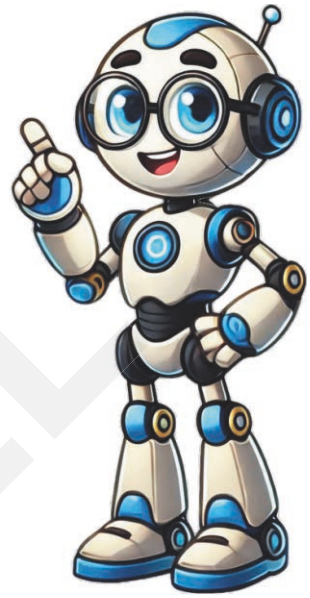
7
Chapter

Fractions

We'll cover the following key points:

- → Introduction to Fractions
- → Types of Fractions
- → Importance of Fractions
- → Fractional Units and Equal Shares
- → Fractional Units as Parts of a Whole
- → Measuring Using Fractional Units
- → Marking Fraction Lengths on the Number Line
- → Mixed Fractions
- → Equivalent Fractions
- → Comparing and Ordering of Fractions
- → Addition and Subtraction of Fractions



Hi, I'm EeeBee

Do you Remember fundamental concept in previous class.
In class 5th we learnt

- → Addition of Fractions
- → Addition of Whole Numbers and Fractions
- → Subtraction of Fractions
- → Subtraction of a Fraction From a Whole Number

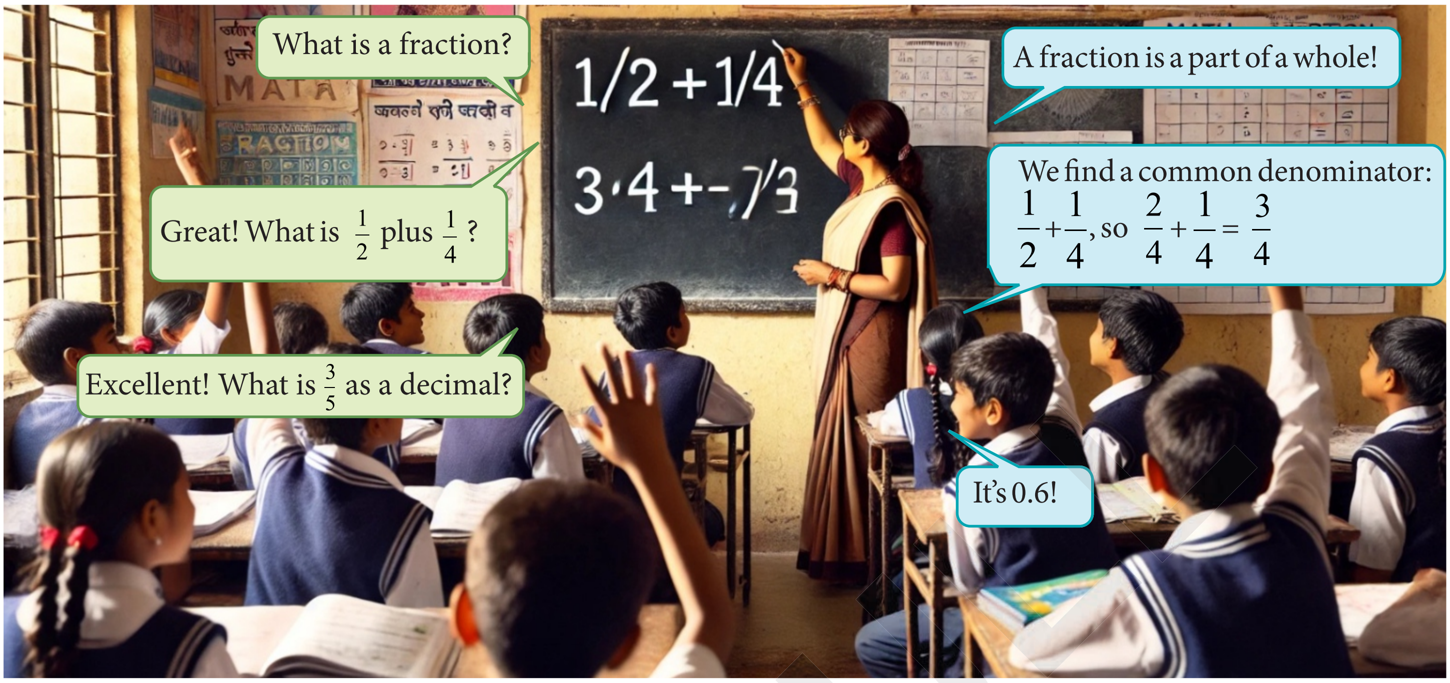
Still curious? Talk to me by scanning the QR code.

Learning Outcomes

By the end of this chapter, students will be able to:

- Represent fractions on a number line and understand their meaning.
- Simplify, add, subtract, multiply, and divide fractions.
- Convert between improper fractions and mixed numbers.
- Solve real-life problems involving fractions.
- Compare and order fractions using common denominators.
- Convert fractions to decimals and percentages and vice versa.
- Identify equivalent fractions and simplify them.
- Apply the concept of fractions in measurement and cooking contexts.
- Interpret fractions as parts of a whole, fostering a deeper understanding of ratios and proportional relationships.
- Utilize visual models and real-world examples to analyze and compare fractions effectively.
- Develop problem-solving strategies for multi-step tasks involving fractions in various contexts.

Introduction



Fractions are a way of representing parts of a whole or a collection. In simple terms, a fraction shows how many parts of a whole we have.

A fraction consists of two parts:

1. Numerator

The top part of the fraction, which tells how many parts we have.

2. Denominator

The bottom part of the fraction, which tells how many equal parts the whole is divided into.

For example, in the fraction $\frac{3}{4}$

- 3 is the numerator (the number of parts we have).
- 4 is the denominator (the number of equal parts the whole is divided into).

Take a Task

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Types of Fractions:

1. **Proper Fraction:** The numerator is smaller than the denominator (e.g., $\frac{3}{4}$).
2. **Improper Fraction:** The numerator is equal to or greater than the denominator (e.g., $\frac{5}{4}$ or $\frac{7}{7}$).
3. **Mixed Fraction:** A whole number and a proper fraction combined (e.g., $1\frac{5}{4}$).
4. **Equivalent Fractions:** Different fractions that represent the same amount (e.g., $\frac{1}{2}, \frac{2}{4}$, and $\frac{4}{8}$).

Importance of Fractions

Fractions are used in everyday life, for example:

- Sharing food, like pizza or cake.
- Measuring ingredients while cooking.
- Dividing a set of objects or money.

Here's a simple conversation on fractions:

- **Teacher:** Good morning, class! Today, we're going to talk about fractions. Can anyone remind me what a fraction is?
- **Sara:** A fraction is a way to show part of a whole, right?
- **Teacher:** That's right, Sara! A fraction has two parts: the numerator and the denominator. The numerator is the top number, and the denominator is the bottom number. The denominator tells us how many equal parts the whole is divided into, and the numerator tells us how many parts we are talking about. Let's look at an example: $\frac{3}{4}$. What does this mean?
- **Raman:** It means we have 3 parts out of 4 equal parts.
- **Teacher:** Exactly! Now, let's say we have a pizza that is divided into 8 slices. If you eat 3 slices, how would you write that as a fraction?
- **Riya:** It would be $\frac{3}{8}$ because you ate 3 slices out of the 8.
- **Teacher:** Great job! Now, if you have $\frac{5}{8}$ of the pizza left, how much of the pizza did you eat?
- **Sara:** I ate $\frac{3}{8}$ of the pizza, because $\frac{5}{8}$ is left.
- **Teacher:** Correct! See how fractions help us understand parts of a whole. Let's try one more. If a chocolate bar is divided into 10 pieces and you ate 6 pieces, what fraction of the chocolate bar did you eat?
- **Raman:** I ate $\frac{6}{10}$ of the chocolate bar.
- **Teacher:** Right, Raman! And we could simplify that fraction by dividing both numbers by 2. What's $\frac{6}{10}$ simplified?
- **Riya:** It's $\frac{3}{5}$.
- **Teacher:** Perfect! Remember, simplifying fractions makes them easier to understand. Well done, everyone! Any questions about fractions?

Fractional Units and Equal Shares

When working with fractions, it's important to understand the concepts of fractional units and equal shares. These two ideas help us understand how a whole can be divided into parts and how fractions represent these parts.

1. Fractional Units

A fractional unit refers to a single part of a whole when it is divided into equal parts. The number of parts into which the whole is divided is shown by the denominator of the fraction.

For example:

- $\frac{1}{2}$ represents one part out of two equal parts. Here, 2 is the denominator, which tells us the whole is divided into 2 parts, and 1 is the numerator, which tells us how many parts we have.
- $\frac{1}{4}$ represents one part out of four equal parts. Here, 4 is the denominator, showing the whole is divided into 4 parts.

2. Equal Shares

Equal shares mean dividing something into parts that are exactly the same size. This helps in distributing a whole object, quantity, or set into parts that are equal in value.

For example:

- If you divide a pizza into 4 equal parts, each part is called a fractional share of the whole pizza. Each slice would be $\frac{1}{4}$ of the pizza.
- If you divide ₹10 into 5 equal shares, each share would be ₹2. Mathematically, each share would be $\frac{2}{10}$ or simplified as $\frac{1}{5}$ of the total amount.

Examples of Equal Shares:

1. Dividing a Cake into Equal Shares:

- If you cut a cake into 6 equal parts, each part is a fractional unit and would be represented as $\frac{1}{6}$ of the cake.

2. Dividing a Chocolate Bar:

- If you break a chocolate bar into 4 equal parts, each part is $\frac{1}{4}$ of the chocolate bar.

3. Sharing a Pizza:

- If a pizza is cut into 8 equal slices, each slice is $\frac{1}{8}$ of the pizza.

Visualizing Fractional Units and Equal Shares:

- Imagine a circle (pizza) divided into 3 equal parts. If you take 1 part, you have $\frac{1}{3}$ of the pizza.
- A rectangular chocolate bar divided into 5 equal pieces means each piece is $\frac{1}{5}$ of the bar.

Fractional Units as Parts of a Whole

When we talk about fractional units as parts of a whole, we are referring to how a whole is divided into equal-sized pieces or parts, each of which can be represented as a fraction.

A fraction shows how many parts of a whole are being considered, and the size of each part depends on how many equal parts the whole is divided into.

Points to Remember

- **Whole:** The entire object, quantity, or set.
- **Fractional Unit:** A single part of a whole when it is divided into equal pieces.
- **Numerator:** The top number of the fraction, which tells how many parts are being considered.
- **Denominator:** The bottom number of the fraction, which tells how many equal parts the whole is divided into.

When a whole is divided into equal parts, each part is a fractional unit. For example:

- If a whole is divided into 2 parts, each part is $\frac{1}{2}$ of the whole.
- If a whole is divided into 3 parts, each part is $\frac{1}{3}$ of the whole.
- If a whole is divided into 4 parts, each part is $\frac{1}{4}$ of the whole.

Examples of Fractional Units as Parts of a Whole:

1. **Pizza Example:**

- If you have a whole pizza and cut it into 4 equal slices, each slice is $\frac{1}{4}$ of the pizza. So, $\frac{1}{4}$ represents one part out of the 4 equal parts.
- If you eat 2 slices, you've eaten $\frac{2}{4}$ of the pizza, or half of it. The fractional units here are $\frac{1}{4}$.

2. **Cake Example:**

- If you cut a cake into 8 equal pieces, each piece is $\frac{1}{8}$ of the cake. This means the whole cake is divided into 8 parts, and each piece is a fractional unit of the cake.

3. Chocolate Bar Example:

- If a chocolate bar is divided into 5 equal pieces, each piece is $\frac{1}{5}$ of the chocolate bar. If you have 3 pieces, that means you have $\frac{3}{5}$ of the bar.

Visualizing Fractional Units

- Imagine you have a circle (representing a pizza or a cake). If you divide the circle into 4 equal parts, each part is a fractional unit of the whole, represented as $\frac{1}{4}$.
- Similarly, if a rectangular bar of chocolate is divided into 3 equal pieces, each piece is $\frac{1}{3}$ of the bar.

Example : A pizza is cut into 6 equal slices. If Sarah eats 2 slices, what fraction of the pizza has she eaten?

Solution: The pizza is divided into 6 equal parts, so each slice is $\frac{1}{6}$ of the pizza.

Sarah ate 2 slices, so she ate $\frac{2}{6}$ of the pizza.

Simplify the fraction $\frac{2}{6}$:

$\frac{2}{6} = \frac{1}{3}$.

Sarah ate $\frac{1}{3}$ of the pizza.

Example : A cake is divided into 8 equal parts. If 3 parts are eaten, what fraction of the cake is left?

Solution: The total number of parts in the cake is 8, and 3 parts are eaten.

The fraction of the cake that is eaten is $\frac{3}{8}$.

The fraction left is the total minus the eaten parts:

$\frac{8}{8} - \frac{3}{8} = \frac{5}{8}$.

$\frac{5}{8}$ of the cake is left.

Example : A chocolate bar is divided into 5 equal pieces. If you have 4 pieces, what fraction of the chocolate bar do you have?

Solution: The chocolate bar is divided into 5 equal parts, so each part is $\frac{1}{5}$.

You have 4 pieces, so you have $\frac{4}{5}$ of the chocolate bar.

You have $\frac{4}{5}$ of the chocolate bar.

Example : A group of friends decides to share a chocolate cake. If they divide the cake into 12 equal slices and one person eats 4 slices, what fraction of the cake has that person eaten?

Solution: The cake is divided into 12 equal slices, so each slice is $\frac{1}{12}$ of the cake.

The person ate 4 slices, so they ate $\frac{4}{12}$ of the cake.

Simplify the fraction $\frac{4}{12}$:

$\frac{4}{12} = \frac{1}{3}$.

The person ate $\frac{1}{3}$ of the cake.

Example: A ribbon is 3 meters long. It is cut into 6 equal pieces. How long is each piece?

Solution: The ribbon is divided into 6 equal parts, so each part is $\frac{1}{6}$ of the total length of the ribbon.

The total length of the ribbon is 3 meters, so each piece is:

$3 \div 6 = 0.5$ meters.

Each piece of the ribbon is 0.5 meters long.

Exercise 7.1

1. **A chocolate bar is divided into 5 equal pieces. If you have 1 piece, what fraction of the chocolate bar do you have?**

2. **Write the numerator and denominator of each of the following fractions:**

   (a) $\frac{12}{15}$ (b) $\frac{7}{9}$ (c) $\frac{28}{14}$ (d) $\frac{22}{09}$ (e) $\frac{16}{14}$ (f) $\frac{12}{19}$ (g) $\frac{25}{25}$

3. **A ribbon is 4 meters long. It is cut into 8 equal pieces. How long is each piece?**

4. **Does the following statement stand True (T) or False (F):**

   (a) The fraction $\frac{3}{5}$ is greater than $\frac{2}{3}$.

   (b) $\frac{1}{2}$ is equivalent to $\frac{2}{4}$.

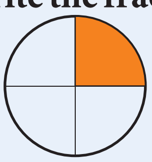
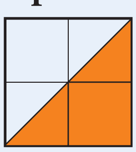
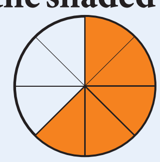
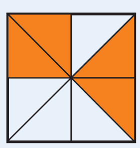
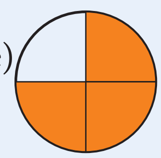
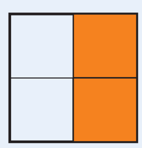
   (c) $\frac{5}{8}$ is a proper fraction.

   (d) $\frac{4}{7}$ is greater than $\frac{7}{4}$.

   (e) $\frac{3}{6}$ simplifies to $\frac{1}{3}$.

5. **A cake is divided into 12 equal parts. If 9 parts are eaten, what fraction of the cake is remaining?**

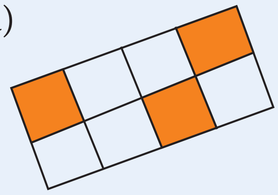
6. **Write the fraction representing the shaded portion:**

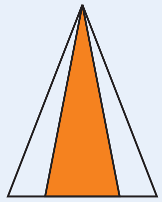
   (a)  (b)  (c)  (d)  (e)  (f) 

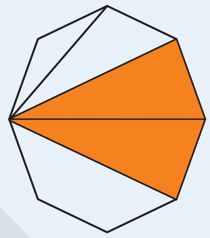
7. A ribbon is cut into 10 equal pieces, each measuring 0.3 meters. How long is the ribbon in total?

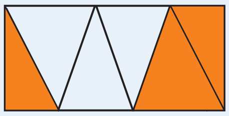
8. A class is sharing a bag of 30 marbles. If each student gets $\frac{1}{5}$ of the marbles, how many marbles does each student get?

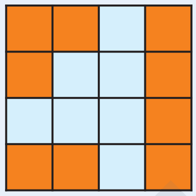
9. Fill the blank of following fractions representing shaded portion:

(a)  $= \frac{3}{\square}$

(b)  $= \frac{\square}{3}$

(c)  $= \frac{\square}{5}$

(d)  $= \frac{3}{\square}$

(e)  $= \frac{\square}{16}$

(f)  $= \frac{5}{\square}$

10. Provide the missing information in the blanks:

(a) The fraction $\frac{8}{12}$ simplifies to.

(b) $\frac{1}{4} + \frac{3}{8} = \frac{\square}{8}$.

(c) If you have $\frac{1}{3}$ of a pizza and your friend has $\frac{2}{3}$, together you have $\frac{\square}{3}$.

(d) $\frac{4}{7} \times \frac{3}{5} = ?$

(e) Each slice of a cake cut into 6 equal parts is $\frac{\square}{6}$ of the cake.

(f) $\frac{2}{5} = \frac{\square}{10}$.

Activity

Conceptual Understanding

Fraction Relay Race!

Materials Needed: Flash cards with fraction problems, markers, and a whiteboard.

How to Play:

1. Divide the class into teams and line them up for a relay race.
2. Place a set of fraction problems (e.g., addition, subtraction, or comparison) at a station.
3. One student from each team runs to the station, picks a card, solves it, and writes the answer on the board.
4. They run back and tag the next teammate, who does the same.
5. The first team to correctly solve all their fraction problems wins!

Types of Fractions

1. Proper Fraction:

A proper fraction is a fraction where the numerator (top number) is smaller than the denominator (bottom number). This means the value of the fraction is **less than 1**.

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

2. Improper Fraction:

An improper fraction is a fraction where the numerator is greater than or equal to the denominator. This means the value of the fraction is **equal to** or **greater than 1**.

Example: $\frac{5}{4}, \frac{7}{3}, \frac{9}{8}$

3. Mixed Fraction:

A mixed fraction (or mixed number) is a combination of a whole number and a proper fraction. It is used to show numbers that are **greater than 1**.

Example: 11, 21, 32, 33, $\frac{41}{44}$

4. Equivalent Fractions:

Equivalent fractions are different fractions that represent the same amount or value. You can find equivalent fractions by multiplying or dividing both the numerator and denominator by the **same number**.

Example: $\frac{1}{2}$ is equivalent to $\frac{2}{4}, \frac{3}{6}$, and $\frac{4}{8}$ because they all represent the same value (0.5).

Points to Remember

- Proper fractions are less than 1.
- Improper fractions are equal to or greater than 1.
- Mixed fractions are made up of a whole number and a proper fraction.

Example : Convert the mixed fraction $\frac{23}{4}$ into an improper fraction.

Solution: To convert a mixed fraction into an improper fraction, multiply the whole number by the denominator and add the numerator. Then write the result over the denominator.

$$\frac{23}{4} = 2 \times 4 + \frac{3}{4}$$

$$= 8 + \frac{3}{4}$$

$$= \frac{11}{4}$$

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Example : Which of the following fractions is a proper fraction?

a) $\frac{7}{8}$ b) $\frac{9}{7}$ c) $\frac{5}{5}$ d) $\frac{10}{3}$

Solution:

a) $\frac{7}{8}$ – The numerator is smaller than the denominator, so it is a Proper Fraction.

b) $\frac{9}{7}$ – The numerator is larger than the denominator, so it is an Improper Fraction.

c) $\frac{5}{5}$ – This is equal to 1, and is considered a Mixed Fraction (or can be seen as an improper fraction).

d) $\frac{10}{3}$ – The numerator is larger than the denominator, so it is an Improper Fraction.

The correct answer is a) $\frac{7}{8}$, which is a Proper Fraction.

Example : Find two equivalent fractions for $\frac{6}{8}$.

Solution: To find equivalent fractions, we can simplify by dividing both the numerator and the denominator by their greatest common divisor (GCD).

The GCD of 6 and 8 is 2.

$$\frac{6}{8} = 6 \div \frac{2}{8} \div 2$$

$$= \frac{3}{4}$$

Another equivalent fraction can be found by multiplying both the numerator and denominator by 2:

$$\frac{6}{8} = 6 \times \frac{2}{8} \times 2 = \frac{12}{16}$$

So, two equivalent fractions for $\frac{6}{8}$ are $\frac{3}{4}$ and $\frac{12}{16}$.

Exercise 7.2

1. Solve the following word problems:

(a) A pizza is cut into 8 equal slices. John eats 3 slices. What fraction of the pizza did he eat? What fraction is left?

(b) A tank is filled with $\frac{5}{8}$ of its capacity. Later, $\frac{3}{8}$ more is added. What fraction of the tank is now full?

(c) A book has 120 pages. If Sarah has read 40 pages, what fraction of the book has she read?

(d) If a box contains 15 red balls and 5 blue balls, what fraction of the balls are red?

(e) A chocolate bar is divided into 12 equal pieces. If you eat 4 pieces, what fraction of the chocolate bar remains?

2. Express the following as mixed fraction;

(a) $\frac{15}{4}, \frac{22}{7}, \frac{18}{5}$ (b) $\frac{9}{2}, \frac{14}{3}, \frac{23}{6}$

3. Express the following as improper fraction;

(a) $1\frac{3}{5}, 2\frac{2}{7}, 3\frac{1}{4}$ (b) $4\frac{3}{8}, 5\frac{5}{6}, 6\frac{7}{9}$

4. Which of the following group of fractions are like and which are unlike?

(a) $\frac{3}{5}, \frac{6}{10}, \frac{9}{15}, \frac{12}{20}$ (b) $\frac{2}{4}, \frac{3}{5}, \frac{4}{8}, \frac{5}{10}$ (c) $\frac{1}{3}, \frac{5}{7}, \frac{2}{6}, \frac{3}{9}$

5. Identify the Proper, Improper, and unit fractions among the following. [Analytical Thinking]

(a) $\frac{3}{5}, \frac{7}{3}, \frac{4}{4}, \frac{2}{7}, \frac{6}{8}$ (b) $\frac{9}{10}, \frac{8}{3}, \frac{5}{5}, \frac{1}{4}, \frac{12}{15}$

6. Write a proper fraction whose:

(a) Write a proper fraction where the numerator and denominator add up to 12. How many such fractions can you make?

(b) Write a proper fraction where the denominator is 5 more than the numerator. How many such fractions can you make?

(c) Write a proper fraction where the numerator and denominator add up to 8. How many such fractions can you make?

(d) Write a proper fraction where the denominator is 2 more than the numerator. How many such fractions can you make?

7. Compare the fractions and fill in the blanks with '>' or '<';

(a) $\frac{7}{8} \ldots\ldots \frac{5}{6}$ (b) $\frac{3}{4} \ldots\ldots \frac{2}{3}$ (c) $\frac{11}{12} \ldots\ldots \frac{13}{14}$ (d) $\frac{1}{3} \ldots\ldots \frac{2}{5}$ (e) $\frac{5}{9} \ldots\ldots \frac{4}{8}$

8. True/False questions in one line:

(a) A proper fraction has a numerator greater than its denominator.

(b) $\frac{4}{3}$ is an improper fraction.

(c) $\frac{1}{2}$ and 36 are equivalent fractions.

(d) $\frac{5}{5}$ is a proper fraction.

(e) $\frac{6}{8}$ is in its simplest form.

Measuring Using Fractional Units

In mathematics, measurement is the process of determining the size, length, weight, or amount of something. Often, measurements are not always whole numbers, especially when dealing with smaller parts of a unit. This is where fractional units come in handy.

Fractional units represent a part of a whole. For example, if we divide a whole unit into equal parts, each part can be represented as a fraction. Fractions are written as one number over another, like this: $\frac{1}{2}$, $\frac{3}{4}$, or $\frac{5}{10}$. In this lesson, you will learn how to measure things using fractional units in different contexts.

Key Concepts

1. Understanding Fractions:

- A fraction has two parts: the numerator (the top number) and the denominator (the bottom number).
- The numerator tells you how many parts you have, and the denominator tells you how many equal parts the whole is divided into.

2. Measuring Length Using Fractional Units:

- Sometimes, when measuring lengths, we use fractions of a unit. For example, a ruler can be marked with fractions of an inch or a centimeter. If a line is between $\frac{1}{2}$ and 1 inch, you would say the length is $\frac{3}{4}$ of an inch, depending on its exact position.

3. Measuring Mass/Weight Using Fractional Units:

- When weighing objects, fractional units are also used. If you weigh fruits and vegetables, for example, you might see measurements like $\frac{1}{2}$ kilogram or $\frac{3}{4}$ pound.

4. Measuring Capacity Using Fractional Units:

- When measuring liquid amounts, you can use fractional units. For example, you might measure $\frac{1}{4}$ liter of water, or $\frac{3}{4}$ cup of flour.

Marking Fraction Lengths on the Number Line

In this concept, you'll learn how to mark fractional lengths on a number line. A number line is a straight line with numbers placed in order along it. It's a useful tool for visualizing numbers, including fractions.

Take a Task

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Steps to Mark Fractions on a Number Line:

1. Draw a Number Line:

- Start by drawing a horizontal line and labeling at least two whole numbers. For example, you might mark 0 and 1 on the line.

2. Divide the Segment Between Two Whole Numbers:

- To mark a fraction, you need to divide the segment between two whole numbers into equal parts. The number of parts depends on the denominator of the fraction.
  - For example, if you're marking $\frac{1}{2}$, divide the space between 0 and 1 into 2 equal parts.
  - For $\frac{1}{4}$, divide the space between 0 and 1 into 4 equal parts.

3. Label the Fractions:

- After dividing the segment into equal parts, label each point where the parts meet.
  - For $\frac{1}{2}$, you would label the first mark between 0 and 1 as $\frac{1}{2}$.
  - For $\frac{1}{4}$, you would label the first mark as $\frac{1}{4}$, the second mark as $\frac{2}{4}$ (or $\frac{1}{2}$), and so on.

4. Mark Other Fractions:

- If you need to mark fractions greater than 1, extend the number line beyond 1. For example, for $\frac{3}{4}$, you would divide the segment between 0 and 1 into 4 equal parts, and count three parts from 0.

Example: Marking $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{3}{4}$ on a Number Line

1. Marking $\frac{1}{2}$:

- Draw a number line from 0 to 1.
- Divide the space between 0 and 1 into 2 equal parts.
- Label the point halfway between 0 and 1 as $\frac{1}{2}$.

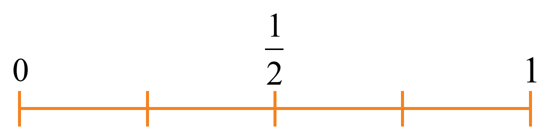

Fig. 7.1

2. Marking $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$:

- Draw a number line from 0 to 1.
- Divide the space between 0 and 1 into 4 equal parts.
- Label the points as $\frac{1}{4}$, $\frac{2}{4}$ (or $\frac{1}{2}$), and $\frac{3}{4}$.

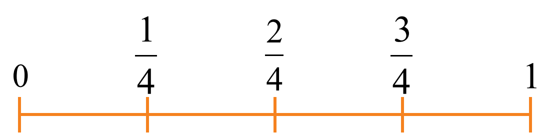

Fig. 7.2

3. Marking $\frac{3}{2}$:

- Extend the number line beyond 1.
- Divide the space between 1 and 2 into 2 equal parts.

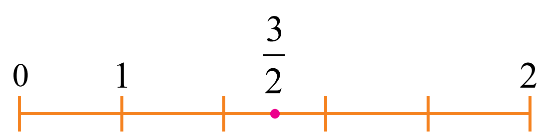

Fig. 7.3

- Label the first point as $\frac{1}{2}$ and the second point as $\frac{3}{2}$.

Mixed Fractions

A mixed fraction (also known as a mixed number) is a combination of a whole number and a fraction. It represents a value greater than one, where the whole number part shows how many complete units there are, and the fraction part shows the leftover part of a unit.

For example:

- $1\frac{1}{2}$ is a mixed fraction, where 1 is the whole number, and $\frac{1}{2}$ is the fraction part.
- $3\frac{3}{4}$ is another mixed fraction, where 3 is the whole number and $\frac{3}{4}$ is the fractional part.

Parts of a Mixed Fraction

- **The whole number:** This represents how many complete units are there.
- **The fraction:** This shows the part of the unit that is left.

Converting Mixed Fractions to Improper Fractions:

An improper fraction is a fraction where the numerator (the top number) is greater than or equal to the denominator (the bottom number). You can convert a mixed fraction to an improper fraction by following these steps:

- Multiply the whole number by the denominator of the fraction.
- Add the numerator of the fraction to this product.
- The result will be the new numerator of the improper fraction. The denominator remains the same.

Example 1: Converting $2\frac{1}{3}$ to an Improper Fraction

Step 1: Multiply the whole number (2) by the denominator (3):

- $2 \times 3 = 6$

Step 2: Add the numerator (1) to the product:

- $6 + 1 = 7$

So, $2\frac{1}{3}$ is converted to the improper fraction $\frac{7}{3}$.

Converting Improper Fractions to Mixed Fractions:

To convert an improper fraction to a mixed fraction, you follow these steps:

1. Divide the numerator by the denominator to get the whole number part.
2. The remainder will be the numerator of the fractional part.

3. The denominator of the fraction remains the same.

Example 2: Converting $\frac{9}{4}$ to a Mixed Fraction

Step 1: Divide the numerator (9) by the denominator (4):

- $9 \div 4 = 2$ (whole number part).

Step 2: The remainder is 1, which becomes the numerator of the fraction part. The denominator remains 4.

- So, $\frac{9}{4}$ becomes $2\frac{1}{4}$.

Visualizing Mixed Fractions:

You can visualize mixed fractions by representing them as a combination of whole units and fractional parts.

For example, $1\frac{3}{4}$ means you have 1 whole unit and $\frac{3}{4}$ of another unit. You can show this as 1 full square and 3 out of 4 parts of another square.

Points to Remember

- A mixed fraction consists of a whole number and a fraction.
- An improper fraction has a numerator greater than or equal to its denominator.
- Converting between mixed fractions and improper fractions helps in operations like addition, subtraction, multiplication, and division of fractions.

Example : Convert the mixed fraction $4\frac{2}{5}$ into an improper fraction.

Solution: **Step 1:** Multiply the whole number (4) by the denominator (5): $4 \times 5 = 20$

Step 2: Add the numerator (2) to the result: $20 + 2 = 22$

The improper fraction is $\frac{22}{5}$.

Example: Convert the improper fraction $\frac{17}{4}$ into a mixed fraction.

Solution: **Step 1:** Divide the numerator (17) by the denominator (4):

$17 \div 4 = 4$ (whole number part) with a remainder of 1.

Step 2: The remainder (1) becomes the numerator, and the denominator stays the same (4).

The mixed fraction is $4\frac{1}{4}$.

Example : Mark $\frac{1}{2}, \frac{2}{3}$, and $\frac{3}{4}$ on a number line.

Solution:

Draw a number line from 0 to 1.

Marking $\frac{1}{2}$: Divide the space between 0 and 1 into 2 equal parts. The first mark is at $\frac{1}{2}$.

Marking $\frac{2}{3}$: Divide the space between 0 and 1 into 3 equal parts. The second mark is at $\frac{2}{3}$.

Marking $\frac{3}{4}$: Divide the space between 0 and 1 into 4 equal parts. The third mark is at $\frac{3}{4}$.

Your number line should look like this:

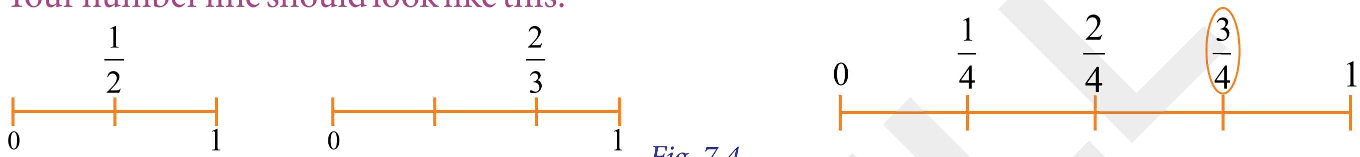

Fig. 7.4

Example : Place $\frac{5}{6}$ and $\frac{7}{8}$ on the number line between 0 and 1.

Solution:

Marking $\frac{5}{6}$: Divide the space between 0 and 1 into 6 equal parts. The fifth mark will be at $\frac{5}{6}$.

Marking $\frac{7}{8}$: Divide the space between 0 and 1 into 8 equal parts. The seventh mark will be at $\frac{7}{8}$.

Your number line should look like this:

Fig. 7.5

Example : A piece of ribbon is $2\frac{3}{4}$ meters long. If we cut it into 4 equal pieces, what is the length of each piece?

Solution:

Step 1: Convert $2\frac{3}{4}$ into an improper fraction.

$$2\frac{3}{4} = \frac{2 \times 4 + 3}{4} = \frac{11}{4}$$

Step 2: Divide $\frac{11}{4}$ by 4 (to split the ribbon into 4 equal pieces).

$$\frac{11}{4} \div 4 = \frac{11}{4} \times \frac{1}{4} = \frac{11}{16}$$

The length of each piece is $\frac{11}{16}$ meters.

Example : A piece of wood is $1\frac{1}{2}$ meters long. If you need to measure a part of it that is $\frac{2}{3}$ of the total length, what is the length of the part?

Solution:

Step 1: Convert $1\frac{1}{2}$ into an improper fraction.

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

Step 2: Multiply $\frac{3}{2}$ by $\frac{2}{3}$ to find the length of the part.

$$\frac{3}{2}\times\frac{2}{3} = \frac{6}{6} = 1$$

The length of the part is 1 meter.

Exercise 7.3

1. **Mark the following fractions on a number line:**

   (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) $\frac{5}{6}$ (e) $\frac{7}{8}$ (f) $\frac{7}{4}$ (g) $\frac{5}{6}$ (h) $\frac{10}{4}$

2. **Convert the mixed fraction into an improper fraction.**

   (a) $5\frac{3}{4}$ (b) $7\frac{1}{6}$ (c) $8\frac{4}{2}$ (d) $6\frac{2}{3}$ (e) $5\frac{6}{6}$ (f) $7\frac{9}{4}$ (g) $3\frac{3}{6}$ (h) $5\frac{4}{4}$

3. **Add the mixed fractions $3\frac{1}{2}$ and $2\frac{2}{3}$. Express the answer as a mixed fraction.**

4. **A container holds $5\frac{1}{4}$ liters of water. If you pour out $\frac{3}{4}$ of it, how much water is left in the container?**

5. **Draw a number line from 0 to 2 and mark $1\frac{1}{4}$ and $1\frac{3}{4}$ on it.**

6. **A garden is $6\frac{3}{4}$ meters long. If you want to plant flowers in $\frac{3}{4}$ of the garden, how long will the flowerbed be?**

7. **Provide the missing information in the blanks:**

   (a) The improper fraction equivalent of $3\frac{2}{3}$ is ___________.

   (b) On a number line between 0 and 1, the fraction at the second mark when divided into 5 equal parts is ___________.

   (c) If a piece of rope is $6\frac{1}{2}$ meters long and cut into 4 equal pieces, each piece will be ___________ meters long.

(d) The sum of $2\frac{1}{4}$ and $\frac{33}{4}$ is __________.

(e) If you divide $7\frac{1}{2}$ liters of water into 3 equal containers, each container will hold ________ liters.

8. **A rope is $12\frac{1}{2}$ meters long. You want to use $\frac{5}{6}$ of the rope for a project. How long will the piece of rope be that you use for the project?**

9. **A floor is $8\frac{1}{3}$ meters long. You want to tile $2\frac{1}{3}$ meters of the floor. How much area is left to tile?**

10. **Match the following**

Column A	Column B
(i) Convert the mixed fractions $5\frac{2}{3}$ to an improper fraction	(a) $\frac{3}{4}$
(ii) The fraction at the 3rd mark on a number line divided into 4 equal parts	(b) $\frac{39}{20}$
(iii) The result of subtracting $4\frac{1}{4}$ from $7\frac{1}{2}$	(c) $\frac{17}{3}$
(iv) The length of each piece when a ribbon of $9\frac{3}{4}$ meters is cut into 5 equal pieces	(d) $\frac{5}{2}$
(v) The improper fraction equivalent of $2\frac{1}{2}$	(e) $3\frac{1}{4}$

Equivalent Fractions

Equivalent fractions are fractions that represent the same value or amount, even though they have different numerators and denominators.

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For example:

➢ $\frac{1}{2}$ is equivalent to $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}$, etc.

How to Find Equivalent Fractions:

To create equivalent fractions, you can:

Multiply or divide both the numerator (top number) and the denominator (bottom number) of a fraction by the same number (except zero).

Example : Find equivalent fractions for $\frac{1}{2}$:

- Multiply the numerator and denominator by 2:
  - $\frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$
- Multiply the numerator and denominator by 3:
  - $\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$
- Multiply the numerator and denominator by 4:
  - $\frac{1}{2} \times \frac{4}{4} = \frac{4}{8}$

So, $\frac{1}{2}$ is equivalent to $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}$, etc.

Example : Find equivalent fractions for $\frac{3}{5}$:

- Multiply by 2:
  - $\frac{3}{5} \times \frac{2}{2} = \frac{6}{10}$
- Multiply by 3:
  - $\frac{3}{5} \times \frac{3}{3} = \frac{9}{15}$
- Multiply by 4:
  - $\frac{3}{5} \times \frac{4}{4} = \frac{12}{20}$
- So, $\frac{3}{5}$ is equivalent to $\frac{6}{10}, \frac{9}{15}, \frac{12}{20}$, etc.

Identifying Equivalent Fractions

You can also identify equivalent fractions by simplifying or reducing fractions to their simplest form.

Example : Is $\frac{4}{8}$ equivalent to $\frac{1}{2}$?

- Simplify $\frac{4}{8}$ by dividing both the numerator and denominator by 4: $\frac{4}{8} \div \frac{4}{4} = \frac{1}{2}$
- So, $\frac{4}{8}$ is equivalent to $\frac{1}{2}$.

Practice Questions on Equivalent Fractions:

1. Find 3 equivalent fractions for $\frac{5}{6}$.
2. Are $\frac{12}{16}$ and $\frac{3}{4}$ equivalent fractions? (Simplify $\frac{12}{16}$ to check).

Points to Remember

- Equivalent fractions have the same value, even though the numbers are different.
- You can find equivalent fractions by multiplying or dividing the numerator and denominator by the same number.
- Simplifying fractions helps in finding equivalent fractions in their simplest form.

Example : Find three equivalent fractions for $\frac{3}{4}$.

Solution: To find equivalent fractions, multiply both the numerator and denominator by the same number.

- Multiply by 2:
- ➢ $\frac{3}{4} \times \frac{2}{2} = \frac{6}{8}$
- Multiply by 3:
- ➢ $\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$
- Multiply by 4:
- ➢ $\frac{3}{4} \times \frac{4}{4} = \frac{12}{16}$

Equivalent fractions of $\frac{3}{4}$ are: $\frac{6}{8}, \frac{9}{12}$, and $\frac{12}{16}$.

Example : Are $\frac{6}{8}$ and $\frac{3}{4}$ equivalent fractions?

Solution: To check if fractions are equivalent, simplify one of the fractions and compare.

- ➢ Simplify $\frac{6}{8}$:
- ➢ Divide both the numerator and denominator by 2:
- ➢ $\frac{6}{8} \div \frac{2}{2} = \frac{3}{4}$

Since $\frac{6}{8}$ simplifies to $\frac{3}{4}$, the fractions $\frac{6}{8}$ and $\frac{3}{4}$ are equivalent.

Example : Write an equivalent fraction for $\frac{5}{9}$ with a denominator of 27.

Solution: To create an equivalent fraction, multiply both the numerator and the denominator of $\frac{5}{9}$ by the same number to get the denominator 27.

- ➢ Multiply both the numerator and denominator by 3:

➢ $\frac{5}{9} \times \frac{3}{3} = \frac{15}{27}$

So, $\frac{5}{9}$ is equivalent to $\frac{15}{27}$.

Example : Simplify $\frac{12}{16}$ and check if it is equivalent to $\frac{3}{4}$.

Solution: To simplify $\frac{12}{16}$, divide both the numerator and denominator by their GCD (Greatest Common Divisor), which is 4:

➢ $\frac{12}{16} \div \frac{4}{4} = \frac{3}{4}$

Since $\frac{12}{16}$ simplifies to $\frac{3}{4}$, the fractions are equivalent.

Exercise 7.4

1. **Find three equivalent fractions for**

   (a) $\frac{5}{8}$ (b) $\frac{3}{4}$ (c) $\frac{2}{5}$ (d) $\frac{6}{7}$ (e) $\frac{4}{9}$ (f) $\frac{1}{3}$ (g) $\frac{8}{12}$ (h) $\frac{7}{10}$

2. **Is $\frac{2}{3}$ equivalent to $\frac{14}{21}$? Show your work by simplifying or cross-multiplying.**

3. **Convert the fraction $\frac{7}{9}$ to an equivalent fraction with a denominator of 27.**

4. **Find the equivalent fraction for $\frac{13}{26}$ with the smallest possible denominator.**

5. **Provide the missing information in the blanks:**

   (a) Two fractions are equivalent if their ___________ are proportional to each other.

   (b) To find an equivalent fraction for $\frac{3}{5}$, we multiply both the numerator and denominator by the same ___________.

   (c) The fraction $\frac{6}{9}$ can be simplified to its equivalent fraction by dividing both the numerator and denominator by their ___________.

   (d) If we multiply both the numerator and denominator of a fraction by the same number, the fraction's value ___________.

   (e) The fraction $\frac{8}{12}$ is equivalent to $\frac{2}{3}$ after simplifying by dividing both the numerator and denominator by ___________.

Comparing and Ordering of Fractions

Comparing Fractions

When comparing fractions, we determine which fraction is larger, smaller, or if they are equal.

Method 1: Using Common Denominators

To compare fractions, it's easiest when they have the same denominator. If the fractions have the same denominator, the fraction with the larger numerator is the larger fraction.

For example:

- $\frac{3}{5}$ and $\frac{2}{5}$: Since the denominators are the same (5), compare the numerators. $\frac{3}{5}$ is greater than $\frac{2}{5}$ because $3 > 2$.

Method 2: Cross-Multiplication

If the fractions have different denominators, you can use cross-multiplication to compare them.

1. Multiply the numerator of the first fraction by the denominator of the second fraction.
2. Multiply the numerator of the second fraction by the denominator of the first fraction.
3. Compare the results of the cross-multiplication.

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Example : Compare $\frac{3}{4}$ and $\frac{5}{6}$

- **Cross-multiply:**

➢ $3 \times 6 = 18$

➢ $4 \times 5 = 20$

Since $18 < 20$, $\frac{3}{4}$ is smaller than $\frac{5}{6}$.

Example : Compare $\frac{7}{8}$ and $\frac{5}{6}$

- **Cross-multiply:**

➢ $7 \times 6 = 42$

➢ $8 \times 5 = 40$

➢ Since $42 > 40$, $\frac{7}{8}$ is greater than $\frac{5}{6}$.

Ordering Fractions

Ordering fractions means arranging them from the smallest to the largest or vice versa.

Method 1: Converting to Like Denominators

To order fractions, convert them to have the same denominator and then compare their numerators.

For example, to order $\frac{2}{3}, \frac{1}{2}$, and $\frac{3}{4}$:

- Convert each fraction to have a denominator of 12:
  - $\frac{2}{3} = \frac{8}{12}$
  - $\frac{1}{2} = \frac{6}{12}$
  - $\frac{3}{4} = \frac{9}{12}$

Now compare the numerators: $\frac{6}{12}, \frac{8}{12}, \frac{9}{12}$.

Order from smallest to largest: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$.

Method 2: Using Decimal Conversion

You can also convert fractions into decimals and then compare them.

- $\frac{2}{5} = 0.4$
- $\frac{3}{4} = 0.75$
- $\frac{5}{8} = 0.625$

Order: $\frac{2}{5} < \frac{5}{8} < \frac{3}{4}$

Examples of Comparing and Ordering Fractions

Example : Compare $\frac{5}{8}$ and $\frac{3}{5}$ using cross-multiplication.

- **Cross-multiply:**
  - $5 \times 5 = 25$
  - $8 \times 3 = 24$

Since $25 > 24$, $\frac{5}{8}$ is greater than $\frac{3}{5}$.

Example : Order $\frac{2}{3}, \frac{5}{6}$ and $\frac{4}{5}$ from smallest to largest.

- Convert each fraction to have a denominator of 30:
  - $\frac{2}{3} = \frac{20}{30}$

- $\frac{5}{6} = \frac{25}{30}$
- $\frac{4}{5} = \frac{24}{30}$

Now compare the numerators: $\frac{20}{30}, \frac{24}{30}, \frac{25}{30}$.

Order: $\frac{2}{3}, \frac{4}{5}, \frac{5}{6}$.

Points to Remember

- When fractions have the same denominator, compare the numerators.
- When fractions have different denominators, use cross-multiplication or convert to the same denominator.
- To order fractions, convert them to equivalent fractions with the same denominator or convert them to decimals.

Example : Compare the following fractions: $\frac{5}{8}$ and $\frac{3}{4}$.

Solution: To compare $\frac{5}{8}$ and $\frac{3}{4}$, we need to make the denominators the same.

- The least common denominator (LCD) of 8 and 4 is 8.
- $\frac{3}{4}$ can be written as $\frac{6}{8}$ (multiply both the numerator and denominator by 2).
- Now, compare $\frac{5}{8}$ and $\frac{6}{8}$. Since $5 < 6$, we know that $\frac{5}{8} < \frac{3}{4}$.
- $\frac{5}{8}$ is smaller than $\frac{3}{4}$.

Example : Order the following fractions from smallest to largest: $\frac{1}{2}, \frac{3}{4}, \frac{2}{3}$.

Solution:

First, find the least common denominator (LCD) of 2, 3, and 4, which is 12.

Convert each fraction to have a denominator of 12:

- $\frac{1}{2} = \frac{6}{12}$
- $\frac{2}{3} = \frac{8}{12}$
- $\frac{3}{4} = \frac{9}{12}$

Now, order the fractions by comparing the numerators: $\frac{6}{12}, \frac{8}{12}, \frac{9}{12}$.

From smallest to largest: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$.

The fractions in order are: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$.

Example : Which of the following is greater: $\frac{7}{9}$ or $\frac{5}{6}$?

Solution:

- To compare $\frac{7}{9}$ and $\frac{5}{6}$, we need to find the LCD of 9 and 6, which is 18.
- Convert each fraction to have a denominator of 18:
- $\frac{7}{9} = \frac{14}{18}$ (multiply by 2)
- $\frac{5}{6} = \frac{15}{18}$ (multiply by 3)

Now, compare the numerators: $\frac{14}{18}$ and $\frac{15}{18}$. Since $15 > 14$, $\frac{5}{6}$ is greater than $\frac{7}{9}$.

$\frac{5}{6}$ is greater than $\frac{7}{9}$.

Example : Which fraction is smaller: $\frac{5}{7}$ or $\frac{3}{4}$?

Solution:

- To compare $\frac{5}{7}$ and $\frac{3}{4}$, find the LCD of 7 and 4, which is 28.
- Convert each fraction to have a denominator of 28:
- $\frac{5}{7} = \frac{20}{28}$ (multiply by 4)
- $\frac{3}{4} = \frac{21}{28}$ (multiply by 7)

Now, compare the numerators: $\frac{20}{28}$ and $\frac{21}{28}$. Since $20 < 21$, $\frac{5}{7}$ is smaller than $\frac{3}{4}$.

$\frac{5}{7}$ is smaller than $\frac{3}{4}$.

Example : Arrange the following fractions in ascending order: $\frac{3}{5}, \frac{5}{10}, \frac{2}{3}$.

Solution:

- Find the least common denominator (LCD) of 5, 10, and 3, which is 30.
- Convert each fraction to have a denominator of 30:

- $\frac{3}{5} = \frac{18}{30}$ (multiply by 6)
- $\frac{7}{10} = \frac{21}{30}$ (multiply by 3)
- $\frac{2}{3} = \frac{20}{30}$ (multiply by 10)

Now, order the fractions by comparing the numerators: $\frac{18}{30}, \frac{20}{30}, \frac{21}{30}$.

From smallest to largest: $\frac{3}{5}, \frac{2}{3}, \frac{7}{10}$.

The fractions in ascending order are: $\frac{3}{5}, \frac{2}{3}, \frac{7}{10}$.

Exercise 7.5

1. Order the following fractions from smallest to largest:

(a) $\frac{5}{8}, \frac{3}{4}, \frac{7}{12}$ (b) $\frac{2}{5}, \frac{4}{7}, \frac{3}{6}$ (c) $\frac{5}{9}, \frac{2}{3}, \frac{7}{11}$

(d) $\frac{1}{2}, \frac{3}{8}, \frac{5}{6}$ (e) $\frac{3}{5}, \frac{4}{9}, \frac{2}{3}$ (f) $\frac{2}{7}, \frac{3}{5}, \frac{4}{9}$

2. Arrange the following fractions in descending order:

(a) $\frac{3}{5}, \frac{7}{10}, \frac{4}{9}$ (b) $\frac{5}{8}, \frac{2}{3}, \frac{7}{12}$ (c) $\frac{1}{2}, \frac{3}{7}, \frac{5}{9}$ (d) $\frac{3}{4}, \frac{2}{5}, \frac{7}{8}$

(e) $\frac{4}{7}, \frac{1}{2}, \frac{5}{6}$ (f) $\frac{2}{3}, \frac{5}{8}, \frac{3}{5}$ (g) $\frac{6}{10}, \frac{7}{12}, \frac{3}{4}$ (h) $\frac{8}{9}, \frac{5}{6}, \frac{4}{5}$

3. Compare two fractions and determine which is greater:

(a) $\frac{2}{10}$ *or* $\frac{3}{5}$ (b) $\frac{5}{8}$ *or* $\frac{3}{4}$ (c) $\frac{2}{3}$ *or* $\frac{5}{9}$ (d) $\frac{4}{7}$ *or* $\frac{6}{10}$

(e) $\frac{9}{12}$ *or* $\frac{7}{8}$ (f) $\frac{3}{5}$ *or* $\frac{2}{4}$ (g) $\frac{5}{6}$ *or* $\frac{4}{7}$ (h) $\frac{8}{9}$ *or* $\frac{7}{10}$

4. Arrange the following fractions in ascending order:

(a) $\frac{5}{9}, \frac{4}{7}, \frac{9}{12}$ (b) $\frac{4}{7}, \frac{1}{2}, \frac{4}{6}$ (c) $\frac{2}{3}, \frac{5}{9}, \frac{7}{10}$ (d) $\frac{3}{5}, \frac{7}{8}, \frac{9}{12}$

(e) $\frac{5}{6}, \frac{3}{5}, \frac{2}{3}$ (f) $\frac{1}{2}, \frac{4}{7}, \frac{3}{8}$ (g) $\frac{5}{9}, \frac{6}{10}, \frac{7}{12}$ (h) $\frac{2}{5}, \frac{7}{9}, \frac{3}{8}$

5. **Provide the missing information in the blanks:**

(a) When comparing $\frac{3}{5}$ and $\frac{4}{7}$, if the fractions are converted to have a common denominator, the fraction with the greater value is ___________.

(b) To arrange $\frac{5}{6}, \frac{3}{4}$, and $\frac{2}{3}$ in ascending order, the correct sequence is ___________, ________, ___________.

(c) When comparing $\frac{1}{2}$ and $\frac{5}{8}$, the fraction ___________ ($\frac{1}{2}$ *or* $\frac{5}{8}$) is greater because it has a larger numerator when expressed with the same denominator.

(d) If you compare $\frac{7}{10}$ and $\frac{2}{3}$ by converting them to fractions with a denominator of 30, the fraction ___________ ($\frac{7}{10}$ or $\frac{2}{3}$) will have the larger numerator.

(e) When ordering the fractions $\frac{3}{7}, \frac{5}{8}$, and $\frac{4}{9}$, the fraction _________ ($\frac{3}{7}, \frac{5}{8}$ *or* $\frac{4}{9}$) is the smallest because it has the smallest numerator when expressed with a common denominator.

6. **Using the symbols <, >, and = for comparing fractions:**

(a) $\frac{3}{5}$ .... $\frac{4}{7}$ (b) $\frac{5}{6}$ .... $\frac{7}{8}$ (c) $\frac{2}{3}$ .... $\frac{3}{4}$

(d) $\frac{1}{2}$ .... $\frac{2}{5}$ (e) $\frac{7}{10}$ .... $\frac{5}{8}$ (f) $\frac{3}{6}$ .... $\frac{1}{2}$

Addition and Subtraction of Fractions

Addition of Fractions

We have previously learned to add natural numbers, whole numbers, and integers. In this section, we will focus on the addition of fractions, specifically like fractions, unlike fractions, and mixed fractions.

Addition of Like Fractions (Fractions with the Same Denominator):

When we have to add fractions with the same denominator, such as $\frac{3}{7}$ and $\frac{2}{7}$, the process becomes straightforward. The general steps to follow for adding like fractions are:

Step 1: Identify the given like fractions.

Step 2: Add the numerators of the fractions.

Step 3: The denominator remains the same, and we write the sum of the numerators over the common denominator.

For example, $\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$

Points to Remember

Sum of like fractions = $\frac{\text{Sum of Numerators}}{\text{Common Denominator}}$

Addition of Unlike Fractions (Fractions with Different Denominators)

Adding fractions with different denominators requires converting them into equivalent fractions with a common denominator. The process is as follows:

Step 1: Identify the given unlike fractions.

Step 2: Find the LCM (Least Common Multiple) of the denominators of the given fractions.

Step 3: Convert each fraction to an equivalent fraction with the LCM as the common denominator.

Step 4: Once the fractions are like fractions, add the numerators and keep the common denominator.

This method, also known as Brahmagupta's method, was first described by the Indian mathematician Brahmagupta in 628 CE.

For example, $\frac{1}{3} + \frac{1}{4}$:

LCM of 3 and 4 = 12.

Convert to $\frac{4}{12} + \frac{3}{12} = \frac{7}{12}$

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Addition of Mixed Fractions

Mixed fractions can be written as a whole number plus a proper fraction (e.g., $2\frac{1}{3}$). To add mixed fractions, you can follow these two approaches:

Method 1: Separate the whole numbers and the fractions: Add the whole numbers separately, then add the fractions (which might be like or unlike).

Method 2: Convert to improper fractions: Convert the mixed fractions into improper fractions and add them using the methods for like or unlike fractions.

For example: $2\frac{1}{4} + 3\frac{2}{5}$:

- Convert both to improper fractions: $\frac{9}{4} + \frac{17}{5}$.
- Find the LCM of 4 and 5, which is 20.
- Convert the fractions: $\frac{45}{20} + \frac{68}{20} = \frac{113}{20}$.
- Convert the improper fraction back to a mixed fraction: $\frac{113}{20} = 5\frac{13}{20}$.

These methods of adding fractions, whether like or unlike, and adding mixed fractions, help us perform accurate fraction addition.

Example. Add $\frac{2}{3}$ and $\frac{4}{9}$.

Solution: These fractions have different denominators. The LCM of 3 and 9 is 9. Convert $\frac{2}{3}$ to $\frac{6}{9}$.

Now, add the fractions:

$$\frac{6}{9}+\frac{4}{9}=6+\frac{4}{9}=\frac{10}{9}$$

Convert $\frac{10}{9}$ to a mixed fraction: $1\frac{1}{9}$.

Example: Add $3\frac{1}{4}$ and $2\frac{3}{5}$.

Solution: Convert both mixed fractions to improper fractions:

$$3\frac{1}{4}=\frac{13}{4},\ 2\frac{3}{5}=\frac{13}{5}$$

Find the LCM of 4 and 5, which is 20. Convert both fractions:

$$\frac{13}{4}=\frac{65}{20},\ \frac{13}{5}=\frac{52}{20}$$

Now, add the fractions:

$$\frac{65}{20}+\frac{52}{20}=65+\frac{52}{20}=\frac{117}{20}$$

Convert $\frac{117}{20}$ to a mixed fraction: $5\frac{17}{20}$.

Example: A tailor needs $5\frac{3}{4}$ meters of cloth for a dress and $3\frac{1}{4}$ meters for a jacket. How much cloth must the tailor buy in total?

To find out how much cloth the tailor must buy in total, we need to add the amounts required for the dress and the jacket.

- The dress requires $5\frac{3}{4}$ meters, and the jacket requires $3\frac{1}{4}$ meters.
- First, let's convert these mixed numbers into improper fractions:
- $5\frac{3}{4}$ meters $=5+\frac{3}{4}=\frac{20}{4}+\frac{3}{4}=\frac{23}{4}$
- $3\frac{1}{4}$ meters $=3+\frac{1}{4}=\frac{12}{4}+\frac{1}{4}=\frac{13}{4}$

Now, we add the two fractions:

$$\frac{23}{4}+\frac{13}{4}=23+\frac{13}{4}=\frac{36}{4}=9\text{ meters}$$

So, the tailor must buy 9 meters of cloth in total.

Subtraction of Fractions

Subtraction of Like Fractions (Fractions with the Same Denominator):

When we have two fractions with the same denominator, we can subtract them easily. For example, if we have the fractions $\frac{2}{6}$ and $\frac{4}{6}$, and we want to subtract $\frac{2}{6}$ from $\frac{4}{6}$, we follow these steps:

Step 1: Identify the two fractions you need to subtract.

Step 2: Subtract the numerators (the top numbers) while keeping the denominator (the bottom number) the same.

Step 3: Write the new fraction with the result from step 2 as the numerator and the common denominator as the denominator.

For example: $\frac{4}{6} - \frac{2}{6} = \frac{4-2}{6} = \frac{2}{6}$.

Subtraction of Unlike Fractions (Fractions with Different Denominators):

When the fractions have different denominators, we need to make the denominators the same before we can subtract. Here's how:

Step 1: Identify the fractions you need to subtract.

Step 2: Find the Least Common Multiple (LCM) of the denominators.

Step 3: Convert each fraction to an equivalent fraction with the common denominator found in step 2.

Step 4: Once the fractions have the same denominator, subtract the numerators (the top numbers) and keep the common denominator.

For example: To subtract $\frac{1}{4}$ and $\frac{1}{6}$, we first find the LCM of 4 and 6, which is 12. We then convert the fractions: $\frac{1}{4} = \frac{3}{12}$ and $\frac{1}{6} = \frac{2}{12}$.

Now, subtract: $\frac{3}{12} - \frac{2}{12} = \frac{1}{12}$.

Subtraction of Mixed Fractions (Fractions with Whole Numbers):

To subtract mixed fractions, we first need to change them into improper fractions (fractions where the numerator is bigger than the denominator). Once they are improper fractions, we can subtract them using the same method as for like or unlike fractions.

Step 1: Convert each mixed fraction into an improper fraction.

Step 2: Follow the steps for subtracting like or unlike fractions, as needed.

For example: To subtract $3\frac{1}{2}$ from $5\frac{2}{3}$:

Convert to improper fractions: $3\frac{1}{2}=\frac{7}{2}$ and $5\frac{2}{3}=\frac{17}{3}$.

Now, find a common denominator (6) and subtract.

Here are some questions on the subtraction of fractions, along with their solutions:

Subtracting Like Fractions

Example: Subtract $\frac{3}{8}$ from $\frac{7}{8}$

Solution: Since the denominators are the same (8), we subtract the numerators:

$$\frac{7}{8}-\frac{3}{8}=7-\frac{3}{8}=\frac{4}{8}$$

Simplify $\frac{4}{8}$

$$\frac{4}{8}=\frac{1}{2}$$

Subtracting Unlike Fractions

Example: Subtract $\frac{2}{5}$ from $\frac{3}{4}$.

Solution:

First, find the LCM of 5 and 4, which is 20.

Now, convert both fractions to have a denominator of 20:

$$\frac{3}{4}=\frac{15}{20} \text{ and } \frac{2}{5}=\frac{8}{20}$$

Now subtract the numerators:

$$\frac{15}{20}-\frac{8}{20}=\frac{15-8}{20}=\frac{7}{20}$$

Subtracting Fractions with Different Denominators

Example: Subtract $\frac{5}{12}$ from $\frac{7}{18}$.

Solution:

First, find the LCM of 12 and 18, which is 36.

Convert both fractions to have a denominator of 36:

$$\frac{7}{18}=\frac{14}{36} \text{ and } \frac{5}{12}=\frac{15}{36}$$

Now subtract the numerators:

$$\frac{14}{36}-\frac{15}{36}=\frac{14-15}{36}=\frac{-1}{36}$$

Example: Subtract $2\frac{1}{3}$.from $4\frac{2}{5}$.

Solution:

Convert the mixed fractions into improper fractions:

$2\frac{1}{3} = \frac{7}{3}$ and $4\frac{2}{5} = \frac{22}{5}$

Now, find the LCM of 3 and 5, which is 15.

Convert both fractions to have a denominator of 15:

$\frac{7}{3} = \frac{35}{15}$ and $\frac{22}{5} = \frac{66}{15}$

Now subtract the numerators:

$\frac{66}{15} - \frac{35}{15} = \frac{66 - 35}{15} = \frac{31}{15}$

Convert $\frac{31}{15}$ into a mixed fraction:

$\frac{31}{15} = 2\frac{1}{15}$

Example: A baker has $8\frac{1}{3}$ cups of flour. He uses $5\frac{2}{5}$ cups to bake a cake. How much flour does the baker have left?

Solution:

To find out how much flour is left, subtract the amount used for the cake from the total amount of flour:

Convert the mixed fractions into improper fractions:

$8\frac{1}{3} = \frac{25}{3}$

$5\frac{2}{5} = \frac{27}{5}$

Now, find the LCM of 3 and 5, which is 15.

Convert both fractions to have a denominator of 15:

$\frac{25}{3} = \frac{125}{15}$

$\frac{27}{5} = \frac{81}{15}$

Now subtract the numerators:

$\frac{125}{15} - \frac{81}{15} = \frac{125 - 81}{15} = \frac{44}{15}$

Convert $\frac{44}{15}$ into a mixed fraction: $2\frac{14}{15}$

Exercise 7.6

1. **Find the sum of these like fractions and simplify if necessary:**

(a) $\frac{3}{8}+\frac{2}{8}$ (b) $\frac{5}{7}+\frac{1}{7}$ (c) $\frac{4}{9}+\frac{1}{9}$

(d) $\frac{6}{11}+\frac{4}{11}$ (e) $\frac{7}{12}+\frac{2}{12}$ (f) $\frac{9}{10}+\frac{3}{10}$

2. **Add the fractions and simplify of Unlike Fractions :**

(a) $\frac{2}{5}+\frac{3}{10}$ (b) $\frac{7}{8}+\frac{1}{4}$ (c) $\frac{3}{4}+\frac{5}{6}$

(d) $\frac{2}{3}+\frac{4}{9}$ (e) $\frac{5}{12}+\frac{7}{18}$ (f) $\frac{3}{5}+\frac{4}{15}$

3. **Add the mixed fractions and simplify:**

(a) $2\frac{1}{4}+3\frac{2}{5}$ (b) $5\frac{3}{8}+2\frac{1}{4}$ (c) $7\frac{2}{3}+4\frac{1}{6}$

(d) $3\frac{5}{12}+2\frac{7}{8}$ (e) $6\frac{1}{2}+3\frac{3}{4}$ (f) $4\frac{2}{5}+2\frac{3}{10}$

4. **Add the following:**

(a) $2\frac{3}{5}+1\frac{2}{5}$ (b) $3\frac{4}{7}+1\frac{5}{7}$ (c) $5\frac{1}{6}+3\frac{5}{6}$

(d) $4\frac{3}{8}+2\frac{1}{8}$ (e) $7\frac{2}{9}+5\frac{4}{9}$ (f) $6\frac{1}{3}+2\frac{2}{3}$

5. **Subtract the following;**

(a) $4\frac{1}{2}-2\frac{1}{2}$ (b) $5\frac{3}{4}-2\frac{1}{4}$ (c) $7\frac{2}{5}-3\frac{1}{5}$

(d) $6\frac{5}{6}-2\frac{2}{6}$ (e) $9\frac{1}{3}-4\frac{2}{3}$ (f) $8\frac{4}{7}-3\frac{2}{7}$

6. **A gardener planted $2\frac{3}{4}$ meters of flowers in the garden and $3\frac{1}{2}$ meters in the backyard. How much area did the gardener plant in total?**

7. **A driver drove $7\frac{7}{8}$ kilometers on the first day and $4\frac{5}{8}$ kilometers on the second day. How much distance did the driver travel in total?**

8. **Sonia had $9\frac{1}{2}$ liters of water. She drank $4\frac{1}{3}$ liters. How much water does she have left?**

9. **A farmer had $12\frac{3}{4}$ kilograms of seeds. He planted $5\frac{2}{3}$ kilograms in his field. How many kilograms of seeds does he have left?**

10. **Provide the missing information in the blanks:**

(a) $\frac{2}{5}+\frac{3}{5}=\frac{\text{---}}{5}$ (b) $\frac{7}{8}+\frac{5}{8}=\frac{\text{---}}{8}$ (c) $4\frac{1}{6}+3\frac{5}{6}=7\frac{\text{---}}{6}$

(d) $5\frac{2}{3}-2\frac{1}{3}=$ .... (e) $8\frac{4}{7}-3\frac{1}{7}=$ .... (f) $7\frac{5}{8}-3\frac{2}{8}=$ ....

11. **A tailor needs $2\frac{2}{3}$ meters of cloth for a dress and $3\frac{1}{3}$ meters for a scarf. How much cloth must he buy in total?**

12. **John traveled $4\frac{1}{2}$ km by bike and $3\frac{1}{4}$ km by walking. How much distance did John travel in total?**

13. **A chef had $10\frac{3}{4}$ liters of soup. He used $6\frac{2}{3}$ liters to serve the guests. How much soup does the chef have left?**

14. **A shopkeeper had $12\frac{1}{2}$ kilograms of rice. He sold $4\frac{1}{3}$ kilograms. How much rice does the shopkeeper have left?**

15. **John had $15\frac{5}{8}$ meters of rope. He used $7\frac{1}{4}$ meters to tie his luggage. How much rope does John have left?**

Think Tank

Gap Analyzer™
Take a Test

1. **Tick (✓) the correct answer:**

a. Which of the following fractions is equivalent to $\frac{1}{2}$?

(i) $\frac{3}{6}$ ☐ (ii) $\frac{2}{3}$ ☐ (iii) $\frac{2}{5}$ ☐ (iv) $\frac{5}{10}$ ☐

b. Which of the following fractions is a proper fraction?

(i) $\frac{7}{5}$ ☐ (ii) $\frac{3}{8}$ ☐ (iii) $\frac{8}{8}$ ☐ (iv) $\frac{9}{6}$ ☐

c. Which fraction is in its simplest form?

(i) $\frac{6}{12}$ ☐ (ii) $\frac{3}{9}$ ☐ (iii) $\frac{7}{10}$ ☐ (iv) $\frac{8}{16}$ ☐

d. The fraction $\frac{12}{16}$ in simplest form is:

(i) $\frac{3}{4}$ ☐ (ii) $\frac{4}{3}$ ☐ (iii) $\frac{6}{8}$ ☐ (iv) $\frac{1}{2}$ ☐

e. Which of the following fractions is greater than $\frac{1}{2}$?

(i) $\frac{2}{5}$ ☐ (ii) $\frac{4}{10}$ ☐ (iii) $\frac{3}{4}$ ☐ (iv) $\frac{1}{3}$ ☐

2. **Provide the missing information in the blanks:**

a. A fraction is called an _______ fraction if the numerator is smaller than the denominator.

b. The sum of $\frac{1}{3}$ and $\frac{1}{6}$ is _______.

c. $\frac{3}{5}$ is equivalent to _______ when the numerator and denominator are multiplied by 2.

d. To subtract fractions, their _______ must be the same.

e. The mixed fraction form of $\frac{4}{3}$ is _______.

3. **A pizza is divided into 8 equal slices. Maya ate 3 slices, and her brother ate 2 slices. What fraction of the pizza was eaten, and how much is left?**

4. **Match the Columns:**

Column A	Column B
a) $\frac{8}{12}$	i) $\frac{2}{5}$
b) $\frac{9}{15}$	ii) $\frac{3}{4}$
c) $\frac{10}{25}$	iii) $\frac{3}{5}$
d) $\frac{12}{16}$	iv) $\frac{2}{3}$

Case Study

Critical Thinking

A class is conducting a survey to determine the favorite fruits of students. The results are represented as fractions of the total class strength.

Fruit	Fraction of Students
Apple	$\frac{1}{4}$
Banana	$\frac{1}{3}$
Mango	$\frac{1}{6}$
Orange	$\frac{1}{4}$

Assertion and Reason

Experiential Learning

Each question has two statements, Assertion (A) and Reason (R). Choose the correct option:

A: Both A and R are true, and R is the correct explanation of A.

B: Both A and R are true, but R is not the correct explanation of A.

C: A is true, but R is false.

D: A is false, but R is true.

1. **Assertion (A):** A fraction is in its simplest form when its numerator and denominator have no common factors other than 1.

   Reason (R): To simplify a fraction, divide the numerator and denominator by their greatest common factor (GCF).

2. **Assertion (A):** $\frac{7}{2}$ is an improper fraction.

   Reason (R): In an improper fraction, the numerator is smaller than the denominator.

3. **Assertion (A):** Adding fractions with the same denominator is simpler than adding fractions with different denominators.

   Reason (R): Fractions with the same denominator do not require finding a common denominator before addition.

4. **Assertion (A):** The reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$.

   Reason (R): The reciprocal of a fraction is obtained by interchanging its numerator and denominator.

5. **Assertion (A):** $\frac{8}{16} = \frac{4}{8}$.

   Reason (R): Both fractions simplify to $\frac{1}{2}$.

HOTS (Higher Order Thinking Skills)

Critical Thinking

1. If a class has 30 students and $\frac{2}{5}$ of them are boys, how many boys and girls are there in the class?
2. If a water tank is filled to $\frac{3}{4}$ of its capacity and 20 liters of water are added to make it full, what is the total capacity of the tank?
3. Compare $\frac{7}{8}$ and $\frac{5}{6}$ by converting them to equivalent fractions with the same denominator. Which one is larger?