# FRACTIONS – GCSE MATHS

CONTENTS:



## 1. Introduction

Fractions are a way to show parts of a whole. We use them when something is divided into equal pieces, and we want to talk about some of those pieces.

**For example**: if a pizza is cut into 8 equal slices and you eat 3, you've eaten 3/8 of the pizza.

## 2. Types of Fractions

A fraction is a number that represents a part of a whole. It is written in the form a/b, where:

- **a** is the numerator – the number of parts you have.
- **b** is the denominator – the total number of equal parts the whole is divided into.

**For example:**

In 1/2, the whole is divided into 2 parts, and we have 1 of them.

# FRACTIONS – GCSE MATHS

**Let us take an example:**

**a pizza of having 9 slices**

**one slice of pizza is in the form of fraction as:** $\frac{1}{9}$

## Now let us discuss different types of fractions:

- **Unit Fractions**

A unit fraction is a fraction in which the numerator is **always 1,** and the denominator is some **positive integer**. In other words, unit fractions are of the form 1/n, where n is any natural number **(1, 2, 3, ...)**

**For example:** $\frac{1}{2}, \frac{1}{8}, \frac{1}{5}$

- **Improper Fractions**

An improper fraction is a fraction in which the numerator (the top number) is **greater than or equal** to the denominator (the bottom number). In other words, the **fraction** represents a value that is **equal to or greater than 1.**

**For example:** $\frac{5}{2}, \frac{3}{2}, \frac{6}{5}$

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- **Mixed Numbers**

A mixed number is a **combination of a whole number** and a proper fraction (a fraction where the numerator is **smaller** than the denominator). It is used to represent quantities **greater than 1** in a more intuitive way.

**For example:** $2\frac{1}{4}, 5\frac{3}{5}, 9\frac{3}{2}$

## 3. Converting into Forms

- **Converting Mixed fractions to Improper fractions.**

**Steps:**

1. Multiply whole number × denominator.
2. Add numerator.
3. Write over the same denominator.

**Problem:** Convert $5\frac{1}{4}$ to an improper fraction.

**Solution:**

**Step #1: Multiply whole number × denominator.**

$$5 \times 4 = 20$$

**Step #2: Add numerator.**

$$20 + 1 = 21$$

**Step # Write over the same denominator.**

**Result:** $\frac{21}{4}$

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- **Converting Decimals to Fractions.**

## 1. Terminating Decimals

A Terminating Decimal is a decimal number that ends after a finite number of digits.

**Steps:**

**Step #1:** Write the decimal as a fraction over 1

$$0.75 = \frac{0.75}{1}$$

**Step #2:** Multiply numerator and denominator by 10, 100, 1000, etc. to eliminate the decimal.

1 decimal place → × 10
2 decimal place → × 100
3 decimal place → × 1000

**Step #3:** Simplify the fraction by dividing numerator and denominator by their Greatest Common Divisor (GCD).

**For example:**

**Problem:** Convert 0.125 as a fraction

**Solution:**

**Step #1:** Write the decimal as a fraction over 1

$$0.125 = \frac{0.125}{1}$$

**Step #2:** Multiply numerator and denominator by 10, 100, 1000, etc. to eliminate the decimal.

3 decimal place → × 1000

**Step #3:** Simplify the fraction by dividing numerator and denominator by their Greatest Common Divisor (GCD).

$$\frac{0.125}{1000} = \frac{1}{8}$$

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## 2. Recurring Decimals

A Recurring Decimal is a decimal number in which one or more digits repeat infinitely after the decimal point.

**Let x be the repeating decimal.**

**Steps:**

**Step #1:** Multiply by $10^n$ (where n= number of repeating digits).
**Step #2:** **Subtract** the original equation to eliminate the repeating part.
**Step #3:** **Solve for x** and simplify.

**For example:**

**Problem:** Convert $0.\bar{7}$ to a fraction.

**Solution:**

Let $x = 0.\bar{7}$

**Step #1:** Multiply be 10 since 1 digit repeats itself

$$10x = 7.\bar{7}$$

**Step #2:** Subtract the original equation

$$10x - x = 7.\bar{7} - 0.\bar{7}$$

$$9x = 7$$

**Step #3:** Solve for x:

$$x = \frac{7}{9}$$

## 4. Reciprocals

**Reciprocal** is generally the "flip" of a fraction or the multiplicative inverse that results in 1 when multiplied by the original number.

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**FRACTIONS:** Flip the top and bottom of the fraction as

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

**WHOLE NUMBER:** It is 1 divided by that number.

$$5 = \frac{1}{5}$$

**MIXED NUMBERS:** Firstly convert into improper fraction and then flip the equation

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

## 5. Operations with Fractions

### 1. Addition and Subtraction

**Steps:**

**Step #1:** Make the bottom numbers the same

**Step #2:** Add or subtract the top numbers

**Step #3:** Convert back to a mixed number if needed

### 2. Multiplication

**Steps:**

**Step #1:** Multiply top numbers together.

**Step #2:** Multiply bottom numbers together.

**Step #3:** Simplify the result.

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## 3. Division

**Steps:**

**Step #1:** Keep the first fraction the same.

**Step #2:** Change the division sign to a multiplication sign.

**Step #3:** Flip the second fraction over to write the reciprocal.

## Solved Examples:

**Problem:** Convert **3/4+ 7/2** as a fraction

**Solution:**

**Step #1:** Make the bottom numbers the same

$$= \frac{3}{4} + \frac{7}{2}$$

$$= \frac{3+14}{8}$$

**Step #2:** Add the top numbers

$$= \frac{17}{4}$$

**Step #3:** Convert back to a Mixed Fraction

$$= 3\frac{5}{4}$$

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**Problem:** Convert **1/3 × 3/5** as a fraction

**Solution:**

**Step #1:** Multiply top numbers together.

$$= \frac{1}{3} \times \frac{3}{5}$$

**Step #2:** Multiply bottom numbers together.

$$= \frac{1 \times 3}{3 \times 5}$$

**Step #3:** Simplify the result

$$\frac{3}{15} = \frac{1}{5}$$

**Problem:** Convert **3/4 ÷ 7/2** as a fraction

**Solution:**

**Step #1:** Keep the first fraction same and change the divide sign to multiplication sign and reciprocate the second fraction.

$$= \frac{3}{4} \times \frac{2}{7}$$

**Step #2:** Multiply bottom and top numbers together.

$$= \frac{6}{28}$$

# FRACTIONS – GCSE MATHS

## 6. Solved Examples

**Problem:** A builder completed 5/8 of a wall on Monday and 1/4 on Tuesday. What fraction of the wall is left to complete?

**Solution:**

**Step #1:** Write down the given information

On Monday, fraction of wall gets completed:- $\frac{5}{8}$

On Tuesday, fraction of wall gets completed:- $\frac{1}{4}$

**Step #2:** Simplify to make a common denominator

We know that:

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

**Step #3:** Calculate the final result by applying favorable operations

The total amount of work that has been completed: $\frac{5+2}{4} = \frac{7}{8}$

Fraction of wall that is left to complete: $1 - \frac{7}{8}$

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

# FRACTIONS – GCSE MATHS

**Problem:** A box has 24 pencils. 1/3 of them are red, and 1/4 are blue. How many pencils are neither red nor blue?

**Solution:**

**Step #1:** Write down the given information

Red pencils :- $\frac{1}{3} \times \frac{8}{8} = \frac{8}{24}$

Blue pencil :- $\frac{1}{4} \times \frac{6}{6} = \frac{6}{24}$

**Step #2:** Simplify to make a common denominator

We know that:

$$\frac{8+6}{24} = \frac{14}{24}$$

**Step #3:** Calculate the final result by applying favorable operations

The total number of pencils that is either red or blue : $\frac{14}{24}$

Pencils that are neither red nor blue: $1 - \frac{14}{24}$

$$\frac{10}{24}$$