Chapter- 10
Decimal Fractions

STUDY NOTES

In this chapter, you will

- **Learn the concept of tenths, hundredths and thousandths.**
- **Learn mixed numbers as decimals.**
- **Learn the place value of decimals numbers.**
- **Learn expanded form of decimal numbers.**
- **Be able to convert decimals into fractions.**
- **Know about equivalent decimals.**
- **Learn like and unlike decimals.**
- **Learn comparing and ordering of decimals numbers.**
- **Be able to perform addition and subtraction of decimal numbers.**
- **Be able to perform multiplication and division of decimal numbers.**

Let us suppose on the occasion of Diwali, you are painting the walls of your room with the help of your sister. You painted $\frac{3}{10}$ part of the wall and your sister painted remaining $\frac{7}{10}$ part.

Now, we can convey the same in decimal form

$\frac{3}{10}$ = 3 tenths can be written as 0.3

$\frac{7}{10}$ = 7 tenths can be written as 0.7

0.3 means, you painted three tenths part of the wall.

0.7 means, you painted seven tenths part of the wall.

Tenths :

When 'one' is divided into ten equal parts, each equal part is called tenths or one tenth.
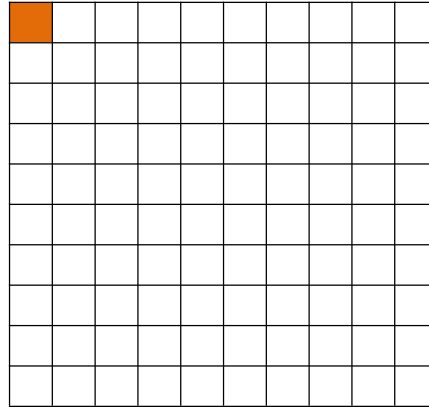
$\frac{1}{10}$ = 0.1

= Zero point one

Hundredths :

When 'one' is divided into hundred equal parts, then each equal part is called one hundredths.
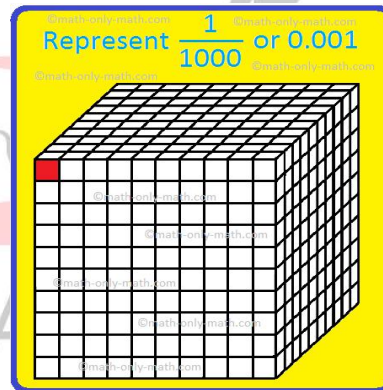
$\frac{1}{100}$ = 0.01

= Zero point zero one

Thousandths :

When 'one' is divided into thousand equal parts, then each equal part is called one thousandths.

$$\frac{1}{1000} = 0.001$$

= Zero point zero zero one

Represent $\frac{1}{1000}$ or 0.001

Decimals

Tenths, Hundredths and Thousandths

1 tenth = $\frac{1}{10}$ = 0.1
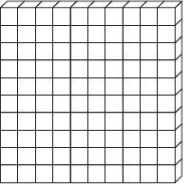
5 tenths = $\frac{5}{10}$ = 0.5

1 hundredth = $\frac{1}{100}$ = 0.01

3 hundredths = $\frac{3}{100}$ = 0.03

1 thousandth = $\frac{1}{1000}$ = 0.001
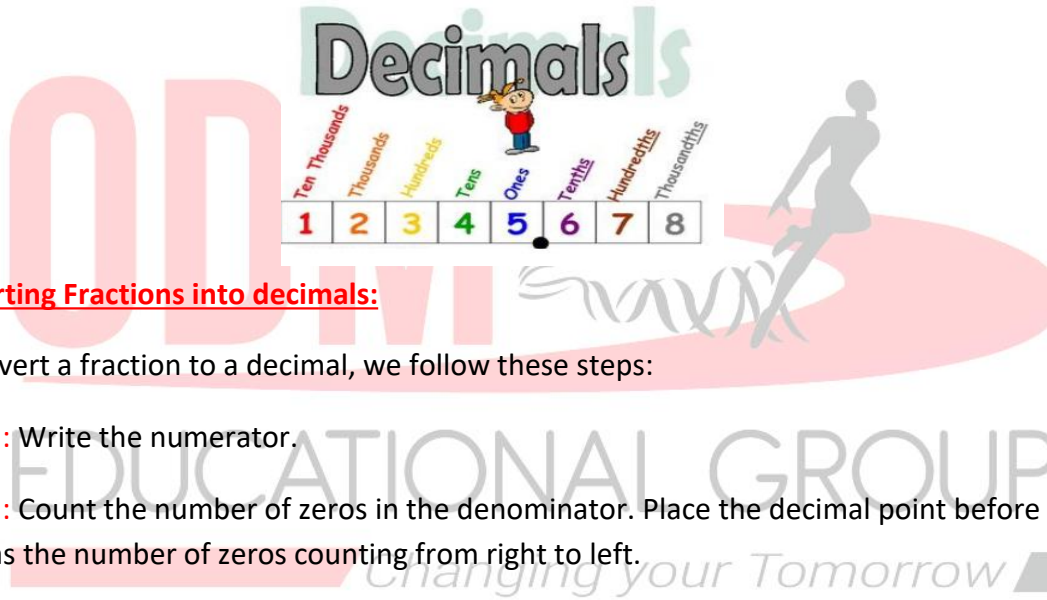
7 thousandth = $\frac{7}{1000}$ = 0.007

A flat is 1 whole unit. A rod is $\frac{1}{10}$ of the whole.

A block is $\frac{1}{100}$ of the whole

Decimal Numbers

- Fractions which has denominator 10, 100, 1000 etc are called **Decimal Fractions**.
- A decimal number is a number with a decimal point. Numbers left to the decimal are 10 greater and numbers to the right of the decimal are 10 smaller.

Converting Fractions into decimals:

To convert a fraction to a decimal, we follow these steps:

Step-1 : Write the numerator.

Step-2 : Count the number of zeros in the denominator. Place the decimal point before as many digits as the number of zeros counting from right to left.

For example: Express the following fractions into decimals.

a) $\frac{8}{10}$ b) $\frac{8}{100}$ c) $\frac{8}{1000}$

Solut:ion: a) 0.8   b) 0.08   c) 0.008

Mixed numbers as decimals :

We can express mixed number $3\frac{4}{10}$ as a decimal number.

The whole number is written as it is, and $\frac{4}{10}$ is written as a decimal number.

$3\frac{4}{10} = 3.4$

Similarly, $8\frac{15}{100} = 8.15$; $15\frac{89}{1000} = 15.089$

To write an improper fraction as decimal, convert it into a mixed number,

For example : $\frac{10567}{1000} = 10.567$, $\frac{2105}{100} = 21.05$

Place-value of decimals numbers :

Ten thousands	Thousands	Hundreds	Tens	Ones		Tenths	Hundredths	Thousandths
10,000	1,000	100	10	1	•	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

$\frac{1}{10}$ can be written as 0.1 (one tenths) = zero point one

$\frac{1}{100}$ can be written as 0.01 (one hundredths) = zero point zero one

$\frac{1}{1000}$ can be written as 0.001 (one thousandths) = zero point zero zero one

The dot (•) used after ones place in the numbers above is called decimal point.

Place value of each digit in 457.67 is shown below.

4 5 7 . 6 7

7 hundredths = . 07

6 tenths = . 6

7 ones = 7

5 tens = 50

4 hundreds = 400

units
tens
13.95 ← hundredths (1/100)
tenths (1/10)
decimal point
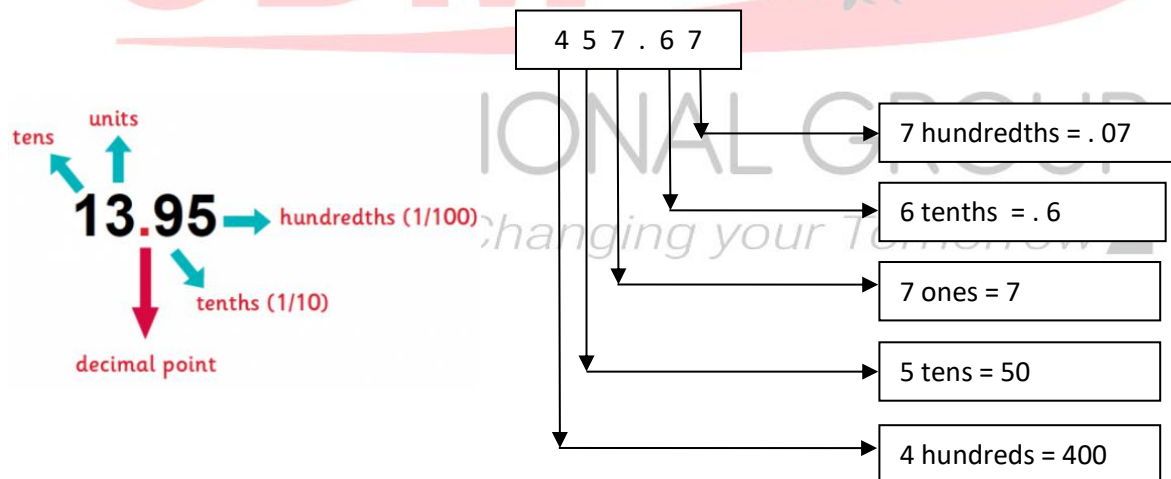
Expanded form of decimals :

	Thousands	Hundreds	Tens	Ones		tenths	hundredths	thousandths
a)		1	7	3	.	8	5	7
b)			4	3	.	7	9	

These are read as :

1) One hundred seventy-three point eight five seven
2) Forty-three point seven nine

In the expanded form :

To express a number in expanded form, write each digit of the number with its corresponding place value with a + sign between them.

a) 173.857 = 100 + 70 + 3 + o.8 + 0.05 + 0.007

$$= 100 + 70 + 3 + \frac{8}{10} + \frac{5}{100} + \frac{7}{1000}$$

b) 43.79 = 40 + 3 + 0.7 + 0.09

$$= 40 + 3 + \frac{7}{10} + \frac{9}{100}$$

Converting decimals into fractions :

To convert decimals into fractions, we follow these steps.

Step 1: In the numerator, remove the decimal point. The number that remains is the numerator.

Step 2: In the denominator, write 1 followed by as many zeroes as there are decimal places.

Step 3: Simplify the fraction if possible.

Example: Convert the following decimals into fractions.

a) 0.7   b) 8.5 c) 0.5   d) 1.25

Solution: a) $0.7 = \frac{7}{10}$ b) $\frac{85}{10} = \frac{85 \div 5}{10 \div 5} = \frac{17}{2} = 8\frac{1}{2}$

c) $\frac{5}{10} = \frac{1}{2}$ d) $1.25 = \frac{125 \div 25}{100 \div 25} = \frac{5}{4} = 1\frac{1}{4}$

Equivalent decimals :

Equivalent decimals are two **decimal numbers** that are equivalent, that is, they represent the same value or amount.
Here, both the decimal numbers show the same amount of space taken.
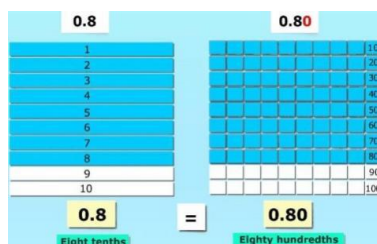
Decimals that have the same value are called equivalent decimals

Example:

a) 0.5, 0.05 and 0.005 are equivalent decimals.
b) 4.5 and 4.005 are not equivalent decimals.

Like and unlike decimals :

Decimals having the same number of decimal places are called **like decimals**.

They are having the same number of digits on the right of the decimal point.

5.45, 17.04 and 272.89 are like decimals as all these decimal numbers are written upto 2 places of decimals.

Decimals not having the same number of decimal places are called **unlike decimals**.

7.5, 23.16, 31.054 are unlike decimals, As 7.5 has one decimal place. 23.16 has two decimal places .

31.054 has three decimal places.

Converting unlike decimals into like decimals :

Step 1: Identify the decimal with the largest number of decimal places..

Step 2: Add one or more zeros to the extreme right of each decimal number to have equal number of digits in the decimal part. This converts all unlike decimals into like decimals.

Example: Convert the decimals 0.246, 45.25, 2.78, 5.132 into like decimals.

Solution: The numbers 0.246 and 5,132 have the greatest number of decimal places ie, 3 .part. So, we have to convert them into equivalent decimals with three decimal places.

Hence, the set of like decimals is 0.246, 45.250, 2.780 and 5.132.

Comparing of decimals :

Decimals can be compared in the same way as whole number.

First, convert the decimals to like decimals, by adding zeroes as necessary.

Step 1: First compare the **whole number** part.

The decimals with the greater whole number is greater.

$$23.566 > 9.639$$

Step 2: If the whole number parts are equal, compare the **tenths** digits.

The decimal with the greater tenths digit is greater.

$$6.967 > 6.435$$

Step 3: If the whole number and the tenths digit are equal, compare the **hundredths** digits.

$$6.543 > 6.512$$

Step 4: If the hundredths digit are also equal, compare the **thousandths** digits.

$$54.329 > 54.320$$

Example: Compare 23.14 and 8.67

Solution: In 23.14, the whole part is 23 and in 8.67 the whole number part is 8.

As 23 > 8 , 23.14 > 8.67.

Example: Compare 53.47 and 53.81

Solution: In 53.47 and 53.81, the whole number part is the same, i.e., 53.

In 53.47, the decimal part is .47 and the digit in the tenths place is 4.

In 53.81, the decimal part is .81 and the digit in the tenths place is 8.

8 > 4. Hence, 53.81 > 53.47

Ordering of decimals :

Important rules :

- Convert all the decimal numbers into like decimals, if they are unlike.
- Compare the whole number parts. The decimal numbers with the greater whole numbers part is greater.
- If the whole number parts are equal, compare the digits at the tenths place. The decimal with the greater digit at tenths place is greater.
- If the digits at tenths place are equal, then compare the digits at hundredths place and so on.

Example: Rewrite the numbers 1.25, 1.17, 1.32, 0.99, 1.06, 1.7 in ascending order.

Solution: First convert all the decimal numbers in like decimal numbers.

1.25, 1.17, 1.32, 0.99, 1.06, 1.70

Now on comparing, we get numbers in ascending order as:

0.99, 1.06, 1.17, 1.25, 1,32, 1.70.

Addition of decimals :

Addition of decimal is just like addition of whole numbers. To add decimal numbers, we have to follow the given steps:

Step 1: Write down the decimal numbers, one number under the other number and line up the decimal points.

Step 2: Convert the given decimals to like decimals.

Step 3: Arrange the place values in such a way that the digits of the same place are in the same column.

Step 4: Add the arranged numbers like whole numbers.

Step 5: Remember to place the decimal point down in the answer at the same place as the numbers above it.

Example: Add 1.83, 21.105, 236.8 and 0.9

Solution: First convert all the addends to like decimals.

1.830 + 21.105 + 236.800 + 0.900

Arrange the addends in column.

	1	**2**				
		1	•	8	3	0
	2	1	•	1	0	5
2	3	6	•	8	0	0
		0	•	9	0	0
2	6	0	•	6	3	5

(+)

Hence, the sum is 260. 635.

Subtraction of decimals :

Subtraction of decimal is just like subtraction of whole numbers. To subtract decimal numbers, we have to follow the given steps:

Step 1: Write the smaller number below the bigger number such that the **decimal point are placed one below the other.**

Step 2: Convert the given decimals to like decimals.

Step 3: Arrange the place values in such a way that the digits of the same place are in the same column.

Step 4: Regroup while subtracting in the same way as in whole numbers.

Step 5: Remember to place the decimal point down in the answer at the same place as the numbers above it.

Example: Subtract 27.59 from 31.4

Solution: First convert the decimal number into to like decimals.

31.40 – 27.59

Then arrange in columns and subtract them.

	2	**10**		**13**	**10**
	3	1	•	4	0
(−)	2	7	•	5	9
	0	3	•	8	1

Hence, the difference is 3.81

<u>Multiplication of decimals :</u>

1. Multiplication by 10, 100, 1000 etc (multiples of 10) :

To multiply a decimal fractions by 10, 100, 1000 etc. Move the decimal point in the multiplicand by as many places **to the right** as there are zeroes in the multiplicand.

Example: 0.849 × 100 = 84.9

2. Multiplication of a decimal fraction by a whole number :

Multiply the multiplicand with the multiplier as in common multiplication. Then, the product should have the same number of decimal places as the multiplicand.

Example: 16.32 × 8 = 130.56

3. Multiplication of a decimal fraction by a decimal fraction :

Multiply the multiplicand with the multiplier as in common multiplication. Then, the number of decimal places in the product is equal to the total number of decimal places in the multiplicand and the multiplier together.

Example: 16.32 × 32.321 = 527.47872

<u>Division of decimals :</u>

1. Division by 10, 100, 1000 etc (multiples of 10) :

To divide a decimal fractions by 10, 100, 1000 etc. Move the decimal point in the multiplicand by as many places **to the left** as there are zeroes in the divisor.

Example: 7.849 ÷ 10 = 0.7849

201.2 ÷ 100 = 2.012

2. Division of a decimal fraction by a whole number :

When division with the whole number in the dividend is over, put a decimal point in the quotient.

3.Division of a decimal fraction by a decimal fraction :

To divide a decimal number by a decimal number, first change the divisor into a whole number by multiplying the denominator by 10,100,100 etc.(multiples of 10) as required.

Multiply the dividend (numerator) also by the same number so that the value of the given number remains the same.

4. Division of a decimal fraction by a decimal fraction :

To divide a whole number by a decimal, convert the divisor into a whole number by multiplying the dividend and the divisor by 10 or 100 or 1000, depending upon the number of decimal places in the divisor, and then divide the new dividend (product of the given dividend and 10 or 100 or 1000) by the whole number divisor.

POINTS TO REMEMBER :

◇ **The fractions in which the denominators are 10, 100, 1000 etc. Are known as *decimal fractions.***

◇ **Numbers written in decimal form are called decimal numbers or simply decimals.**

◇ **A decimal has two parts - whole number part and decimal part.**

◇ **The number of digits contained in the decimal part of a decimal gives the number of its decimal places.**

◇ **Decimals having same number of decimal decimal places are called like decimals, otherwise they are unlike decimals.**

◇ **We have 0.6 = 0.60 = 0.600 etc.**

◇ **We can convert unlike decimals into like decimals by adding the desired number of zeroes at the end of the decimal part.**

MIND MAP

Decimal Fractions

- Recall-the decimal representation of tenths,hundredths, thousandths
- Mixed numbers as decimals
- Place-value chart
- Expanded form of decimals
- Like and unlike decimals
  - Equivalent decimals

- Conversion of a decimal fraction into a common fraction
- Conversion of a common fraction into a decimal fraction
- Comparing and ordering decimals
- Rounding off decimals

- Addition and Subtraction of decimal fractions
- Multiplication and division of decimal fractions