CHAPTER-1

Rational Numbers

1Mark Q&A

Exercise 1.1

1. How to Identify a Rational Number?

If the Number is expressed in the form of p/q where p, q are integers and q is non zero then it called a Rational Number.

2. Is 5 a Rational Number?

Yes, 5 is a Rational Number as it can be expressed in the form of 5/1.

3. What do we get on adding zero to a Rational Number?

On Adding Zero to a Rational Number, you will get the Same Rational Number.

4. What is the difference between Rational and Irrational Numbers?

Rational Numbers are terminating decimals whereas Irrational Numbers are Non-Terminating Decimals.

5. Example 1.

Identify whether Mixed Fraction 1 3/4 is a Rational Number or Not?

Solution: The Simplest Form of Mixed Number 1 3/4 is 7/4

Numerator = 7 which is an integer

Denominator = 4 which is an integer and not equal to 0.

Thus, 7/4 is a Rational Number.

Exercise 1.2

***Fill in the blanks.**

(i) Zero has _____reciprocal.

(ii) The numbers _____and _____are their own reciprocals

(iii) The reciprocal of – 5 is _____.

(iv) Reciprocal of 1/x, where x ≠ 0 is _____.

(v) The product of two rational numbers is always a _____.

(vi) The reciprocal of a positive rational number is _____.

Solution:

(i) Zero has no reciprocal.

(ii) The numbers -1 and 1 are their own reciprocals

(iii) The reciprocal of – 5 is -1/5.

(iv) Reciprocal of 1/x, where $x \neq 0$ is x.

(v) The product of two rational numbers is always a rational number.

(vi) The reciprocal of a positive rational number is positive.

2Marks Q&A

Exercise 1.3

1. Using appropriate properties, find:

(i) -2/3 × 3/5 + 5/2 – 3/5 × 1/6

Solution:

-2/3 × 3/5 + 5/2 – 3/5 × 1/6

= -2/3 × 3/5– 3/5 × 1/6+ 5/2 (by commutativity)

= 3/5 (-2/3 – 1/6)+ 5/2

= 3/5 ((- 4 – 1)/6)+ 5/2

= 3/5 ((–5)/6)+ 5/2 (by distributivity)

= – 15 /30 + 5/2

= – 1 /2 + 5/2

= 4/2

= 2

(ii) $2/5 \times (-3/7) - 1/6 \times 3/2 + 1/14 \times 2/5$

Solution:

$2/5 \times (-3/7) - 1/6 \times 3/2 + 1/14 \times 2/5$

$= 2/5 \times (-3/7) + 1/14 \times 2/5 - (1/6 \times 3/2)$ (by commutativity)

$= 2/5 \times (-3/7 + 1/14) - 3/12$

$= 2/5 \times ((-6 + 1)/14) - 3/12$

$= 2/5 \times ((-5)/14)) - 1/4$

$= (-10/70) - 1/4$

$= -1/7 - 1/4$

$= (-4-7)/28$

$= -11/28$

2. Write the additive inverse of each of the following:

Solution:

(i) 2/8

The Additive inverse of 2/8 is – 2/8

(ii) -5/9

The additive inverse of -5/9 is 5/9

(iii) -6/-5 = 6/5

The additive inverse of 6/5 is -6/5

(iv) 2/-9 = -2/9

The additive inverse of -2/9 is 2/9

(v) 19/-16 = -19/16

The additive inverse of -19/16 is 19/16

3. Verify that: -(-x) = x for:

(i) x = 11/15

(ii) x = -13/17

Solution:

(i) x = 11/15

We have, x = 11/15

The additive inverse of x is – x (as x + (-x) = 0).

Then, the additive inverse of 11/15 is – 11/15 (as 11/15 + (-11/15) = 0).

The same equality, 11/15 + (-11/15) = 0, shows that the additive inverse of -11/15 is 11/15.

Or, – (-11/15) = 11/15

i.e., -(-x) = x

(ii) -13/17

We have, x = -13/17

The additive inverse of x is – x (as x + (-x) = 0).

Then, the additive inverse of -13/17 is 13/17 (as 13/17 + (-13/17) = 0).

The same equality (-13/17 + 13/17) = 0, shows that the additive inverse of 13/17 is -13/17.

Or, – (13/17) = -13/17,

i.e., -(-x) = x

4. Find the multiplicative inverse of the following:

(i) -13 (ii) -13/19 (iii) 1/5 (iv) -5/8 × (-3/7) (v) -1 × (-2/5) (vi) -1

Solution:

(i) -13

Multiplicative inverse of -13 is -1/13.

(ii) -13/19

Multiplicative inverse of -13/19 is -19/13.

(iii) 1/5

Multiplicative inverse of 1/5 is 5.

(iv) -5/8 × (-3/7) = 15/56

Multiplicative inverse of 15/56 is 56/15.

(v) -1 × (-2/5) = 2/5

Multiplicative inverse of 2/5 is 5/2.

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(vi) -1

Multiplicative inverse of -1 is -1.

5. Name the property under multiplication used in each of the following:

(i) -4/5 × 1 = 1 × (-4/5) = -4/5

(ii) -13/17 × (-2/7) = -2/7 × (-13/17)

(iii) -19/29 × 29/-19 = 1

Solution:

(i) -4/5 × 1 = 1 × (-4/5) = -4/5

Here 1 is the multiplicative identity.

(ii) -13/17 × (-2/7) = -2/7 × (-13/17)

The property of commutativity is used in the equation.

(iii) -19/29 × 29/-19 = 1

The multiplicative inverse is the property used in this equation.

6. Multiply 6/13 by the reciprocal of -7/16.

Solution:

Reciprocal of -7/16 = 16/-7 = -16/7

According to the question,

6/13 × (Reciprocal of -7/16)

6/13 × (-16/7) = -96/91

7. Tell what property allows you to compute 1/3 × (6 × 4/3) as (1/3 × 6) × 4/3.

Solution:

1/3 × (6 × 4/3) = (1/3 × 6) × 4/3

Here, the way in which factors are grouped in a multiplication problem supposedly does not change the product. Hence, the Associativity Property is used here.

8. Is 8/9 the multiplication inverse of $-1\frac{1}{8}$? Why or why not?

Solution:

$-1\frac{1}{8}$ = -9/8

[Multiplicative inverse ⟹ product should be 1]
According to the question,

8/9 × (-9/8) = -1 ≠ 1

Therefore, 8/9 is not the multiplicative inverse of $-1\frac{1}{8}$.

9. If 0.3 is the multiplicative inverse of $3\frac{1}{3}$? Why or why not?

Solution:

$3\frac{1}{3}$ = 10/3

0.3 = 3/10

[Multiplicative inverse ⟹ product should be 1]
According to the question,

3/10 × 10/3 = 1

Therefore, 0.3 is the multiplicative inverse of $3\frac{1}{3}$.

10. Write:

(i) The rational number that does not have a reciprocal.

(ii) The rational numbers that is equal to their reciprocals.

(iii) The rational number that is equal to its negative.

Solution:

(I) The rational number that does not have a reciprocal is 0.

Reason:

0 = 0/1

Reciprocal of 0 = 1/0, which is not defined.

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(ii) The rational numbers that are equal to their reciprocals are 1 and -1.

Reason:

1 = 1/1

Reciprocal of 1 = 1/1 = 1, similarly, reciprocal of -1 = – 1

(iii) The rational number that is equal to its negative is 0.

Reason:

Negative of 0=-0=0

Exercise 1.4

1. Represent these numbers on the number line.

(i) 7/4

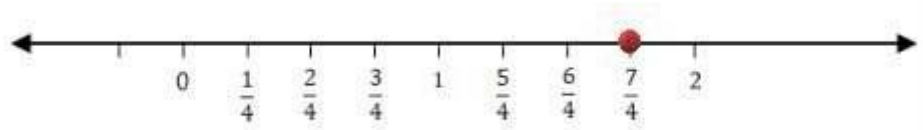
(ii) -5/6

Solution:

(i) 7/4

Divide the line between the whole numbers into 4 parts, i.e. divide the line between 0 and 1 to 4 parts, 1 and 2 to 4 parts, and so on.

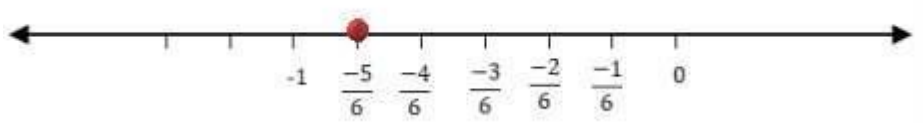
Thus, the rational number 7/4 lies at a distance of 7 points away from 0 towards the positive number line.



(ii) -5/6

Divide the line between the integers into 4 parts, i.e. divide the line between 0 and -1 to 6 parts, -1 and -2 to 6 parts, and so on. Here, since the numerator is less than the denominator, dividing 0 to – 1 into 6 parts is sufficient.

Thus, the rational number -5/6 lies at a distance of 5 points, away from 0, towards the negative number line.

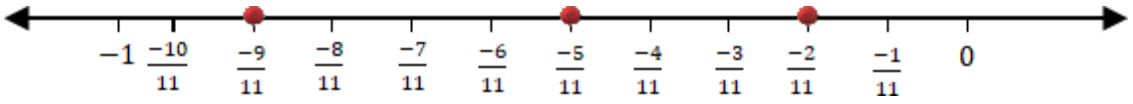


2. Represent -2/11, -5/11, -9/11 on a number line.

Solution:

Divide the line between the integers into 11 parts.

Thus, the rational numbers -2/11, -5/11, and -9/11 lie at a distance of 2, 5, and 9 points away from 0, towards the negative number line, respectively.



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3. Write five rational numbers which are smaller than 2.

Solution:

The number 2 can be written as 20/10

Hence, we can say that the five rational numbers which are smaller than 2 are:

2/10, 5/10, 10/10, 15/10, 19/10

4. Find the rational numbers between -2/5 and ½.

Solution:

Let us make the denominators the same, say 50.

-2/5 = (-2 × 10)/(5 × 10) = -20/50

½ = (1 × 25)/(2 × 25) = 25/50

Ten rational numbers between -2/5 and ½ = ten rational numbers between -20/50 and 25/50.

Therefore, ten rational numbers between -20/50 and 25/50 = -18/50, -15/50, -5/50, -2/50, 4/50, 5/50, 8/50, 12/50, 15/50, 20/50.

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5. Find five rational numbers between:

(i) 2/3 and 4/5

(ii) -3/2 and 5/3

(iii) ¼ and ½

Solution:

(i) 2/3 and 4/5

Let us make the denominators the same, say 60

i.e., 2/3 and 4/5 can be written as:

$2/3 = (2 \times 20)/(3 \times 20) = 40/60$

$4/5 = (4 \times 12)/(5 \times 12) = 48/60$

Five rational numbers between 2/3 and 4/5 = five rational numbers between 40/60 and 48/60.

Therefore, five rational numbers between 40/60 and 48/60 = 41/60, 42/60, 43/60, 44/60, 45/60.

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(ii) -3/2 and 5/3

Let us make the denominators the same, say 6

i.e., -3/2 and 5/3 can be written as:

$-3/2 = (-3 \times 3)/(2 \times 3) = -9/6$

$5/3 = (5 \times 2)/(3 \times 2) = 10/6$

Five rational numbers between -3/2 and 5/3 = five rational numbers between -9/6 and 10/6.

Therefore, five rational numbers between -9/6 and 10/6 = -1/6, 2/6, 3/6, 4/6, 5/6.

(iii) ¼ and ½

Let us make the denominators the same, say 24

i.e., ¼ and ½ can be written as:

$¼ = (1 \times 6)/(4 \times 6) = 6/24$

$½ = (1 \times 12)/(2 \times 12) = 12/24$

Five rational numbers between ¼ and ½ = five rational numbers between 6/24 and 12/24.

Therefore, five rational numbers between 6/24 and 12/24 = 7/24, 8/24, 9/24, 10/24, 11/24.

6. Write five rational numbers greater than -2.

Solution:

-2 can be written as – 20/10

Hence, we can say that the five rational numbers greater than -2 are

-10/10, -5/10, -1/10, 5/10, 7/10

7. Find ten rational numbers between 3/5 and ¾.

Solution:

Let us make the denominators the same, say 80.

3/5 = (3 × 16)/(5× 16) = 48/80

3/4 = (3 × 20)/(4 × 20) = 60/80

Ten rational numbers between 3/5 and ¾ = ten rational numbers between 48/80 and 60/80.

Therefore, ten rational numbers between 48/80 and 60/80 = 49/80, 50/80, 51/80, 52/80, 54/80, 55/80, 56/80, 57/80, 58/80, 59/80.

Exercise 1.5

MULTIPLE-CHOICE QUESTIONS:

1. **What is a rational number?**

   A) Any number that can be expressed as a fraction

   B) Any whole number

   C) Any number that cannot be expressed as a fraction

   D) Any decimal number

   Answer: A) Any number that can be expressed as a fraction

2. **Which of the following numbers is not a rational number?**

   A) 0.75

   B) 5/4

   C) $\sqrt{2}$

   D) -3

   Answer: C) $\sqrt{2}$

3. **Which of the following is a rational number in decimal form?**

   A) 0.333...

   B) 0.123456789...

   C) π

   D) $\sqrt{5}$

Answer: A) 0.333...

4. **What is the additive inverse of -7/8?**

A) 7/8

B) -7/8

C) 8/7

D) -8/7

Answer: A) 7/8

5. **Which of the following pairs of numbers are reciprocals of each other?**

A) 3 and 1/3

B) 5 and 2/5

C) -4 and 4

D) 0 and 1

Answer: A) 3 and 1/3

6. **What is the product of -1/2 and 4/5?**

A) -2/5

B) 2/5

C) -9/10

D) 1/10

Answer: A) -2/5

7. **If you add 3/4 to its reciprocal, what do you get?**

A) 1

B) 3/4

C) 7/4

D) 5/4

Answer: A) 1

8. **Simplify the expression: 2/3 + 1/6.**

A) 1/2

B) 2/3

C) 1/6

D) 4/3

Answer: A) 1/2

9. **What is the least common multiple (LCM) of 4 and 6?**

A) 6

B) 12

C) 24

D) 2

Answer: B) 12

10. **What is the greatest common factor (GCF) of 24 and 36?**

A) 6

B) 12

C) 24

D) 1

Answer: A) 6

Summary

1. Definition:

- Rational numbers are numbers that can be expressed as the quotient or fraction "a/b," where "a" and "b" are integers, and "b" is not equal to zero.

2. Examples:

- Examples of rational numbers include 3/4, -2/5, 0.6 (which is the same as 3/5), etc.

3. Operations:

- **Addition and Subtraction:** To add or subtract rational numbers, find a common denominator and perform the operation on the numerators.

- Example: (3/5) + (2/5) = 5/5 = 1

- **Multiplication:** Multiply the numerators together and the denominators together.

- Example: (2/3) * (4/5) = 8/15

- **Division:** Invert the divisor (the second fraction) and then multiply.

- Example: (2/3) ÷ (4/5) = (2/3) * (5/4) = 5/6

4. Simplification:

- Simplify fractions by dividing both the numerator and denominator by their greatest common factor.

- Example: (8/12) = (2/3) (divide both by 4)

5. Representation on the Number Line:

- Rational numbers can be plotted on the number line, and they may be positive, negative, or zero.

6. Terminology:

- The numerator is the top part of the fraction, and the denominator is the bottom part.

- Proper fractions have numerators smaller than denominators, while improper fractions have numerators equal to or greater than denominators.

7. Decimal Representation:

- Rational numbers can be expressed as decimals. Terminating decimals (e.g., 0.75) or repeating decimals (e.g., 0.333...) are examples.

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