

Class: 7	Subject: Math	Topic: Rational Numbers
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SUMMARY SHEET		
Learner Previous Knowledge	Whole numbers, natural numbers, integers, fractions.	
Target Knowledge for this Topic	Understand how rational numbers came into being in study of number system. Introduction to rational numbers. Represent rational numbers on a number line (horizontal and vertical). Comparing and ordering of rational numbers with and without number line. Understand that there are infinite numbers of rational numbers between two rational numbers. Find rational numbers between any two rational numbers. Perform addition, subtraction, multiplication, division of rational numbers. Solve simple word problems on addition and subtraction of rational numbers.	
Learning Goals		
More Complex Learning Goal- Students will be able to describe how or why rational numbers came into being in study of number system.		
Target Learning Goal – Students will be able to order rational numbers solve problems on addition, subtraction, multiplication and division of rational numbers.		
Simpler Learning Goal- Students will be able to recognize rational numbers in number system.		
Period No.	Lesson Objectives	Teaching Learning Materials Required
1	- Recapitulation of fraction. - Introduction to rational numbers. - Know the history of origin of rational numbers.	Worksheet-1 (1 per student);

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2	• Know types of rational numbers and their comparison with other forms of numbers like whole numbers, integers, fractions and decimals. • Represent rational number on a number line. • Comparing and ordering of without number line. • Write rational numbers in standard form.	• Representation on number line: Worksheet-2, Worksheet-3 (1 per person)
3 & 4 <i>Note: this plan will take 2 days</i>	• Compare two rational numbers. • Understand that there are infinite numbers of rational numbers between two rational numbers. • Find out rational numbers between given pair of rational number.	Comparison of rational numbers: Worksheet -4 (1 per student); projector (1 per class) • Number of rational numbers between two numbers: Worksheet-5 (1 per student of the group);
5 and 6 <i>Note: this plan will take 2 days</i>	• Perform addition, subtraction, multiplication, division of rational numbers. • Solve simple word problem on addition, subtraction, multiplication and division of rational numbers.	• Addition and subtraction: A4 sheet (1 per student); • Multiplication: Worksheet-6 (1 per student); • Division: Worksheet-7 (1 per student); Projector (1 per class);

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Period 1

Lesson Objectives

At the end of this lesson students will be able to:

- Recapitulate concept of fractions.
- Introduction to rational numbers.
- Understand how rational numbers came into being in study of number system.

Teaching Learning Materials required

- Worksheets: **Worksheets-1**

Details of Teaching Learning Experience

Seating Arrangement: In groups of 4 to 6 in the computer lab

Lesson Beginning <u>Time:</u> 10 mins . <u>Purpose:</u> Activate prior knowledge To introduce the topic	<u>Discussion/Groups</u> • Provide Worksheet-1 to students to recall about fractions • Give 10 mins time to students and let them discuss among others and then discuss the worksheet <i>Note: The intent here is to recall the fractional forms of the whole numbers and the steps used to convert the whole numbers into the fractional form. Also, through discussion help students to arrive at the understanding that depth below sea level can be represented by putting a negative sign before the fraction.</i> • Ask, students is there any other name which they can use for $\frac{3}{4}$ and $-\frac{3}{4}$ instead of fractions?
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	<i>Note: Students can come up with a name negative fraction and positive fraction as they can relate the knowledge with integers. In such a case accept their responses.</i>
Lesson Middle <u>Time:</u> 15 minutes <u>Purpose:</u> Introduce the topic Develop conceptual understanding	<u>Introduction to rational number/Groups</u> Tell them that they are going to do a research work to find out what these types of numbers – $\frac{3}{4}$ and $\frac{3}{4}$ are called as instead of positive and negative fractions? <i>Note: Though students are doing the research work in groups but they are going to record the findings individually on the given A4 sheet. Also the intent here is to arrive at the fact that there are positive and negative fractions which can be named as rational numbers.</i>
Lesson End <u>Time:</u> 15 minutes <u>Purpose:</u> Consolidate students learning	<u>Discussion/ Whole class</u> - Project Worksheet-1 - Hold a class discussion for students to share the definition and examples of rational numbers collected by them during the research work. - Understand how rational numbers came into being in study of number system. - Build a class consensus on the definition of rational numbers which they have created own their own. <i>Note: Students may come up with incorrect and illogical definitions. In this case, ask other students who may have the correct definition or explanation of what rational number are to explain and justify. It is important to build consensus – this will help eradicate any errors.</i> <u>Home assignment</u> - Tell students to list four different rational numbers.

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Worksheet-1

Topic: Rational Numbers

1. Circle the rational numbers from the given set of numbers:

-3	2	$\frac{3}{4}$	$-\frac{1}{2}$	24
-4	$\frac{4}{5}$	$-\frac{6}{7}$	44	63

2. Explain why $\frac{3}{4}$ is plotted to the right of $\frac{1}{4}$ on the number line but $-\frac{3}{4}$ is plotted to the left of $-\frac{1}{4}$.

3. Find two rational numbers greater than $\frac{1}{3}$ whose product is lesser than $\frac{1}{3}$.

4. Kelly and Marina finds $-4\frac{1}{6} \times 2\frac{2}{9}$. Is either of them correct? Explain your reasoning

Kelly

$$-4\frac{1}{6} \cdot 2\frac{2}{9} = -4\frac{1}{\frac{6}{3}} \cdot 2\frac{2}{9}$$

$$= -8\frac{1}{27}$$

Marina

$$-4\frac{1}{6} \cdot 2\frac{2}{9} = \frac{25}{\frac{6}{3}} \cdot \frac{20}{9}$$

$$= \frac{250}{27} \text{ or } -9\frac{7}{27}$$

5. Which is greater? $40 \times \frac{1}{4}$ or $40 \div \frac{1}{4}$? Explain

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Period 2

Lesson Objectives

At the end of this lesson students will be able to:

- Compare rational numbers with other forms of numbers like whole numbers, integers, fractions and decimals.
- Represent rational numbers on a number line.
- Compare and order rational numbers with number line.
- Write rational numbers in standard form.

Teaching Learning Materials required

- **Representation on number line: Worksheet-2**(1 per student); **Worksheet-3** (1 per student)

Details of Teaching Learning Experience

Seating Arrangement: In groups of 4 to 6

Lesson Beginning <u>Time:</u> 10 mins. <u>Purpose:</u> Activate prior knowledge Develop the conceptual understanding Consolidate students learning	<u>Discussion group/Whole Class</u> • Review the definitions of all forms of numbers in the number system like natural numbers, whole numbers, integers, fractions and rational numbers. <i>Note:</i> • <i>Ensure that they come up with the types of fraction: negative rational number and positive rational numbers</i> • <i>Equivalent rational number.</i> • <i>Comparison between all forms of numbers.</i>
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	<i>Note: Students may come up with incorrect and illogical definitions and relevance. In this case, ask other students who may have the correct answers to justify. It is important to build consensus – this will help eradicate any errors.</i>
Lesson Middle <u>Time:</u> 15 minutes <u>Purpose:</u> Activate prior knowledge Introduce the topic Develop conceptual understanding	<u>Representation of rational numbers on number line</u> • Provide Worksheet-2 to each student of the group and ask students to complete it. • Also ask them to give reasons for their answer. • Give them time to answer the given questions <u>Discussion/whole class:</u> • Project Worksheet-2. • Ask a few students at random to share the representation of positive and negative rational numbers on a number line along with their reasons behind the placement of both the numbers. <i>Note: students may come up with incorrect answers. In this case, ask other students who may have the correct answers to explain and justify. It is important to build consensus on all answers – this will help eradicate any errors. Also, make sure they will come up with the given explanations:</i> • <i>As done in the case of positive integers, the positive rational numbers would be marked on the right of 0 and the negative rational numbers would be marked on the left of 0.</i> <u>Order of rational numbers</u> • Distribute the Worksheet-3 • Ask students to follow the instruction on worksheet and answer the questions and derive a conclusion at the end. <u>Discussion /whole class:</u> • Project Worksheet-3.

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	- Ask a few students at random to share the answers of all the questions. - Build a class consensus on the end conclusion that rational numbers on the right side of the 0 are arranged in ascending order and rational numbers on the left side of the 0 are arranged in descending order. <i>Note: students may come up with incorrect answers. In this case, ask other students who may have the correct answers to explain and justify. It is important to build consensus on all answers – this will help eradicate any errors.</i>
Lesson End <u>Time:</u> 15 minutes <u>Purpose:</u> Activate the prior knowledge Introduce the topic Recap student understanding	<u>Standard form of rational numbers/ Whole Class</u> - Write few rational numbers on blackboard like $\frac{3}{8}, \frac{-6}{7}, \frac{13}{9}, \frac{-12}{31}$ - Ask students what they observe: - About numerators of each rational number. - Denominator of each of them. - What is the common factor of numerator and denominator of each fraction? - What these forms of rational numbers are called as? - How can they reduce the rational number $\frac{45}{30}$ to its standard form? - Eradicate the steps to reduce the rational number to its standard form. - Take up a discussion on the above asked questions and build the students consensus on the standard form of the rational numbers. - After the discussion allow students to write what have they understood about the standard form of rational numbers along with the steps to reduce the rational number to its standard form in their own words in the math notebook. <i>Note: students may come up with incorrect answers. In this case, ask other students who may have the correct answers to explain and justify. It is important to build consensus on all answers – this will help eradicate any errors. Also, make them deduce the fact from the discussion that a rational number is said to be in the standard form if its denominator is a positive integer and the numerator and denominator have no common factor other than 1 for example: $\frac{3}{5}, \frac{-5}{8}, \frac{4}{7}, \frac{-7}{11}$ the denominators of their rational numbers are positive</i>

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	<i>integers and 1 is the only common factor in between the numerators and denominators. The negative sign occurs only in the numerator.</i> <u>Home assignment</u> Tell the students to practice questions 2 to 7- Exercise 9.1 on Pg 182 of NCERT Textbook.
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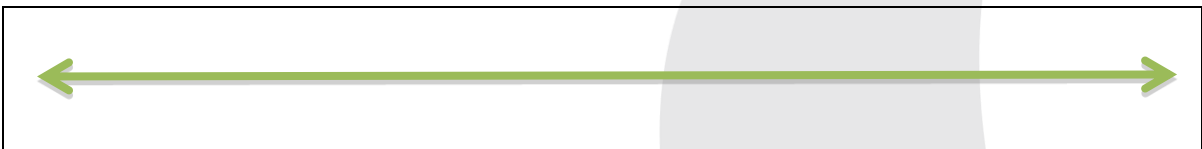
Worksheet-2

Skill: Logical Reasoning

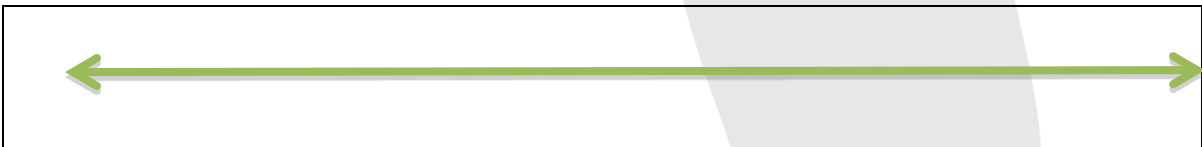
Topic: Representation of Rational numbers on a number line

Directions- Represent the given numbers on number line

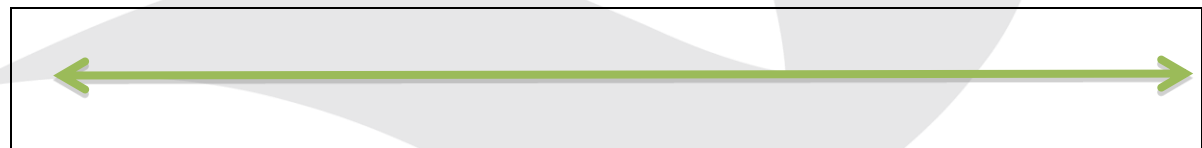
1. Mark $\frac{5}{9}$ on the given number line.



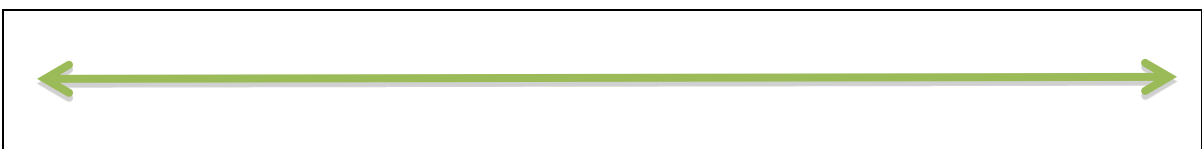
2. Mark $\frac{3}{4}$ on the number line.



3. Mark $\frac{-3}{4}$ on the number line.



4. Mark $-\frac{1}{2}$ on the number line



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5. Mark $\frac{4}{5}$ on the number line.



Name: _____

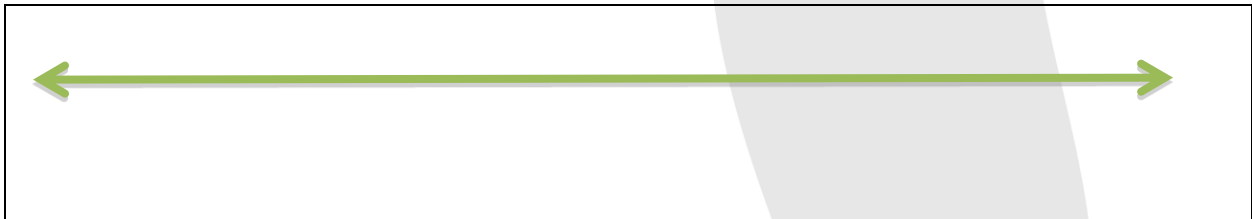
Worksheet-3

Skill: Problem Solving

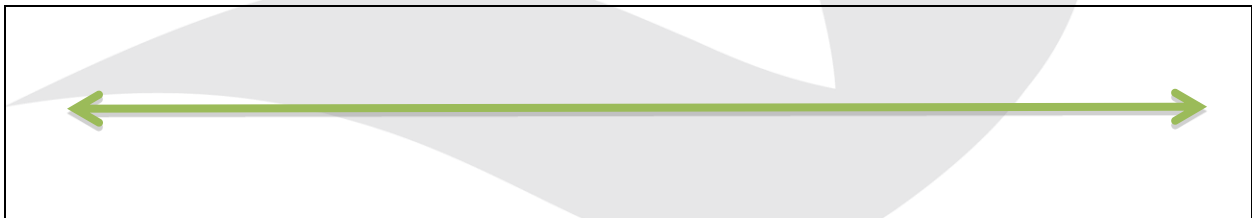
Topic: Representation of rational numbers on a number line

Directions: Represent the given numbers on number line

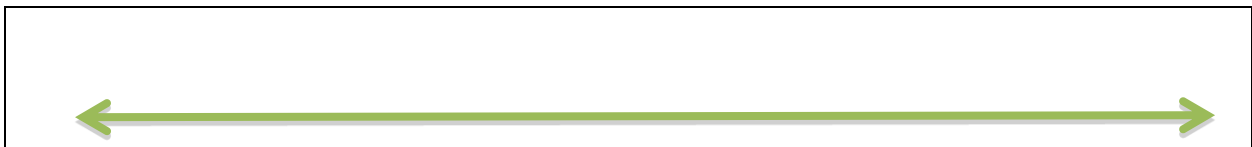
1. Mark two rational numbers $\frac{7}{2}$ and $-\frac{7}{2}$ on the number line.



2. Mark any one rational number between 0 and $\frac{7}{2}$ and another rational number between 0 and $-\frac{7}{2}$.



3. Continue the process and mark all rational numbers in between $\frac{7}{2}$ and $-\frac{7}{2}$



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4. Now describe in which order the numbers in both directions are arranged. What can you conclude with this activity?

Period 3 & 4

Lesson Objectives

At the end of this lesson students will be able to:

- Compare two rational numbers.
- Understand that there are infinite number of rational numbers between two rational numbers.
- Find out rational numbers between given pair of rational numbers.

Teaching Learning Materials required

- **Comparison of rational numbers: Worksheet-4** (1 per student);
- **Number of rational numbers between two numbers: Worksheet-5** (1 per student of the group);

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Seating Arrangement: In groups of 4 to 6

Lesson Beginning <u>Time:</u> 15 mins <u>Purpose:</u> Activate prior knowledge	<u>Recap/ Whole Class</u> • Provide Worksheet-4 to students and give them to complete the sheet. • Discuss the correct answers. • Later, collect the sheets for review. <u>Review Homework/ Peer check</u> • Ask the students, if they have any doubts regarding the home assignment. • Ask students to exchange their homework sheet with their respective neighbors in the group. • Give below instruction: ○ Check the answers you have. ○ And make necessary correction if needed.
Lesson Middle <u>Time:</u> 30 minutes <u>Purpose:</u> Activate prior knowledge Introduce the topic Develop conceptual understanding	<u>Comparison of rational numbers</u> • Distribute Worksheet -5 to each student of the group. • Ask them to read the instructions carefully and do the worksheet. • Also, derive the conclusion at the end. • Give them 15 mins to complete the task. <u>Discussion /whole class:</u> • Project Worksheet-5. • Ask: ○ Share the examples to support the first question. ○ How can you compare two positive rational numbers? ○ They are similar with _____ comparison? ○ How can they compare two negative rational numbers? Support their answers using the number line. ○ What conclusion can they draw? ○ How can you compare a positive and a negative rational numbers?

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	• Build a class consensus on the above asked questions. <i>Note: Students may come up with incorrect answers. In this case, ask other students who may have the correct answers to explain and justify. It is important to build consensus on all answers – this will help eradicate any errors. Also, make sure you guide them to come up with the given explanations:</i> ○ The comparison of two positive rational numbers is similar to the comparison of fractions. ○ To compare two negative rational numbers, we compare them ignoring their negative signs and then reverse the order. ○ Comparison of a negative and a positive rational number is obvious. A negative rational number is to the left of zero whereas a positive rational number is to the right of zero on a number line. So, a negative rational number will always be less than a positive rational number.
Lesson End <u>Time:</u> 35 minutes <u>Purpose:</u> Recap student understanding	<u>Number of rational numbers between two rational numbers</u> • Ask them to read the instructions carefully and do the worksheet along with the end conclusion. • Give them 15 mins to complete the task. <u>Discussion /whole class:</u> • Ask a few students at random to share the answers of the questions. • Build a class consensus on each answer of the questions. <i>Note: students may come up with incorrect answers. In this case, ask other students who may have the correct answers to explain and justify. It is important to build consensus on the fact that there are finite numbers in between the whole numbers and integers. But there are infinite numbers of rational numbers in between two rational numbers.</i> <u>Discussion/ Whole Class</u>

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	<i>Take up this lesson end discussion at the same day if time permits or else take up this discussion in the beginning of the next class.</i> <u>Home Assignment</u> Tell the students to practice questions 1, 8, 9, 10- Exercise 9.1 on pg 182 of NCERT Textbook.
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Worksheet-4

Skill: Logical Reasoning

Topic: Comparison of Rational Numbers

Directions: Read and answer the questions

- You know how to compare two integers or two fractions and tell which is smaller or which is greater among them. Give examples to support the statement.

- If you have to compare two positive rational numbers ($\frac{2}{3}$ and $\frac{5}{7}$) how can you compare them? Is it similar to any form of comparison of numbers?

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3. How can you compare 2 negative rational numbers ($-\frac{1}{2}$ and $-\frac{1}{5}$)? Explain using the number line.

4. What can you conclude with the above activity?

Practice Questions

1. Compare
- (i) $\frac{9}{15}$ and $\frac{11}{6}$
 - (ii) $\frac{3}{-14}$ and $-\frac{5}{21}$

2. Arrange the rational numbers $-\frac{3}{7}$, $\frac{5}{-14}$, $-\frac{7}{12}$ in ascending order.

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3. Which of the two rational numbers is greater?

- (i) $-7/12$ or $5/12$
(ii) $-3/14$ or $-6/7$

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Worksheet-5
Solving

Skill: Problem

Topic: Rational numbers between rational numbers

Directions: Solve the given problems.

1. List all rational numbers in between $2/8$ and $9/8$ on the number line.



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2. How many rational numbers lie in between $\frac{2}{8}$ and $\frac{7}{8}$? Give reasons.

3. List three rational numbers between -2 and -1 .

4. List five rational numbers between $-\frac{4}{5}$ and $-\frac{2}{3}$.

5. List ten rational numbers between $-\frac{3}{11}$ and $\frac{8}{11}$.

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Period 5 and 6

Lesson Objectives

At the end of this lesson students will be able to:

- Perform addition, subtraction, multiplication, division of rational numbers.
- Solve simple word problem on addition and subtraction of rational numbers.

Teaching Learning Materials required

- **Addition and subtraction:** A4 sheet (1 per student);
- **Multiplication: Worksheet - 6** (1 per student);
- **Division: Worksheet- 7** (1 per student);

Details of Teaching Learning Experience

Seating Arrangement: In groups of 4 to 6

Lesson Beginning <u>Time:</u> 35 mins. <u>Purpose:</u> Activate prior knowledge To introduce the topic Develop conceptual understanding	<u>Addition and subtraction of rational numbers/ Pairs</u> • Provide A4 sheet to students and tell them that today they are going to work in pairs. • Instruct students to write any rational number on their sheet. • Ask the following questions and tell them to record the same on the given A4 sheet while discussing with their partner: ○ What will be the additive inverse of this rational number? ○ What will be the sum of these two rational numbers? ○ Is the sum also a rational number? ○ What will be their difference? ○ What do you observe? • Write two rational numbers (with same denominator) on the black board and ask students: ○ What will be the sum of these two rational numbers? ○ What will be the difference of these two rational numbers? ○ What do they observe?
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	○ Is sum or difference of two rational numbers is also a rational number? ○ How will they add/subtract two rational numbers with different denominators? ○ Ask them to recall the addition of fraction with different denominators. <u>Discussion Group/ Whole Class</u> <i>Note: The intent here is to recall the addition and subtraction of fractions and relate them with the addition and subtraction of fractions. Make sure that the students answer questions you ask on their A4 sheet by following the steps. The purpose here is to eradicate the following facts:</i> • <i>In case of adding rational numbers with same denominators, we add the numerators keeping the denominators same.</i> • <i>In the case of rational numbers with different denominators, we first find the LCM of the two denominators. Then, we find the equivalent rational numbers of the given rational numbers with this LCM as the denominator. Then, add the two rational numbers. (Recall the addition of fraction with different denominators.)</i>
Lesson Middle <u>Time:</u> 20 minutes <u>Purpose:</u> Develop conceptual understanding	<u>Multiplication of rational numbers</u> • Provide Worksheet-6 to each student of the group. • Ask them to answer the questions given in the sheet while discussing in their respective groups. • Give them 10 mins to solve the sheet. <u>Discussion/whole class:</u> • Project Worksheet-6 • Ask a few students at random to share the answers of the questions.

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	• Build a class consensus on the multiplication of rational numbers using the number line and the knowledge of fractions. <u>Discussion group/ Whole Class</u> <i>Note: students may come up with incorrect answers. In this case, ask other students who may have the correct answers to explain and justify. It is important to build consensus on the following points:</i> ○ While multiplying a rational number by a positive integer, we multiply the numerator by that integer, keeping the denominator unchanged. ○ While multiplying two negative rational numbers we get a positive product.
Lesson End <u>Time:</u> 25 minutes <u>Purpose:</u> Recap student understanding	<u>Division of Rational numbers/ Groups</u> • Distribute Worksheet-7 • Ask them to answer the questions given in the sheet while discussing in their respective groups. • Give them 10 mins to solve the sheet. <u>Discussion/whole class</u> • Project Worksheet-7 • Ask a few students at random to share the answers of the questions. • Build a class consensus on the reciprocal of rational numbers and steps related to the division of rational numbers. <u>Discussion group/ Whole Class</u> <i>Note: students may come up with incorrect answers. In this case, ask other students who may have the correct answers to explain and justify. It is important to build consensus on the following points:</i>

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	○ The product of a rational number with its reciprocal is always 1 whether the numbers are positive or negative. ○ To divide one rational number by the other rational number we multiply the rational number by the reciprocal of the other. ● Collect the worksheets for review. <u>Home assignment</u> ● Tell the students to practice questions on Pg 190-Exercise 9.2 of NCERT Textbook.
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Worksheet-6

Skill: Problem Solving

Topic: Multiplication of rational numbers

Directions: Solve the given problems

1. Multiply:

- (i) $\frac{4}{9}$ by $\frac{5}{7}$
- (ii) $-\frac{7}{10}$ by $\frac{5}{8}$
- (iii) $\frac{11}{12}$ by $-\frac{8}{15}$

2. Multiply

- (i) $-\frac{9}{16}$ by 60
- (ii) $-\frac{9}{7}$ by -14
- (iii) $28/(-9)$ by -27

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2. Divide

- (i) 8 by $-\frac{4}{9}$
- (ii) $\frac{1}{-4}$ by $\frac{1}{12}$
- (iii) $\frac{50}{77}$ by (-25)
- (iv) $\frac{65}{12}$ by $\frac{13}{15}$

3. Divide the reciprocal of $\frac{2}{5} \times \frac{-10}{3}$ by $\left(\frac{1}{2} - \frac{1}{3}\right)$.

4. Verify that $(x \div y)^{-1} = x^{-1} \div y^{-1}$ by taking $x = \frac{7}{11}, y = \frac{-22}{21}$.
