

4.1 Decimals

A decimal is a number that is written using the base-ten place value system. A decimal point separates the ones and tenths digits.

4.1.1 Add and subtract decimals

Addition of decimals

You have learnt addition of decimals upto two decimal places in class 4.

Let us review it.

Example 1

Add: 32.14 and 18.92

Solution

$$\begin{array}{r}
 \textcircled{1} \textcircled{1} \\
 32.14 \\
 + 18.92 \\
 \hline
 51.06
 \end{array}$$

Example 2

Find $417.46 + 58.9$

Solution

$$\begin{array}{r}
 \textcircled{1} \textcircled{1} \\
 417.46 \\
 + 58.90 \quad \leftarrow \text{Write zero as a placeholder} \\
 \hline
 476.36
 \end{array}$$

We have seen that in addition of decimals the following points are kept in mind.

- i. We line up the decimal point.
- ii. The decimals are made equal decimal places by adding zeros.
- iii. We add the decimals as we add the whole numbers.
- iv. The decimal points are in column.

We proceed ahead to learn the addition of decimal up to four places.

Example 1Solve: $57.3851 + 62.5764$ **Solution**

$$57.3851 + 62.5764$$

Writing in the vertical form

$$\begin{array}{r}
 \textcircled{1} \textcircled{1} \\
 57.3851 \\
 + 62.5764 \\
 \hline
 119.9615
 \end{array}$$

Example 2Solve: $318.533 + 721.6454$ **Solution**

$$318.533 + 721.6454$$

Writing in the vertical form

$$\begin{array}{r}
 \textcircled{1} \textcircled{1} \\
 318.5330 \\
 + 721.6454 \\
 \hline
 1040.1784
 \end{array}$$

Subtraction of decimals

We have learnt subtraction of decimals upto two decimal places in class 4. Let us review it.

Example 1

Subtract: 34.87 from 65.29

Solution

$$65.29 - 34.87$$

Writing in the vertical form

$$\begin{array}{r}
 \textcircled{10} \\
 6^4 \cancel{5}^{\textcircled{10}} . 29 \\
 - 34.87 \\
 \hline
 30.42
 \end{array}$$

Example 2Solve: $334.20 - 86.48$ **Solution**

$$334.20 - 86.48$$

Writing in the vertical form

$$\begin{array}{r}
 \textcircled{10} \textcircled{10} \textcircled{10} \textcircled{10} \\
 2^{\textcircled{10}} \cancel{3}^{\textcircled{10}} \cancel{4}^{\textcircled{10}} . 2^{\textcircled{10}} 0 \\
 - \quad 86.48 \\
 \hline
 247.72
 \end{array}$$

We have seen that in subtraction of decimals the following points are kept in mind.

- i. We line up the decimal points.

- ii. The decimals are made equal decimal places by adding zeros.
- iii. We subtract the decimals as we subtract the whole numbers.
- iv. The decimal points are in column.

We proceed ahead to learn the subtraction of decimals upto four decimal places.

Example 1 Solve: $751.64 - 384.3545$

Solution $751.64 - 384.3545$

Writing in the vertical form.

$$\begin{array}{r}
 \overset{6}{\cancel{7}} \overset{4}{\cancel{5}} \overset{10}{1} . \overset{5}{\cancel{6}} \overset{3}{\cancel{4}} \overset{10}{0} \overset{9}{\cancel{0}} \overset{10}{0} \leftarrow \text{Write zeros as place holder} \\
 - 384 . 3545 \\
 \hline
 367 . 2855
 \end{array}$$

Example 2 Subtract: 875.3678 from 986.2598

Solution $986.2598 - 875.3678$

Writing in the vertical form.

$$\begin{array}{r}
 98 \overset{5}{\cancel{6}} . \overset{10}{\cancel{2}} \overset{10}{5} 98 \\
 - 875 . 3678 \\
 \hline
 110 . 8920
 \end{array}$$

Exercise 4.1

1. Solve:

- | | |
|--------------------------|-------------------------|
| i. $45.23 + 23.76$ | ii. $726.53 + 47.8$ |
| iii. $67.2358 + 70.5234$ | iv. $33.4035 + 65.7028$ |
| v. $45.204 + 68.3268$ | vi. $87.7201 + 64.653$ |

2. Solve:

i. $951.3745 - 802.454$

ii. $778.342 - 47.8$

iii. $138.632 - 88.3409$

iv. $537.4532 - 412.32$

4.1.2 Recognize like and unlike decimals

Consider the following decimals:

- i. 33.2 It has one decimal place.
- ii. 124.35 It has two decimal places.
- iii. 41.237 It has three decimal places.
- iv. 29.1345 It has four decimal places.

Like decimals:

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

For example, 12.345, 2.127 are like decimals, each has three decimal places.

Unlike decimals:

Decimals with different number of decimal places are called unlike decimals.

For example, 9.72, 13.5, 321.578 and 3.1245 are unlike decimals. Each has a different number of decimal places.

NOTE: We can transform unlike decimals to like decimals by adding placeholder zeros on right side of decimal part.

Activity: Write like/unlike against each pair of decimals.

Decimals	Like/Unlike decimals
37.23 , 37.32	like
65.40 , 16.21	
29.432 , 30.43	
381.532 , 181.340	
13.1818 , 14.199	
74.1702 , 17.0004	

4.1.3 Multiplication of decimals by 10, 100 and 1000

(a) Multiplication of decimals by 10

Multiplying a decimal by 10 is equivalent to forming a new number by moving the decimal point of the given decimal to the right 1 place.

Examples

- i. $3.57 \times 10 = 35.7$ ii. $15.453 \times 10 = 154.53$
 iii. $97.23 \times 10 = 972.3$ iv. $321.4 \times 10 = 3214$

(b) Multiplication of decimals by 100

Multiplying a decimal by 100 is equivalent to forming a new number by moving the decimal point of the given decimal to the right 2 places.

Examples

- i. $38.241 \times 100 = 3824.1$ ii. $4.1532 \times 100 = 415.32$
 iii. $65.32 \times 100 = 6532$ iv. $987.5 \times 100 = 98750$

(c) Multiplication of decimals by 1000

Multiplying a decimal by 1000 is equivalent to forming a new number by moving the decimal point of the given decimal to the right 3 places.

Examples

i. $2.3781 \times 1000 = 2378.1$ ii. $8.23451 \times 1000 = 8234.51$

iii. $7.32 \times 1000 = 7320$ iv. $5.7 \times 1000 = 5700$

4.1.4 Division of decimals by 10, 100 and 1000**(a) Division of decimals by 10**

Dividing a decimal by 10 is equivalent to forming a new number by moving the decimal point of the given decimal to the left 1 place.

Examples

i. $51.23 \div 10 = 5.123$ ii. $321.25 \div 10 = 32.125$

iii. $7.98 \div 10 = 0.798$ iv. $0.275 \div 10 = 0.0275$

(b) Division of decimals by 100

Dividing a decimal by 100 is equivalent to forming a new number by moving the decimal point of the given decimal to the left 2 places.

Examples

i. $321.5 \div 100 = 3.215$ ii. $98.2 \div 100 = 0.982$

iii. $8.34 \div 100 = 0.0834$ iv. $0.391 \div 100 = 0.00391$

(c) Division of decimals by 1000

Dividing a decimal by 1000 is equivalent to forming a new number by moving the decimal point of the given decimal to the left 3 places.

Examples

- i. $3451.2 \div 1000 = 3.4512$ ii. $345.91 \div 1000 = 0.34591$
iii. $27.51 \div 1000 = 0.02751$ iv. $0.378 \div 1000 = 0.000378$

Exercise 4.2**1. Multiply the following decimals by 10.**

- i. 66.78 ii. 103.681 iii. 88.6734
iv. 111.22 v. 29.34 vi. 38.2

2. Multiply the following decimals by 100.

- i. 72.721 ii. 137.2351 iii. 21.82

3. Multiply the following decimals by 1000.

- i. 70.0345 ii. 31.8301 iii. 57.223

4. Divide the following decimals by 10.

- i. 83.52 ii. 172.002 iii. 0.651

5. Divide the following decimals by 100.

- i. 161.31 ii. 1472.53 iii. 0.231

6. Divide the following decimals by 1000.

- i. 3434.43 ii. 293.75 iii. 37.582

4.1.5 Multiplication of a decimal with a whole number:

Let us learn this method by taking a few simple examples

Example 1 Solve 35.2×3

Solution 35.2×3

$$\begin{array}{r}
 35.2 \times 3 \\
 = \frac{352}{10} \times 3 \\
 = \frac{1056}{10} \\
 = 105.6
 \end{array}$$

Example 2 Solve 2.34×15

Solution 2.34×15

$$\begin{array}{r}
 2.34 \times 15 \\
 = \frac{234}{100} \times 15 \\
 = \frac{3510}{100} \\
 = 35.10
 \end{array}$$

Rule:

Multiplication of the decimal by the whole number ignoring the decimal point. See the decimal point in the given decimal and mark the decimal point in the product with the same number of places.

More Examples

Example 3 Solve 7.324×5

Solution 7.324×5

$$\begin{aligned}
 &= 7.324 \times 5 \quad [3 \text{ decimal places}] \\
 &= 36.620 \quad [3 \text{ decimal places}]
 \end{aligned}$$

Example 4 Solve 1.4235×67

Solution 1.4235×67

$$\begin{aligned}
 &= 1.4235 \times 67 \quad [4 \text{ decimal places}] \\
 &= 95.3745 \quad [4 \text{ decimal places}]
 \end{aligned}$$

Working

$$\begin{array}{r}
 1.4235 \\
 \times \quad \quad \quad 67 \\
 \hline
 99645 \\
 854100 \\
 \hline
 95.3745
 \end{array}$$

4.1.6 Division of a decimal with a whole number

Consider the following examples:

Example 1 Divide 782.25 by 21

Solution $782.25 \div 21$

Divide as you would with whole numbers .

$$\begin{array}{r}
 37.25 \\
 21 \overline{) 782.25} \\
 \underline{-63} \\
 152 \\
 \underline{-147} \\
 52 \\
 \underline{-42} \\
 105 \\
 \underline{-105} \\
 0
 \end{array}$$

Line up decimal point in quotient with decimal point in dividend.

Stop dividing when you get a zero remainder.

Thus $782.25 \div 21 = 37.25$

Dividend decimal has 2 decimal places.

Quotient decimal has 2 decimal places.

Example 2 Divide 725.772 by 31

Solution $725.772 \div 31$

$$\begin{array}{r}
 23.412 \\
 31 \overline{) 725.772} \\
 \underline{62} \\
 105 \\
 \underline{93} \\
 127 \\
 \underline{124} \\
 37 \\
 \underline{31} \\
 62 \\
 \underline{62} \\
 0
 \end{array}$$

Line up decimal point in quotient with decimal point in dividend.

Thus, $725.772 \div 31 = 23.412$

Dividend decimal has 3 decimal places.

Quotient decimal has 3 decimal places.

4.1.7 Multiplication of a decimal with tenth, and hundredths only

Consider the following example:

Example 1

Find the product of 7.5 and 0.6

$$\begin{aligned} \text{Solution } 7.5 \times 0.6 \\ &= \frac{75}{10} \times \frac{6}{10} \\ &= \frac{450}{100} = 4.50 \end{aligned}$$

Example 3

Solve 2.3×0.05

$$\begin{aligned} \text{Solution } 2.3 \times 0.05 \\ &= \frac{23}{10} \times \frac{5}{100} \\ &= \frac{115}{1000} = 0.115 \end{aligned}$$

Example 2

Find the product of 12.3 and 0.5

$$\begin{aligned} \text{Solution } 12.3 \times 0.5 \\ &= \frac{123}{10} \times \frac{5}{10} \\ &= \frac{615}{100} = 6.15 \end{aligned}$$

Example 4

Solve 37.3×0.05

$$\begin{aligned} \text{Solution } 37.3 \times 0.05 \\ &= \frac{373}{10} \times \frac{5}{100} \\ &= \frac{1865}{1000} = 1.865 \end{aligned}$$

4.1.8 Multiplication of decimal by a decimal (with three decimal places)

Example 1 Solve 4.2×0.004

$$\begin{aligned} \text{Solution } 4.2 \times 0.004 \\ &= \frac{42}{10} \times \frac{4}{1000} \\ &= \frac{168}{10,000} = 0.0168 \end{aligned}$$

Example 2

Find the product of 15.6 and 0.423

Solution	Working
15.6×0.423	$\begin{array}{r} 15.6 \\ \times 0.423 \\ \hline 468 \\ 3120 \\ 62400 \\ \hline 65988 \end{array}$
$= \frac{156}{10} \times \frac{423}{1000}$	
$= \frac{65988}{10,000} = 6.5988$	

Exercise 4.3

1. Solve the following.

i. 13.2×7 ii. 37.4×12 iii. 45.31×32 iv. 3.456×23

2. Solve the following.

i. $97.29 \div 23$ ii. $185.74 \div 37$ iii. $341.88 \div 42$ iv. $252.32 \div 83$

3. Solve the following.

i. 3.75×8.4 ii. 47.31×32.56 iii. 4.381×2.4 iv. 58.32×37.02

4.1.9 Division of a decimal by a decimal (by converting decimals to fractions)

Example 1

Divide 0.8 by 0.4

Solution

$$\begin{aligned} & 0.8 \div 0.4 \\ &= \frac{8}{10} \div \frac{4}{10} \\ &= \frac{8}{10} \times \frac{10}{4} \\ &= \frac{\overset{2}{\cancel{8}}}{\underset{4}{\cancel{4}}} = 2 \end{aligned}$$

Example 2

Divide 0.05 by 0.005

Solution

$$\begin{aligned} & 0.05 \div 0.005 \\ &= \frac{5}{100} \div \frac{5}{1000} \\ &= \frac{\cancel{5}}{1\cancel{1}00} \times \frac{\cancel{1000}^{10}}{\cancel{5}1} \\ &= 10 \end{aligned}$$

Example 3 Solve $1.575 \div 4.5$

Solution

$$\begin{aligned} & 1.575 \div 4.5 \\ &= \frac{1575}{1000} \div \frac{45}{10} \\ &= \frac{\overset{315}{\cancel{1575}}}{\overset{35}{\cancel{1000}}} \times \frac{\overset{10}{\cancel{45}}}{\underset{9}{\cancel{45}}_1} \\ &= \frac{35}{100} = 0.35 \end{aligned}$$

4.1.10 Use of division to change fractions into decimals

Examples 1 Convert $\frac{1}{4}$ to decimal.

Solution

$$\begin{array}{r} 0.25 \\ 4 \overline{) 1.00} \\ \underline{- 8} \\ 20 \\ \underline{- 20} \\ 0 \end{array}$$

Thus, $\frac{1}{4} = 0.25$

Remember:

- i. Dividend 1 is smaller than divisor 4. We cannot divide it.
- ii. Put decimal point on the right of 1 and put decimal point in the quotient.
- iii. Now $4 \times 2 = 8$, we add one more zero on the right of already taken zero.
- iv. Now we complete the division process. Leave it when remainder in zero.
- v. Always line up the decimal points.

Example 2

Convert $\frac{4}{5}$ to decimal.

Solution

$$\begin{array}{r} 0.8 \\ 5 \overline{) 4.0} \\ \underline{- 4.0} \\ 0 \end{array}$$

Thus, $\frac{4}{5} = 0.8$

Example 3

Convert $1\frac{3}{4}$ to decimal.

Solution $1\frac{3}{4} = \frac{7}{4}$

$$\begin{array}{r} 1.75 \\ 4 \overline{) 7.00} \\ \underline{- 4} \quad \downarrow \quad \downarrow \\ 30 \quad \downarrow \\ \underline{- 28} \quad \downarrow \\ 20 \\ \underline{- 20} \\ 0 \end{array}$$

Thus, $1\frac{3}{4} = 1.75$

Example 4 Convert $3\frac{1}{8}$ to decimal.

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

$$\begin{array}{r}
 3.125 \\
 8 \overline{) 25.000} \\
 \underline{-24} \quad \downarrow \downarrow \downarrow \\
 10 \quad \downarrow \downarrow \downarrow \\
 \underline{-8} \quad \downarrow \downarrow \downarrow \\
 20 \quad \downarrow \downarrow \downarrow \\
 \underline{-16} \quad \downarrow \downarrow \downarrow \\
 40 \\
 \underline{-40} \\
 0
 \end{array}$$

Thus, $3\frac{1}{8} = 3.125$

Note: we can take 3 as whole number and change $\frac{1}{8}$ to decimal.

Example 5 Change $2\frac{1}{80}$ to decimal.

Solution $2\frac{1}{80} = \frac{161}{80}$

$$\begin{array}{r}
 2.0125 \\
 80 \overline{) 161.0000} \\
 \underline{-160} \quad \downarrow \downarrow \downarrow \downarrow \\
 100 \quad \downarrow \downarrow \downarrow \downarrow \\
 \underline{-80} \quad \downarrow \downarrow \downarrow \downarrow \\
 200 \quad \downarrow \downarrow \downarrow \downarrow \\
 \underline{-160} \quad \downarrow \downarrow \downarrow \downarrow \\
 400 \\
 \underline{-400} \\
 0
 \end{array}$$

Thus, $2\frac{1}{80} = 2.0125$

4.1.11 Simplify decimal expressions involving brackets (applying one or more basic operations)

Example 1 Simplify: $2.1 + (1.3 \times 2.1 \div 0.7)$

Solution

$$\begin{aligned} & 2.1 + (1.3 \times 2.1 \div 0.7) \\ &= 2.1 + (1.3 \times 3) \\ &= 2.1 + 3.9 \\ &= 6.0 \end{aligned}$$

Working

$$\begin{aligned} & 2.1 \div 0.7 \\ &= \frac{21}{10} \times \frac{10}{7} \\ &= 3 \end{aligned}$$

Example 2 Simplify: $8.2 - (2.2 \times 1.1 + 3.1)$

Solution

$$\begin{aligned} & 8.2 - (2.2 \times 1.1 + 3.1) \\ &= 8.2 - (2.42 + 3.1) \\ &= 8.2 - 5.52 \\ &= 2.68 \end{aligned}$$

Working

$$\begin{array}{r} 2.2 \quad 8.2 \ 0 \\ \times 1.1 \quad - 5.5 \ 2 \\ \hline 2 \ 2 \\ 2 \ 2 \ 0 \\ \hline 2.4 \ 2 \end{array}$$

Example 3 Simplify: $2.2 (6.4 - 2.52 \div 2.1)$

Solution

$$\begin{aligned} & 2.2 (6.4 - 2.52 \div 2.1) \\ &= 2.2(6.4 - 1.2) \\ &= 2.2 \times 5.2 \\ &= 11.44 \end{aligned}$$

Working

$$\begin{array}{r} 2.52 \div 2.1 \quad 2.2 \\ = \frac{252}{100} \div \frac{21}{10} \quad \times 5.2 \\ = \frac{252}{100} \times \frac{10}{21} \quad \frac{11 \ 0 \ 0}{11.4 \ 4} \\ = \frac{12}{10} = 1.2 \end{array}$$

Exercise 4.4

1. Solve:

i. $25.5 \div 0.5$ ii. $33.6 \div 1.4$ iii. $32.5 \div 2.5$ iv. $103.4 \div 4.7$

2. Change the following fractions to decimals.

i. $\frac{1}{25}$ ii. $\frac{3}{20}$ iii. $3\frac{2}{5}$ iv. $6\frac{3}{5}$

3. Simplify the following expressions.

i. $(5.3 + 2.1 - 3.4) \times 2.8$

ii. $6.3 - (2.4 - 1.2 \times 1.3)$

iii. $3.7 (2.87 \div 0.7 \times 2)$

iv. $2.2 + (8.4 \div .12 - 20.6)$

v. $(19.4 - 8.2 \times 1.2) + 11.7$

vi. $8.8 - (2.1 + 5.4 \div 0.9)$

4.1.12 Round off decimals upto specified number of decimal places**Definition:**

To round a number means to approximate the number to a given value. When rounding look at the digit to the right of the given place value. If the digit to the right is less than 5, round down. If the digit to the right is 5 or greater than 5, round up.

Example 1

Round 7.12 to the nearest tenth.

Solution

We want to round to the nearest tenth.

7.12 Because the hundredths' digit 2 is less than 5, round down and drop the remaining digits.

The decimal 7.12 rounded to the nearest tenth is 7.1

Example 2

Round 6.237 to the nearest hundredth.

Solution

6.237 Because the thousandths' digit is greater than 5, round up.

The decimal 6.237 rounded to the nearest hundredths is 6.24

Example 3 Round 17.5678 to the nearest thousandths.

Solution 17.5678 Because $8 > 5$, we round up

The decimal 17.5678 rounded to the nearest thousandths is 17.568

4.1.13 Convert fractions to decimals and vice versa

We have learnt how to convert fraction to decimals in article 4.1.1.

We know that:

i. $\frac{1}{4} = 0.25$

ii. $\frac{4}{5} = 0.8$

iii. $1\frac{3}{4} = 1.75$

iv. $3\frac{1}{8} = 3.125$ and $2\frac{1}{80} = 2.0125$

Let us learn how to convert decimals to fractions.

Example 1 Convert 0.25 to fraction.

Solution 0.25 consist of 2 tenths and 5 hundredths.

$$\begin{aligned} \text{Thus, } 0.25 &= \frac{2}{10} + \frac{5}{100} \\ &= \frac{2 \times 10 + 5 \times 1}{100} \\ &= \frac{20 + 5}{100} \\ &= \frac{25}{100} \\ &= \frac{1}{4} \quad (\text{simplest form}) \end{aligned}$$

Alternatively:

$$\begin{aligned} 0.25 &(\text{it has 25 hundredths}) \\ &= \frac{25}{100} \\ &= \frac{1}{4} \quad (\text{simplest form}) \end{aligned}$$

Example 2 Convert 3.125 to fraction.

Solution 3.125 to fraction

$$3.125 = \frac{3125}{1000} = \frac{\overset{25}{\cancel{125}} \overset{625}{\cancel{3125}}}{\underset{200}{\cancel{1000}} \underset{40}{\cancel{1000}}} = \frac{25}{8} = 3\frac{1}{8}$$

Rule to convert decimals to fractions

- i. Remove the decimal point.
- ii. In the denominator put 1 under decimal point.
- iii. Add as many zeros on the right side of 1 as decimal places in the given decimal.
- iv. Simplify the fraction to its simplest form

More examples:

- i. Convert 2.73 to fraction

Solution

$$\begin{aligned} & 2.73 \\ &= \frac{273}{100} \\ &= 2\frac{73}{100} \end{aligned}$$

- ii. Convert 1.65 to fraction

Solution

$$\begin{aligned} & 1.65 \\ &= \frac{165}{100} \\ &= \frac{33}{20} \\ &= \frac{33}{20} = 1\frac{13}{20} \end{aligned}$$

Exercise 4.5

1. Round the following to the nearest one decimal place:
 - i. 8.23
 - ii. 5.38
 - iii. 6.62
2. Round the following to the nearest two decimal places:
 - i. 15.635
 - ii. 8.772
 - iii. 17.827
3. Round the following to the nearest three decimal places:
 - i. 71.8345
 - ii. 90.0362
 - iii. 108.3184
4. Convert the following fractions to decimals:
 - i. $\frac{3}{4}$
 - ii. $5\frac{1}{8}$
 - iii. $17\frac{2}{5}$
5. Convert the following decimals to fractions:
 - i. 17.23
 - ii. 24.52
 - iii. 19.11

4.1.14 Solve real life problems involving decimal

Example 1 Noureen bought 6 note books at the rate of Rs. 22.75 per notebook. How much did she pay?

Solution Cost of one notebook = Rs. 22.75
 Number of notebooks = 6
 Cost of 6 notebooks = 22.75×6
 = Rs. 136.50

Example 2 Javeria bought 13.1 meters of cloth and paid Rs. 238.42 to the shopkeeper. Find the cost per metre of the cloth?

Solution

Number of metres the cloth was bought = 13.1
 Money paid to the shopkeeper = Rs. 238.42
 Rate of the cloth per metre = $238.42 \div 13.1$
 $= 238.42 \times \frac{1}{13.1}$
 $= \frac{2384.2}{131}$
 = Rs. 18.20

Working

$$\begin{array}{r} 18.2 \\ 131 \overline{) 2384.2} \\ \underline{131} \\ 1074 \\ \underline{1048} \\ 262 \\ \underline{262} \\ 0 \end{array}$$

Example 3 Mehwish is 1.91m tall and Nazli is 0.03m smaller than Mehwish. Find Nazli's height.

Solution Mehwish's height = 1.91m
 Nazli's height = $1.91 - 0.03$
 = 1.88m

Exercise 4.6

1. Cost of 15.2kg of rice is Rs. 1220.56. Find the cost of 1kg of rice.
2. 12.5kg of apples cost Rs. 1065. Find the cost of 8.5kg of apples.

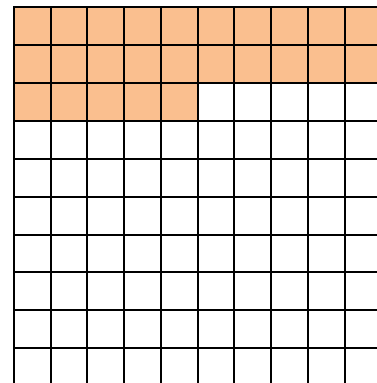
3. Your CD player runs for about 6.5 hours on new batteries. The average length of CDs in your collection is about 1.3 hours. How many CDs can you expect to listen using one new set of batteries?
4. Total length of a pole is 21.3 meters. If 0.2 meter of the length of this pole is inside the ground. Find how much of its length is outside the ground?
5. A person died leaving property worth Rs. 4000.40. His widow got 0.125 of the property. His son got 0.4 of the remainder. What did his widow and son get?

4.2 Percentages

4.2.1 Recognize percentage as a special kind of fraction

Percent:

A ratio whose denominator is 100. The symbol for percent is %. The model on right has 25 out of 100 squares shaded. You can say that 25 percent of the squares are shaded.



Numbers:

You can write 25 percent as $\frac{25}{100}$ or as 25%.

Now percentage has been deduced from percentum which mean rate per hundred or out of 100.

You can see that percentage is a special kind of fraction whose denominator is 100.

- | | |
|---|---|
| <p>i. $\frac{11}{100}$ means 11%</p> <p>iii. $\frac{17}{100}$ means 17%</p> | <p>ii. $\frac{23}{100}$ means 23%</p> <p>iv. $\frac{123}{100}$ means 123%</p> |
|---|---|

4.2.2 Convert percentage to fraction and to decimal and vice versa

(a) Conversion of percentage to fraction and decimal

Example 1 Convert 13% to fraction and decimal.

Solution 13% [13 out of 100]

$$= \frac{13}{100} = 0.13$$

Example 2 Convert 27% to fraction and decimal.

Solution 27% [27 out of 100]

$$= \frac{27}{100} = 0.27$$

Example 3 Convert 137% to fraction and decimal.

Solution 137%

$$= \frac{137}{100} = 1.37$$

(b) Conversion of fraction and decimal to percentage

Example 1

Convert $\frac{4}{5}$ to percentage.

Solution $\frac{4}{5}$

$$= \frac{4 \times 20}{5 \times 20} = \frac{80}{100}$$

$$= 80\%$$

Example 3

Convert $\frac{3}{10}$ to percentage.

Solution $\frac{3}{10}$

$$= \frac{3 \times 10}{10 \times 10} = \frac{30}{100}$$

$$= 30\%$$

Example 2

Convert $\frac{3}{4}$ to percentage.

Solution $\frac{3}{4}$

$$= \frac{3 \times 25}{4 \times 25} = \frac{75}{100}$$

$$= 75\%$$

Example 4

Convert 0.19 to percentage.

Solution 0.19

$$= \frac{19}{100}$$

$$= 19\%$$

Example 5 Convert 0.294 to percentage.

Solution $0.294 = \frac{294}{1000}$
 $= \frac{294}{100 \times 10}$
 $= \frac{29.4}{100} = 29.4\%$

Activity: Fill in the blanks as given in (i)

Sr. No,	Percentage	Fraction	Decimal
i.	61	$\frac{61}{100}$	0.61
ii.	25		
iii.			0.33
iv.		$\frac{11}{25}$	
v.	37		
vi.			0.65
vii.		$\frac{17}{26}$	
viii.	49		

Exercise 4.7

1. Write the percentage as a fraction.

- i. 63% ii. 31% iii. 93% iv. 17%
v. 80% vi. 27% vii. 76% viii. 41%

2. Write the fraction as a percent.

i. $\frac{17}{50}$

ii. $\frac{16}{25}$

iii. $\frac{7}{10}$

iv. $\frac{3}{20}$

v. $\frac{9}{10}$

vi. $\frac{1}{4}$

vii. $\frac{3}{5}$

viii. $\frac{3}{4}$

3. Write the decimal as percent.

i. 0.17

ii. 0.23

iii. 0.51

iv. 0.19

4. Calculate the following:

i. 20% of 80

ii. 50% of 40

iii. 40% of 85

4.2.3 Solve real life problems involving percentage

Example 1 15 out of 20 men were wearing caps in the mosque. What percent of men were wearing caps?

Solution

Total number of men = 20

Number of men wearing caps = 15

$$\begin{aligned} \text{Percent of men wearing caps} &= \frac{15}{20} \times 100 \\ &= 75\% \end{aligned}$$

Example 2 There are 50 green pages of a book and 200 pages are white. What percentage of pages are green?

Solution Total number of pages of the book = $50 + 200 = 250$

Number of green pages = 50

$$\begin{aligned} \text{Percentage of green pages} &= \frac{50}{250} \times 100 \\ &= 20\% \end{aligned}$$

Exercise 4.8

1. Price of a pen is Rs. 450. The shopkeeper sold it at a discount of 20%. What did the customer pay to the shopkeeper?

2. A man spends 30% of his income on the education of his children. If he spends Rs. 2100 on education, then find his income.
3. Anwar purchased a table for Rs. 4000. He paid 40% of the price in cash and promised to pay the remaining amount after one month. What did he pay in cash and what amount shall he pay after one month?
4. A student read 70% of pages of a book. If the total number of the pages are 300, how many pages are left to be read?

Review Exercise 4

1. Four possible options have been given. Encircle the correct one.
 - i. Adding 2.12 and 2.6
(a) 4.18 (b) 4.72 (c) 4.0 (d) 4.08
 - ii. Subtracting 3.4 from 5.84
(a) 2.44 (b) 2.80 (c) 9.24 (d) 2.4
 - iii. How many decimal places has 3.456?
(a) 6 (b) 5 (c) 4 (d) 3
 - iv. Multiplying 36.57 by 1000.
(a) 0.03657 (b) 3657 (c) 36570 (d) 365.7
 - v. Dividing 983.6 by 100.
(a) 9.836 (b) 98360 (c) 98.36 (d) 9836
 - vi. What is the product of 0.6 and 3?
(a) 18 (b) 1.8 (c) 9 (d) 0.2
 - vii. Dividing 0.4 by 0.2
(a) 0.02 (b) 0.003 (c) 2 (d) 0.008

- viii. Change $\frac{4}{5}$ to decimal.
(a) 0.008 (b) 1.25 (c) 0.08 (d) 0.8
- ix. Round 13.568 to the nearest hundredth.
(a) 13.57 (b) 13.569 (c) 13.6 (d) 13
2. Simplify the following expressions.
- i. $3.21(7.5 - 2.3 \times 1.2)$ ii. $(8.4 - 2.4 \div .6) + 2.7$
iii. $5.03 + (3.2 + 2.9 \times 2.1)$ iv. $8.9 - (12.7 - 3.2 \times 2.2)$
3. Convert the following decimals to fraction.
- i. 7.23 ii. 13.97 iii. 6.032
4. Write the percent as a fraction.
- i. 54% ii. 72% iii. 97%
5. Write the fraction as a percent.
- i. $\frac{13}{50}$ ii. $\frac{7}{10}$ iii. $\frac{29}{100}$
6. Calculate the following:
- i. 30% of 30 ii. 20% of 60 iii. 40% of 65
7. Ashraf has Rs. 5000. He gave Rs. 3000 to his brother. What percentage of his amount did he give to his brother?
8. Monthly income of a man is Rs. 7000. He spends Rs. 6000/- monthly. What percentage of his income is he saving?
9. A tailor has 33.6m long piece of cloth. He uses 2.1m cloth for a shirt. How many shirts can he prepare out of this cloth?
10. How many jugs of milk are needed to fill a bucket of capacity 201.15 litres with 1.25 litre jug?

SUMMARY

- A decimal is a number that is written using the base-ten place value system where a decimal point separates the ones and tenths digits.
- In addition of decimals we line up the decimals points, decimals are made of equal decimal places, decimals are added as whole number are added and decimal points are kept in a column.
- In subtraction of decimals we line up the decimal points, decimals are made of equal decimal places, decimal are subtracted as whole numbers and decimals points are kept in a column.
- Decimals with different number of decimal places are called unlike decimals.
- Unlike decimals can be transformed to like decimals by adding placeholder zeros on right side of decimal part.
- Multiplying decimals by 10, 100 and 1000, decimal point of given decimal is moved to the right by 1, 2 and 3 decimal places receptively.
- Dividing a decimal by 10, 100 or 1000 is equivalent to forming a new number by moving the decimal point of the given decimal to the left 1, 2 and 3 places respectively.
- To multiply the decimal by the whole number, we ignore the decimal point. See the decimal places in the given decimal and put the decimal point in the product with the same number of places.
- To multiply a decimal by a decimal is to count the decimal places in the multiplicand and the multiplier and find their sum. Put in the decimal point in the product with this sum of places counting from the right.
- To round means to approximate the number in a given place value. When rounding look at the digit to the right of the given place value. If the digit to the right is less than 5, round down. If the digit to the right is 5 or greater than 5, round up.