DECIMALS

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Decimals : Decimals are an extension of our number system. Decimals are fractions whose denominators are 10, 100, 1000 etc. A decimal has two parts, namely, the whole number part and decimal part.

Decimal Places : The number of digits contained in the decimal part of a decimal number is known as the number of decimal places.

For example :

3.75 has two decimal places and 85.325 has three decimal places.

Like and unlike decimals : Decimals having the same number of decimals places are called like decimals, otherwise they are known as unlike decimals.

For example :

5.25, 15.04, 273.89 are like decimals and 9.5, 18.235, 20.0254 etc. are unlike decimals.

NOTE

We have 0.1 = 0.10 = 0.100 etc, 0.5 = 0.50 etc. and so on. That is by annexing zeros on the right side of the extreme right digit of the decimal part of a number does not alter the value of the number. Unlike decimals may be converted into like decimals by annexing the requisite number of zeros on the right side of the extreme right digit in the decimal part.

DIVISION OF A UNIT IN TEN EQUAL PARTS

If an object is divided into 10 equal parts then its each part is one tenth of the whole. It is written as $\frac{1}{10}$.

$\frac{1}{10}$ is also written as 0.1 and is read as 'one tenth' or 'decimal one or point one'. thus 1 ones = 10 tenth

Ex. 0.5 is read as 5 tenth.

REPRESENTATION DECIMALS ON NUMBER LINE

We have learnt the representation of whole numbers and fractions on a number line. Now we shall explain the method of representing decimal numbers on number line

Let us represent 1.3 on a number line

1.3 is more than 1 and less than 2

1.3 is 1 + 0.3, i.e 1 + 3 tenths

Draw a number line and mark whole numbers 0,1 ,2,3, ... on it.

Divide the portion between 1 and 2 into 10 equal parts and take 3 parts for 3 tenths or 0.3 Mark it as P. In the above figure P presents the number 1.3.

Ex. Mark the following decimals in place value table :

(a) 0.3 (b) 19.4 (c) 205.9

Sol. Place Value Table

Number	Hundreds	Tens	Ones	Decimal	Tenths
0.3			0	-	3
19.4		1	9	-	4
205.9	2	0	5	-	9

Ex. Write the following in decimal notation :

(a) Eight tenths (b) Eight and 3 tenths

(c) $17\frac{1}{10}$ (d) $\frac{3}{5}$ (e) $5\frac{1}{2}$

Sol. (a) 0.8 (b) 8.3

(c) 17.1 (d) $\frac{3}{5} = \frac{3\times2}{5\times2} = \frac{6}{10} = 0.6$

(e) $5\frac{1}{2} = 5 + \frac{1\times5}{2\times5} = 5 + \frac{5}{10} = 5.5$

Ex. Write the following in decimal fractions :

(a) 0.8 (b) 1.3

Sol. (a) 0.8 = 8 tenths = $\frac{8}{10}$

(b) 1.3 = 1 + 3 tenths = $1 + \frac{3}{10} = 1\ \frac{3}{10}$

Ex. Write the following as fractions. Reduce them to lowest terms :

(a) 1.0 (b) 3.8

(c) 21.2

Sol. (a) 1.0 = 1

(b) $3.8 = 3\frac{8}{10} = 3\frac{4}{5}$

(c) $21.2 = 21\frac{2}{10} = 21\frac{1}{5}$

DIVISION OF A UNIT IN HUNDRED EQUAL PARTS

If an object is divided into 100 equal parts then its each part is one hundredth of the whole. It is written as $\frac{1}{100}$. $\frac{1}{100}$ is also written as 0.01 and is read as 'one hundredth' or 'decimal zero one' or zero point zero one'.

DIVISION OF A UNIT IN THOUSAND EQUAL PARTS

If an object is divided into 1000 equal parts then its each part is one thousandth of the whole. It is written as $\frac{1}{1000}$.

$\frac{1}{1000}$ is also written as 0.001 and is read as 'one thousandth' or decimal zero one' or zero point zero zero one'.

Ex. Write the following decimals in words :

(a) 0.03 (b) 17.38

(c) 10.07 (d) 5.008

Sol. (a) Zero point zero three

(b) Seventeen point three eight

(c) Ten point zero seven

(d) Five point zero zero eight

Ex. Place values of digits of numbers are given below.

Write them in decimal form :

(a) 3 tenths, 5 ones, 2 tens, 9 hundredths

(b) 2 hundredths, 3 thousandths, 2 ones

(c) 6 ones, 3 hundreds, 9 tenths, 5 hundredths, 1 thousandth

Sol.

Hundreds	Tens	Ones	Decimal	Tenths 1/10	Hundredths 1/100	Thousandths 1/1000	Number
	2	5	-	3	9		25.39
		2	-	0	2	3	2.023
3	0	6	-	9	5	1	306.951

Ex. Write as fraction in lowest terms :

(a) 17.05 (b) 6.32 (c) 45.25

Sol. (a) $17.05 = 17\frac{5}{100} = 17\frac{1}{20}$

(b) $6.32 = 6\frac{32}{100} = 6\ \frac{8}{25}$

(c) $45.25 = 45\frac{25}{100} = 45\frac{1}{4}$

EXPANDED NOTATION FOR DECIMAL NUMERS

Let us study the following examples :

(a) 14.5

$= 10 + 4 + \frac{5}{10} = 10 + 4 + 0.5$

(b) 49.08

$= 40 + 9 + \frac{0}{10} + \frac{8}{10} = 40 + 9 + 0.08$

in the above example 14.5 & 49.08 have been written in the expanded form

Ex. Write in the expanded form :

(a) 35.63 (b) 5.003

Sol. (a) 35.63

$30 + 5 + \frac{6}{10} + \frac{3}{100} = 30 + 5 + 0.6 + 0.03$

(b) 5.003

$5 + \frac{0}{10} + \frac{0}{100} + \frac{3}{1000} = 5 + 0.003$

Ex. Write in decimal :

(a) $200 + 30 + 5 + \frac{7}{100}$ (b) $6 + \frac{7}{10} + \frac{5}{100}$

Sol. (a) 235.07 (b) 6.75

COMPATISON OF DECIMALS

Decimal numbers may be compared by using the following steps :

Step I Obtain the decimal numbers.

Step II Compare the whole number parts of the numbers. The number with greater whole number part will be greater. If the whole number parts are equal, go to next step.

Setp III Compare the extreme left digit of the decimal parts of two numbers. The number with greater extreme left digit will be greater. If the extreme left digits of decimal parts are equal, then compare the next digits and so on.

Ex. Which is greater of 48.23 and 39.35?

Sol. The given decimals have distinct whole number parts, so we compare whole number parts only.

In 48.23, the whole number parts is 48.

In 39.35, the whole number part is 39.

$\because$ 48 > 39

$\therefore$ 48.23 > 39.35

Ex. Which is greater of 69.7 and 69.68?

Sol. The given decimals have same whole number parts.

so we will compare the decimal parts.

In 69.7 decimal parts is 0.7

In 69.68 decimal part is 0.068

$\therefore$ Extreme left digit of 0.7 is 7 and that of 0.68 is 6.

$\therefore$ 69.7 > 69.68

Ex. Write the following decimals in ascending order :

5.64, 2.54, 3.05, 0.259 and 8.32

Sol. Converting the given decimals into like decimals, we get:

5.640, 2.540, 3.050, 0.259 and 8.320

Ciearly, 0.259 < 2.540 < 3.050 < 5.640 < 8.320

Hence, the given decimals in the ascending order are 0.259, 2.54, 3.05, 5.64 and 8.32

OPERATIONS ON DECIMAL

Addition and Subtraction of Decimals : Decimals can be added or subtracted by using the following steps:

Step - I Convert the given decimals to like decimals.

Step - II Write the decimals in columns with their decimal points directly below each other so that tenths come under tenths, hundredths come under hundredths and so on.

Step -III Add or subtract as we add or subtract whole numbers.

Step -IV Place the decimal point, in the answer, directly below the other decimal points.

Ex. Add 15.44, 7.524 and 25.

Sol. Converting the given decimals to like decimals, we have 15.440, 7.524 and 25.000.

Now,

$$\begin{array}{r} 15.440 \\ +7.524 \\ +25.000 \\ \hline 47.964 \end{array}$$

Ex. Aakash bought vegetables weighing 10 kg. Out of this 3 kg 500 g is onion, 2 kg 75 g is tomab and the rest is potato. What is the weight of potato?

Sol. We have,

Weight of onion = 3 kg 500 g = 3.500 kg

Weight of tomato = 2 kg 75 g = 2.075 kg

∴ Total weight of onion and tomato is :

$$\begin{array}{r} 3.500\,\text{kg} \\ +2.075\,\text{kg} \\ \hline 5.575\ \text{kg} \end{array}$$

Total weight of vegetables = 10 kg

Weight of potato = 10 kg – 5.575 kg = 4.425 kg

Ex. Amit bought a Maths book for Rs. 45.60 and a geometry box for Rs. 62.55 What is the total amount spent by Amit?

Sol. Money spent on Maths book = Rs. 45.60

Money spent on Geometry box = Rs. 62.55

∴ Total amount spent

= Rs. 45.60 + Rs. 62.55

= Rs. 108.15

$$\begin{array}{r} 45.60 \\ +62.55 \\ \hline 108.15 \end{array}$$

Ex. Priya travelled 8 km 95 min the first hour, 6 km 298m in the second hour and 7 km 9m in the third hour. Find the total distance travelled by her in three hours.

Sol. Distance travelled in first hour = 8 km 95 m = 8.095 km

Distance travelled in second hour = 6km 298 m = 6.298 km

Distance travelled in third hour = 7 km 9 m = 7.009 km

∴ Total distance travelled in 3 hours

= 8.095 km + 6.298 km

+ 7.009 km

= 21.402 km

$$\begin{array}{r} 8.095 \\ 6.298 \\ +7.009 \\ \hline 21.402 \end{array}$$

Ex. An empty box weight 1 kg 240 g. When filled with oranges it weights 19 kg 70 g. What is the weight of the oranges?

Sol. Weight of empty box = 1 kg 240 g

= 1.240 kg

Weight of box with oranges

= 19 kg 70 g = 19.070 kg

∴ Weight of oranges

= 19.070 kg – 1.240 kg

= 17.830 kg.

$$\begin{array}{r} 19.070 \\ -1.240 \\ \hline 17.830 \end{array}$$

Ex. A can can hold 12.5 litres of mixed fruit juice. 4.035 litres of apple juice and 6 litres 15 ml of orange juice have been poured in the can. What would be the amount of grape juice that can still be added in the can?

Sol. Amount of apple juice = 4.035 L

Amount of orange juice = 6 litres 15 mL = 6.015 L

Capacity of can = 12.5 L

∴ Reqd. amount of grape juice

= 12.5 L – (4.035 + 6.015) L

= 12.5 L – 10.050 L

= 2.45 L

$$\begin{array}{r} 12.500 \\ -10.050 \\ \hline 2.450 \end{array}$$

Ex. Subtract the difference of 15.13 and 9.7 from their sum.

Sol. Sum = 15.13 + 9.7 = 24.83

Difference = 15.13 – 9.7 = 5.43

∴ Sum – Difference = 24.83 – 5.43

= 19.40

$$\begin{array}{r} 15.13 \\ +9.70 \\ \hline 24.83 \end{array} \qquad \begin{array}{r} 15.13 \\ -9.70 \\ \hline 5.43 \end{array}$$

Ex. Sundaram bought a toothpaste for Rs. 18.75, soap for Rs. 6 and shoe polish for Rs. 12.50 . He gave a fifty rupees note to the shopkeeper. Find the money he got back.

Sol. Cost of the toothpaste = Rs. 18.75

cost of the soap = Rs. 6.00

Cost of the shoe polish = + Rs. 12.50

Total expenditure = Rs. 37.25

Money he got back = Rs. 50 – Rs. 37.25

Rs. 50.00

Rs. 37.25

= Rs. 12.75

Ex. The height of Som is 1.25 m and that of Reena is 1.3 m. Who is taller and by how much?

Sol. Difference in height

= 1.30 m – 1.25 m

= 0.05 m

$$\begin{array}{r} 1.30 \\ -1.25 \\ \hline 0.05 \end{array}$$

Thus, Reena is taller by 0.05 m i.e., 5 cm then Som.

Multiplication of Decimals by 10, 100, 1000 etc.:

In order to multiply a decimal by 10, 100, 1000 etc., we use the following rules :

Rule I On multiplying a decimal by 10, the decimal point is shifted to the right by one place.

Rule II On multiplying a decimal by 100, the decimal point is shifted to the right by two places.

Rule III On multiplying a decimal by 1000, the decimal point is shifted to the right by three places and so on.

Ex. Find the following products :

(i) 27.05 × 10 (ii) 429.7 × 100

Sol. We have,

(i) 27.05 × 10 = 270.5 [Shifting the decimal point by one place to the right]

(ii) 429.7 × 100 = 429.70 × 100

= 42970

[Shifting the decimal point by two places to the right]

Multiplication of a decimal by a whole number :

A decimal can be multiplied by a whole number by using the following steps :

Step I Multiply the decimal without the decimal point by the given whole number.

Step II Mark the decimal point in the product to have as many places of decimal as there are in the given decimal.

Ex. Find the product of 0.0275 × 17.

Sol. We have,

275 × 17 = 4675

∴ 0.0275 × 17 = 0.4675

Multiplication of a decimal by another decimal :

To multiply a decimal by another decimal, we follow following steps :

Step I Multiply the two decimals without decimal point just like whole numbers.

Step II Insert the decimal point in the product by counting as many places from the right to left as the sum of the number of decimal places of the given decimals.

Ex. Find the product of 9.2 and 6.07.

Sol. We have,

$$\begin{array}{r} 92 \\ \times\ 607 \\ \hline 644 \\ 000 \\ +55200 \\ \hline 55844 \end{array}$$

$\therefore$ 92 × 607 = 55844

Since the sum of the decimal places in the given decimals is 1 + 2 = 3.

So, the product must contain 3 places of decimals.

Hence 9.2 × 6.07 = 55.844

Ex. Multiply 0.0345 by 0.0237

Sol. We have,

$$\begin{array}{r} 345 \\ \times\ 237 \\ \hline 2415 \\ 10350 \\ +69000 \\ \hline 81765 \end{array}$$

$\therefore$ 345 × 237 = 81765

We observe that the sum of the decimals in the given decimals is 4 + 4 = 8

So, the product must contain 8 places of decimals

Hence, 0.0345 × 0.0237 = 0.00081765

Dividing a decimal by 10, 100, 1000 etc.:

A decimal, can be divided by 10, 100, 1000 etc. by using the following rules :

Rule I When a decimal is divided by 10, the decimal point is shifted to the left by one place.

Rule II When a decimal is divided by 100, the decimal point is shifted to the left by two places.

Rule III When a decimal is divided by 1000, the decimal point is shifted to the left by three places.

Ex. Divide

(i) 12.75 by 10 (ii) 1275.7 by 1000

Sol. (i) $12.75 \div 10 = \frac{12.75}{10} = 1.275$

[Shifting decimal point to the left by 1 place]

(ii) $1275.7 \div 1000 = \frac{1275.7}{1000} = 1.2757$

[Shifting decimal point to the left by 3 place]

DIVIDING A DECIMAL BY A WHOLE NUMBER

A decimal can be divided by a whole number by using the following steps :

Step I Check the whole number part of the dividend.

Step II If the whole number part of the dividend is less then the divisor, then place a '0' in the ones place in the quotient, other wise, go to step III.

Step III Divide the whole number part of the dividend.

Step IV Place the decimal point to the right of ones place in the quotient obtained in step I.

Step V Divide the decimal part of the dividend by the divisor. If the digits of the dividend are exhausted, then place zeros to the right of dividend and remainder each time and continue the process.

Ex. Divide 93.45 by 15

Sol. We have,

```
15)93.45(6.23
  -90
  ----
   34
  -30
  ----
   45
  -45
  ----
    0
```

$\therefore$ 93.45 ÷ 15 = 6.23

Ex. Divide 0.6204 by 5

Sol. We have,

```
5)0.62040(0.12408
  0
  ---
   6
  -5
  ---
   12
  -10
  ---
   20
  -20
  ---
   40
  -40
  ---
    0
```

Thus, 0.6204 ÷ 5 = 0.12408.

Dividing a decimal by a decimal : A decimal can be divided by a decimal by using the following steps :

Step I Multiply the dividend and divisor by 10 or 100 or 1000 etc. to convent the divisor into a whole number.

Step II Divide the new dividend by the whole number obtained in step I.

Ex. Divide 42.8 by 0.02

Sol. We have,

$$\frac{42.8}{0.02} = \frac{42.8 \times 100}{0.02 \times 100} = \frac{4280}{2} = 2140$$

Hence, 42.8 ÷ 0.02 = 2140.

Ex. Divide 0.00942 by 0.314

Sol. We have,

$$\begin{array}{r} 314\overline{)9.42}(0.03 \\ \underline{0} \\ 942 \\ \underline{-942} \\ 0 \end{array}$$

$$\frac{0.00942}{0.314} = \frac{0.00942 \times 1000}{0.314 \times 1000} = \frac{9.42}{314}$$

Hence, $0.00942 \div 0.314 = 0.03$

Ex. Divide 0.0024 by 0.04

Sol. We have,

$$\frac{0.0024}{0.04} = \frac{0.0024 \times 100}{0.04 \times 100} = \frac{0.24}{4}$$

$$\begin{array}{r} 4\overline{)0.24}(0.06 \\ \underline{0} \\ 24 \\ \underline{-24} \\ 0 \end{array}$$

Hence, $0.0024 \div 0.04 = 0.06$.

Ex. The cost of 28 toys of the same kind is Rs 3462.20. Find the cost of each toy.

Sol. Cost of 28 toys = Rs 3462.20.

Cost of 1 toy = Rs $(3462.20 \div 28)$

$$= \text{Rs}\left(\frac{3462.20}{28}\right)$$

$$= \text{Rs } 123.65$$

Hence, the cost of each toy is Rs 123.65.

Ex. The product of two decimals is 1.5008. If one of them is 0.56, find the other.

Sol. Product of given decimals = 1.5008.

One decimal = 0.56.

The other decimal = $1.5008 \div 056$

$$= \left(\frac{1.5008}{0.56} \times \frac{100}{100}\right)$$

$$= \frac{150.08}{56} = 2.68$$

Hence, the other decimal is 2.68