Number Systems

Suggested Formative Assessment Tasks

Task-1: Observe and answer

Topic	Number System
Nature of task	Post Content
Content Coverage	Types of numbers and relation between various types of numbers.
Learning Objectives	To gain the knowledge of various types of numbers viz. natural numbers, whole numbers, integers, rational numbers and irrational numbers which constitutes the Real number system
Task	Observe and Answer
Execution of task	This task may be performed in the classroom. Each student would be given the activity sheet. They would be then asked to write the answers to questions.
Duration	1 period
Criteria for assessment	Teacher may ask questions in groups and observe the level of understanding. It is not necessary to give marks for this assessment. It may be used for diagnostic purpose.
Follow up	If the students are not clear with the concept and relation between the types of numbers then as a remedial task Number activity* can be done in the classroom. Through this activity students would be able to visualize the relationship between types of numbers from the observations in their activity sheet.

Activity Sheet: Observe and answer

Description: Look into the given table and say whether the following statements are true or false. Give reasons for your answer with examples.
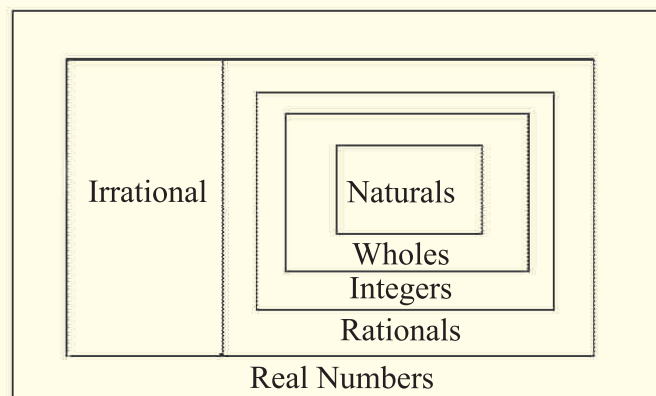
Real Numbers

a.   Every integer is a rational number.

b.   Every rational number is an irrational number.

c.   Every natural number is an integer.

d.   Every integer is a natural number.

e.   Every rational number is a real number.

f.   Every real number is a rational number.

g.   Every whole number is a natural number.

h.   Every natural number is a whole number.

i.   Every integer is a natural number.

j.   Every rational number is a whole number.

Follow up task: Number Activity*

In each box there is a number. Encircle N, W, Z, Q, Not Q, R if a given number in the box is so. Symbols used: N for natural numbers, W for whole numbers, Z for integers, Q for rational numbers, and Not Q for irrational numbers, R for real numbers.

5	-8	7/3	0	7
N	N	N	N	N
W	W	W	W	W
Z	Z	Z	Z	Z
Q	Q	Q	Q	Q
Not Q	Not Q	Not Q	Not Q	Not Q
R	R	R	R	R
-5	-64	$\sqrt{7}$	$\sqrt{2}$	4/5
N	N	N	N	N
W	W	W	W	W
Z	Z	Z	Z	Z
Q	Q	Q	Q	Q
Not Q	Not Q	Not Q	Not Q	Not Q
R	R	R	R	R
25	189	41.9	9	$2\sqrt{2}$
N	N	N	N	N
W	W	W	W	W
Z	Z	Z	Z	Z
Q	Q	Q	Q	Q
Not Q	Not Q	Not Q	Not Q	Not Q
R	R	R	R	R

Observe your readings and answer the following in True/False.

(a)   Every integer is a rational number.

(b)   Every rational number is an irrational number.

(c)   Every natural number is an integer.

(d)   Every integer is a natural number.

(e)   Every rational number is a real number.

(f)   Every real number ia rational number.

(g)   Every whole number is a natural number.

(h)   Every natural number is a whole number.

(i)   Every integer is a natural number.

(j)   Every rational number is a whole number.

Task-2: Class Worksheet / Oral assessment

Topic	Number System
Nature of task	Post Content
Content Coverage	Rational and irrational numbers
Learning Objectives	• To learn to insert rational numbers between two rational numbers. • To appreciate the fact that infinitely many rational numbers can be inserted between two given rational numbers • To learn to represent irrational numbers like $\sqrt{2}, \sqrt{3}, \sqrt{5.4}$, etc. on the number line. • To find the decimal expansion of real numbers and determine a rational and irrational number on this basis. • Learn to insert irrational numbers between two rational numbers.
Task	Class Worksheet /Oral assessment
Execution of task	This task may be performed in the classroom in the last 15 minutes of a teaching period. A small worksheet containing short questions may be given. They would be then asked to write the answers to questions. In one period oral assessment may be done in groups.
Duration	2 periods
Criteria for assessment	Teacher may prepare a rating scale according to marks assigned to this task.
Follow up	Worksheet for practicing may be given

Class Worksheet

Do as directed   **(10 × 1 mark)**

1. Write one rational number between 3 and 4.

2. Justify 2.010010001….. is an irrational number.

3. $-1 + \sqrt{2}$ lies in the negative side on the number line. What do you say?

4. Am I right if I say only 100 rational numbers can be inserted between 1 and 101?

5. Every rational number is
   a) a natural no.   b) a whole no.   c) a real no.   d) integer

6. Select irrational number from the following:

   a) 1.2525….   b) 1.21555….   c) 1.2505005…. d) 1.25555…..

7. Insert 2 irrational numbers between $\dfrac{2}{5}$ and $\dfrac{3}{4}$.

8. Write two irrational numbers between 1 and 2.

9. Justify 3.010010001 is a rational number.

10. $-1 + \sqrt{3}$ lies in the positive side on the number line. What do you say?

Suggested questionnaire for oral assessment

For developing thinking skills

1. Is every natural number a rational number?

2. Is every rational number a natural number?

3. Is every natural number a real number?

4. Is every real number a natural number?

For developing analytical thinking skills

1. 100 rational numbers can be inserted between 2 and 7. Give your views on this statement.

2. Can we insert only 100 rational numbers between 2 and 7?

3. How many rational numbers can be inserted between 2 and 7?

For testing understanding of concept taught

1. Are 2 and 5 coprimes?

2. 1.010010001… is an irrational number? True/False

3. What is rationalizing factor of $(2 + \sqrt{3})$?

For testing knowledge of concept taught

1.   Give an example of an irrational number between 2 and 3.

2.   Give an example of a rational number between 2 and 3.

3.   What is smallest Prime number?

4.   Which whole number is not a natural number?

5.   Am I right if I say "4 is smallest composite number?"

6.   Every real number is represented by a unique point on a number line. (True/False)

Follow up: Practice worksheet

1.   Insert 3 rational numbers between $\dfrac{1}{5}$ and $\dfrac{3}{5}$.

2.   Write 5 rational numbers and 5 irrational numbers in decimal form.

3.   Represent $2 + \sqrt{2}$ on number line.

4.   Which of the following number lies between 2 and 3?

(a) $1 + \sqrt{5}$ (b) $\sqrt{3} + 2$ (c) $1 + \sqrt{2}$ (d) $\sqrt{3} - 1$

5. $\sqrt{7.29}$ is a

a)   rational number between 2 and 3

b)   integer

c)   irrational number

d)   A rational number greater than 7.

6.   Which of the following is an irrational number between 2 and 3 ?

a)   2.357357….

b)   2.101001000….

c)   2.05131313….

d)   2.579

Task-3: Home Assignment

Topic	Number System
Nature of task	Post Content
Content Coverage	Complete Chapter
Learning Objectives	To apply the knowledge of Number Systems to solve given problems.
Task	Home Assignment-1 (MCQ) Home Assignment-2 (Short/Long questions)
Execution of task	Printed assignment may be given after completing the chapter.
Duration	2 days
Criteria for assessment	Follow Rubric for H.W/Assignments
Follow up	Reference material in the form of important points to remember can be given as a support material. Assignment Questions should be discussed in class afterwards.
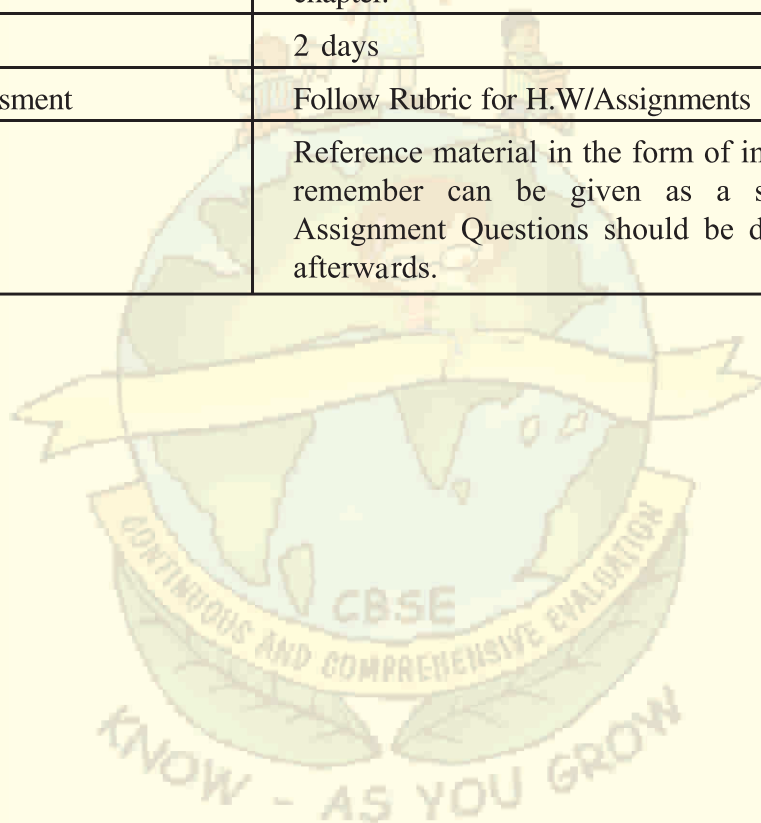
Home Assignment-1
(Multiple Choice Questions)

1. Which of the following is true?
   A. Every whole number is a natural number
   B. Every integer is a rational number
   C. Every rational number is an integer
   D. Every integer is a whole number

2. For positive real numbers a and b

   A. $\sqrt{ab} = \sqrt{a}\ \sqrt{b}$

   B. $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$

   C. $\sqrt{\dfrac{a}{b}} = \dfrac{\sqrt{a}}{\sqrt{b}}$

   C. $(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a + b$

3. Out of the following, the irrational number is

   A. $1.\overline{5}$　　　B. $1.2\overline{77}$　　　C. π　　　D. $2.4\overline{77}$

4. To rationalise the denominator of $\dfrac{1}{\sqrt{a}+b}$, we multiply this by

   A. $\dfrac{1}{\sqrt{a}+b}$　　　B. $\dfrac{\sqrt{a}-b}{\sqrt{a}-b}$　　　C. $\dfrac{1}{\sqrt{a}+b}$　　　D. $\dfrac{\sqrt{a}+b}{\sqrt{a}+b}$

5. The number of rational numbers between $\sqrt{3}$ and $\sqrt{5}$ is

   A. One　　　B. 3　　　C. None　　　D. Infinitely many

6. If we add two irrational numbers, the resulting number
   A. is always an irrational number　　　B. is always a rational number
   C. may be a rational or an irrational number　　　D. always an integer

7. The rationalising factor of $7 - 2\sqrt{3}$ is

   A. $7 + 2\sqrt{3}$　　　B. $7 - 2\sqrt{3}$　　　C. $4 + 2\sqrt{3}$　　　D. $5 + 2\sqrt{3}$

8. If $\dfrac{1}{7} = 0.\overline{142857}$, then $\dfrac{4}{7}$ equals

   A. $0.\overline{428571}$　　　B. $0.\overline{285718}$　　　C. $0.\overline{857142}$　　　D. $0.\overline{571428}$

9. The value of n for which $\sqrt{n}$ be a rational number is

   A. 2　　　B. 4　　　C. 3　　　D. 5

10. $\dfrac{3\sqrt{12}}{6\sqrt{27}}$ equals

    A. $\dfrac{1}{2}$ B. $\sqrt{3}$ C. $\dfrac{1}{3}$ D. $\sqrt{2}$

11. $(3+\sqrt{3})(3-\sqrt{2})$ equals

    A. $9-5\sqrt{2}-\sqrt{6}$ B. $9-\sqrt{6}$

    C. $3+\sqrt{2}$ D. $9-3\sqrt{2}+3\sqrt{3}-\sqrt{6}$

12. The arrangement of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ in ascending order is

    A. $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ B. $\sqrt{5}$, $\sqrt{3}$, $\sqrt{2}$

    C. $\sqrt{2}$, $\sqrt{5}$, $\sqrt{3}$ D. $\sqrt{3}$, $\sqrt{2}$, $\sqrt{5}$

13. If m and n are two natural numbers and $m^n = 32$, then n^{mn} is

    A. 5^2 B. 5^3 C. 5^{10} D. 5^{12}

14. If $\sqrt{10}=3.162$, then the value of $\dfrac{1}{\sqrt{10}}$ is

    A. 0.3162   B. 3.162   C. 31.62   D. 316.2

15. If $\left(\dfrac{3}{4}\right)^6 \times \left(\dfrac{16}{9}\right)^5 = \left(\dfrac{4}{3}\right)^{x+2}$, then the value of x is

    A. 4   B. -2 C. 2   D. 6

Home Assignment-2 (Short / Long Questions)

1. Prove that $\sqrt{5}-\sqrt{3}$ is not a rational number.

2. Arrange the following in descending order of magnitude: $\sqrt[8]{90}$, $\sqrt[4]{10}$, $\sqrt{6}$

3. Simplify the following: $(4\sqrt{3}-2\sqrt{2})(3\sqrt{2}+4\sqrt{3})$

4. If $a=6-\sqrt{35}$, find the value of $a^2+\dfrac{1}{a^2}$

5. Simplify, by rationalising the denominator

    $$\dfrac{2\sqrt{6}}{\sqrt{2}+\sqrt{3}}+\dfrac{6\sqrt{2}}{\sqrt{6}+\sqrt{3}}-\dfrac{8\sqrt{3}}{\sqrt{6}+\sqrt{2}}$$

6. If $x=\dfrac{\sqrt{2}+1}{\sqrt{2}-1}$ and $y=\dfrac{\sqrt{2}-1}{\sqrt{2}+1}$, find the value of $x^2 + y^2 + xy$

7. If $\dfrac{5+2\sqrt{3}}{7+\sqrt{3}}=a-\sqrt{3b}$, find a and b where a and b are rational numbers.

8. Evaluate:

$$\dfrac{1}{\sqrt{2}+1}+\dfrac{1}{\sqrt{3}+\sqrt{2}}+\dfrac{1}{\sqrt{4}+\sqrt{3}}+...............+\dfrac{1}{\sqrt{9}+\sqrt{8}}$$

9. If $x=\dfrac{1}{2+\sqrt{3}}$, find the value of $2x^3-7x^2-2x+1$

10. If $\sqrt{2}$ = 1.414 and $\sqrt{5}$ = 2.236, find the value of $\dfrac{\sqrt{10}-\sqrt{5}}{2\sqrt{2}}$ upto three places of decimals

Task-4: Hands on activity

| Topic	Number System
Nature of task	Content
Content Coverage	Representation of irrational numbers
Learning Objectives	To learn to make a square root spiral using compass and ruler on a sheet of paper.
Task	Maths activity
Execution of task	An instruction sheet containing pictures of initial steps can be given to students for reference. They will be then asked to complete the square root spiral and interpret the figure obtained.
Duration	1 period
Criteria for assessment	This activity will be a part of Maths activity , so it will be assessed according to the following given parameters: Class Ethics Performance of activity File Record (marks may be allotted by the teacher accordingly)
Follow up	–

Task: Hands on activity

Instruction Sheet

Follow the steps shown in the following picture and make a square root spiral.
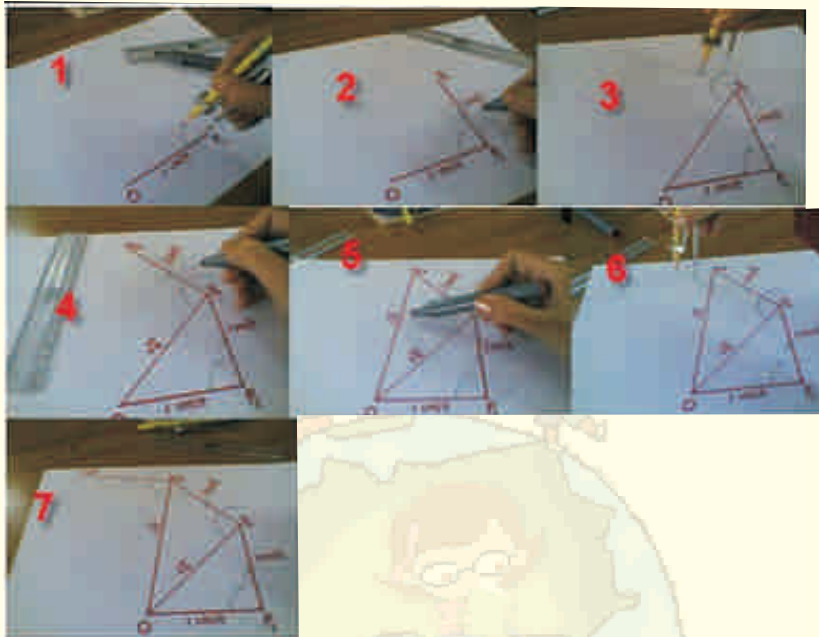
a)   Which theorem you have used for finding the hypotenuse of a right triangle?

b)   Show the calculations in all the right triangles which are obtained.

c)   Do you think $\sqrt{4}$ is an irrational number?
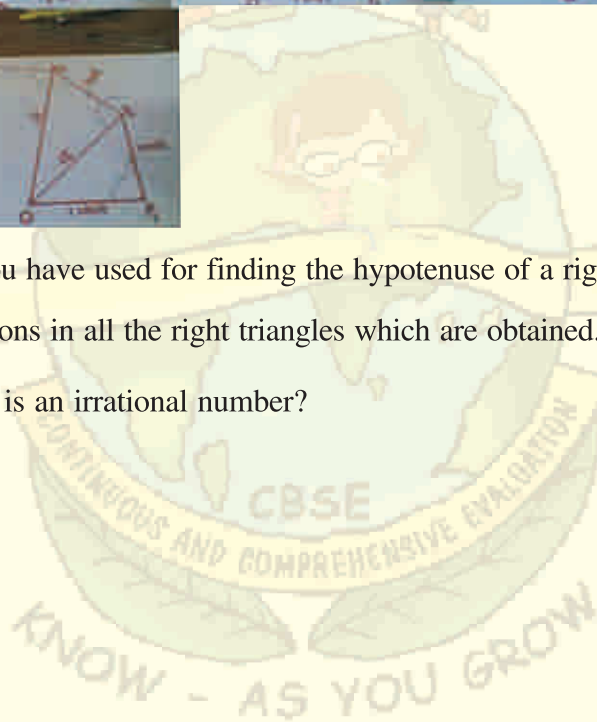
Evaluation to Enhance Learning during Formative Stages in Algebra with Emphasis on the Language as the Medium of the Abstract

Underlying Principles :

• 	In upper primary children are in that psychological age group where learning is internalised better through concrete experiences.

• 	The transition to the adolescent is not only a metamorphosis of the physical but also of the mental processes.

• 	The student questions each and everything however trivial it maybe. (S)he gains the prowess of traversing the unknown, perceiving beyond seeing and exploring in the abstract.

• 	Such transition still requires a medium and the best tool is the human language.

• 	In a world where Mathematics evaluation is generally considered to be problem solving how to master the discipline specific language and what kind of questions will facilitate understanding and correlating the concepts by articulating them is the focus at present

• 	Generally evaluation is an integral part of pedagogy that helps a teacher to develop an evaluative eye enabling him to assess individual differences and needs.

• 	This evaluation is not about a dispassionate assessment judgemental in character of a child's performance but is more humane in nature to empathize and refine learning standards

• 	Therefore a teacher's task is to cast the lesson plan with certain pre determined parameters identified on a need, based on the criteria of the learning components vis-à-vis the anticipated short comings in students.

• 	At the same time keeping an open mind for possible new issues during class room interaction which will make a teacher more dynamic and evolving.

• 	Towards this a teacher has to develop a logical sequence of the presentation of a lesson covering various expected learning outcomes and put them in perspective. In Algebra these perspectives pertain to physical (real life) relevance, geometrical relevance, the art of symbolization and generating the technical aspects, vocabulary (jargon), concrete to abstract and vice versa

• 	For getting an insight into the level of learning and the areas where clarity is an issue the evaluative questions should be diagnostic. For this the questions framed should be discriminatory in nature taking into account the finer and subtle nuances of the concepts.

• 	The teacher should also have a set of remedial tasks to ensure conceptual clarity.

- The continuity of assessment is reconciled with documentation of the effect of formative steps in the learning process as follows:

  i.   Continuity is not of the time frame but of the process of learning.

  ii.   Identify appropriate integral stages with well defined process culminating in such stages.

  iii. At each such stage prepare a test item including atleast one question for each aspect in the process of learning so as to ensure continuity in respect of the learning process.

  iv.   above will enable to know how effective diagnosis and remedial had been and place the children in exact positions in the ladder of learning.

  v.   Add up all stages to ascertain the final weightage.