomials.

2. PAIR OF LINEAR EQUATIONS IN TWO VARIABLES (15) Periods

Pair of linear equations in two variables and graphical method of their solution, consistency/inconsistency.

Algebraic conditions for number of solutions. Solution of a pair of linear equations in two variables algebraically - by substitution, by elimination. Simple situational problems.

3. QUADRATIC EQUATIONS (15) Periods

Standard form of a quadratic equation $ax^2 + bx + c = 0$, $(a \neq 0)$. Solutions of quadratic equations (only real roots) by factorization, and by using quadratic formula. Relationship between discriminant and nature of roots.

Situational problems based on quadratic equations related to day to day activities to be incorporated.

4. ARITHMETIC PROGRESSIONS (10) Periods

Motivation for studying Arithmetic Progression. Derivation of the n^{th} term and sum of first n terms of A.P. and their application in solving daily life problems.

UNIT III: COORDINATE GEOMETRY

Coordinate Geometry (15) Periods

Review : Concepts of coordinate geometry, graphs of linear equations. Distance formula. Section formula (internal division).

Syllabus

UNIT IV: GEOMETRY

1. TRIANGLES (15) Periods

Definitions, examples, counter examples of similar triangles.

1. **(Prove)** If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
2. **(Motivate)** If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
3. **(Motivate)** If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.
4. **(Motivate)** If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
5. **(Motivate)** (Motivate) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.

2. CIRCLES (10) Periods

Tangents to a circle at, point of contact.

1. **(Prove)** The tangent at any point of a circle is perpendicular to the radius through the point of contact.
2. **(Prove)** The lengths of tangents drawn from an external point to a circle are equal.

UNIT V: TRIGONOMETRY

1. INTRODUCTION TO TRIGONOMETRY (10) Periods

Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined); motivate the ratios whichever are defined at 0° and 90°. Values of the trigonometric ratios of 30°, 45° and 60°. Relationships between the ratios.

2. TRIGONOMETRIC IDENTITIES (15) Periods

Proof and applications of the identity $\sin^2 A + \cos^2 A = 1$. Only simple identities to be given.

3. HEIGHTS AND DISTANCES: Angle of elevation, Angle of Depression. (10) Periods

Simple problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation / depression should be only 30°, 45°, 60°.

UNIT VI : MENSURATION

1. AREAS RELATED TO CIRCLES (12) Periods

Area of sectors and segments of a circle. Problems based on areas and perimeter / circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60°, 90°and 120° only).

2. SURFACE AREAS AND VOLUMES (12) Periods

Surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones.

Syllabus

UNIT VII : STATISTICS AND PROBABILITY

1. STATISTICS (18) Periods

Mean, median and mode of grouped data (bimodal situation to be avoided).

2. PROBABILITY (10) Periods

Classical definition of probability. Simple problems on finding the probability of an event.

❑❑

Syllabus

MATHEMATICS-Basic

QUESTION PAPER DESIGN

CLASS – X

Time : 3 Hours **Max. Marks : 80**

S. No.	Typology of Questions	Total Marks	% Weightage (approx.)
1.	**Remembering:** Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers. **Understanding:** Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	60	75
2.	**Applying:** Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	12	15
3.	**Analysing:** Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations **Evaluating:** Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. **Creating:** Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions	8	10
	Total	**80**	**100**

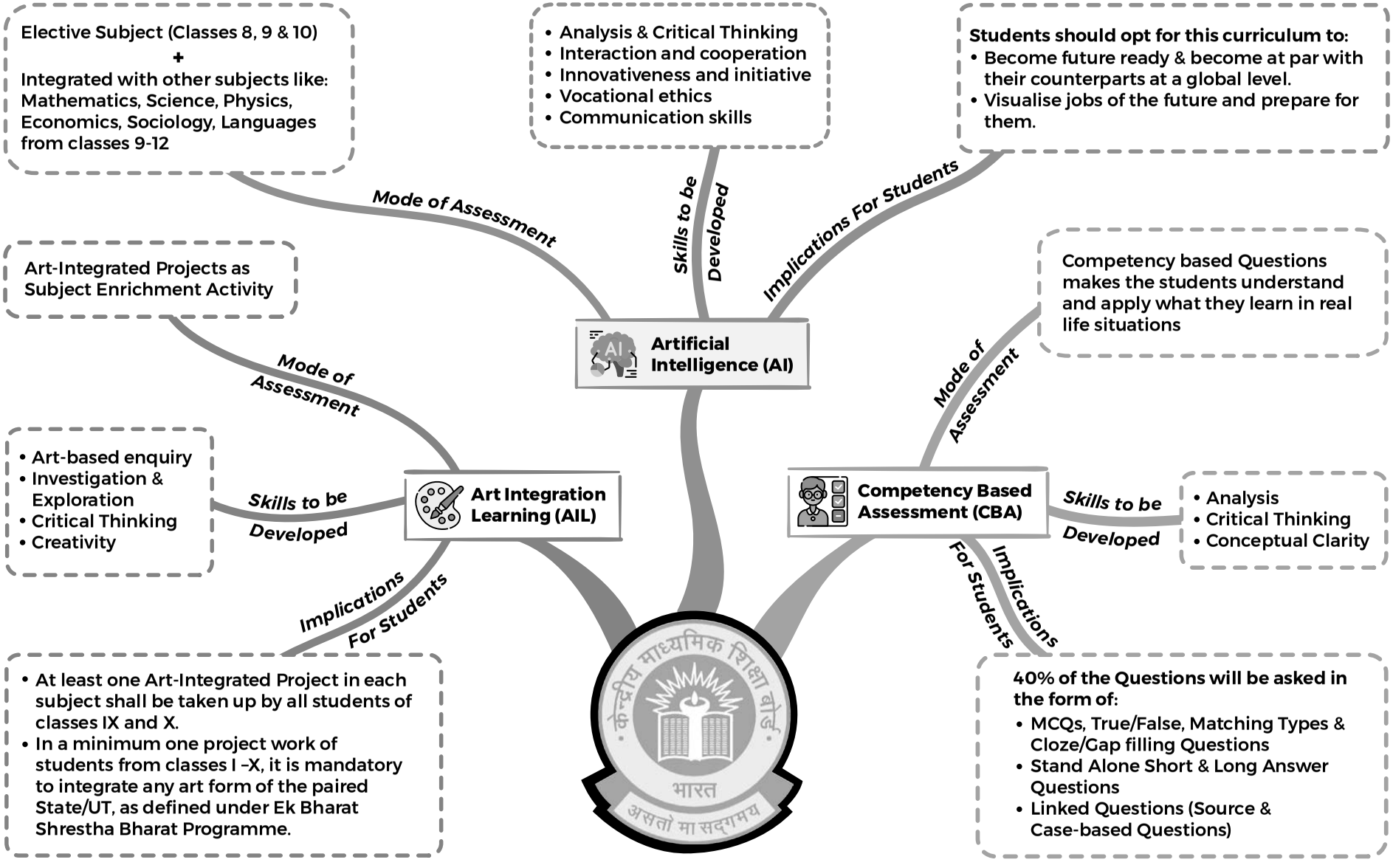
INTERNAL ASSESSMENT	**20 Marks**
Pen Paper Test and Multiple Assessment (5+5)	10 Marks
Portfolio	05 Marks
Lab Practical (Lab activities to be done from the prescribed books)	05 Marks

PRESCRIBED BOOKS:

1. Mathematics - Textbook for class IX - NCERT Publication
2. Mathematics - Textbook for class X - NCERT Publication
3. Guidelines for Mathematics Laboratory in Schools, class IX - CBSE Publication
4. Guidelines for Mathematics Laboratory in Schools, class X - CBSE Publication
5. Laboratory Manual - Mathematics, secondary stage - NCERT Publication
6. Mathematics exemplar problems for class IX, NCERT publication.
7. Mathematics exemplar problems for class X, NCERT publication.

❑❑

NEP Derived Learning Resources Prescribed by CBSE for Year 2023-24

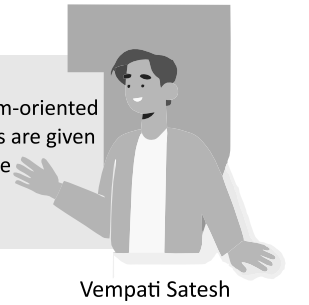


Hear it from our Happy Readers!

Looks Good!
This book is sooooo helpful! The amazing content and colors boost our interest. A must buy book!!

Rimjhim Pandey

Nice Book
Excellent book. All exam-oriented (2022-2023), Questions are given and deleted topics were excluded which ease our study



Vempati Satesh Kumar

Best quality and choice of questions are excellent!

Jadhav Balu

Very helpful Book for 2022-23 Board Exam.
The main attraction of this book is the competency-based questions which are hard to find anywhere else.

Daksh B.

Great Book
This book is great. According to me, it has all necessary types of questions with the answers of toppers. Go for it!!

R Balaji Vignesh

Best Book for Maths
No need for tonnes of reference books, this one is enough for your maths board exam.It has past years' papers, mind maps and much more so what are you waiting for????

Rishabh Gupta

All concepts have been explained with examples which simplifies the understanding of the concept and makes practice very easy. It is worth the money.

Siddharth Gupta

This book made my students to achieve their goals without any obstacle
This book is really useful for students' exam preparation because the Oswaal team knows CBSE pattern as well as students' mindset of preparation. With my 10 years of teaching experience I have produced many centum in Mathematics, I made my students to work out all Oswaal problems, so they can easily achieve 100/100 . Thanks Oswaal team for your Great Work, Salute to you

Dinesh Y

CHAPTER

1

REAL NUMBERS

Syllabus

Fundamental Theorem of Arithmetic–statement after reviewing work done earlier and after illustrating and motivating through examples, proofs of irrationality of $\sqrt{2}, \sqrt{3}, \sqrt{5}$.

In this chapter you will study

- *Fundamental Theorems of Arithmetic;*
- *Proofs for irrationality of some real numbers;*
- *Rational and Irrational Numbers.*

List of Topics

Topic

Fundamental Theorem of Arithmetic, Rational and Irrational numbers, Proofs of irrationality of √2, √3, √5.

Concepts Covered • *Fundamental Theorem of Arithmetic; Prime Factorization Method to find LCM and HCF; Proofs of irrationality of √2, √3, √5.*

Revision Notes

➢ **The Fundamental Theorem of Arithmetic**

Every composite number can be expressed as a product of **prime numbers** and this factorisation is unique, apart from the order in which the prime factors occur. Fundamental theorem of arithmetic is also called a **Unique Factorisation Theorem.**

Scan to know more about this topic

Fundamental Theorem of Arithmetic

Composite number = Product of prime numbers

Or

Any integer greater than 1 can either be a prime number or can be written as a unique product of **prime numbers**. *e.g.,*

(i) $2 \times 11 = 22$ is the same as $11 \times 2 = 22$.

(ii) 6 can be written as 2×3 or 3×2, where 2 and 3 are prime numbers.

(iii) 15 can be written as 3×5 or 5×3, where 3 and 5 are prime numbers.

The prime factorisation of a natural number is unique, except the order of its factors.

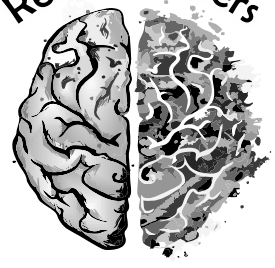
e.g., 12 made by multiplying the prime numbers 2, 2 and 3 together, $12 = 2 \times 2 \times 3$

We would probably write it as $12 = 2^2 \times 3$

➢ By using Fundamental Theorem of Arithmetic, we shall find the *HCF* and *LCM* of given numbers (two or more).

This method is also called **Prime Factorization Method.**

Real Numbers



Theorems

1. Let p be a prime number. If p divides a^2, then p divides a, where a is a positive integer

2. $\sqrt{2}, \sqrt{3}$ are irrational number

3. Let x be a rational number whose decimal expansion terminates. Then x can be expressed in the form, $\frac{p}{q}$ where p & q are coprime, the prime factorisation of q is of the form 2^n5^m, where n, m are non-negative integers

4. Let $x = \frac{p}{q}$ be a rational number, such that the prime factorisation of q is not of the form of $2^n\,5^m$, where n, m are non-negative integers. Then, x has a decimal expansion which is non-terminating repeating and recurring

Prime Factorization Method

To obtain H.C.F. & L.C.M.
For any two positive integers,
a and b
H.C.F. $(a, b) \times$ L.C.M. $(a, b) = a \times b$
For Example
$f(x) = 3x^2y$
and $g(x) = 6xy^2$
H.C.F. $= 3xy$
and L.C.M. $= 6x^2y^2$

Fundamental Theorem of Arithmetic

Every composite number can be expressed as a product of primes, and this factorization is unique, apart from the order in which the prime factors occur

Composite Number
$x = p_1 \times p_2 \times p_3 \ldots \times p_n$, where $p_1, p_2, \ldots, p_n$ are prime numbers

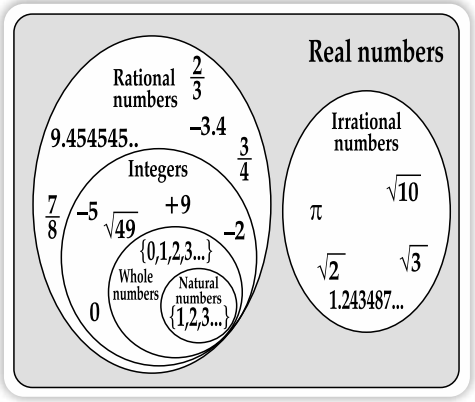
Trace the Mind Map

- First Level
- Second Level
- Third Level

Key Word

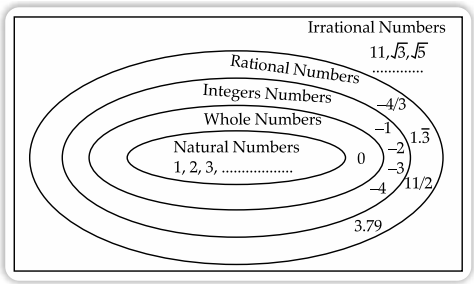
Prime number: A prime number is a whole number greater than 1 whose only factors are 1 and the number itself.

Key Diagram



Mnemonics

Interpretations:
R: Real Numbers
Q: Rational Numbers
W: Whole Numbers
I: Irrational Numbers
Z: Integers
N: Natural Numbers



➢ **Prime Factorization Method to find *HCF* and *LCM* :**

(i) Find all the prime factors of given numbers.

(ii) *HCF* of two or more numbers = Product of the smallest power of each common prime factor, involved in the numbers.

(iii) *LCM* of two or more numbers = Product of the greatest power of each prime factor, involved in the numbers.

Key Formulae

For two positive integers a and b, we have

$HCF\,(a, b) \times LCM\,(a, b) = a \times b$

or $\quad HCF\,(a, b) = \dfrac{a \times b}{LCM(a,b)}$

and $\quad LCM\,(a, b) = \dfrac{a \times b}{HCF(a,b)}$

➢ **Rational and Irrational Numbers**

(i) Rational Numbers: A number in the form $\frac{p}{q}$, where p and q are co-prime numbers and $q \neq 0$, is known as rational number.

For example : $2, -3, 37\,25, -56$, etc. are rational numbers.

(ii) Irrational Numbers: A number is called irrational if it cannot be written in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Scan to know more about this topic

Rational and Irrational numbers

For example, $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ are irrational numbers.

(iii) Let p be a prime number. If p divides a^2, then p divides a, where a is a positive integer.

OBJECTIVE TYPE QUESTIONS (1 mark each)

A Multiple Choice Questions

Q. 1. $n^2 - 1$ is divisible by 8, if n is

(A) an integer. **(B)** a natural number.

(C) an odd integer. **(D)** an even integer.

Sol. Option (C) is correct.

Explanation: Any odd integer can be written as $2m + 1$.

Put $n = 2m + 1$ in $n^2 - 1$

$n^2 - 1 = (n + 1)(n - 1) = (2m + 2)(2m) = 4m\,(m + 1)$

The product of two consecutive numbers is divisible by 2. Thus, $m(m + 1)$ is divisible by 2. Let

$m(m + 1) = 2k$

$n^2 - 1 = (n + 1)(n - 1) = (2m + 2)(2m)$

$= 4m\,(m + 1) = 4 \times 2k = 8k$

Thus, if n is an odd integer then $n^2 - 1$ is divisible by 8.

Q. 2. The largest number which divides 70 and 125, leaving remainders 5 and 8, respectively, is

(A) 13. **(B)** 65.
(C) 875. **(D)** 1,750.

Sol. Option (A) is correct.

Explanation: Required largest number = HCF of (70 – 5) and (125 – 8) = HCF of 65 and 117 = 13.

Q. 3. If two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$; x, y are prime numbers, then HCF (a, b) is

(A) xy. **(B)** xy^2.
(C) x^3y^3. **(D)** x^2y^2.

Q. 4. If two positive integers p and q can be expressed as $p = ab^2$ and $q = a^3b$; a, b being prime numbers, then LCM (p, q) is

(A) ab. **(B)** a^2b^2.
(C) a^3b^2. **(D)** a^3b^3.

Sol. Option (C) is correct.

Explanation:

Since $p = ab^2 = a \times b \times b$

and $q = a^3b = a \times a \times a \times b$

Thus, LCM of p and $q = a \times a \times a \times b \times b = a^3b^2$

Q. 5. The least number that is divisible by all the numbers from 1 to 10 (both inclusive) is

(A) 10. **(B)** 100.
(C) 504. **(D)** 2,520.

Sol. Option (D) is correct.

Explanation: Required number
= LCM (1, 2, 3, 4, 5, 6, 8, 9, 10)
$= 1 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 7 = 2{,}520$

Q. 6. 325 can be expressed as a product of its primes as

(A) $5^2 \times 7$ **(B)** $5^2 \times 13$
(C) 5×13^2 **(D)** $2 \times 3^2 \times 5^2$

[CBSE SQP, 2020]

Q. 7. HCF of 92 and 152 is:

(A) 4 **(B)** 19
(C) 23 **(D)** 57

[CBSE Term-1 2020-21]

Sol. Option (A) is correct.

Explanation: Prime factorisation of 92
$= 2 \times 2 \times 23$
Prime factorisation of $152 = 2 \times 2 \times 2 \times 19$
To find HCF, we multiply all the prime factors common to both numbers:
Therefore, HCF $= 2 \times 2 = 4$

Q. 8. $\sqrt{2} - \sqrt{3}$ is _____:

(A) Rational Number **(B)** Integer
(C) Irrational Number **(D)** None of these

Sol. Option (C) is correct.

Explanation: We know that $\sqrt{2}$ and $\sqrt{3}$ both are irrational numbers and Difference of two irrational number is always irrational.

Q. 9. The simplest form of $\sqrt{35} / \sqrt{5}$ is :

(A) 1 **(B)** 2
(C) $\sqrt{5}$ **(D)** $\sqrt{7}$

Sol. Option (D) is correct.

Explanation: We have

$$\sqrt{35} / \sqrt{5} = \sqrt{(5 \times 7)} / \sqrt{5} = \sqrt{7}$$

Q. 10. Pi (π) is _____:

(A) Rational Number **(B)** Integer
(C) Irrational Number **(D)** None of these

Sol. Option (C) is correct.

Explanation: π is always an irrational number as it has non-terminating decimal expansion.

Q. 11. HCF of two consecutive even numbers is :

(A) 0 **(B)** 1
(C) 2 **(D)** 4

[CBSE Term-1 2020-21]

Sol. Option (C) is correct.

Explanation: Let the two consecutive even numbers be $2n$ and $(2n + 2)$.
Prime factorisation of

$$2n = 2 \times n$$

Prime factorisation of

$$(2n + 2) = 2 \times (n + 1)$$

To find HCF, we multiply all the prime factors common to both numbers.
Therefore, HCF $= 2$

Q. 12. LCM of smallest prime and smallest composite number is :

(A) 1 **(B)** 2
(C) 3 **(D)** 4

Sol. Option (D) is correct.

Explanation: We know that,
Smallest prime number = 2
Smallest composite number = 4

$$\text{LCM } (2,4) = 4$$

Q. 13. According to Fundamental theorem of Arithmetic, Composite number = _____ of prime numbers:

(A) Sum **(B)** Product
(C) Difference **(D)** Ratio

Sol. Option (B) is correct.

Explanation: According to fundamental theorem of arithmetic, we know that,

Composite number = Product of primes.

Q. 14. What is the Greatest Common Divisor of 5 and 15?

(A) 10 **(B)** 20
(C) 5 **(D)** 1

Sol. Option (C) is correct.

Explanation: We know that
Greatest common divisor = HCF
So, HCF(5,15) = GCD(5,15) = 5

Q. 15. The (HCF × LCM) for the numbers 50 and 20 is :

(A) 1000 **(B)** 50
(C) 100 **(D)** 500

U [CBSE Term-1 2020-21]

Sol. Option (A) is correct.

Explanation: We know that HCF × LCM
= Product of two numbers
$\Rightarrow$ HCF × LCM = 20 × 50
$\therefore$ HCF × LCM = 1000

Q. 16. The product of a non-zero rational and an irrational number is :

(A) always irrational
(B) always rational
(C) rational or irrational
(D) one

U [CBSE SQP, 2020]

Sol. Option (A) is correct.

Explanation: The product of a non-zero rational and an irrational number is always an irrational number.

Q. 17. What will be the simplest form of $\frac{\sqrt{45}+\sqrt{20}}{\sqrt{5}}$?

(A) $5\sqrt{5}$ **(B)** 5
(C) $2\sqrt{5}$ **(D)** $\sqrt{5}$

Sol. Option (B) is correct.

Explanation: $\frac{3\sqrt{5}+2\sqrt{5}}{\sqrt{5}} = \frac{5\sqrt{5}}{\sqrt{5}} = 5$

Q. 18. Which of these numbers can be expressed as a product of two or more prime numbers?

(i) 15
(ii) 34568
(iii) (15 × 13)

(A) only (ii) **(B)** only (iii)
(C) only (i) and (ii) **(D)** All - (i), (ii) and (iii)

U [CBSE QB 2021-22]

Sol. Option (D) is correct.

Explanation: All of the three numbers can be expressed as a product of prime numbers write factors of all number.

Q. 19. 1245 is a factor of the numbers p and q.

Which of the following will always have 1245 as a factor?

(i) $p + q$
(ii) $p \times q$
(iii) $p \div q$

(A) only (ii) **(B)** only (i) and (ii)
(C) only (ii) and (iii) **(D)** all - (i), (ii) and (iii)

U [CBSE QB 2021-22]

Sol. Option (B) is correct.

Explanation: Only $p + q$ and $p \times q$ have 1245 as a factor.

Q. 20. P and Q are two positive integers such that $P = p^3q$ and $Q = (pq)^2$, where p and q are prime numbers. What is LCM (P, Q)?

(A) pq **(B)** p^2q^2
(C) p^3q^2 **(D)** p^5q^3

U [CBSE QB 2021-22]

Sol. Option (C) is correct.

Explanation:

$P = p^3q$
and $Q = (pq)^2$
Then LCM $(P, Q) = p^3q^2$

SUBJECTIVE TYPE QUESTIONS

Very Short Answer Type Questions (1 mark each)

Q. 1. Find the HCF of 168 and 126.

U [CBSE SQP, 2021]

Sol. $168 = 2 \times 2 \times 2 \times 3 \times 7$ ½
$126 = 2 \times 3 \times 3 \times 7$
HCF of 168 and 126 $= 2 \times 3 \times 7$ ½
$= 42$

Q. 2. Find the HCF of 144 and 198.

U [CBSE Delhi Set-I, 2020]

Q. 3. The HCF of two numbers is 27 and their LCM is 162. If one of the number is 54, then find the other number. AI U [CBSE O.D. Set-I, 2020]

Sol. Let y be the second number.

Since, Product of two numbers = LCM × HCF
Therefore, $54 \times y = 162 \times 27$
Or, $y = \frac{162 \times 27}{54}$
$= 81$ **1**

Q. 4. If a and b are co-prime numbers, then find the HCF (a, b). A [SQP, 2020]

Sol. Since 1 is the only common factor of co-prime numbers.
Thus, HCF (a, b) = 1 **1**

Q. 5. State the fundamental theorem of Arithmetic.

R [SQP, 2020]

Sol. Every composite number can be expressed as a product of prime numbers, and this factorization is unique, apart from the order in which the factor occurs. **1**

These questions are for practice and their solutions are available at the end of the chapter

Q. 6. Given that HCF (96, 404) is 4, find the LCM (96, 404). U [CBSE SQP, 2022]

Q. 7. Express 156 as the product of primes.

U [SQP, 2020]

Sol. By prime factorization of 156, we get

2	156
2	78
3	39
13	13
	1

$$156 = 2 \times 2 \times 3 \times 13$$
$$= 2^2 \times 3 \times 13$$

Q. 8. Find a rational number between $\sqrt{2}$ and $\sqrt{3}$.

U [CBSE Delhi Set-I, 2019]

Sol. Any one rational number between $\sqrt{2}$ (1.41 approx.) and $\sqrt{3}$ (1.73 approx.)
e.g., 1.5, 1.6, 1.63 etc. **1**
[CBSE Marking Scheme, 2019]

Detailed Solution :

Since,

$$\sqrt{2} = 1.414$$

and $\sqrt{3} = 1.732$

Now, we can write '*n*' is a rational number between $\sqrt{2}$ & $\sqrt{3}$ *e.g.*, just greater than 1.414 and less than 1.732 and it should be terminating or not

e.g.: 1.415659, 1.416893, 1.715644, ---

Therefore, one rational number between $\sqrt{2}$ and $\sqrt{3}$ is 1.416893.

Q. 9. Two positive integers a and b can be written as $a = x^3y^2$ and $b = xy^3$. x, y are prime numbers. Find LCM (a, b). A [CBSE Delhi Set-III, 2019]

Sol. LCM $(a, b) \times$ HCF $(a, b) = a \times b$
Since, LCM $(x^3y^2, xy^3) = x^3y^3$.
[CBSE Marking Scheme, 2019] **1**

Detailed Solution :

Given $a = x^3y^2$ and $b = xy^3$

Where a and b are positive integers and x and y are prime numbers

$$a = x^3y^2$$
$$= x \times x \times x \times y \times y$$
$$b = xy^3$$
$$= x \times y \times y \times y$$
$$\text{LCM } (a, b) = \text{LCM } (x^3y^2, xy^3) = x^3y^3$$

Q. 10. If HCF (336, 54) = 6, find LCM (336, 54).

A I U [CBSE Outside Delhi Set-I, 2019]

Sol. $\text{LCM } (336, 54) = \frac{336 \times 54}{6}$ ½

$= 336 \times 9 = 3024.$ ½
[CBSE Marking Scheme, 2019]

Detailed Solution :

Since,

$$\text{HCF} \times \text{LCM} = \text{Product of numbers}$$

$\therefore$ $6 \times \text{LCM} = 336 \times 54$ ½

$\Rightarrow$ $\text{LCM} = \frac{336 \times 54}{6}$

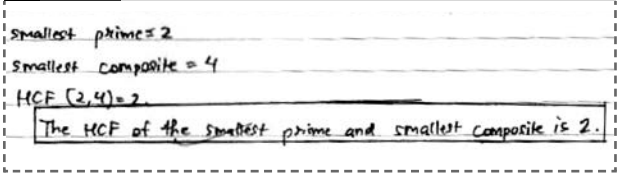
$\Rightarrow$ $\text{LCM} = 56 \times 54$

$\Rightarrow$ $\text{LCM} = 3024.$ ½

Q. 11. What is the *HCF* of smallest prime number and the smallest composite number ?

U [CBSE Delhi OD, 2018]

Topper Answer, 2018



Q. 12. Explain why 13233343563715 is a composite number ? R [Board Term-1, 2016]

Sol. Since, the given number ends in 5. Hence, it is a multiple of 5. Therefore, it is a composite number.
[CBSE Marking Scheme, 2016] **1**

Q. 13. a and b are two positive integers such that the least prime factor of a is 3 and the least prime factor of b is 5. Then, calculate the least prime factor of ($a + b$). R [Board Term-1, 2015]

Sol. a and b are two positive integers such that the least prime factor of a is 3 and the least prime factor of b is 5.

$a + b = 3 + 5 = 8$ **1**

Hence, least prime factor of $(a + b)$ is 2.

Q. 14. Express 325 as a product of its prime factors.

U [SQP 2020]

Sol. By prime factorization of 325, we get

$$325 = 5 \times 5 \times 13$$
$$= 5^2 \times 13$$ **1**
[CBSE SQP Marking Scheme, 2020]

Q. 15. Express 225 as a product of its prime factors.

U [CBSE Delhi Set-I, 2020]

Sol. By prime factorization of 225, we get

$$225 = 3 \times 3 \times 5 \times 5$$
$$= 3^2 \times 5^2 \text{ or } 5^2 \times 3^2$$ **1**

Q. 16. Write whether $\frac{2\sqrt{45} + 3\sqrt{20}}{2\sqrt{5}}$ on simplification gives an irrational or a rational number. A I

U [CBSE Compt Set I, II, III 2018]

These questions are for practice and their solutions are available at the end of the chapter

Sol. For writing $\frac{6\sqrt{5}+6\sqrt{5}}{2\sqrt{5}} = \frac{12\sqrt{5}}{2\sqrt{5}}$ ½

$= 6$ which is rational. ½

[CBSE Marking Scheme, 2018]

Detailed Solution :

$$\frac{2\sqrt{45}+3\sqrt{20}}{2\sqrt{5}} = \frac{2\sqrt{9\times5}+3\sqrt{4\times5}}{2\sqrt{5}}$$

$$\Rightarrow \quad = \frac{2\times3\sqrt{5}+3\times2\sqrt{5}}{2\sqrt{5}}$$

$$\Rightarrow \quad = \frac{6\sqrt{5}+6\sqrt{5}}{2\sqrt{5}}$$

$$\Rightarrow \quad = \frac{(6+6)\sqrt{5}}{2\sqrt{5}}$$

$$\Rightarrow \quad = \frac{12\sqrt{5}}{2\sqrt{5}} = 6$$

which is a rational number.

Short Answer Type Questions-I (2 marks each)

Q. 1. Show that $7-\sqrt{5}$ is irrational, given that $\sqrt{5}$ is irrational. U [SQP 2018-19]

Q. 2. Given that $\sqrt{3}$ is an irrational number, prove that $(2+\sqrt{3})$ is an irrational number.

AI A [CBSE Comptt. Set I, II, III, 2018]

Sol. Let assume $2+\sqrt{3}$ be a rational number in the form $\frac{p}{q}$

$$\Rightarrow \quad 2+\sqrt{3} = \frac{p}{q}, \text{ (where } p, q \in \text{I and } q \neq 0)$$

$$\Rightarrow \quad \sqrt{3} = \frac{p}{q}-2 \Rightarrow \frac{p-2q}{q} \quad \mathbf{1}$$

$\frac{p-2q}{q}$ is rational = $\sqrt{3}$ is irrational number. ½

which is contradiction with our assumption ½

Thus, $2+\sqrt{3}$ is an irrational number

[CBSE Marking Scheme, 2018]

Q. 3. Write the smallest number which is divisible by both 306 and 657. A [Ouside Delhi Set–2019]

Sol. Smallest number divisible by 306 and 657

= LCM (306, 657) **1**

LCM (306, 657) = 22338 **1**

[CBSE Marking Scheme, 2019]

Detailed Solution :

The smallest number that is divisible by two numbers is obtained by finding the LCM of these numbers

Here, the given numbers are, 306 and 657

LCM 306 and 657

2	306, 657
3	153, 657
3	51, 219
17	17, 73
73	1, 73
	1, 1

$\therefore$ LCM $= 2 \times 3 \times 3 \times 17 \times 73 = 22{,}338$

Hence, the smallest number which is divisible by 306 and 657 is 22, 338.

Commonly Made Error

- Mostly students got confuse and find HCF instead of LCM.

Answering Tip

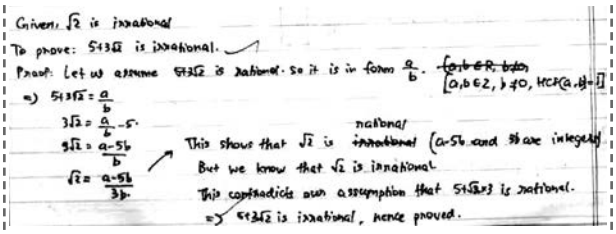
- Students must do a lot of practice of questions based on divisibility of/by smallest or largest number.

Q. 4. The HCF and LCM of two numbers are 9 and 360 respectively. If one number is 45, find the other number. R [SQP 2019]

Q. 5. Given that $\sqrt{2}$ is irrational, prove that $(5+3\sqrt{2})$ is an irrational number.

AI A [CBSE Delhi Set and OD 2018]

Topper Answer, 2018



Q. 6. Show that $5\sqrt{6}$ is an irrational number.

U [Board Term-1, 2015]

Q. 7. The length, breadth and height of a room are 8 m 50 cm, 6 m 25 cm and 4 m 75 cm respectively. Find the length of the longest rod that can measure the dimensions of the room exactly.

AI A [Board Term-1, 2016]

These questions are for practice and their solutions are available at the end of the chapter

Sol. Given length = 8 m 50 cm = 850 cm

breadth = 6 m 25 cm = 625 cm

height = 4 m 75 cm = 475 cm

Since, the length of the longest rod is equal to HCF of 850, 625 and 475

$\Rightarrow$ $850 \Rightarrow 2 \times 5 \times 5 \times 17$

$\Rightarrow$ $625 \Rightarrow 5 \times 5 \times 5 \times 5$

$475 \Rightarrow 5 \times 5 \times 19$

HCF of $850 \Rightarrow 5 \times 5$

625

475

Hence, HCF (625, 850, 475) = 25 ½

Thus, the longest rod that can measure the dimensions of the room exactly = 25 cm.

[CBSE Marking Scheme, 2016]

Commonly Made Errors

- Mostly candidates are unable to determine about what they have to find. Actually, many candidates don't understand what the question is about HCF or LCM.
- Sometimes students calculate the longest length of rod that lies in the room by finding its diagonal.

Answering Tips

- Adequate practice is necessary for such type of questions and basic concept of HCF and LCM should be clear.
- Students should read the question properly.

Q. 8. Find HCF of the numbers given below :

***k*, 2*k*, 3*k*, 4*k* and 5*k*, where *k* is a positive integer.**

U **[Board Term-I, 2015]**

Sol. HCF of k, $k.2$, $k.3$, $k.2^2$ and $k.5$ is k. **2**

Q. 9. Find the smallest natural number by which 1,200 should be multiplied so that the square root of the product is a rational number.

AI U **[Board Term-1, 2015]**

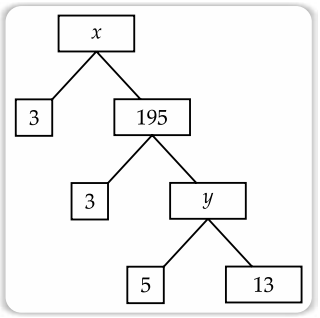
Sol. Since, $1{,}200 = 4 \times 3 \times (2 \times 5)^2$

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

Hence, the required smallest natural number is 3. **2**

[CBSE Marking Scheme, 2015]

Q. 10. Complete the following factor tree and find the composite number *x*.



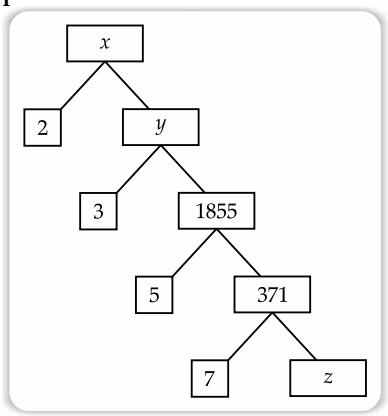
U **[Board Term-I, 2015]**

Sol. $y = 5 \times 13 \Rightarrow 65$ **1**

and $x = 3 \times 195 \Rightarrow 585$

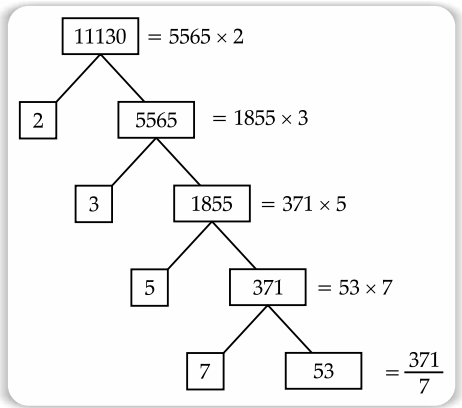
Hence, $x = 585$ **1**

Q. 11. Complete the following factor tree and find the composite number *x* :



U **[Board Term-I, 2015]**

Sol.



$\therefore$ $x = 11{,}130$ **2**

Short Answer Type Questions-II (3 marks each)

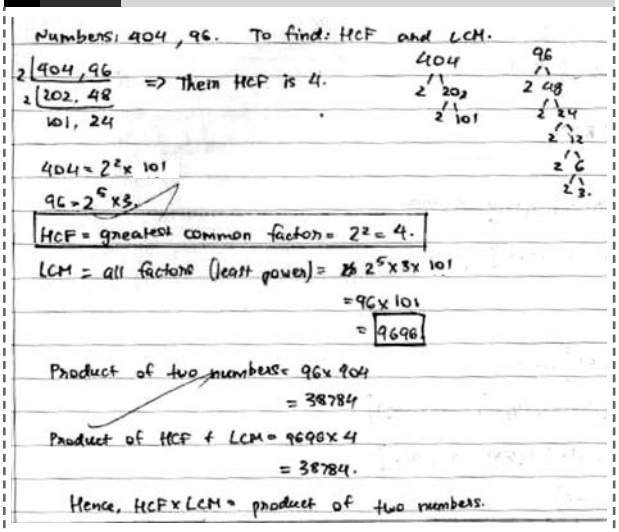
Q. 1. Given that $\sqrt{3}$ is an irrational number, show that $(5 + 2\sqrt{3})$ is an irrational number.

A [CBSE Delhi Set-I, 2020]

Q. 2. Find HCF and LCM of 404 and 96 and verify that HCF × LCM = Product of the two given numbers.

A [CBSE Delhi Set-I, 2018]

Topper Answer, 2018



Q. 3. An army contingent of 612 members is to march behind an army band of 48 members in a parade. The two groups are to march in the same number of columns. What is the maximum number of columns in which they can march ?

A [CBSE Delhi Set-I, 2020]

Sol. Let the number of columns be x.

Then, x is the largest number, which should divide both 612 and 48. ½

$612 = 48 \times 12 + 36$ **1**

$48 = 36 \times 1 + 12$

$36 = 12 \times 3 + 0$ **1**

Since, HCF of 612 and 48 is = 12. ½

Thus, 12 columns are required.

Q. 4. Prove that $\sqrt{3}$ is an irrational number.

U [CBSE OD Set-I, 2020, SQP 2020]

Q. 5. Prove that $5 - \sqrt{3}$ is irrational, given that $\sqrt{3}$ is irrational. U [SQP 2020]

Sol. Let us assume that $5 - \sqrt{3}$ is a rational number in the form $\frac{a}{b}$ ½

We can find co prime a & b ($b \neq 0$) such that

$$5 - \sqrt{3} = \frac{a}{b}$$

Therefore, $5 - \frac{a}{b} = \sqrt{3}$

So, we get $\frac{5b - a}{b} = \sqrt{3}$ **1**

Since a & b are integers, we get $\frac{5b - a}{b}$ as rational so, $\sqrt{3}$ is rational. But $\sqrt{3}$ is an irrational number. ½

Which contradicts our statement

$\therefore\ 5 - \sqrt{3}$ is irrational **1**

[CBSE SQP Marking Scheme, 2020]

Commonly Made Error

- Some Students do not write the appropriate explanation in proof which leads to deduction of marks.

Answering Tip

- Students must know about the theory part in proofs and use appropriate language according to context.

Q. 6. Find the greatest number of six digits exactly divisible by 18, 24 and 36. A [Board Term-1, 2016]

Sol. LCM of 18, 24 and 36

$18 = 2 \times 3^2$

$24 = 2^3 \times 3$

$36 = 2^2 \times 3^2$

LCM (18, 24, 36) $= 2^3 \times 3^2 \Rightarrow 72$ **1**

The largest 6 digit number is 999999

13888 Quotient

72) 999999

–72

279

–216

639

–576

639

–576

639

–576

63 → Remainder **1½**

∴ The required number = 9,99,999 – 63 = 9,99,936.

So, 9,99,936 is the required largest number. Since digit number divisible by 18, 24 and 36. ½

These questions are for practice and their solutions are available at the end of the chapter

Commonly Made Error

- Mostly students got confuse and find LCM instead of HCF.

Answering Tip

- Students must do a lot of practice of word problems based on HCF and LCM.

Q. 7. Prove that $\sqrt{2}$ is an irrational number ?

AI A **[CBSE Delhi Set-1, 2019]**

Sol. Let us assume $\sqrt{2}$ be a rational number and its simplest form be $\frac{a}{b}$, a and b are co-prime positive integers and $b \neq 0$.

So, $\sqrt{2} = \frac{a}{b}$

$\Rightarrow$ $a^2 = 2b^2$ **1**

Thus a^2 is a multiple of 2

$\Rightarrow a$ is a multiple of 2. ½

Let $a = 2m$ for some integer m

$\therefore b^2 = 2m^2$ ½

Thus b^2 is a multiple of 2

$\Rightarrow b$ is a multiple of 2 ½

Hence, 2 is a common factor of a and b.

This contradicts the fact that a and b are co-primes

Hence, $\sqrt{2}$ is an irrational number. ½

[CBSE Marking Scheme, 2019]

Detailed Solution:

Let $\sqrt{2}$ be a rational number, Then, $\sqrt{2} = \frac{p}{q}$, where p, q are integers, $q \neq 0$.

If HCF $(p, q) \neq 1$, then by dividing p and q by HCF (p, q), $\sqrt{2}$ can be reduced as

$\sqrt{2} = \frac{a}{b}$, where HCF $(a, b) = 1$ (i)

$\Rightarrow \sqrt{2}\, b = a$

$\Rightarrow 2b^2 = a^2$

$\Rightarrow a^2$ is divisible by 2

$\Rightarrow a$ is divisible by 2 (ii)

$\Rightarrow a = 2c$, where c is an integer

$\Rightarrow \sqrt{2}b = 2c$

$\Rightarrow 2b^2 = 4c^2$

$\Rightarrow b^2 = 2c^2$

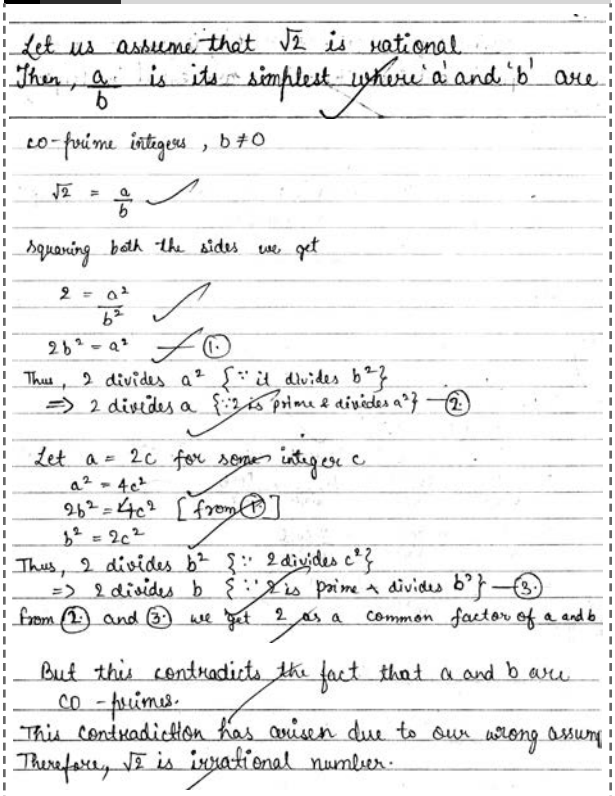
$\Rightarrow b^2$ is divisible by 2

$\Rightarrow b$ is divisible by 2 (iii)

From (ii) and (iii), 2 is a common factor of a and b, which contradicts (i).

So, $\sqrt{2}$ is an irrational number

Topper Answer, 2019


Let us assume that $\sqrt{2}$ is rational
Then, $\frac{a}{b}$ is its simplest where 'a' and 'b' are
co-prime integers, $b \neq 0$
$\sqrt{2} = \frac{a}{b}$
Squaring both the sides we get
$2 = \frac{a^2}{b^2}$
$2b^2 = a^2$ — (1.)
Thus, 2 divides a^2 {∵ it divides b^2}
⇒ 2 divides a {∵ 2 is prime & divides a^2} — (2.)
Let $a = 2c$ for some integer c
$a^2 = 4c^2$
$2b^2 = 4c^2$ [from (1.)]
$b^2 = 2c^2$
Thus, 2 divides b^2 {∵ 2 divides c^2}
⇒ 2 divides b {∵ 2 is prime & divides b^2} — (3.)
from (2.) and (3.) we get 2 as a common factor of a and b
But this contradicts the fact that a and b are co-primes.
This contradiction has arisen due to our wrong assump
Therefore, $\sqrt{2}$ is irrational number.

Q. 8. Three sets of English, Hindi and Sociology books dealing with cleanliness have to be stacked in such a way that all the books are stored topic wise and the height of each stack is the same. The number of English books is 96, the number of Hindi books is 240 and the number of sociology books is 336.

(i) Assuming that the books are of the same thickness, determine the number of stacks of English, Hindi and Sociology books.

(ii) Which mathematical concept is used in the problem? A; E

Sol. (i) In order to arrange the books as required, we have to find the largest number that divides 96, 240 and 336 exactly, clearly, such a number is their HCF.

We have, by prime factorisation

$96 = 2^5 \times 3$

$240 = 2^4 \times 3 \times 5$

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

$\therefore$ HCF of 96, 240, and 336 is $2^4 \times 3 = 48$

So, there must be 48 books in each stack. **1**

Number of stacks of English books

$= \frac{96}{48} = 2$

Number of stacks of Hindi books

$= \frac{240}{48} = 5$

Number of stacks of Sociology books

$$= \frac{336}{48} = 7$$ **1**

(ii) HCF of numbers. **1**

Commonly Made Error

- Some candidates do not read the given text carefully and got confused.

Answering Tip

- Students must do practice of questions based on the HCF and LCM of numbers.

Long Answer Type Questions-I (5 marks each)

Q. 1. State Fundamental theorem of Arithmetic. Find LCM of numbers 2520 and 10530 by prime factorization method. AI R **[Board Term-1, 2016]**

Sol. Fundamental Theorem of Arithmetic : Every composite number can be expressed as the product of powers of primes and this factorization is unique.

Since, $2520 = 2^3 \times 3^2 \times 5 \times 7$ **1**

and $10530 = 2 \times 3^4 \times 5 \times 13$ **1**

$\therefore$ LCM $= 2^3 \times 3^4 \times 5 \times 7 \times 13$ **1**

$= 294840$ **1**

[CBSE Marking Scheme, 2016]

Commonly Made Error

- Some students do not write the correct statement for fundamental theorem of Arithmetic which leads to deduction of marks.

Answering Tip

- Students should learn the statements clearly and write it correctly.

Q. 2. State Fundamental theorem of Arithmetic. Is it possible that HCF and LCM of two numbers be 24 and 540 respectively. Justify your answer.

AI A **[Board Term-1, 2015]**

Sol. Fundamental Theorem of Arithmetic : Every integer greater than one either is prime itself or is the product of prime numbers and that factorization is unique. Apart from the order of the factors. **2**

Given, HCF $= 24$

and LCM $= 540$

Then, $\frac{\text{LCM}}{\text{HCF}} = \frac{540}{24} \Rightarrow 22.5$ not an integer **1**

Since, LCM is always a multiple of HCF, hence, two numbers cannot have HCF and LCM as 24 and 540 respectively. **[CBSE Marking Scheme, 2015]** **1**

Q. 3. Prove that $\frac{2+\sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

A **[CBSE Delhi Set-I, 2019]**

Sol. Let us assume $\frac{2+\sqrt{3}}{5}$ be a rational number of the form $\frac{a}{b}$

i.e., $\frac{2+\sqrt{3}}{5} = \frac{a}{b}$ ($b \neq 0$, a and b are integers)

$\Rightarrow \quad \sqrt{3} = \frac{5a-2b}{b}$ **1**

$\Rightarrow a, b$ are integers

$\therefore \frac{5a-2b}{b}$ is a rational number **1**

i.e. $\sqrt{3}$ is a rational number

which contradicts the fact that $\sqrt{3}$ is irrational

Therefore is $\frac{2+\sqrt{3}}{5}$ is an irrational number. **1**

[CBSE Marking Scheme, 2019]

Detailed Solution :

Let $\frac{2+\sqrt{3}}{5}$ is a rational number.

Therefore, we can write it in the form of $\frac{p}{q}$.

(where, $q \neq 0$)

$$\therefore \quad \frac{2+\sqrt{3}}{5} = \frac{p}{q}$$

$$\Rightarrow \quad 2+\sqrt{3} = \frac{5p}{q}$$

$$\Rightarrow \quad \sqrt{3} = \frac{5p}{q} - 2$$

$$\Rightarrow \quad \sqrt{3} = \frac{5p-2q}{q}$$

Since, p and q are co-prime integers, then $\frac{5p-2q}{q}$ is a rational number.

But this contradicts the fact that $\sqrt{3}$ is an irrational number.

So, our assumption is wrong.

Therefore, $\frac{2+\sqrt{3}}{5}$ is an irrational number,

Hence Proved.

Q. 4. Prove that $2+5\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

A **[CBSE Outside Delhi Set-I, 2019]**

Sol. Let $2 + 5\sqrt{3} = a$, where 'a' is a rational number. ½

then $5\sqrt{3} = a - 2$ **1**

$$\sqrt{3} = \frac{a-2}{5}$$

Which is a contradiction as LHS is irrational and RHS is rational **1**

$\therefore 2 + 5\sqrt{3}$ can not be rational ½

Hence, $2 + 5\sqrt{3}$ is irrational.

Alternate method :

Let $2 + 5\sqrt{3}$ be rational numbers in the form $\frac{p}{q}$ ½

$\therefore \quad 2 + 5\sqrt{3} = \frac{p}{q}, (p, q \text{ are integers}, q \neq 0)$

$\Rightarrow \quad \sqrt{3} = \left(\frac{p}{q} - 2\right) \div 5 = \frac{p-2q}{5q}$ **1**

LHS is irrational and RHS is rational which is a contradiction. **1**

$\therefore 2 + 5\sqrt{3}$ is irrational. ½

[CBSE Marking Scheme, 2019]

Commonly Made Error

- Some students do not read the given conditions carefully and do wrong proof.

Answering Tip

- Students must read the question carefully and make use of given conditions to avoid wastage of time.

Q. 5. Prove that $\sqrt{5}$ is an irrational number.

Sol. Let us assume on the contrary that $\sqrt{5}$ is a rational number. Then, there exist co-prime positive integers a and b such that

$$\sqrt{5} = \frac{a}{b}$$

$\Rightarrow \quad 5b^2 = a^2 \quad [\because (\sqrt{5}\, b)^2 = 5b^2]$

$\Rightarrow \quad 5b^2 = a^2$

$\Rightarrow \quad 5 \mid a^2$

$\Rightarrow \quad 5 \mid a$ (i)

$\Rightarrow \quad a = 5c$

for some positive integer c

$\Rightarrow \quad a^2 = 25c^2 \quad [\because a^2 = 5b^2]$

$\Rightarrow \quad 5b^2 = 25c^2$

$\Rightarrow \quad b^2 = 5c^2$

$\Rightarrow \quad 5 \mid b^2$

$\Rightarrow \quad 5 \mid b$ (ii)

From (i) and (ii), we find that a and b have at least 5 as a common factor. This contradicts the fact that a and b are co-prime.

Hence, $\sqrt{5}$ is an irrational number.

[CBSE Marking Scheme, 2018-20]

Q. 6. Show that there is no positive integer n, for which $\sqrt{n-1} + \sqrt{n+1}$ is rational. A

Sol. Let us assume that there is a positive integer n for which $\sqrt{n-1} + \sqrt{n+1}$ is rational and equal to $\frac{q}{p}$, where, p and q are positive integers and $(q \neq 0)$.

$$\sqrt{n-1} + \sqrt{n+1} = \frac{q}{p} \quad \text{...(i)}$$

or $$\frac{q}{p} = \frac{1}{\sqrt{n-1}+\sqrt{n+1}}$$

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

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

$$= \frac{\sqrt{n-1}-\sqrt{n+1}}{-2}$$

or $$\sqrt{n+1} - \sqrt{n-1} = \frac{2q}{p} \quad \text{...(ii) 1}$$

Adding (i) and (ii), we get

$$2\sqrt{n+1} = \frac{p}{q} + \frac{2q}{p}$$

$$= \frac{p^2 + 2q^2}{pq}$$

$$\sqrt{n-1} = \frac{p^2 + 2q^2}{2pq} \quad \text{...(iii)}$$

Subtracting (i) and (ii), we get

$\Rightarrow \quad \sqrt{n-1} = \frac{p^2 - 2q^2}{2pq}$ ...(iv) 1

From (iii) and (iv), $\sqrt{n+1}$ and $\sqrt{n-1}$ both are rational because p and q both are rational. But it is possible only when $(n + 1)$ and $(n - 1)$ both are perfect squares. But they differ by 2 and two perfect squares never differ by 2. So, both $(n + 1)$ and $(n - 1)$ cannot be perfect squares, hence there is no positive integer n for which $\sqrt{n-1} + \sqrt{n+1}$ is rational. **[CBSE Marking Scheme, 2018] 1**

Q. 7. Prove that $\sqrt{2}+\sqrt{5}$ is irrational.

Sol. Let us assume on the contrary that $\sqrt{2}+\sqrt{5}$ is a rational number. Then, there exist co-prime positive integers a and b such that

$$\sqrt{2}+\sqrt{5} = \frac{a}{b}$$

$$\Rightarrow \quad \frac{a}{b} - \sqrt{2} = \sqrt{5}$$

$$\Rightarrow \quad \left(\frac{a}{b}-\sqrt{2}\right)^2 = \left(\sqrt{5}\right)^2$$

[Squaring both sides]

$$\Rightarrow \quad \frac{a^2}{b^2}-\frac{2a}{b}\sqrt{2}+2 = 5$$

$$\Rightarrow \quad \frac{a^2}{b^2}-3 = \frac{2a}{b}\sqrt{2}$$

$$\Rightarrow \quad \frac{a^2-3b^2}{2ab} = \sqrt{2}$$

$\Rightarrow \sqrt{2}$ is a rational number

$$\left[\because a, b \text{ are integers } \frac{a^2-3b^2}{2ab} \text{ is rational}\right]$$

This contradicts the fact because $\sqrt{2}$ is irrational so, our assumption is wrong .
Hence, $\sqrt{2}+\sqrt{5}$ is irrational.

[CBSE Marking Scheme, 2017]

Q. 8. Enlist the types of real numbers and define rational number. Also prove that $\sqrt{3}$ is an irrational number. U R

Sol. Various types of real numbers are:
- Rational number
- Irrational number
- Whole number
- Integer
- Natural number

Rational number: Any number that can be expressed in the form of $\frac{p}{q}$ where $q \neq 0$ and p, q are integers is called a rational number.
Let $\sqrt{3}$ be a rational number

$\therefore \sqrt{3} = \frac{p}{q}$, where p and q are co–prime integers and $q \neq 0$.
On squaring both sides, we get

$$3 = \frac{p^2}{q^2}$$

or $p^2 = 3q^2$
$\because p^2$ is divisible by 3.
$\therefore p$ is divisible by 3. ...(i)
Let $p = 3r$ for some positive integer r.
$\therefore \quad p^2 = 9r^2$
or, $3q^2 = 9r^2$
or, $q^2 = 3r^2$
or, q^2 is divisible by 3.
$\therefore q$ is divisible by 3. ...(ii)
From eqn. (i) and (ii), p and q are divisible by 3, which contradicts the fact that p and q are co-primes.
Hence, our assumption is wrong.
$\therefore \sqrt{3}$ is an irrational number.

[CBSE Marking Scheme, 2019]

Assertion and Reason (Chapterwise) (1 mark each)

Directions: In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as :

(A) Both A and R are true and R is the correct explanation for A.
(B) Both A and R are true but R is not correct explanation for A.
(C) A is true but R is false.
(D) A is false but R is true.

Q. 1. Assertion (A): For any two positive numbers a and b,
HCF $(a, b) \times$ LCM $(a, b) = a \times b$.
Reason (R): The HCF of any two numbers is 5 and their product is 150. Then their LCM is 40.

Sol. Option (C) is correct.

Explanation: Assertion is correct.
In case of Reason:

$$\text{LCM}(a, b) = \frac{a \times b}{\text{HCF}(a, b)} = \frac{150}{5} = 30$$

So, Reason is false.

Q. 2. Assertion (A): The HCF of 131 and 201 = 1
Reason (R): The HCF of co-prime numbers is 1.

Sol. Option (A) is correct.

Explanation: 131 is a prime number so it has 1 and 131 as its factors.
But 201 has 1, 3, 67, 201 as factors.
HCF (131, 201) = 1
Hence, Both A and R are true and R is the carrect explanation for A.

Q. 3. Assertion (A): For any natural number n, $(n)^2$ is of the form $2q$ or $2q + 2$.
Reason (R): Square of every odd number is odd.

Sol. Option (D) is correct.

Explanation: Square of every odd number is odd. *e.g.*, $(3)^2 = 9$ [3 and 9 both odd].
$2q$ & $2q + 2$ are both even numbers.

Q. 4. Assertion (A): $\sqrt{a}$ is an irrational number, when a is a prime number.
Reason (R): Square root of any prime number is an irrational number.

Sol. Option (A) is correct.

Explanation: $\sqrt{2}, \sqrt{3}, \sqrt{11}$ are irrational, also 2, 3, and 11 are prime.
But $\sqrt{4} = 2$ which is a rational number but 4 is composite.

Q. 5. Assertion (A): The fraction value of $3.\overline{12} = \frac{309}{99}$, so that makes $3.\overline{12}$ a rational number.

Reason (R): Non-terminating and recurring decimals are also irrational numbers.

Sol. Option (C) is correct.

Explanation: Non-terminating and recurring decimals are rational numbers.
and $3.\overline{12}$ is a non-terminating and recurring decimal.
$\therefore 3.\overline{12}$ is a rational number.

Q. 6. Assertion (A): 6^n ends with the digit zero, where n is a natural number.

Reason (R): Any number ends with digit zero, if its prime factor is of the form $2^m \times 5^n$, where m, n are natural numbers.

Sol. Option (D) is correct.

Explanation: $6^n = 2^n \times 3^n$, to get the last digit zero we need $2^m \times 5^n$.

Q. 7. Assertion (A): A number N when divided by 15 gives the remainder 2. Then the remainder is same when N is divided by 5.

Reason (R): $\sqrt{3}$ is an irrational number.

Sol. Option (B) is correct.

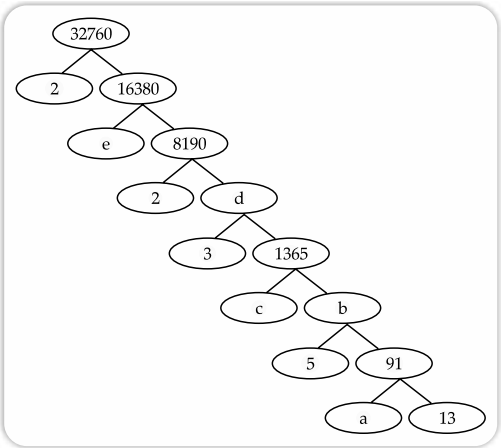
Explanation: If we divide 32, 47, 62 by 15 and 5 both remainder is always 2.
$\therefore$ Both Assertion and Reason are true.
But Reason is not the correct explanation of assertion.

COMPETENCY BASED QUESTIONS

Case based MCQs

Attempt any 4 sub-parts from each question. Each sub-part carries 1 mark.

I. Read the following text and answer the following questions on the basis of the same :



Mr. Arun Mishra of XYZ Public School is a Mathematics teacher. He is going to teach grade X students about the factorization of natural numbers. He taught the students how to find the factors of a given natural number greater than one. He is famous for his tricks which help the students to solve the questions easily in less time. He taught the students about the method of factor tree to find the factors of a natural number. He told the students that a factor tree is a diagram used to determine the prime factors of a natural number greater than one. A special diagram where we find the factors of a number, then the factors of those numbers, etc, until we can't factor any more. It is the diagrammatic representation of the factors of any natural number greater than one and shows the factor of each corresponding factor separately. After teaching the students he gave them a question based on the factor tree. In the question, the natural number 32760 is represented as the product of its prime factors using the factor tree. Some values in the factor tree are missing and students have to find them using the concept as taught by their teacher.

Q. 1. Find the value of *a*

(A) 7 **(B)** 5
(C) 2 **(D)** 3

Sol. Option (A) is correct.

Explanation: $91 = a \times 13$

$$a = \frac{91}{13} = 7$$

Q. 2. Find the value of *b*

(A) 2 **(B)** 455
(C) 91 **(D)** 1365

Sol. Option (B) is correct.

Explanation: $b = 5 \times 91$
$= 455.$

Q. 3. Find the value of *c*

(A) 2 **(B)** 3
(C) 5 **(D)** 7

Sol. Option (B) is correct.

Explanation: $1365 = c \times b$

$$c = \frac{1365}{b} = \frac{1365}{455}$$

$= 3$

Q. 4. Find the value of d

(A) 8190 **(B)** 1365

(C) 455 **(D)** 4095

Sol. Option (D) is correct.

Explanation: $d = 3 \times 1365$

$= 4095$

Q. 5. Find the value of e

(A) 2 **(B)** 3

(C) 5 **(D)** 7

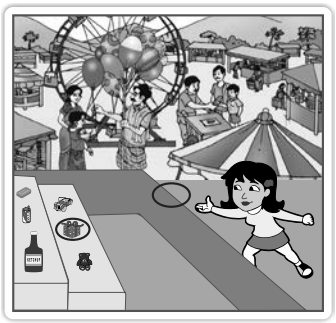
Sol. Option (A) is correct.

Explanation: $16380 = e \times 8190$

$$e = \frac{16380}{8190}$$

$$= 2$$

II. Read the following text and answer the following questions on the basis of the same :



Ram and Rita are two friends of age around ten. They live in the same locality and went to the same school. Once they heard about a fair organized in their town by Royal Welfare Association. The fair has many rides,snacks and stalls for entertainment. Ram and Rita decided to go to fair for refreshment. Ram has ₹ 200 and Rita has ₹ 250 for fair. Ram wanted to enjoy a ride on the Giant Wheel while Rita played Hoopla(A game in which rings are thrown over objects placed). They also enjoyed ice-cream ,burger etc. and purchased some toys and models. They spent all their money and came back to home happily with various toys after a long enjoyment in fair. On Next day in school they told their experience to their classmates and teachers. They told their teacher how they enjoyed in fair and went on various rides and purchased many toys as well. The teacher asked them about the amount they spend in fair and their manner of expenditure.

Q. 1. Write the prime factor of ₹ 200

(A) $2^3 \times 5^2$ **(B)** $2^2 \times 5^3$

(C) $2^2 \times 5^2$ **(D)** 2×5^3

Sol. Option (A) is correct.

Explanation: $200 = 2 \times 2 \times 2 \times 5 \times 5$

$= 2^3 \times 5^2$

Q. 2. Find the prime factor of ₹ 250

(A) $2^2 \times 5^2$ **(B)** $2^2 \times 5^3$

(C) 2×5^2 **(D)** 2×5^3

Sol. Option (D) is correct.

Explanation: $250 = 2 \times 5 \times 5 \times 5$

$= 2 \times 5^3$

Q. 3. Find the LCM of two numbers 200 and 250

(A) 800 **(B)** 500

(C) 1000 **(D)** 200

Sol. Option (C) is correct.

Explanation: $200 = 2^3 \times 5^2$

$250 = 2 \times 5^3$

LCM of 200 and $250 = 2^3 \times 5^3$

$= 8 \times 125 = 1000$

Q. 4. Find the HCF of two numbers 200 and 250

(A) 100 **(B)** 50

(C) 60 **(D)** 40

Sol. Option (B) is correct.

Explanation: $200 = 2^3 \times 5^2$

$250 = 2 \times 5^3$

H.C.F. fo 200 and $250 = 2 \times 5^2$

$= 2 \times 25$

$= 50$

Q. 5. If the product of two number is 1575 and HCF of these number is 5. Find the LCM of two numbers.

(A) 415 **(B)** 305

(C) 315 **(D)** 45

Sol. Option (C) is correct.

Explanation: We know that

Product of two numbers = HCF × LCM

$1575 = 5 \times \text{LCM}$

$$\text{LCM} = \frac{1575}{5}$$

$$= 315$$

III. Read the following text and answer the following questions on the basis of the same :

Suppose you are a student of XYZ Senior Secondary Public School located in Delhi.

Your school has a lot of space vacant, so your school management has decided to setup class wise library separately for each class' students.

Although a library common to all students is already present but setting up a class wise library will be beneficial for the students and also help in proper utilisation of the space which is not in use. So to enhance the reading skills of class X students, your class coordinator nominates you and two of your friends to set up a class library. There are 2 sections of your class as Section-A and Section -B. Section-A has 32 students while Section -B consists of 36 students. Students of both the sections are excited to study in their class library and waiting for the set up of the library as soon as possible. You and your team has to arrange all the books available for your class in a structured manner according to subjects and writers in various book shelves available to you.

You will be rewarded if you set up the library in a well defined and efficient manner.

Q. 1. What is the minimum number of books you will acquire for class library, so that they can be distributed equally among students of section *A* or section *B* ?

(A) 144 **(B)** 128

(C) 288 **(D)** 272

Sol. Option (C) is correct.

Explanation: LCM (32 and 36) = $2^5 \times 3^2 = 32 \times 9 = 288$

Q. 2. If product of two positive integers is equal to the product of their HCF and LCM is true then HCF (32, 36) is:

(A) 2 **(B)** 4

(C) 6 **(D)** 8

Sol. Option (B) is correct.

Explanation:

$$\text{LCM} \times \text{HCF} = a \times b$$

$$\text{HCF} = \frac{(a \times b)}{\text{LCM}} = \frac{(32 \times 36)}{288} = 4$$

Q. 3. 36 can be expressed as a product of its primes as

(A) $2^2 \times 3^2$ **(B)** 2×3

(C) $2^3 \times 3$ **(D)** $2 \times 3 \times 5$

Sol. Option (A) is correct.

Explanation: $36 = 2 \times 2 \times 3 \times 3$

$= 2^2 \times 3^2$

Q. 4. $7 \times 11 \times 13 \times 15 + 15$ is a

(A) Prime number **(B)** Composite number

(C) Negative integer **(D)** None of the above

Sol. Option (B) is correct.

Explanation: $7 \times 11 \times 13 \times 15 + 15$

$= 15 (7 \times 11 \times 13 + 1)$

Hence, this will be composite number.

Q. 5. If p and q are positive integers such that $p = ab^2$ and $q = a^2 b$ where a, b are prime numbers, then the LCM (p, q) is

(A) ab **(B)** a^3b^2

(C) a^2b^2 **(D)** a^3b^3

Sol. Option (C) is correct.

Explanation: $p = ab^2 = a \times b \times b$

$q = a^2b = a \times a \times b$

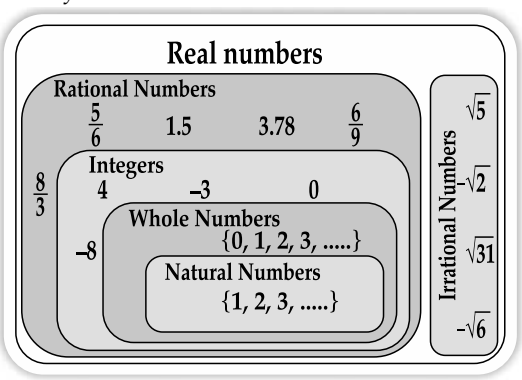
$\therefore$ LCM $(p, q) = a \times a \times b \times b = a^2b^2$.

Case based Subjective Questions

Attempt any 4 sub-parts from each question. Each sub-part carries 1 mark.

I. Read the following text and answer the following questions on the basis of the same:

Krishna made a project on real numbers, where he finely explained the applicability of exponential laws and divisibility conditions on real numbers. He wrote that Real numbers can be defined as the union of both rational and irrational numbers. They can be both positive and negative and are denoted by the symbol "*R*". All the natural numbers, decimals and fractions come under this category. The set of real numbers consists of different categories, such as natural and whole numbers, integers, rational and irrational numbers. Any number which can be defined in the form of a fraction $\frac{p}{q}$ is called a rational number. The numerator in the fraction is represented as 'p' and the denominator as 'q', where 'q' is not equal to zero. A rational number can be a natural number, a whole number, a decimal, or an integer. For example, 1/2, – 2/3, 0.5, 0.333 are rational numbers. Irrational numbers are the set of real numbers that cannot be expressed in the form of a fraction $\frac{p}{q}$ where 'p' and 'q' are integers and the denominator 'q' is not equal to zero ($q \neq 0$.). For example, π (pi) is an irrational number. π = 3.14159265...In this case, the decimal value never ends at any point. Therefore, numbers like $\sqrt{2}$, – $\sqrt{7}$, and so on are irrational numbers. He found that Real numbers are extremely useful in everyday life. That is probably one of the main reasons we all learn how to count and add and subtract from a very young age. Real numbers help us to count and to measure out quantities of different items in various fields like retail, buying, catering, publishing etc. Every normal person uses real numbers in his daily life.



He also included some assessment questions at the end of his project as listed below. Answer them.

Q. 1. For what value of n, $\sqrt{n}$ is rational ?

Sol. For $n = 1$

we have $\sqrt{n} = \sqrt{1}$

$= 1$

which is a rational number.

Q. 2. Whether *Pi*(π) is rational or irrational number ?

Sol. *Pi*(π) is a or irrational number.

Q. 3. Write any two irrational numbers.

Sol. Two irrational numbers are $\sqrt{2}$, $\sqrt{3}$.

Q. 4. Define rational numbers.

Sol. Any number which can be defined in the form of a fraction p/q is called a rational number. Where $q \neq 0$

Q. 5. Write some uses of real numbers in daily life.

Sol. Real numbers help us to count and to measure out quantities of different items in various fields like retail, buying, catering, publishing etc.

II. Read the following text and answer the following questions on the basis of the same:

Mr. Allen of *XYZ* Public School is a Math teacher. He is going to teach students about the real numbers and their applications in real life. He told the students that real numbers are extremely useful in everyday life that is probably one of the main reasons why we all learn how to count and add and subtract from a very young age. We also use them to measure out quantities of different items in various fields like retail, buying, selling, and publishing. It is the fact that every normal person uses real numbers in his daily life. He also told the students that real numbers are the numbers that include both rational and irrational numbers. He also teach them about the factorization of the natural number and how various problems can be solved based on least common multiple (LCM) and highest common factor (HCF) of the real numbers. He made the real numbers a fun for them and to solve the word problems as an activity to enhance their skills and mathematical ability.

After teaching he asked the students some questions based on the real life applications of real numbers. Answer the following questions based on the above text:

Q. 1. Three people go for a morning walk together from the same place. Their steps measure 80 cm, 85 cm and 90 cm respectively. What is the minimum distance travelled when they meet at first time after starting the walk assuming that their walking speed is same?

Sol. Here $80 = 2^4 \times 5$,

$85 = 17 \times 5$

and $90 = 2 \times 3^2 \times 5$

L.C.M of 80, 85 and 90

$= 2^4 \times 3 \times 3 \times 5 \times 17$

$= 12{,}240$

Hence, the minimum distance each should walk when they meet at first time is 12,240 cm.

Q. 2. In a school Independence Day parade, a group of 594 students need to march behind a band of 189 members. The two groups have to march in the same number of columns. What is the maximum number of columns in which they can march?

Sol. Here $594 = 2 \times 3^3 \times 11$

and $189 = 3^3 \times 7$ HCF of 594 and $189 = 3^3 = 27$

Hence, the maximum number of columns in which they can march is 27.

Q. 3. Two tankers contain 768 litres and 420 litres of fuel respectively. Find the maximum capacity of the container which can measure the fuel of either tanker exactly.

Sol. Here $768 = 2^8 \times 3$

and $420 = 2^2 \times 3 \times 5 \times 7$

HCF of 768 and $420 = 2^2 \times 3 = 12$

So, the container which can measure fuel of either tanker exactly must be of 12 L.

Q. 4. The dimensions of a room are 8 m 25 cm, 6 m 75 cm and 4 m 50 cm. Find the length of the largest measuring rod which can measure the dimensions of room exactly.

Sol. Here, Length = 825 cm,

Breadth = 675 cm

and Height = 450 cm

Also, $825 = 5 \times 5 \times 3 \times 11$,

$675 = 5 \times 5 \times 3 \times 3 \times 3$

and $450 = 2 \times 3 \times 3 \times 5 \times 5$

$HCF = 5 \times 5 \times 3 = 75$

Therefore, the length of the longest rod which can measure the three dimensions of the room exactly is 75 cm.

Q. 5. Pens are sold in pack of 8 and note pads are sold in pack of 12. Find the least number of pack of each type that one should buy so that there are equal number of pens and note pads.

Sol. LCM of 8 and 12 is 24.

The least number of pack of pens

$$= \frac{24}{8} = 3$$

The least number of pack of note pads

$$= \frac{24}{12} = 2$$

III. Read the following text and answer the following questions on the basis of the same:

ABC Public School in Delhi is famous for its activities for teaching and learning process. The management of the school believes that students learn easily by going through certain activities in their classroom. The activities performed by the students makes the harder concepts easier for the students to learn. Mr. Pal, a Mathematics teacher of class 10^{th} organized an activity in the classroom to help students enhance their skills and also learn about the concepts easily.

The activity was based on the concept of the real numbers. In the activity students have to pick a card from a pile of cards and frame question on it, if it is a rational number or irrational number for the rest of the of class. The number of cards picked up by first five students and their questions on the number for the rest of the class are as denoted by the questions provided.

Q. 1. Suraj picked up $\sqrt{8}$ and his question was – Whether $\sqrt{8}$ is rational or irrational?

Sol. $\sqrt{8}$ is a irrational number.

Q. 2. Shreya picked up 'BONUS' and her question was – Write any number which is not rational?

Sol. Number which is not rational is $\sqrt{2}$.

Q. 3. Ananya picked up $\sqrt{15} - \sqrt{10}$ and her question was the given number is rational or irrational.

Sol. $\sqrt{15} - \sqrt{10}$ is an irrational number.

Q. 4. Suyash picked up 3 and his question was 3 is rational or irrational number?

Sol. 3 is a rational number.

Q. 5. Ram picked 0 and his question was: Zero is a natural number, Is it true or false?

Sol. False, as zero is not a natural number.

Solutions for Practice Questions (Topic-1)

Multiple Choice Questions

Sol. 3: Option (B) is Correct.

***Explanation*:** Since $a = x^3y^2 = x \times x \times x \times y \times y$ and $b = xy^3 = x \times y \times y \times y$,

Thus, HCF of a and $b = x \times y \times y = xy^2$

Sol. 6: Option (B) is Correct.

***Explanation*:** By prime factorization,

$$325 = 5 \times 5 \times 13$$
$$= 5^2 \times 13.$$

Very Short Answer Type Questions

Sol. 2: Using Prime factorization method,

$$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

and $198 = 2 \times 3 \times 3 \times 11$ ½

$\therefore$ HCF (144, 198) $= 2 \times 3 \times 3$

$= 18$ ½

Sol. 6: Since, HCF × LCM = Product of two numbers

$$\text{LCM (96, 404)} = \frac{96 \times 404}{\text{HCF(96, 404)}}$$

$$= \frac{96 \times 404}{4}$$

LCM (96, 404) = 9696 **1**

Short Answer Type Questions-I

Sol. 1:

Let us assume, to the contrary that $7 - \sqrt{5}$ is a rational number in form $\frac{p}{q}$

$7 - \sqrt{5} = \frac{p}{q}$, (where p and q are co-prime and $q \neq 0$) **1**

$\Rightarrow \quad \sqrt{5} = \frac{7q - p}{q}$

$\frac{7q - p}{q}$ is rational = $\sqrt{5}$ is irrational. which is a contradiction with our assumption.

Hence, $7 - \sqrt{5}$ is irrational **1**

[CBSE SQP Marking Scheme, 2018]

Commonly Made Error

- Some Students do not make the use of given conditions which leads to wastage of time.

Answering Tip

- Students must read the complete question and use the conditions provided.

Sol. 4:

Since, HCF × LCM = Product of two numbers **1**

Then, $9 \times 360 = 45 \times 2^{nd}$ number

$$2^{nd} \text{ number} = \frac{(9 \times 360)}{45}$$

Thus, 2^{nd} number = 72 **1**

[CBSE SQP Marking Scheme, 2019]

Sol. 6: Let $5\sqrt{6}$ be a rational number, which can be expressed as $\frac{a}{b}$, where $b \neq 0$ and a and b are co-primes.

$\therefore \quad 5\sqrt{6} = \frac{a}{b}$ ½

$$\sqrt{6} = \frac{a}{5b}$$

or, $\sqrt{6}$ is irrational = $\frac{a}{5b}$ is rational ½

which is a contradiction to our assumption

Thus, our assumption is wrong of assuming $5\sqrt{6}$ is a rational number.

Hence, $5\sqrt{6}$ is an irrational number. **1**

Short Answer Type Questions-II

Sol. 1: Let us assume $(5+2\sqrt{3})$ is a rational number.

$\therefore \quad 5+2\sqrt{3} = \frac{p}{q}$ **1**

(where, $q \neq 0$ and p and q are co prime integers)

$\Rightarrow \quad \sqrt{3} = \frac{p-5q}{2q}$ **1**

This contradicts the given fact that $\sqrt{3}$ is irrational.

Hence, $(5+2\sqrt{3})$ is an irrational number. **1**

Commonly Made Error

- Some Students do not write the appropriate explanation in proof and write wrong assumptions which leads to deduction of marks.

Answering Tip

- Students must know about the theory part in proofs and use appropriate language according to context.

Sol. 4: Let $\sqrt{3}$ be a rational number

$\therefore \sqrt{3} = \frac{p}{q}$, where p and q are co-prime integers and $q \neq 0$

On squaring both sides, we get

$$3 = \frac{p^2}{q^2}$$

or, $p^2 = 3q^2$ **1**

$\because p^2$ is divisible by 3.

$\therefore p$ is divisible by 3. ...(i)

Let $p = 3r$ for some positive integer r.

$\therefore \quad p^2 = 9r^2$

or, $3q^2 = 9r^2$

or, $q^2 = 3r^2$ **1**

or, q^2 is divisible by 3.

$\therefore q$ is divisible by 3. ...(ii)

From eqn. (i) and (ii), p and q are divisible by 3, which contradicts the fact that p and q are co-primes.

Hence, our assumption is wrong. **1**

$\therefore \sqrt{3}$ is an irrational number.

REFLECTIONS

Fundamental theorem of Arithmetic has some very deep and significant application in the field of mathematics.

- Are you able to write any one of its applications ?
- Will you be able to prove that $\sqrt{2}$, $\sqrt{3}$ & $\sqrt{5}$ are irrational numbers ?

SELF ASSESSMENT PAPER - 1

Maximum Time: 1 hour **MM: 30**

I. Choose the correct alternative from the given options. **[1 × 6 = 6]**

Q. 1. If $a \times b = 1600$ and LCM of a and b is 320, then the HCF of a and b is:

(A) 10 **(B)** 5

(C) 20 **(D)** 16

Q. 2. The difference of the irrational numbers $(3+2\sqrt{3})$ and $(3-2\sqrt{3})$ is:

(A) $4\sqrt{3}$ **(B)** $6+2\sqrt{3}$

(C) $7+4\sqrt{3}$ **(D)** 6

Q. 3. The LCM of $2^5 \times 3 \times 5$ and $2^2 \times 7 \times 5$ is:

(A) 140 **(B)** 3260

(C) 1360 **(D)** 3360

Q. 4. The quotient of $(5+3\sqrt{2})$ and $(5-3\sqrt{2})$ is:

(A) $\frac{43+30\sqrt{2}}{7}$ **(B)** $\frac{43-30\sqrt{2}}{7}$

(C) $43+30\sqrt{2}$ **(D)** $-(43+30\sqrt{2})$

Q. 5. Given that LCM of two numbers is 1449 and their HCF is 23. If one of the numbers is 207, then other number is:

(A) 261 **(B)** 161

(C) 361 **(D)** 167

Q. 6. π is a/an:

(A) rational **(B)** composite

(C) irrational **(D)** prime

II. Case-Based Question **[1 × 4 = 4]**

Q. 7. A sweet seller has 420 Bundi Laddoo and 130 badam barfis. He wants to stack them is such a way that each stack has the same number, and they take up the least area of the tray.

Read carefully the above paragraph and answer any four questions:

(i) The prime factors of 420 are:

(A) $2^2 \times 3^2 \times 5 \times 7$ **(B)** $2 \times 3 \times 5 \times 7$

(C) $2 \times 3 \times 5^2 \times 7$ **(D)** $2^2 \times 3 \times 5 \times 7$

(ii) Using Euclid's algorithm, the HCF of 420 and 130 is:

(A) 10 **(B)** 30

(C) 20 **(D)** 15

(iii) The LCM of 420 and 130 is:

(A) 4560 **(B)** 5460

(C) 6540 **(D)** 5640

(iv) The sum of exponents of prime factors in the prime factorization of 420 is:

(A) 2 **(B)** 3

(C) 5 (D) 4

(v) The sum of exponents of prime factors in the prime factorization of 130 is:

(A) 1 **(B)** 3

(C) 2 (D) 4

III. Very Short Answer Type Questions **[1 × 3 = 3]**

Q. 8. a and b are two positive integers such that the least prime factor of a is 3 and the least prime factor of b is 5. Then calculate the least prime factor of $(a + b)$.

Q. 9. If HCF of two numbers is 18 and their product is 12960, then find the LCM.

Q. 10. If p is a prime number, then find LCM of p, p^2 and p^3.

IV. Short Answer Type Questions-I **[2 × 3 = 6]**

Q. 11. Write whether $\frac{2\sqrt{125}+\sqrt{25}}{3\sqrt{5}}$ on simplification gives an irrational or a rational number.

Q. 12. On a morning walk three persons steps off together and their steps measure 40 cm, 42 cm and 45 cm respectively. What is the minimum distance each should walk so that each can cover the same distance in complete steps ?

Q. 13. Prove that $6+\sqrt{2}$ is an irrational number.

V. Short Answer Type Questions-II **[3 × 2 = 6]**

Q. 14. If p is a prime number, then prove that $\sqrt{p}$ is an irrational.

Q. 15. Three bells toll at intervals of 9, 12, 15 minutes respectively. If they start tolling together, after what time will they next toll together ?

VI. Long Answer Type Questions **[1 × 5 = 5]**

Q. 16. Show that there is no positive integer n, for which $\sqrt{n-1}+\sqrt{n+1}$ is rational.