Decimals

Decimals

A decimal is another way of expressing a fraction.

1. Tenths

$$\frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10} \quad \frac{1}{10}$$
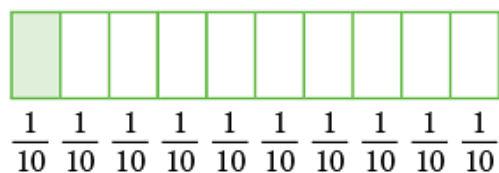
The fraction 1 / 10, as a decimal, is written as **0.1** and read as **zero point one**. The following shaded parts can be read as:
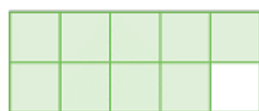
$\frac{9}{10}$ or 9 tenths $\frac{5}{10}$ or 5 tenths $\frac{4}{10}$ or 4 tenths

0.9 or zero point nine 0.5 or zero point five   0.4 or zero point four

The dot or the point between the two digits is called the decimal point.

Whole numbers and decimal numbers can also be combined as shown below: The picture given alongside shows, on a ruler, a length of 1 cm + 7 parts out of 1 cm. Since each cm is further divided into 10 equal parts (as can be seen), the above given number can be written as 1.7.
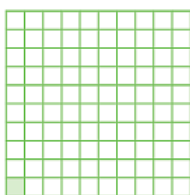
$$1 \text{ cm} + \frac{7}{10} \text{ cm} = 1 \text{ cm} + 0.7 \text{ cm} = 1.7 \text{ cm}.$$

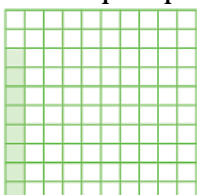1.7 is also a decimal number and is read as one point seven.
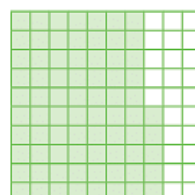
1   + $\frac{7}{10}$ or 0.7
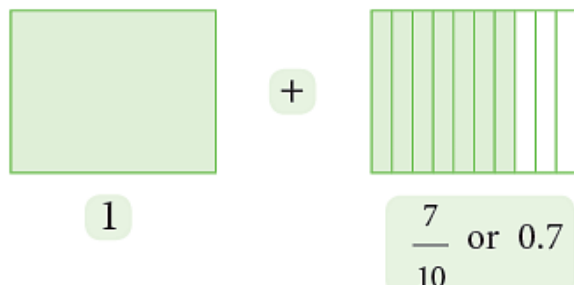
2. Hundredths

Let us now divide a whole into 100 equal parts.

Each part out of 100 equal parts is $\frac{1}{100}$ or 0.01.
0.01 is 1 hundredth.

8 parts out of 100 equal parts is $\frac{8}{100}$ or 0.08.
0.08 is 8 hundredths.

75 parts out of 100 equal parts is $\frac{75}{100}$ or 0.75.
0.75 is 75 hundredths.

We read

- 0.01 as zero point zero one,
- 0.08 as zero point zero eight,
- 0.75 as zero point seven five.

0.41 is 41 hundredths or 4 tenths 1 hundredth.
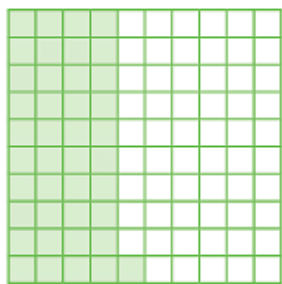
41 hundredths = **4 tenths** + **1 hundredth**
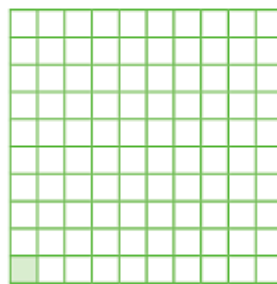
$$0.41 = \frac{41}{100} = \frac{40}{100} + \frac{1}{100}$$
$$= \frac{4}{10} + \frac{1}{100}$$

Similarly,

$$5\frac{29}{100} = 5.29 = 5 + \frac{2}{10} + \frac{9}{100}$$
$$5\frac{3}{100} = 5.03 = 5 + \frac{0}{10} + \frac{3}{100}$$

So, a decimal number has two parts—the **whole number** part and the **decimal** part separated by a decimal point. Number of digits after the decimal point is called the number of decimal places.

Whole number part greater than 1 → 5.29 ← Decimal part less than 1
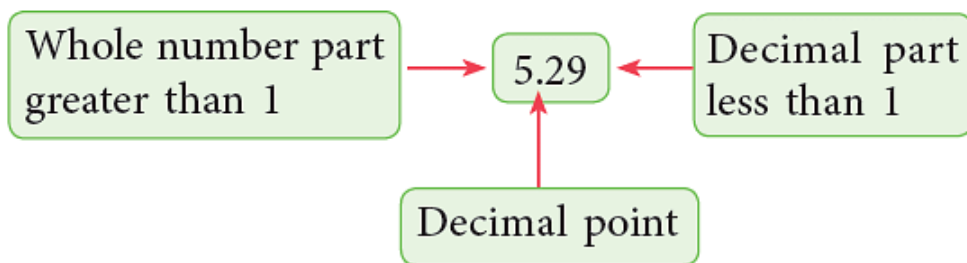
Decimal point

In the above number, there are 2 decimal places after the whole number part.
Edurev Tips: Whenever there is no whole number part, do not forget to write 0 before the decimal point, e.g., .65 is always written as 0.65.

3. Thousandths

If we divide one whole into thousand equal parts, then each part of the whole represents one-thousandth.

Thus, 1 / 1000 = **0.001** or **one-thousandth** read as **zero point zero zero one**.
The decimal 0.716 = 716 / 1000 (716 thousandths) represents 716 parts out of 1000 parts.

Sumit and Ritu are both reading the number 0.716 in different ways. Tick $(\checkmark)$ the correct one?

I read 0.716 as zero point seven one six.

I read 0.716 as zero point seven hundred sixteen.
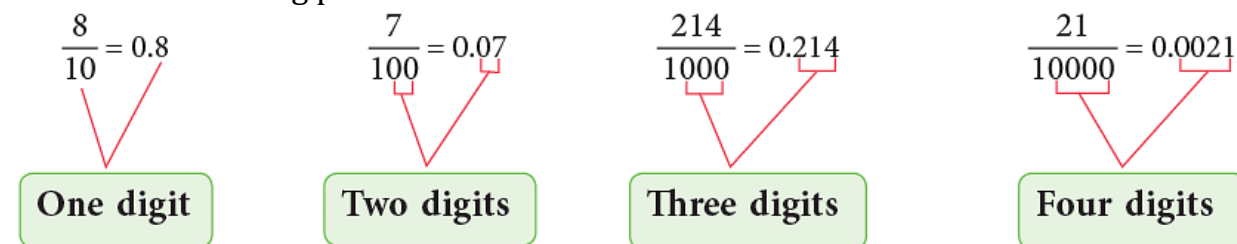
In expanded form, we write 0.716 as:

$$0.716 = \frac{716}{1000} = \frac{700}{1000} + \frac{10}{1000} + \frac{6}{1000} = \frac{7}{10} + \frac{1}{100} + \frac{6}{1000}.$$

Similarly, **49.107** is forty-nine and one hundred seven thousandths and is read as **forty-nine point one zero seven**.
In expanded form,

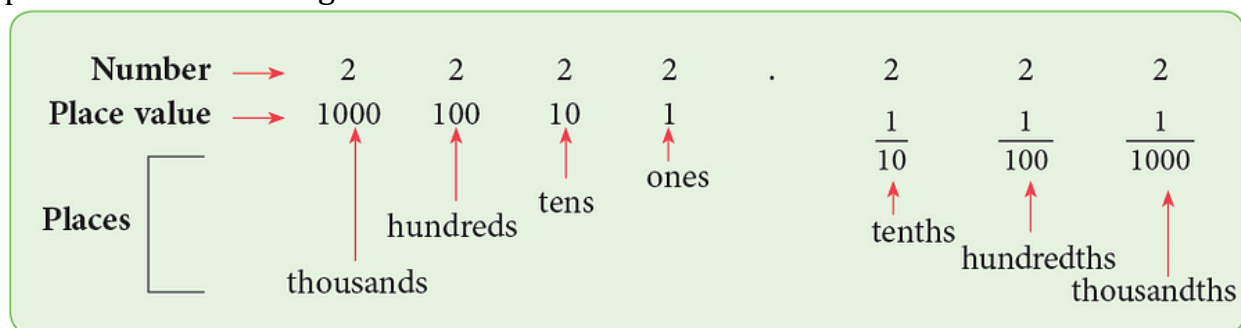$$49.107 = 40 + 9 + \frac{1}{10} + \frac{0}{100} + \frac{7}{1000}.$$

Notice the following pattern.

$$\frac{8}{10} = 0.8$$

$$\frac{7}{100} = 0.07$$

$$\frac{214}{1000} = 0.214$$

$$\frac{21}{10000} = 0.0021$$

| One digit | Two digits | Three digits | Four digits |

The number of digits after the decimal point in the decimal numeral is equal to the number of zeros after 1 in the denominator of the corresponding common fraction.

Place Value and Decimals

The place value chart shown below can also be used to understand decimals. The place value of each digit in the number 2222.222 is shown below.

Number →	2	2	2	2	.	2	2	2
Place value →	1000	100	10	1		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Places: thousands, hundreds, tens, ones, tenths, hundredths, thousandths

The first place to the right of the decimal point is the **tenths** place, the second place to the right is the **hundredths** place and so on. The last place after the decimal point tells us how to name the decimal part.

Edurev Tips: Digit at each place has a place value one-tenth (1 / 10) that of the place to its left.

Here it is 222 thousandths.
Using the place value chart, we can write the expanded form of any decimal number. Take the number 1279.364.

1	2	7	9	.	3	6	4

| 1×1000 | 2×100 | 7×10 | 9×1 | $3 \times \frac{1}{10}$ | $6 \times \frac{1}{100}$ | $4 \times \frac{1}{1000}$ |
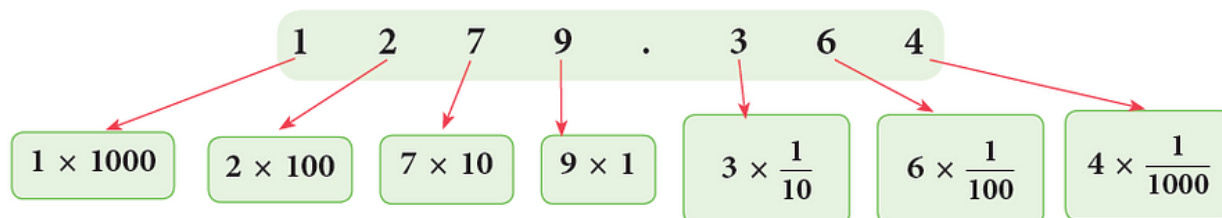
$1279.364 = 1$ thousand $+ 2$ hundreds $+ 7$ tens $+ 9$ ones $+ 3$ tenths $+ 6$ hundredths $+ 4$ thousandths

$= 1 \times 1000 + 2 \times 100 + 7 \times 10 + 9 \times 1 + 3 \times 1 / 10 + 6 \times 1 / 100 + 4 \times 10 / 100$

Or

$$1279\frac{364}{1000}$$

$= 1000 + 200 + 70 + 9 + 3 / 10 + 6 / 100 + 4 / 1000$ **(Fractional form)**
$= 1000 + 200 + 70 + 9 + 0.3 + 0.06 + 0.004$ **(Decimal form)**

Converting Fractions to Decimals and Vice versa

1. **Converting Fractions to Decimals**
   Fractions whose denominators are 10, 100 or 1000 can be easily converted to decimals by putting the decimal point in the numerator accordingly.
   Examples:

   $$\frac{3}{10} = 0.3$$

   $$\frac{12}{10} = 1.2$$

   $$\frac{209}{10} = 20.9$$

   Denominator = 10
   Number of decimal places = 1

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

   $$\frac{12}{100} = 0.12$$

   $$\frac{209}{100} = 2.09$$

   Denominator = 100
   Number of decimal places = 2

$$\frac{3}{1000} = 0.003$$

$$\frac{12}{1000} = 0.012$$

$$\frac{209}{1000} = 0.209$$

Denominator = 1000
Number of decimal places = 3

For fractions which can be converted to equivalent fractions having denominators 10 or multiples of 10, we apply the same method as above.

$$\frac{1}{2} \overset{\times 5}{\underset{\times 5}{=}} \frac{5}{10} = 0.5 \qquad \frac{1}{5} \overset{\times 20}{\underset{\times 20}{=}} \frac{20}{100} = 0.20 \qquad \frac{14}{25} \overset{\times 4}{\underset{\times 4}{=}} \frac{56}{100} = 0.56 \qquad \frac{5}{8} \overset{\times 125}{\underset{\times 125}{=}} \frac{625}{1000} = 0.625$$

Similarly,

$$2\frac{1}{2} = 2 + \frac{1}{2} = 2 + \frac{5}{10} = 2 + 0.5 = 2.5$$

$$4\frac{8}{25} = 4 + \frac{8}{25} = 4 + \frac{32}{100} = 4 + 0.32 = 4.32.$$

2. **Converting Decimals to Fractions**

Decimals can also be converted to fractions as under:

$$0.6 = \frac{6}{10} \overset{\div 2}{\underset{\div 2}{=}} \frac{3}{5} \qquad 0.32 = \frac{32}{100} \overset{\div 4}{\underset{\div 4}{=}} \frac{8}{25} \qquad 2.25 = \frac{225}{100} \overset{\div 25}{\underset{\div 25}{=}} \frac{9}{4}$$

| Reduce to simplest form | Reduce to simplest form | Reduce to simplest form |

Pictorial representation of how to convert a decimal to a fraction

$$0.50$$

$$\frac{50}{100}$$

$$\frac{5}{10}$$

$$\frac{1}{2}$$

Fractions in simplest form
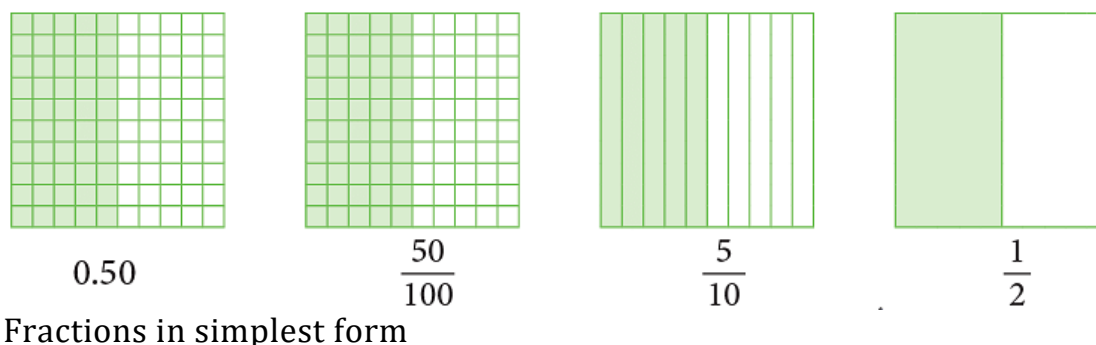
Equivalent Decimals
Decimals that name the same amount are called **equivalent decimals**.

Observe the following.
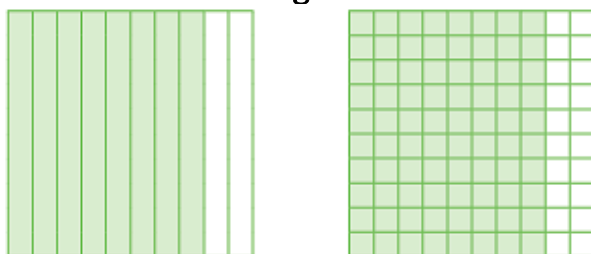
8 tenths = 0.8   80 hundredths = 0.80

As can be seen, these two pictures name the same amount, so 0.8 = 0.80.
8 tenths = 80 hundredths
8 / 10 = 80 / 100
Thus, 0.8 = 0.80 = 0.800 = 0.8000 = _____
Similarly, 1.8 = 1.80 = 1.800 ; 37.41 = 37.410 = 37.4100, etc.
From the above it is clear that writing zeros at the right hand end of a decimal number does not change its value.

1. Like Decimals and Unlike Decimals
Decimals having the same number of decimal places are called **like decimals**.

2.3, 0.8, 7.1   1.31, 45.83, 2.06   270.008, 0.431, 1.105

1 decimal place   2 decimal places   3 decimal places

Decimals having different number of decimal places are called unlike decimals.
Thus, 1.2, 4.03, 0.895 are all unlike decimals.

2. Converting Unlike Decimals to Like Decimals
Unlike decimals can be converted to like decimals by finding their equivalent decimals.
Example 1: Convert 6.8, 7.83 and 12.040 to like decimals.

The greatest number of decimal places is 3, so we convert all of them to equivalent decimals with 3 decimal places.
6.8 → 6.800, 7.83 → 7.830, 12.040
Hence, 6.8, 7.83 and 12.040 when converted to like decimals becomes **6.800, 7.830, 12.040.**

Comparing and Ordering Decimals

1. Comparing Decimals
To compare decimal numbers, we follow the following steps.

Step 1: Convert the decimals into like decimals.
Step 2: First, compare the whole number parts. The number with the greater whole number part is greater.
Step 3: If the whole number parts are the same, compare the tenths digits. The decimal number having greater tenths digit names a greater number.
Step 4: If the tenths digits are the same, compare the hundredths digits and so on.

Example 2: Which number is bigger: 3.612 or 3.621?
The numbers are

3 . 6 1 2
3 . 6 2 1

On comparing the digits from the left, you find that the hundredths digits differ. Since 2 hundredths > 1 hundredths, therefore, 3.621 > 3.612.

2. Ordering Decimals
Example 3: Arrange 21.012, 21.002, 24.102 in increasing order.
On comparing the whole number parts, you find that 24.102 is the greatest. Now, compare 210.12 and 21.002.
The whole number parts being the same, we start comparing from the tenths digit.

2 1 . 0 1 2
2 1 . 0 0 2

The digits at the hundredths differ. Since 1 hundredths > 0 hundredth, so 21.012 > 21.002.
Thus, the given numbers in increasing order are: **21.002, 21.012, 24.102.**

Addition and Subtraction of Decimals

1. Addition
To add two or more decimals, we follow these steps.
Step 1: Convert the decimal to like decimals.
Step 2: Line up the decimal points, i.e., the addends are placed one below the other such that the tens digit is below tens, ones is below ones, decimal points below the decimal point, tenths below the tenths and so on.
Step 3: Add, as in case of whole numbers. Carry wherever necessary.
Step 4: Place the decimal point in the sum directly below the decimal point in the addends.

Example 4: Add: 4.83, 312.9 and 23.031.
First, we convert the numbers to be added to like decimals.
We have: 4.83 → 4.830, 312.9 → 312.900, 23.031.
Now, line up the decimals and add.

```
        ①   ①
            4 .  8  3  0
      3  1  2 .  9  0  0
   +     2  3 .  0  3  1
      3  4  0 .  7  6  1
```

Add the thousandths. 0 + 0 + 1 = 1 thousandth
Add the hundredths. 3 + 0 + 3 = 6 hundredths
Add the tenths. 8 + 9 + 0 = 17 tenths
          17 tenths = 1 one + 7 tenths
Write 7 in the tenths place. Carry over 1 to ones place.
Add the ones. 1 + 4 + 2 + 3 = 10 ones
          10 ones = 1 ten + 0 ones
Write 0 in the ones place. Carry over 1 to tens place.
Add the tens. 1 + 1 + 2 = 4 tens
Add the hundreds. 0 + 3 + 0 = 3 hundreds

Example 5: Add: 6.9, 3.405 and 9.46.
First, we convert the numbers to be added to like decimals.
Converting into like decimals 6.9 → 6.900, 3.405, 9.46 → 9.460.
Now, line up the decimals and add.

```
        ①
        6 .  9  0  0
        3 .  4  0  5
   +    9 .  4  6  0
     1  9 .  7  6  5
```

Tips: A whole number can be expressed in the decimal form as: $12 = 12.0$ or 12.00 or 12.000 and so on.

2. Subtraction

To subtract one decimal number from the other, we follow the steps given below.

Step 1: Convert the decimal to like decimals.

Step 2: Line up the decimal points.

Step 3: Subtract in each place value.

Step 4: Regroup, wherever necessary.

Example 6: Subtract 6.253 from 16.67.

1. **Convert into like decimals as** $16.67 \rightarrow 16.670$, 6.253 and line up the decimal points.
2. **Subtract the thousandths.**
   You cannot subtract 3 thousandths from 0 thousandths, so borrow 1 hundredths from 7 hundredths leaving behind 6 hundredths.
   1 hundredths = 10 thousandths
   0 thousandths → 10 thousandths
   Now, subtract thousandths, 10 – 3 = 7 thousandths.
3. **Subtract the hundredths.**
   6 – 5 = 1 hundredth
4. **Subtract the tenths.**
   6 – 2 = 4 tenths
5. **Subtract the ones.**
   6 – 6 = 0 ones
6. **Subtract the tens.**
   1 – 0 = 1 ten

$$
\begin{array}{ccccccc}
 & & & & & \overset{6}{} & \overset{10}{} \\
 & 1 & 6 & . & 6 & \not{7} & \not{0} \\
- & & 6 & . & 2 & 5 & 3 \\
\hline
 & 1 & 0 & & 4 & 1 & 7 \\
\hline
\end{array}
$$

So, 16.67 – 6.253 = **10.417.**

Example 7: Find 312.8 – 59.98.

② ~~0~~ ① ~~7~~ ⑩
~~3~~ ~~1~~ ~~2~~ . ~~8~~ ~~0~~
− 5 9 . 9 8
_____
2 5 2 . 8 2
_____

Multiplication of Decimals
1. Multiplication by 10, 100, 1000
Observe the following examples.

(i) $0.5 \times 10 = \dfrac{5}{10} \times 10 = 5$

Ones	Tenths
	5	× 10
5	

5 tenths × 10 = 5 ones
0.5 × 10 = 5

(ii) $2.7 \times 10 = \dfrac{27}{10} \times 10 = 27$

Tens	Ones	Tenths
	2	7	× 10
2	7	

2 ones 7 tenths × 10 = 2 tens 7 ones
2.7 × 10 = 27

We observe that:
Multiplying a decimal by 10 moves the decimal point 1 place to the right.

(iii) $1.78 \times 100 = \dfrac{178}{100} \times 100 = 178$

Hundreds	Tens	Ones	Tenths	Hundredths	
		1	7	8	× 100
1	7	8			

1 ones 7 tenths 8 hundredths × 100
= 1 hundreds 7 tens 8 ones

(iv) $0.3 \times 100 = \dfrac{3}{10} \times 100 = 30$

Tens	Ones	Tenths	
		3	× 100
3			

3 tenths × 100 = 3 tens
We observe that:
Multiplying a decimal by 100 moves the decimal point 2 places to the right.

(v) $0.002 \times 1000 = \dfrac{2}{1000} \times 1000 = 2$

Ones	Tenths	Hundredths	Thousandths	
			2	× 1000
2				

2 thousandths × 1000 = 2 ones

Tips: A number without a decimal point is considered to have the decimal point to the extreme right. 317 means 317.0

(vi) $1.8 \times 1000 = \dfrac{18}{10} \times 1000 = 1800$

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	
			1	8		× 1000
1	8					

1 one 8 tenths = 1 thousand 8 hundreds

$$7.813 \times 1000 = \frac{7813}{1000} \times 1000 = 7813$$

(vii)

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths	
			7	8	1	3	× 1000
7	8	1	3				

We observe that:
Multiplying a decimal by 1000 moves the decimal point 3 places to the right.

2. Multiplication by a Counting Number
Example 8: If one litre of petrol costs ₹ 74.03, what will be the cost of 12 litres of petrol?
Cost of 12 L petrol = ₹ 74.03 × 12

$$= ₹ \frac{7403}{100} \times 12$$

$$= ₹ \frac{7403 \times 12}{100} = ₹ \frac{88836}{100} = ₹\ 888.36.$$

Step 1: Multiply, as you would multiply counting numbers.

```
    7 4 0 3
  ×     1 2
  ─────────
  8 8 8 3 6
  ─────────
```

Step 2: Place the decimal point in the product at a place so that the number of decimal places in the product is equal to the total number of decimal places of the factors.

```
    7 4 . 0 3   ←——— 2 decimal places
  ×       1 2   ←——— 0 decimal places
  ─────────────
  8 8 8 . 3 6   ←——— 2 decimal places    2 + 0
  ─────────────
```

Example 9: Multiply 6.095 by 45.

```
  6 . 0 9 5   ←————— 3 decimal places
×       4 5   ←————— 0 decimal places
─────────────
  3 0 4 7 5
2 4 3 8 0
─────────────
2 7 4.2 7 5   ←————— 3 decimal places    3 + 0
─────────────
```

3. Multiplication of a Decimal Number by a Decimal Number

Lets us find the product of 12.7 and 0.4.

$$12.7 \times 0.4 = \frac{127}{10} \times \frac{4}{10} = \frac{127 \times 4}{100} = \frac{508}{100} = 5.08$$

The above work can also be set as:

Working

```
1   2 7
  ×   4
────────
5   0 8
```

Multiply, as you would multiply the counting numbers.

```
1 2 . 7     ←————— 1 decimal place
× 0 . 4     ←————— 1 decimal place
──────────
5 . 0   8   ←————— 2 decimal places    1 + 1
```

The total number of decimal places in the product is equal to the sum of the decimal places of the factors.

Example 10: Multiply:

(a) 0.8×0.3

(b) 0.007×0.03

(c) 0.009×1.2

(a)

$$0.8 \times 0.3 = 0.24$$

1 d.p.   1 d.p.   2 d.p.

Multiply mentally
8 × 3 = 24

(b)

$$0.007 \times 0.03 = 0.00021$$

3 d.p.   2 d.p.   5 d.p.

7 × 3 = 21
The product has 5 decimal places, so add 3 zeros to the left of the product.

(c)

$$0.009 \times 1.2 = 0.0108$$

3 d.p.   1 d.p.   4 d.p.

9 × 12 = 108
The product has 4 decimal places, so add 1 zero to the left of the product.

Example 11: Multiply 23.02 by 0.12.

```
      2 3 . 0  2 ←——— 2 decimal places
    ×   0 . 1  2 ←——— 2 decimal places
      ─────────
      4 6  0  4
  +  2 3  0  2
  ───────────
      2.7  6  2  4 ←——— 4 decimal places
                          2 + 2
```

Example 12: Multiply 1.035 by 2.95.

$$
\begin{array}{r}
1.0\ 3\ 5 \quad \longleftarrow 3 \text{ decimal places}\\
\times\ 2.9\ 5 \quad \longleftarrow 2 \text{ decimal places}\\
\hline
5\ 1\ 7\ 5\\
9\ 3\ 1\ 5\\
+\ 2\ \ 0\ 7\ 0\\
\hline
3.0\ 5\ 3\ 2\ 5 \quad \longleftarrow 5 \text{ decimal places}\\
\hline
\end{array}
$$

3 + 2

Example 13: Multiply:
(a) **2.6 by 30**
(b) **13.46 by 600**
(a) $2.6 \times 30 = 2.6 \times 3 \times 10 = 7.8 \times 10 = $ **78.**
(b) $13.46 \times 600 = 13.46 \times 6 \times 100 = 80.76 \times 100 = $ **8076.**

Division of Decimals

1. Division by 10, 100, 1000
Observe the following examples.

(i) $2 \div 10 = 2 \times \dfrac{1}{10} = \dfrac{2}{10} = 0.2$

Ones	Tenths	
2		÷ 10
	2	

2 ones ÷ 10 = 2 tenths = 0.2

(ii) $0.6 \div 10 = \dfrac{6}{10} \div 10 = \dfrac{6}{10} \times \dfrac{1}{10} = \dfrac{6}{100} = 0.06$

Ones	Tenths	Hundredths	
	6		÷ 10
		6	

6 tenths ÷ 10 = 6 hundredths = 0.06

We observe that:
Dividing a decimal by 10 moves the decimal point one place to the left.

(iii) $4 \div 100 = 4 \times \dfrac{1}{100} = \dfrac{4}{100} = 0.04$

Ones	Tenths	Hundredths	
4			÷ 100
		4	

4 ones ÷ 100 = 4 hundredths = 0.04

(iv) $2.7 \div 100 = \dfrac{27}{10} \times \dfrac{1}{100} = \dfrac{27}{1000} = 0.027.$

Ones	Tenths	Hundredths	Thousandths	
2	7			÷ 100
		2	7	

2 ones 7 tenths ÷ 100 = 2 hundredths 7 thousandths = 0.027
Dividing a decimal by 100 moves the decimal point 2 places to the left.

(v) $7 \div 1000 = 7 \times \dfrac{1}{1000} = \dfrac{7}{1000} = 0.007$

Ones	Tenths	Hundredths	Thousandths	
7				÷ 1000
			7	

7 ones ÷ 1000 = 7 thousandths = 0.007

(vi) $83 \div 1000 = 83 \times \dfrac{1}{1000} = \dfrac{83}{1000} = 0.083$

(vii) $157 \div 1000 = 157 \times \dfrac{1}{1000} = \dfrac{157}{1000} = 0.157$

Dividing a decimal by 1000 moves the decimal point 3 places to the left.

2. Division by a Counting Number
Example 14: Find: 20.22 ÷ 6.
Compare the two workings shown below.

Step 1:

$$6\overline{)20.22} \leftarrow \text{dividend}$$

divisor

1. 20.22 / 6

Step 2:

$$6\overline{)20.22}$$

2. $\dfrac{20.22}{6} \times 100 = \dfrac{2022}{6}$

Step 3:

$$\begin{array}{r} 3\ 3\ 7 \\ 6\overline{)2\ 0\ 2\ 2} \end{array}$$

3. 2022 / 6 = 337

Step 4:

$$\begin{array}{r} 3\ .\ 3\ 7 \\ 6\overline{)2\ 0\ .\ 2\ 2} \end{array}$$

4. 337 ÷ 100 = 3.37

Actual Working

```
        3. 3 7
      _____
  6 ) 2 0. 2 2
    −1 8
      _____
         2 2
       − 1 8
      _____
             4 2
           − 4 2
          _____
               0
```

Method:
1. Divide, as you would divide counting numbers.
2. Place the decimal point in the quotient directly above the decimal point in the dividend.

Short form

```
  6 ) 2 0 . 2 2
  _____
        3 . 3 7
```

So, 20.22 ÷ 6 = **3.37**

Example 15: Divide: 2.67 by 3.

```
        0 . 8 9
      _____
  3 ) 2 . 6 7
    −2   4
      _____
         2 7
       − 2 7
      _____
           0
```

3 > 2, so we put a zero in the quotient.

Check

$3 \times 0.89 = 2.67$

$\therefore 2.67 \div 3 = \mathbf{0.89.}$

Example 16: Solve: 1414.332 ÷ 17.

```
               83.196
        ┌─────────────
   17   )1 4 1 4 . 3 3 2
        −1 3 6
        ─────────
             5 4
           − 5 1
           ─────────
                 3 3
               −1 7
               ─────────
                   1 6 3
                 − 1 5 3
                 ─────────
                       1 0 2
                     − 1 0 2
                     ─────────
                           0
                     ─────────
```

∴ 1414.332 ÷ 17 = **83.196.**

Example 17: Divide the following.
(a) 14.448 ÷ 14
(b) 262.85 ÷ 35
(a)

```
              1 . 0 3 2
        ┌─────────────
   1 4  )1 4 . 4 4 8
        − 1 4
        ─────────
               4 4
             − 4 2
             ─────────
                   2 8
                 − 2 8
                 ─────────
                       0
                 ─────────
```

∴ 14.448 ÷ 14 = **1.032.**

(b)

```
                7.51
       35)2 6 2 .8 5
        − 2 4 5 ↓↓
              1 7 8 ↓
            − 1 7 5 ↓
                  3 5
                − 3 5
                    0
```

$\therefore 262.85 \div 35 = \textbf{7.51.}$

Check

$35 \times 7.51 = 262.85$

If the last remainder is not zero, write as many zeros on the right of the dividend as are necessary to make the last remainder zero.

Example 18: Find: 9.2 ÷ 16.

```
          0 . 5 7 5
       16)9 . 2 0 0 ←── Write two zeros
        − 8   0 ↓
              ┌── Remainder not zero
          1   2 0
        − 1   1 2 ↓
              ┌── Remainder not zero
                8 0
              − 8 0
                  0
```

$\therefore 9.2 \div 16 = \textbf{0.575.}$

When the divisor is a multiple of 10 or 100 or 1000, etc., then the process of division can be shortened, as shown below.

Example 19: Find: 94.24 ÷ 80.

```
              1 . 1 7 8
        ┌──────────────
  8 0 ) 9 4 . 2 4 0  ←──── Write one zero
      - 8 0
      ──────
        1 4   2
      -   8   0
        ──────
            6   2 4
          - 5   6 0
          ──────────
                6 4 0
              - 6 4 0
              ────────
                    0
              ────────
```

∴ 94.24 ÷ 80 = **1.178**

Short form:

$$\frac{94.24}{80} = \frac{94.24}{10 \times 8} = \frac{9.424}{8} = 1.178$$

Tips: 94.24 ÷ 10 = 9.424

3. Division of a Decimal Number by a Decimal Number

You have learnt how to divide a decimal number by a whole number. To divide a decimal number by a decimal number, we make the divisor a whole number. Look at the following example.

> 4.41 ÷ 0.7 = ?

(i) Multiply the divisor by a multiple of 10 to make it a whole number.
Thus, 0.7 × 10 = 7.

(ii) Multiply the dividend by the same multiple of 10.
Thus, 4.41 × 10 = 44.1.
Now, divide as usual:
44.1 ÷ 7 = 44.1 / 7 = 6.3

$$\begin{array}{r} 6\,.3 \\ 7\overline{)\,4\,4\,.1} \\ -\ 4\,2 \\ \hline 2\,1 \\ -\,2\,1 \\ \hline 0 \end{array}$$

The work can be set as:

$$4.41 \div 0.7 = \frac{4.41}{0.7} = \frac{4.41 \times 10}{0.7 \times 10} = \frac{44.1}{7} = \mathbf{6.3}$$

Example 20: Divide : (a) 6.265 ÷ 0.07 (b) 1.8 ÷ 0.003
(a)

$$6.265 \div 0.07 = \frac{6.265}{0.07} = \frac{6.265 \times 100}{0.07 \times 100} = \frac{626.5}{7} = \mathbf{89.5}$$

(b)

$$1.8 \div 0.003 = \frac{1.8}{0.003} = \frac{1.8 \times 1000}{0.003 \times 1000} = \frac{1800}{3} = \mathbf{600}$$

Example 21: Divide: 4.20 by 1.05.
4.20 ÷ 1.05 = 4.20 / 1.05

$$= \frac{4\,.2\,0}{1\,.0\,5} = \frac{420}{105}$$

2 Places

2 Places

2 decimal places in divisor, s o shif t de cima l p oint 2 places to the right both in divisor and dividend.

$$\begin{array}{r} 4 \\ 105\overline{)420} \\ -420 \\ \hline 0 \end{array}$$

$\therefore 4.20 \div 1.05 = 4.$

Example 22: Find 20.169 ÷ 0.83.

2 Places

$$\frac{20.\overset{\frown}{1}69}{0.83_{\curvearrowleft}} = \frac{2016.9}{83}$$

2 Places

Shift decimal point 2 places to the right.

$$\begin{array}{r} 24.3 \\ 83\overline{)2016.9} \\ -166 \\ \hline 356 \\ -332 \\ \hline 249 \\ -249 \\ \hline 0 \end{array}$$

$\therefore 20.169 \div 0.83 = \textbf{24.3.}$

Example 23: Divide 66.468 by 76.4.

$$66.468 \div 76.4 \longrightarrow 764\overline{)664.68} \longrightarrow \begin{array}{r} 0.87 \\ 764\overline{)664.68} \\ -6112 \\ \hline 5348 \\ -5348 \\ \hline 0 \end{array}$$

Shift the decimal point 1 place to the right, both in the divisor and the dividend.

$\therefore 66.468 \div 76.4 = \textbf{0.87.}$

Example 24: Divide:
(a) 90 ÷ 0.60
(b) 36 ÷ 0.06

(a)

So, multiply by 100.

$$90 \div 0.60 = \frac{90}{0.60}$$

Shift decimal point 2 places to the right.

$$= \frac{9000}{60} = 150$$

(b)

So, multiply by 100.

$$36 \div 0.06 = \frac{36}{0.06}$$

Shift decimal point 2 places to the right.

$$= \frac{3600}{6} = 600$$

Changing Common Fractions to Decimal Fractions

Example 25: Change 4 / 5 to a decimal fraction.
To convert 4 / 5 to a decimal, we divide the numerator 4 by the denominator 5, as follows.

```
      0. 8
  5) 4. 0
   -  4 0
        0
```

Put decimal point after the whole number and add 1 zero to ensure complete division.
∴ 4 / 5 = **0.8.**

Example 26: Express 85 / 16 as a decimal.

To convert 85 / 16 to a decimal, divide the numerator 85 by the denominator 16.

```
            5. 3 1 2 5
        _____
  16 ) 8 5. 0 0 0 0
     -  8 0
        _____
           5 0
         - 4 8
           _____
             2 0
           - 1 6
             _____
               4 0
             - 3 2
               _____
                 8 0
               - 8 0
                 _____
                   0
```

Put decimal point after the whole number and add 4 zeros to ensure complete division.

∴ 85 / 16 = **5.3125.**