



Sri Sathya Sai
VIDYA VAHINI
श्री सत्यसाई विद्या वाहिनी

Master Lesson Plan

for

05 - Rational numbers (ପରିମେୟ ସଂଖ୍ୟା)

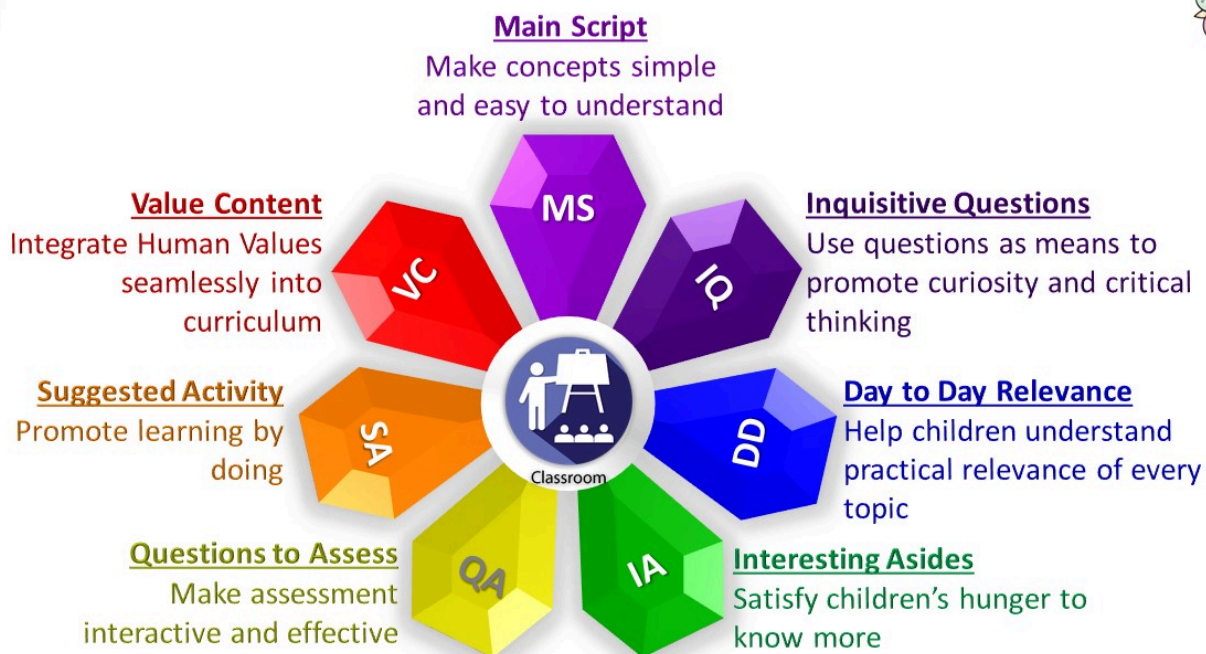
Board	Standard	Subject	Chapter	Language	Creation date
Odisha (English)	STD VII	Mathemat ics	05 - Rational numbers (ପରିମେୟ ସଂଖ୍ୟା)	English	26-03-2024 22:23:27

DISCLAIMER

- 1.Strictly not for Commercial use.
- 2.Provided on **as is** basis with no warranties of any kind.
- 3.Content that falls in Public Domain or common Knowledge facts can be used freely.
- 4.Some of the contents are owned by the Third parties and are used in compliance with their licensing conditions. Any one infringing the Copyright of such Third parties will be doing so at their own risks and costs.
- 5.Content can be downloaded and used for Personal, educational and informational purposes only. Any attempt to remove, alter, circumvent or distort the data that is accessed is Illegal and strictly prohibited.



Master Lesson Plan (MLP) - Covers the entire chapter with the help of these 7 asset types



For more information on how to use the lesson plan effectively, please scroll to the guidelines at the end of this document.

MS_Objectives-Rational numbers

Notes to the teacher:

This asset lays down the proposed plan for transacting this chapter

It states the asset objectives of the MLP. This asset is for teacher's reference and need not be taught to the students

Students will be able to

- appreciate Pythagoras and his work on discovery of rational numbers
- explain rational numbers with simple examples
- identify uses of rational numbers in daily life
- describe equivalent rational numbers with suitable examples
- locate rational numbers on a number line
- describe standard form of a rational numbers
- explain comparison of rational numbers with suitable examples
- identify the largest and smallest rational numbers
- determine the smallest rational number in a given set of numbers
- describe existence of rational numbers between two rational numbers
- solve problems based on rational numbers
- explain addition of rational numbers with suitable examples
- explain subtraction of rational numbers with suitable examples
- explain multiplication of rational numbers with suitable examples
- explain division of rational numbers with suitable examples
- solve problems involving operation on rational numbers
- appreciate the need for love and kindness towards each other within and outside the family

Time to teach	Asset type	Theme	Sub Theme
3 minutes	Main Script	Rational Numbers	Comparing Rational numbers

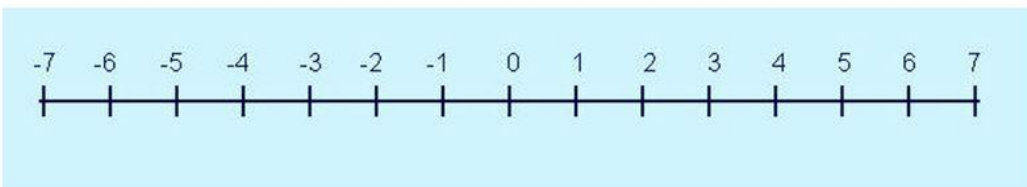
MS_Introduction to Rational Numbers

Introduction

The number system consists of

- Natural numbers N (1,2,3,...)
- Whole numbers W (0,1,2,3,...)
- Integers Z (...,-2,-1,0,1,2,...)

All the above set of numbers can be located on a number line.



Rational numbers

We know that operations on integers are closed under addition, subtraction and multiplication.

Addition of integers results in an integer.

$$-1+(-2)=-3$$

Subtraction of integers results in an integer.

$$-5-(-3)=-5+3=-2$$

Multiplication of integers results in an integer.

$$4 \times -2 = -8$$

Consider the operation division of integers

$48/6=8$, $39/13=3$, $-25/5=-5$ are integers.

However consider the following cases.

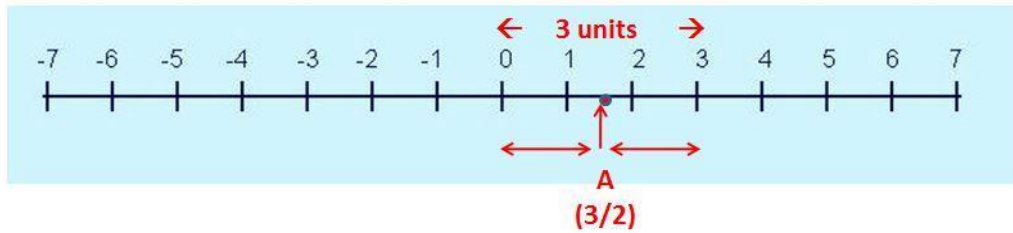
$$-5/2 = ? , -9/13 = ? , 3/2 = ? \dots$$

The answer to the above division is not in the set of integers

ie the quotient is not an integer.

Location of $3/2$ on number line

Consider a number line



- Consider a line segment 3 units long extending from 0 to 3.
- $3/2$ means that it is exactly half the distance from 0 to 3.
- Locate the midpoint between 0 to 3 and name the midpoint as A.
- Point A represents the number $3/2$ on the number line.
- Point A is not an element in the set of integers.
- Hence a new system of numbers is to be introduced in order to name the numbers such as $3/2, -4/5, \dots$ etc.

We extend the number system by introducing quotient of integers called Rational numbers.

Definition

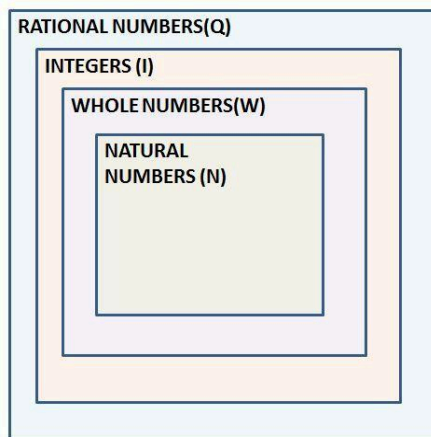
Rational number is a number of the form p/q where p and q are integers and $q \neq 0$.

Examples: $-2/5, 4/7, 3/-8, \dots$

Rational numbers gets its name from the root word 'Ratios'.

Set of Rational numbers is denoted by letter 'Q'.

The following chart clearly explains the number system including rational numbers.



From the above chart it is clear that

- Every natural number n is a rational number as it can be expressed as $n/1$. Example $3=3/1$ is of the form p/q .
- Every whole number w is a rational number as it can be expressed as $w/1$. Example $0=0/1$ is of the form p/q .
- Every integer z is a rational number as it can be expressed as $z/1$. Example $-7=-7/1$ is of

the form p/q .

However, all rational numbers are not natural numbers or whole numbers or integers.

All fractions are rational numbers

Fractions are ratios of the form a/b where a and b are natural numbers. Examples are $3/4$, $9/5$, $1/7$...etc.

Note that all fractions are of the form p/q . Hence, all fractions are rational numbers but all rational numbers need not be fractions

Types of rational numbers

The rational numbers are either positive or negative.

Positive rational number

A rational number p/q is said to be positive if both p and q are positive integers or both are negative integers.

Examples are $1/4$, $-2/-3$, $-6/-7$, $3/8$etc

Observe that a rational number is positive if both numerator and denominator are of the same sign.

Note

Every natural number is a positive rational number.

Every whole number is a positive rational number except 0 which is neither positive nor negative.

Every positive integer is a positive rational number.

Negative rational number

A rational number p/q is said to be negative if its numerator and denominator are of opposite signs such that one of them is a positive integer and other is a negative integer.

Examples are $-5/3$, $1/-2$, $-4/7$, $-3/4$etc

Observe that a rational number is negative if numerator and denominator are of opposite signs.

Note

Every negative integer is a negative rational number.

Image Source: Sailakshmi1973@gmail.com

Time to teach	Asset type	Theme	Sub Theme
15 minutes	Main Script	Rational Numbers	

IA_Discovery of Rational Numbers

Pythagorean School - Discovery of Rational numbers

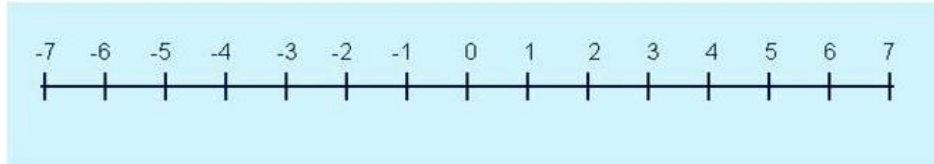
- Pythagoras (580 – 500 BC) was born in a Greek island in the eastern Aegean Sea called Samos.
- Due to continual conflicts in a tyrant system in Samos, he moved to a peaceful place called Croton, which was safe and was just right for him.
- He formed a society for ethical and religious purposes.
- It was known as Pythagorean School.
- The Pythagorean School was a strict society.
- The school was governed by a set of rules.
- The members recognized one another by means of secret signs; simplicity of personal attire and certain restrictions in matter of diet were required.
- The Pythagoreans considered whole numbers to be their rulers and that all quantities could be explained by whole numbers and their ratios (rational numbers).
- The Pythagorean School gained considerable influence in Croton and became politically active on the side of aristocracy.
- Probably because of this, after a time the citizens turned against him and his followers burning his house.
- As a result he moved to Southern Italy and there he died at the age of eighty.
- Unfortunately, very little is known about Pythagoreans due to their very secretive ways.
- Pythagoras left no written works, but his ideas were carried on by his eager disciples.

Time to teach	Asset type	Theme	Sub Theme
3 minutes	Interesting Asides	Rational Numbers	Definition of Rational numbers

MS_Rational Numbers on a Number Line

Introduction

Consider the number line shown below



Observe that the positive integers are represented to the right of zero and negative integers are represented to the left of zero.

Representation of rational numbers on the number line also follows the same rules. A positive rational number is represented to the right of zero and a negative rational number is represented to the left of zero.

Steps for plotting

- 1) Check if the rational number is positive or negative number.
If positive, the rational number is plotted to the right of zero.
If negative, the rational number is plotted to the left of zero.
- 2) Consider the denominator of the rational number. Divide each unit length on the number line into as many equal parts as in the denominator of the rational number.
- 3) Now, plot the rational number by counting the number of parts as in the numerator.

ILLUSTRATIONS

To plot a rational number $4/5$ on the number line

Step 1

$4/5$ is a positive rational number. Hence it would be located to the right of zero.



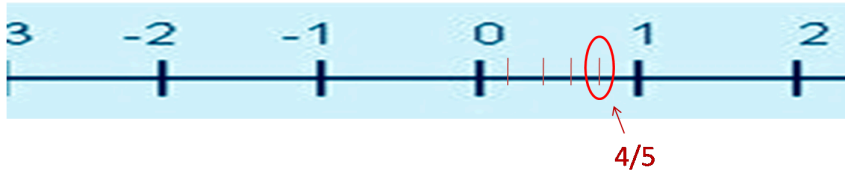
Step 2

$4/5$ is less than 1, so the rational number lies between 0 and 1. In the rational number $4/5$, the denominator is 5. Hence divide each unit length into 5 equal parts.



Step 3

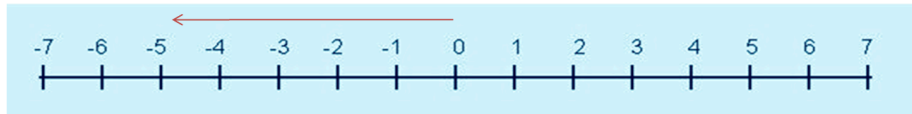
In the rational number $4/5$, the numerator is 4. Hence count 4 places to the right of zero to locate the rational number $4/5$ on the number line.



To plot a rational number $-3/2$ on the number line

Step 1

$-3/2$ is a negative rational number. Hence it would be located to the left of zero.



Step 2

$-3/2$ is less than -1 and lies between -1 and -2 . In the rational number, the denominator is 2. Hence divide each unit length into 2 equal parts.



Step 3

In the rational number $-3/2$, the numerator is 3. Hence count 3 places to the left of zero to locate the rational number $-3/2$ on the number line.

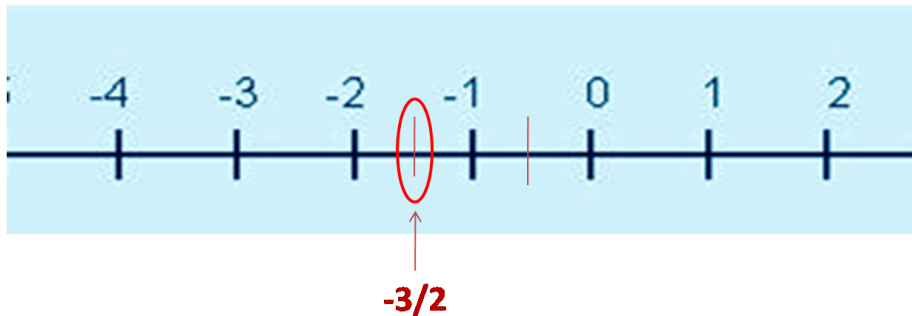


Image Source: Original by sailakshmi1973@gmail.com

Time to teach	Asset type	Theme	Sub Theme
8 minutes	Main Script	Rational Numbers	Representation on number lines

DD_Rational numbers in Daily Life

Rational Numbers in Daily Life

We observe that rational numbers are used extensively in many real life situations.

1) Whenever a bar of chocolate or a cake or fruit is to be shared among people, rational numbers are involved.



When a bar of chocolate is divided among four friends, each one gets $\frac{1}{4}$ of the chocolate. $\frac{1}{4}$ is a rational number.

2) Rational numbers are involved in banking transactions. Interest rates on loans or deposits in banks are expressed as percentage.



Example :

The rate of interest on a loan could be 7 percent i.e. $\frac{7}{100}$, which is a rational number.

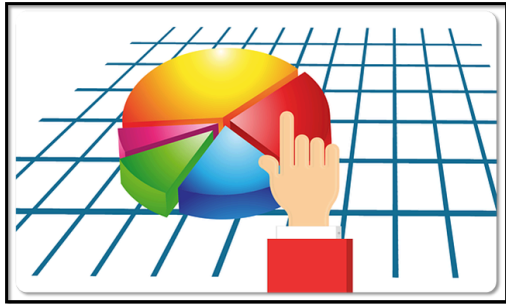
3) Test scores in exams are expressed as rational numbers.



Example :

Mohan scored $\frac{17}{20}$ in Mathematics unit test.

4) Reporting of statistics involves use of rational numbers.



Examples

$\frac{3}{4}$ of the total class strength consists of boys.

$\frac{2}{3}$ of the population of the constituency cast their votes on election day.

5) In purchase of fruits, vegetables, grocery in daily life we take the help of rational numbers.



Examples :

The price of $\frac{1}{4}$ kg of tomato is Rs. 10.

Ram purchased 1 and a half kilogram of apples at the stall.

Sita bought 3 and a half kilogram of wheat at the grocery shop.

6) Mathematical formulae also contain rational numbers.

Examples :

Area of semicircle = $\frac{1}{2} \pi r^2$

Volume of cone = $\frac{1}{3} \pi r^2 h$

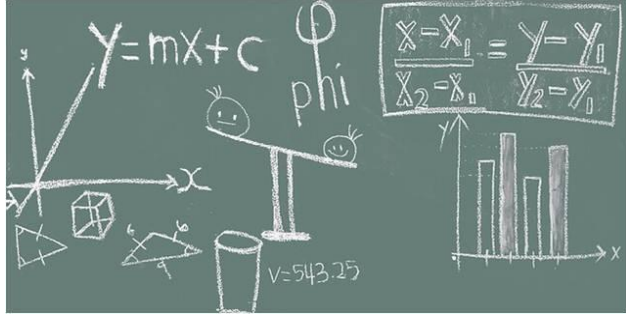


Image Source:

pie - <https://pixabay.com/photos/cake-pie-sweet-food-tasty-2064637/>

chocolate - <https://pixabay.com/photos/chocolate-white-chocolate-3422325>

woman - <https://pixabay.com/illustrations/woman-girl-percent-prices-shopping-1169324/>

notepad and pen -

<https://pixabay.com/illustrations/icon-survey-check-form-mark-test-2967800/>

board with test - <https://pixabay.com/illustrations/board-school-uni-learn-work-test-361516/>

statistics pie chart - <https://pixabay.com/illustrations/hand-finger-show-touch-success-577356/>

weighing scale - <https://pixabay.com/photos/kitchen-scale-horizontal-1636489/>

black board - <https://pixabay.com/photos/math-blackboard-education-classroom-1547018/>

Time to teach	Asset type	Theme	Sub Theme
5 minutes	Day-to-day Relevance	Rational Numbers	

MS_Addition of Rational Numbers

Introduction

Addition of rational numbers is similar to addition of integers and fractions.

Just like in the case of fractions with same denominator, we add the numerators to find the sum and in case of fractions having different denominators, the LCM of the denominators is determined after which the fractions are rewritten with the LCM as common denominator. The fractions now have same denominator and

hence, their sum is found by adding up the numerators.

Addition of rational numbers also follows the same rules as above.

Case 1-Addition of rational numbers having same denominator

If a/c and b/c are two rational numbers where a, b, c are integers and $c \neq 0$ then

$$a/c + b/c = (a+b)/c$$

When the denominators are the same, the sum of two rational numbers is obtained by adding up the numerators.

Example Add $7/15$ and $-11/15$

$$(7/15) + (-11/15) = \{7+(-11)\}/15$$

$$= (7-11)/15$$

$$= -4/15$$

Case 2-Addition of rational numbers having different denominators

When two rational numbers have different denominators then the LCM of the denominators is taken. Equivalent fractions of both the rational numbers with same denominator is obtained.

The two rational numbers are added as in case-1.

Example Add $5/12$ and $7/18$

Step 1

Find the LCM of the denominators 12 and 18.

$$\text{LCM}(12,18)=36$$

Step 2

The equivalent fractions of $5/12$ and $7/18$ is obtained such that their common denominator is 36.

$$(5/12) \times (3/3) = 15/36$$

$$(7/18) \times (2/2) = 14/36$$

Step 3

Add the two rational numbers as in case 1

$$(15/36) + (14/36) = 29/36$$

ILLUSTRATIONS

1) Find the sum of $4/7$, $2/9$ and $1/21$

Solution

Step 1

Find LCM of the denominators 7,9,21.

$$\text{LCM}(7,9,21) = 63$$

Step 2

Find equivalent fractions of each rational number with same denominator 63.

$$4/7 = (4/7) \times (9/9) = 36/63$$

$$2/9 = (2/9) \times (7/7) = 14/63$$

$$1/21 = (1/21) \times (3/3) = 3/63$$

Step 3

Add all the 3 rational numbers

$$(36/63) + (14/63) + (3/63) = (36+14+3)/63 = 53/63$$

$$(4/7) + (2/9) + (1/21) = 53/63$$

2) Radha is preparing for her exams. She studies $7/2$ hrs on Monday, $5/2$ hrs on Tuesday and $9/4$ hrs on Wednesday. How many total hours did she study ?

Solution

Total hours of study = $(7/2) + (5/2) + (9/4)$

Step 1

Find LCM of the denominators 2,2,4

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

Step 2

Find equivalent fractions of each rational number with denominator 4.

$$7/2 = (7/2) \times (2/2) = 14/4$$

$$5/2 = (5/2) \times (2/2) = 10/4$$

$$9/4 = (9/4) \times (1/1) = 9/4$$

Step 3

Add all the 3 rational numbers

$$(14/4) + (10/4) + (9/4) = (14+10+9)/4 = 33/4$$

Radha studied totally for $33/4$ hrs = 8 and $1/4$ hours.

Time to teach	Asset type	Theme	Sub Theme
10 minutes	Main Script	Rational Numbers	

MS_Subtraction of rational numbers

Introduction

Additive inverse of a number

Consider the following operation on integers.

$$12-12 = 0$$

$$-6+6 = 0$$

Observe that whenever an integer is added to its negative, the result is zero. **The negative of the number is called its additive inverse.**

In the above examples,

Additive inverse of +12 is -12.

Additive inverse of -6 is +6.

Similarly, additive inverse exists for rational numbers also.

$$1/4 - 1/4 = 0$$

$$-3/7 + 3/7 = 0$$

Sum of a rational number and its additive inverse is always zero.

In the above examples,

Additive inverse of +1/4 is -1/4.

Additive inverse of -3/7 is +3/7.

Subtraction of Rational numbers

Consider the subtraction of two integers, 4 from 7.

$$7 - (4) = 7 + (-4)$$

Subtraction of two integers can also be considered as addition of an integer and the additive inverse of the other integer. Here, the additive inverse of 4 is -4.

Consider the subtraction of two integers, -8 from 11.

$$11 - (-8) = 11 + 8$$

Here again, we are adding an integer and the additive inverse of the other integer (additive inverse of -8 is +8).

The above operations hold good for rational numbers also.

Definition

If a/b and x/y are two rational numbers, then subtracting x/y from a/b means adding additive inverse (negative) of x/y to a/b .

$$(a/b) - (x/y) = (a/b) + (-x/y)$$

Note that the additive inverse of x/y is $-x/y$.

Steps for subtraction of rational numbers

- 1) Consider the given rational numbers.
- 2) Check if their denominators are the same. If denominators are same, subtract the terms in the numerator.
- 3) If denominators are different, find LCM of the denominators and convert each rational

number into its equivalent fraction such that the denominator is the LCM.

4) Subtract the terms in the numerator to obtain the result.

Case 1- Subtraction of rational numbers with same denominator

Subtract $2/3$ from $7/3$

$$(7/3) + (-2/3) = 7/3 - 2/3$$

$$= (7-2)/3$$

$$= 5/3$$

Subtract $-4/9$ from $17/9$.

$$(17/9) + (4/9) = (17/9) + (4/9)$$

$$= (17+4)/9$$

$$= 21/9$$

Case 2- Subtraction of rational numbers with different denominators

Subtract $-4/5$ from $-3/2$.

Step 1

As the denominators of $-4/5$ and $-3/2$ are different, we are required to find the LCM of the denominators.

$$\text{LCM}(5,2)=10$$

Step 2

Find the equivalent fractions of both the rational numbers with denominator 10.

$$-4/5 = -4/5 \times 2/2 = -8/10$$

$$-3/2 = -3/2 \times 5/5 = -15/10$$

Step 3

Subtract $-4/5$ from $-3/2$ by using the corresponding equivalent fractions.

$$(-3/2) + (4/5) = (-15/10) + (8/10)$$

$$= (-15+8)/10$$

$$= -7/10$$

Illustration

Sita has $17/5$ Kg of wheat flour and $7/8$ Kg of corn flour at home. How many more kilos of wheat flour does she have?

Solution

Amount of wheat flour = $17/5$ Kg

Amount of corn flour = $7/8$ Kg

Excess of wheat flour = $(17/5) + (-7/8)$

$$= (17/5) - (7/8)$$

$$\text{LCM}(5,8)=40$$

Expressing the above rational numbers in terms of equivalent fractions with common denominator 40 we get,

Excess of wheat flour = $(17/5) - (7/8)$

$$= (136/40) - (35/40)$$

$$= 101/40$$

Sita has $101/40$ Kg more of wheat flour.

Time to teach	Asset type	Theme	Sub Theme
13 minutes	Main Script	Rational Numbers	

MS_Multiplication of Rational Numbers

Introduction

Multiplication of rational numbers is similar to multiplication of fractions.

Product of two rational numbers = Product of their numerators/Product of their denominators.

Definition

If a/b and c/d are two rational numbers then,

$$(a/b) \times (c/d) = ac/bd$$

Examples:

1) Multiply $2/3$ by $3/5$

Solution

$$(2/3) \times (3/5) = (2 \times 3)/(3 \times 5) = 2/5$$

2) Multiply $4/7$ by $-8/3$

Solution

$$(4/7) \times (-8/3) = (4 \times -8)/(7 \times 3) = -32/21$$

3) Gopal's truck gives him a mileage of $32/5$ miles/l. He fills the tank with $11/2$ l of petrol. How far can his truck go?

Solution

Distance covered per litre of petrol = $32/5$ miles (Mileage of the truck)

Distance covered with $11/2$ litres of petrol = $(32/5) \times$

$(11/2)$

$$= (32 \times 11)/(5 \times 2)$$

$$= 176/5 \text{ miles.}$$

The truck will cover $176/5$ miles.

Time to teach	Asset type	Theme	Sub Theme
5 minutes	Main Script	Rational Numbers	

MS_Division of Rational Numbers

Introduction

Multiplicative inverse of a number

Consider the following operations

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

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

Observe that

- product of 3 and its reciprocal $\frac{1}{3}$ is 1.
- product of 7 and its reciprocal $\frac{1}{7}$ is 1.

The product of a number and its reciprocal is always 1. Each of them is called the multiplicative inverse of the other.

'Multiplicative Inverse means 'Reciprocal'.

Multiplicative inverse of a rational number

Consider two rational numbers $\frac{2}{3}$ and $\frac{3}{2}$.

$$\frac{2}{3} \times \frac{3}{2} = 1$$

Hence, $\frac{3}{2}$ is the multiplicative inverse of $\frac{2}{3}$ and vice versa.

We can write it mathematically as

$$\frac{1}{(\frac{2}{3})} = \frac{3}{2}$$

The above operation can be rewritten as

$$\frac{1}{(\frac{2}{3})} = \frac{3}{2} = 1 \times \frac{3}{2}$$

$$1 \div (\frac{2}{3}) = 1 \times \frac{3}{2}$$

Thus, we can generalize and say that **division is the inverse process of multiplication.**

Definition

Dividing any rational number by a rational number $\frac{a}{b}$ where $a, b \neq 0$ is equivalent to multiplying it by $\frac{b}{a}$.

Examples:

1) Divide $\frac{3}{4}$ by $\frac{2}{9}$

Solution

$$(\frac{3}{4}) \div (\frac{2}{9}) = (\frac{3}{4}) \times (\frac{9}{2}) = \frac{27}{8}$$

2) Divide $-\frac{9}{10}$ by $-\frac{3}{8}$

Solution

$$\begin{aligned} (-\frac{9}{10}) \div (-\frac{3}{8}) &= (-\frac{9}{10}) \times (\frac{8}{-3}) \\ &= \frac{(-12)}{(-5)} \\ &= \frac{12}{5} \end{aligned}$$

3) The product of two numbers is $-\frac{16}{27}$. If one number is $-\frac{4}{9}$, find the other.

Solution

Let the other number be p.

$$\begin{aligned} P \times (-\frac{4}{9}) &= -\frac{16}{27} \\ P &= (-\frac{16}{27}) \div (-\frac{4}{9}) \\ &= (-\frac{16}{27}) \times (\frac{9}{-4}) \\ p &= \frac{4}{3} \end{aligned}$$

The other number is $\frac{4}{3}$.

Time to teach	Asset type	Theme	Sub Theme
8 minutes	Main Script	Rational Numbers	

QA_Operations on Rational Numbers

Assessment on Operations of Rational Numbers

I. Match the following

- | | |
|---|-----------|
| 1. $(-5/6) - (3/4) + (-9/12)$ | a) $4/9$ |
| 2. $\{93/(-75)\} \times (-2/3) \times (-150/155)$ | b) $1/10$ |
| 3. $\{4/(-7)\} \div (-9/7)$ | c) $-7/3$ |
| 4. $(-8/10) - (3/5) + (6/4)$ | d) $-4/5$ |

II. Solve the following

- 1) From a rope 10 m long, two pieces of length $(13/5)$ m and $(33/10)$ m are cut off. Find the length of the remaining rope.
- 2) Find the area of a square garden whose side measures $(17/3)$ metres.
- 3) Area of a room is $(261/2)$ sq. metre. If its breadth is $87/8$ metre, find its length.

Answers

I. Match the following

1-c, 2-d, 3-a, 4-b

II. Solve the following

1) Total length of rope = 10 m

$$\begin{aligned}\text{Length of two pieces} &= (13/5) + (33/10) \\ &= (26/10) + (33/10) \\ &= (26+33)/10 \\ &= (59/10)\text{m}\end{aligned}$$

$$\begin{aligned}\text{Length of the remaining rope} &= 10 - (59/10) \\ &= (41/10)\text{m}\end{aligned}$$

$$\begin{aligned}\text{2) Area of the square garden} &= \text{side} \times \text{side} \\ &= (17/3) \times (17/3) \\ &= 289/9 \text{ sq. metre}\end{aligned}$$

$$\begin{aligned}\text{3) Area of the room} &= l \times b \\ (261/2) &= l \times (87/8) \\ l &= (261/2) / (87/8) \\ l &= 12 \text{ m}\end{aligned}$$

Extra Questions (Not for PPT)

1) The sum of two rational numbers is $(-4/11)$. If one of the numbers is 6, find the other number.

Hint: $(6+x) = -4/11$ Ans: $(-70/11)$

2) Subtract the sum of $-5/7$ and $15/14$ from $9/28$.

Hint: $(9/28) - \{(-5/7) + (15/14)\}$ Ans: $(13/28)$

3) The difference of two rational numbers is $-6/25$. If the greater number is $-4/9$, what is the smaller number?

Hint: $(-4/9) - x = (-6/25)$ Ans: $(46/225)$

4) A drum full of wheat weighs $24\frac{1}{6}$ Kg. If the empty drum weighs $5\frac{5}{4}$ Kg, what is the weight of wheat in the drum?

Ans: $(31\frac{7}{12})$ Kg

5) A bus is moving at an average speed of $(20\frac{2}{5})$ Km/hr. What would be the distance covered in $(15\frac{1}{2})$ hours?

Ans: 303 Km

Time to teach	Asset type	Theme	Sub Theme
15 minutes	Questions to Assess	Rational Numbers	

MS_Rational Numbers Between Two Rational Numbers

Rational Numbers between two rational numbers

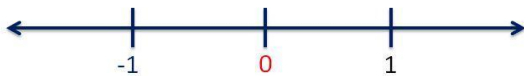
Introduction

Case of Integers

We know that between two integers -5 and +5, there are 9 integers -4,-3,-2,-1,0,1,2,3,4. However between -5 and -4 there are no integers.

Case of Rational numbers

Consider the number line as shown below



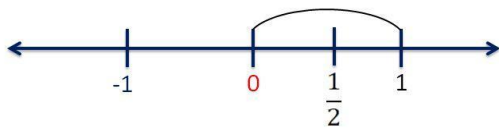
There exists a rational number between 0 and 1 i.e. $\frac{1}{2}$.

Find the average of 0 and 1.

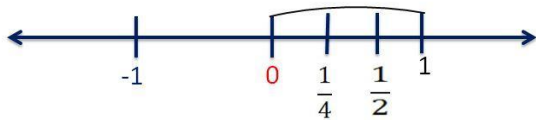
$$(0+1)/2 = \frac{1}{2}$$

Hence, $\frac{1}{2}$ lies in between 0 and 1.

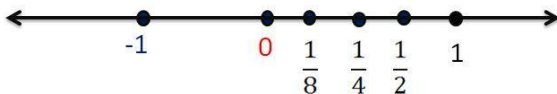
Note that the average of any two numbers lies in between the numbers.



There exists a rational number between 0 and $\frac{1}{2}$ i.e. $\frac{1}{4}$.



There exists a rational number between 0 and $\frac{1}{4}$ i.e. $\frac{1}{8}$.



Proceeding in the same manner, we can get infinitely many rational numbers between 0 and 1.

Thus, there exist infinitely many rational numbers between any two rational numbers.

Rational numbers between any two rational numbers having same denominator

To find rational numbers between -5 and -4

Step 1

Express -5 and -4 as rational numbers

$$-5 = -5/1$$

$$-4 = -4/1$$

Step 2

Start by multiplying and dividing by 3 with -5/1 and -4/1

$$-5/1 = (-5 \times 3) / (1 \times 3) = -15 / 3$$

$$-4/1 = (-4 \times 3) / (1 \times 3) = -12 / 3$$

When multiplied by 3 there exist 2 rational numbers.

$$-5/1 = (-5 \times 5) / (1 \times 5) = -25 / 5$$

$$-4/1 = (-4 \times 5) / (1 \times 5) = -20 / 5$$

When multiplied by 5, there exist 4 rational numbers.

Since we need 6 rational numbers, we multiply and divide by 7.

Multiply and divide both rational numbers by 7.

$$-5/1 = (-5 \times 7) / (1 \times 7) = -35/7$$

$$-4/1 = (-4 \times 7) / (1 \times 7) = -28/7$$

Step 3

The numerators of the two rational numbers -35/7 and -28/7 are -35 and -28. Between -35 and -28 there exist numbers

-34, -33, -32, -31, -30, -29.

Hence, between -35/7 and -28/7, we get the following rational numbers.

$$-35/7 < -34/7 < -33/7 < -32/7 < -31/7 < -30/7 < -29/7 < -28/7$$

Note

In order to get more rational numbers between -5/1 and -4/1 we multiply and divide -5/1 and -4/1 by larger numerals.

If 7 is multiplied, you can write 6 rational numbers. Similarly, if you multiply and divide by 12, you can write 11 rational numbers. The pattern continues similarly.

On multiplying by 15 we get,

$$-5/1 = (-5 \times 15) / (1 \times 15) = -75/15$$

$$-4/1 = (-4 \times 15) / (1 \times 15) = -60/15$$

We obtain the following rational numbers between $-75/15$ and $-60/15$.

$$-75/15 < -74/15 < -73/15 < \dots < -63/15 < -62/15 < -61/15 < -60/15$$

There are 14 rational numbers between $-75/15$ and $-60/15$.

Rational numbers between any two rational numbers having different denominators

Consider two rational numbers $4/7$ and $5/8$.

Step 1

Find the LCM of the denominators 7 and 8.

$$\text{LCM}(7,8)=56$$

Step 2

Multiply the numerator and denominator of each rational number such that both rational numbers have the LCM as denominator.

$$4/7 = (4 \times 8) / (7 \times 8) = 32/56$$

$$5/8 = (5 \times 7) / (8 \times 7) = 35/56$$

Step 3

The rational numbers between $32/56$ and $35/56$ are

$$32/56 < 33/56 < 34/56 < 35/56$$

Image Source: Original Contribution by vallisairam9@gmail.com

Time to teach	Asset type	Theme	Sub Theme
20 minutes	Main Script	Rational Numbers	Rational number between two Rational numbers

QA_Solve the following

Choose the correct answer

- 1) In the following, the positive rational number is
a) $-1/3$ b) $6/-7$ c) $0/-7$ d) $-6/-7$
- 2) The smallest rational number is
a) $-5/7$ b) $-3/14$ c) $4/7$ d) $-6/7$
- 3) Which of the following is true?
a) All integers are not rational numbers.
b) All rational numbers are fractions.
c) Every fraction is a rational number.
d) Zero is a positive rational number.
- 4) How many rational numbers are there between two rational numbers?
a) 0 b) 1 c) 100 d) infinite
- 5) To reduce a rational number to its standard form, we divide its numerator and denominator by their
a) HCF b) LCM c) product d) quotient

II. Answer the following

- 1) Represent the following rational numbers on the number line.
 $-3/4$, $-1/4$, $5/4$, $-7/4$
- 2) Express the rational number in standard form $81/-135$.
- 3) Write 2 more rational numbers in pattern given
 $-4/5$, $-8/10$, $-12/15$, $-16/20$,
- 4) Does $-9/27$ and $5/-15$ represent the same rational number?
- 5) Find 4 rational numbers between $-3/4$ and $-4/5$.
- 6) What should be subtracted from $-2/3$ to get the nearest integer?

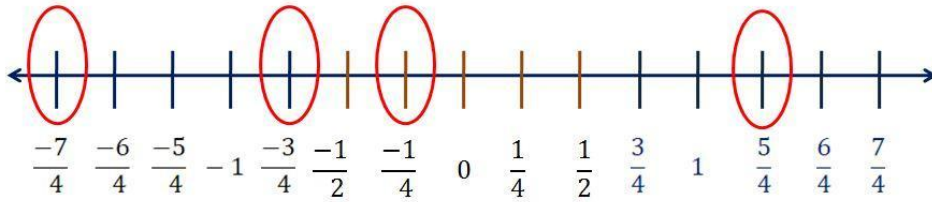
Answers

I. Choose the correct answer

- 1) d
- 2) d
- 3) c
- 4) d
- 5) a

II. Answer the following

- 1) Divide each unit length into 4 equal parts. Count the numerator from zero to locate the rational number on the number line.



2) Convert the rational number such that denominator is positive.

$$81/(-135) = \{81 \times (-1)\} / \{(-135) \times (-1)\} = -81/135$$

Dividing numerator and denominator by 9, we get

$$-81/135 = -9/15$$

Further dividing numerator and denominator by 3, we get,

$$-9/15 = -3/5$$

Standard form of $81/-135 = -3/5$

3) The pattern represents equivalent fractions of the first rational number in the series.

$$(-4/5) \times (2/2) = -8/10$$

$$(-4/5) \times (3/3) = -12/15$$

$$(-4/5) \times (4/4) = -16/20$$

Next two rational numbers would be

$$(-4/5) \times (5/5) = -20/25$$

$$(-4/5) \times (6/6) = -24/30$$

4) Reduce each rational number to standard form and compare.

$$-9/27 = -1/3$$

$$5/(-15) = -5/15 = -1/3$$

The two rational numbers $-9/27$ and $5/-15$ are equivalent. Hence, they represent same rational number.

5) Express both rational numbers with same denominator.

$$\text{LCM}(4, 5) = 20$$

$$(-3/4) \times (5/5) = -15/20$$

$$(-4/5) \times (4/4) = -16/20$$

We need to find 4 rational numbers between $-15/20$ and $-16/20$.

Multiply and divide both rational numbers by 5 we get,

$$(-15/20) \times (5/5) = -75/100$$

$$(-16/20) \times (5/5) = -80/100$$

Thus, we get 4 rational numbers between $-75/100$ and $-80/100$

$$(-75/100) > (-76/100) > (-77/100) > (-78/100) > (-79/100) > (-80/100)$$

$$(-3/4) > (-76/100) > (-77/100) > (-78/100) > (-79/100) > (-4/5)$$

6) The nearest integer to $-2/3$ is -1 .

Let us subtract 'x' from $-2/3$ to get -1 .

Then,

$$(-2/3) - x = -1$$

Or $(-2/3) + 1 = x$

Find LCM of denominators and simplify

$$x = (-2+3)/3 = 1/3$$

Hence, $1/3$ has to be subtracted from $-2/3$ to get the nearest integer.

Extra questions

1) Fill in the blanks with correct symbol(=, >, <)

a) $-3/5$ $-5/3$

b) $-11/15$ $22/-30$

c) $-9/32$ $27/-96$

Answers:

a) Convert into equivalent fractions with LCM as denominator and then compare.

Ans: $(-3/5) > (-5/3)$

b) Reduce to standard form and compare.

Ans: $(-11/15) = \{22/(-30)\}$

c) Reduce to standard form and compare.

Ans: $(-9/32) < (27/-96)$

2) Write the following in ascending order

$1/2, 2/3, -1/3, -5/6$

Ans:

Find LCM of denominators.

$LCM(2,3,6) = 6$

Express each rational number with denominator 6.

$(1/2) \times (3/3) = 3/6$

$(2/3) \times (2/2) = 4/6$

$(-1/3) \times (2/2) = -2/6$

$(-5/6) \times (1/1) = -5/6$

Arranging the above in ascending order, we get,

$(-5/6) < (-2/6) < (3/6) < (4/6)$

Thus, $(-5/6) < (-1/3) < (1/2) < (2/3)$.

Image Source: Original contribution by vallisairam9@gmail.com

Time to teach	Asset type	Theme	Sub Theme
20 minutes	Questions to Assess	Rational Numbers	Comparing Rational numbers

VC_You and Your Family - A Rational Number

A rational number is defined as a number that can be expressed in the form p/q , where p and q are integers and q is not 0. Sometimes this is referred to as a simple fraction. So rational numbers include integers & fractions.

Take the analogy of a family. Imagine the denominator represents your entire family, and the numerator represents you, as a part of the family. Although there is a line demarcating the numerator and denominator, the fraction is one entire unit denoting strong stable support to the numerator. Hence the essential qualities of a family are:

- All the family members need to be attached to each other through mutual love, kindness, respect, team work, mutual loyalty and a positive sensitivity towards each other.
- They need to form a strong support system for every member of the family.

Now let us look at a story that explains how we can be kind, sensitive and supportive of other members of the family.

One cold winter night, a family of two children & their parents sat together for their dinner. Mother prepared the dinner after a very long & tiring day. She placed a plate of sabzi (Gravy of vegetables) & rotis (Indian flat bread) in front of the father but the rotis were burnt.



The children curiously looked at the reaction of their father who himself came back home from work after a long day. But the father quietly ate his rotis without any comment.



The mother apologized to their father for the burnt rotis.



But to the surprise of the children, father said, “Don’t worry dear, I love the burnt rotis”.

Later that night, just before going to sleep, the children mustered their courage, went to their father and asked him, “Dad! Do you really love burnt rotis?”

He put his arms around their shoulders and said, “your mother puts in a very long day at work and is very tired. Moreover a burnt roti is never going to hurt anyone, but harsh words would!”



Your mother puts in a very long day at work and is very tired". Moreover a burnt roti is never going to hurt anyone, but harsh words would!

He continued to say "Life is full of imperfect things and imperfect people. I am myself hardly perfect."

But what the children learnt from that incident got fixed on their minds over years. They learnt to accept one another's faults and to celebrate each other's differences. They understood that this is one of the most important keys for building a healthy, growing and lasting relationship.

So Children! Remember!

- Love the people who treat you right & show compassion towards people who don't.
- This is true not only with your family members but also with everyone else in the society around you.
- Kindness towards others is most important in life.
- People may or may not remember what you do to them or they may forget what you said to them. But they will always remember the way you made them feel.

Image Source: SSSVV Gallery

Time to teach	Asset type	Value	Sub Value
5 minutes	Value Content	Love	Kindness

MS_Summary Rational Numbers

Summary - Rational Numbers

- Rational number is a number of the form $\frac{p}{q}$ where p, q are integers, $q \neq 0$.

Example: $-\frac{2}{5}, \frac{4}{7}, \frac{3}{-8}$

- All integers and fractions are rational numbers
- Rational numbers can be either positive or negative
- A rational number $\frac{p}{q}$ is said to be positive if both numerator and denominator are of the same sign
- A rational number $\frac{p}{q}$ is said to be negative if both numerator and denominator are of opposite signs such that one of them is a positive integer and the other is negative integer
- Example: $-\frac{5}{3}, \frac{1}{-2}$
- Zero is neither positive nor negative rational number
- Rational numbers are extensively used in many real life situations
- By multiplying or dividing the numerator and denominator of a rational number by a non – zero integer we get a rational number equivalent to the given rational number

Example: $\frac{2}{3} = \frac{2}{3} \times \frac{2}{2} = \frac{4}{6}$

$\frac{2}{3}$ and $\frac{4}{6}$ are equivalent rational numbers

$$\frac{-27}{72} = \frac{-27 \div 9}{72 \div 9} = \frac{-3}{8}$$

$\frac{-3}{8}$ and $\frac{-27}{72}$ are equivalent rational numbers

- Any rational can be plotted on a number line. A positive rational number is represented to the right of zero and a negative rational number is represented to the left of zero
- A rational number $\frac{p}{q}$ is said to be in standard form if q is positive and integers p, q have no common factor other than 1

Example: $-\frac{3}{5}, \frac{4}{7}$

- There exist infinitely many rational numbers between any two rational numbers
- When the denominators are the same, the sum of two rational numbers is obtained by adding up the numerators. When the rational numbers have different denominators, then LCM of denominators is taken. Equivalent of both the rational numbers with same denominators is obtained. Then the two rational numbers are added

Example: $\frac{5}{12} + \frac{7}{18} = \frac{15}{36} + \frac{14}{36} = \frac{29}{36}$

Here LCM of 12 and 18 is 36

- While subtracting a rational number from another we add the additive inverse of the rational number to be subtracted to the other rational number

Example: $\frac{7}{3} - \frac{2}{3} = \frac{7}{3} + \text{additive inverse of } \frac{2}{3}$

$$\frac{7}{3} + \frac{-2}{3} = \frac{7+(-2)}{3} = \frac{5}{3}$$

- Product of two rational numbers = $\frac{\text{Product of the numerators}}{\text{Product of the denominators}}$
- Dividing any rational number by another non-zero rational number is equivalent to multiplying the rational number by the reciprocal of the number

Example: $\frac{3}{4} \div \frac{2}{9} = \frac{3}{4} \times \text{Reciprocal of } \frac{2}{9}$

$$= \frac{3}{4} \times \frac{9}{2} = \frac{27}{8}$$

- A rational number of the form $\frac{p}{q}$ denotes p parts out of q. Similarly, each of us is a part of our family. We are bound by the value of mutual love and kindness

Time to teach	Asset type	Theme	Sub Theme
5 minutes	Main Script	Rational Numbers	Comparing Rational numbers

Master Lesson Plan

Seven Asset Methodology for MLP

What is the purpose of this Master lesson Plan?	This Master Lesson Plan (MLP) prepared by Sri Sathya Sai Vidya Vahini (SSSVV), covers the entire chapter for the given board. The MLP for the chapter given in the textbook is broken down into smaller modules known as assets. Any chapter can be taught using the 7 asset types in SSSVV methodology. Several different assets together complete the entire chapter. Depending on the requirement, each asset is supported by teaching aids such as animated presentation, audio, video, and learning aids such as worksheets. The MLP is for the teacher's preparation and the teaching aids are for use in the classroom.
How to use it?	You can prepare for your class with this MLP by following 3 simple steps: 1. Read your textbook; 2. Go through the information given in the assets (document & multimedia); 3. Prepare your teaching notes. Great! Now you are ready to transact the chapter.
Duration	Kindly note the duration given for each asset. Due care has been taken in planning the assets, to ensure the chapter is completed within the time specified by the Board. Note: Preparation time is not included in the asset duration. The teaching time depends on the duration of the teaching aids and is not impacted by the length of the MLP.
What is a 'Main Script' (MS) Asset?	The Main Script asset is there for explaining the main concepts of the chapter clearly. The information given in the textbook is simplified, organised and structured to give more clarity. Additionally, you may find a video or mnemonics or a graphic organiser to deepen the understanding of the concept.
How to teach using the MS asset?	Please use the blackboard, slides and interaction to develop the concept.
What is an 'Inquisitive Questions' (IQ) asset?	The Inquisitive Questions asset uses questions to promote higher order thinking like the n^{th} why, what-if, new perspectives, cause-effect, and others, creating curiosity.
How to teach using the IQ asset?	You may use the questions to connect with the students, encourage exploration to engage them in the learning process. You may allow multiple responses and instead of rejecting any of the responses, ask why, before revealing the suggested answer or hints.
What is a 'Day to day Relevance' (DD) Asset?	The Day to Day Relevance asset helps students understand the practical relevance of every topic, making them eager participants in the classroom. If students connect the concepts to their environment, they would learn meaningfully without dislike or simply memorizing for exams.

How to teach using the DD asset?	You may use the asset by asking questions about their experience and use it to establish why they are learning the topic. If necessary you may substitute with a recent or local example.
What is an 'Interesting Aside' (IA) asset?	The Interesting Aside asset uses attention grabbing titbits or anecdotes to bring joy and satisfy the child's hunger to know more. This is a quick/short asset intended to bring attention back to the main concept being taught.
How to teach using the IA asset?	You may use this asset to give a piece of interesting information relevant to the topic, without prolonged explanation/discussion. You may suggest appropriate books for further reading.
What is a 'Suggested Activity' (SA) Asset?	The Suggested Activity asset provides a detailed step by step procedure for the teacher to conduct a hands-on activity. This promotes Activity Based Learning.
How to teach using the SA asset?	You may use this asset to energise your students to learn by doing simple, fun-filled activities based on the topic. The asset includes - preparation, activity, and follow-up. You may engage the students in the preparation and follow-up stages to develop collaboration and responsibility. You could try it once, yourself, before the actual delivery to be more comfortable with it. Note: The duration mentioned in the asset is usually for the activity part only.
What is a 'Value Content' (VC) Asset?	The Value Content asset integrates Universal Human Values (such as empathy, inclusivity, respect for nature that translates into responsible behaviour) seamlessly into the curriculum, as the "End of education is character".
How to teach using the VC asset?	You may use this asset to engage with the students to bring out their innate values and connect with the intrinsic values in the topic/concept. The asset includes pointers on the specific pedagogical technique followed.
What is a 'Questions to Assess' (QA) asset?	The Questions to Assess asset uses an interactive approach to check learning of different types of learners, and provides feedback to the teacher for appropriate action. The questions cater to all the levels of Bloom's Taxonomy. Questions from 'Apply' level and above enable students to reflect on their learning.
How to teach using the QA asset?	You may go through the slides to understand its flow and know when to click for the answer (slides include suggested answers). While presenting in the class, you may display the question and encourage multiple responses, before revealing the answer. In some cases, this asset may include extra questions/worksheet that can be given as homework.