8 Decimals
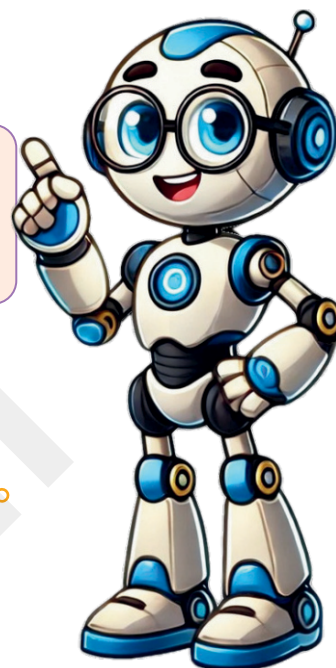
We'll cover the following key points:

→ Introduction to Decimals
→ Expanded form of Decimals

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Learning Outcomes

**By the end of this chapter, students will be able to:**

- Introduction to Decimals: Students will understand what decimals are and where they are used in daily life.

- Reading Decimals: Students will learn how to read and write decimal numbers correctly.

- Place Value in Decimals: Students will understand the place value of digits in decimal numbers (tenths, hundredths, etc.).

- Expanded Form of Decimals: Students will write decimal numbers in their expanded form (e.g., $3.45 = 3 + 0.4 + 0.05$).

- Comparing Decimals: Students will compare decimal numbers and identify which is greater or smaller.

- Adding and Subtracting Decimals: Students will learn to add and subtract decimal numbers up to two decimal places.

- Decimals in Measurements: Students will use decimals to understand measurements like length, weight, and money.

- Rounding Off Decimals: Students will round decimal numbers to the nearest whole number or to one decimal place.
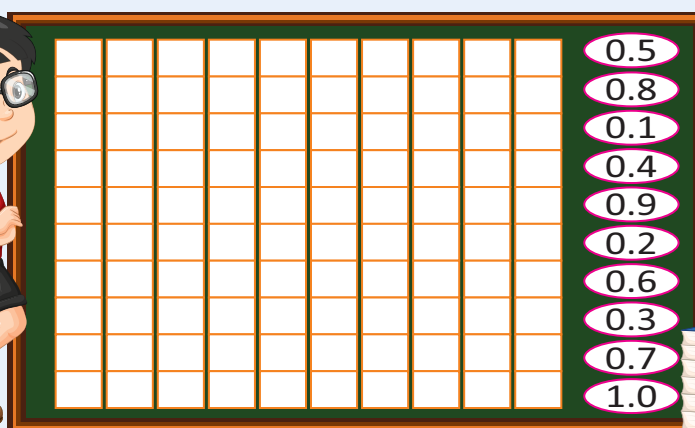
Write the decimal fraction for the following in the oval given below each figure :
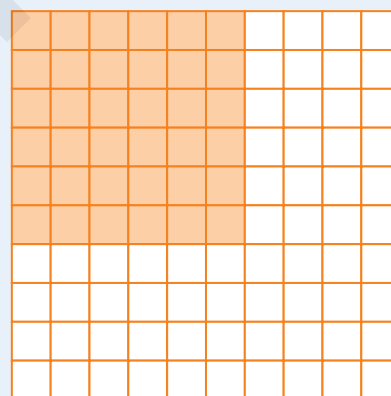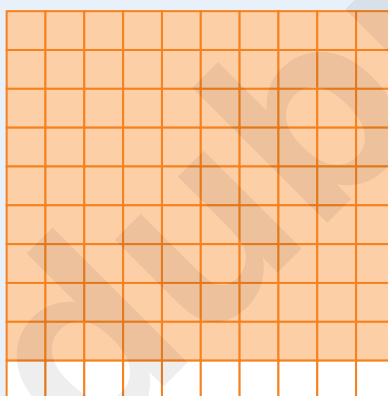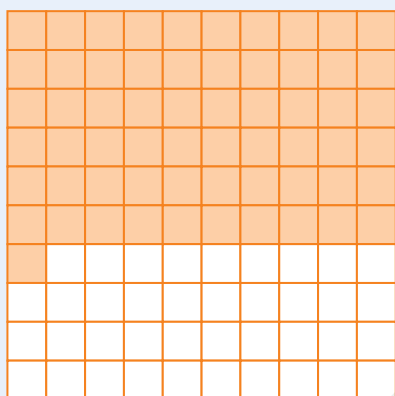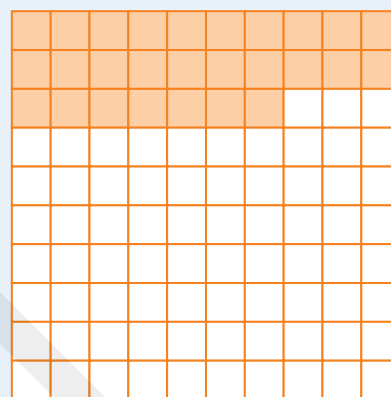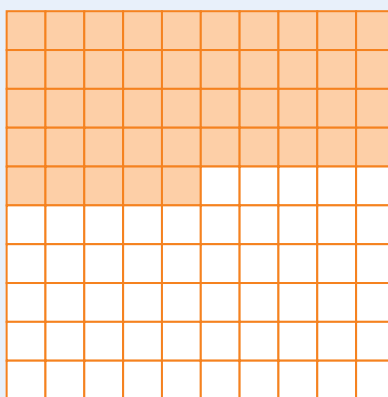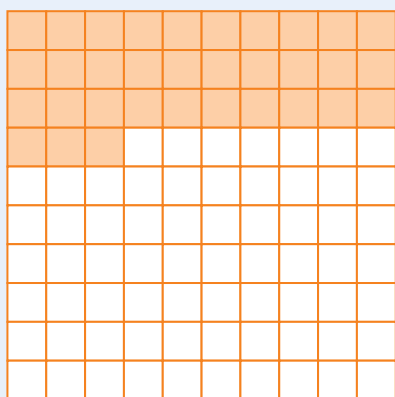
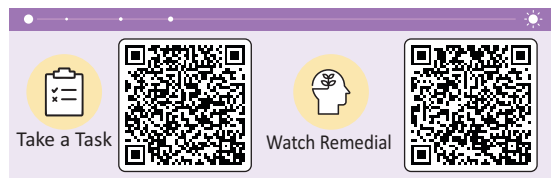**Shade to represent the numbers given.**

0.5
0.8
0.1
0.4
0.9
0.2
0.6
0.3
0.7
1.0

Introduction to Decimals

Study the place value table shown below and note the place value of 6 in each case.

Numerals	Thousands	Hundreds	Tens	Ones
9546 →	9	5	4	6
9564 →	9	5	6	4
9654 →	9	6	5	4
6954 →	6	9	5	4

We find that :

Place value of 6 in 9546 = 6 × 1   =   6

Place value of 6 in 9564 = 6 × 10   =   60

Place value of 6 in 9654 = 6 × 100   =   600

Place value of 6 in 6954 = 6 × 1000   =   6000

We observe that the place value of a digit becomes 10 times as it moves from right to left by one place, i.e. 6 becomes 60 in above table. The value becomes 100 times as it moves from right to left by 2 places, i.e. 6 becomes 600 in above table. Similarly, 1000 times as it moves from right to left by 3 places, i.e. 6 becomes 6000

What happens when a digit moves one place from left to right?

Numerals	Thousands	Hundreds	Tens	Ones
7896	7	8	9	6
2753	2	7	5	3
3978	3	9	7	8
6537	6	5	3	7

Place value 7 in 7896   =   7000

Place value 7 in 2753   =   700 (i.e., 7000 ÷ 10)

Place value 7 in 3978   =   70 (i.e., 700 ÷ 10)

Place value of 7 in 6537   =   7 (i.e., 70 ÷ 10)

Now, we observe that the place value of the digit becomes one-tenth as it moves from left to right by one place.

Similarly, a digit can move from left to right further places.

We can extend the place value chart further as follows.

Hundreds (100)	Tens (10)	Ones (1)	Tenths $\left(\dfrac{1}{10}\right)$	Hundredths $\left(\dfrac{1}{100}\right)$	Thousandths $\left(\dfrac{1}{1000}\right)$	
3						3 hundreds
	3					3 tens
		3				3 ones
			3			3 tenths
				3		3 hundredths
					3	3 thousandths

Place value of 3 tenths $= \dfrac{3}{10}$

Place value of 3 hundredths $= \dfrac{3}{100}$

Place value of 3 thousandths $= \dfrac{3}{1000}$

We know that fractions are used to represent numbers smaller than 1.

To represent a number smaller than 1, we also use decimals. It comes from the Latin word '**decimus**' which means '**tenths**'.

A decimal number (or simply decimal) is represented by a decimal point '.'

How to read and write decimals?

Examples of some numbers	Fraction	Decimal	Read as
Seven tenths	$\dfrac{7}{10}$	.7	decimal seven
Nine tenths	$\dfrac{9}{10}$	.9	decimal nine
One and three tenths	$1\dfrac{3}{10}$	1.3	one decimal three
Sixty hundredths	$\dfrac{60}{100}$	.60	decimal six, zero

Eight hundred thousandths	$\dfrac{800}{1000}$	.800	decimal eight, zero, zero
Six hundredths	$\dfrac{6}{100}$	.06	decimals zero six
Four hundred fifty thousandths	$\dfrac{450}{1000}$	.450	decimal four five zero
Sixty-eight thousandths	$\dfrac{68}{1000}$	.068	decimal zero six eight
Two and forty-two hundredths	$2\dfrac{42}{100}$	2.42	two decimal four, two
Seven and sixty-one hundredths	$7\dfrac{61}{100}$	7.61	seven decimal six, one
Seven and nine hundred sixty-two thousandths	$7\dfrac{962}{1000}$	7.962	seven decimal nine six, two

REMEMBER

1. The digits after the decimal read one by one.
2. We also use word 'point' instead of decimal.
3. We also write. 8 = 0.8, . 6 = 0.6, . 12 = 0.12.

A decimal number consists of two parts, a whole number part and a decimal number part. Decimal point (.) separates both the parts.

Example 1: Write as a decimal :

(i) $\dfrac{8}{10}$ (ii) $\dfrac{3}{10}$ (iii) $\dfrac{25}{100}$ (iv) $\dfrac{69}{100}$ (v) $\dfrac{253}{100}$

(vi) $\dfrac{842}{1000}$ (vii) $2\dfrac{5}{10}$ (viii) $4\dfrac{11}{100}$

Solution :

(i) $\dfrac{8}{10} = 0.8$ (ii) $\dfrac{3}{10} = 0.3$ (iii) $\dfrac{25}{100} = 0.25$ (iv) $\dfrac{69}{100} = 0.69$

(v) $\dfrac{253}{1000} = 0.253$ (vi) $\dfrac{842}{1000} = 0.842$ (vii) $2\dfrac{5}{10} = 2.5$ (viii) $4\dfrac{11}{100} = 4.11$

Example 2: Write as a decimal of the following :

(i) $6\frac{123}{1000}$ (ii) $9\frac{6}{10}$ (iii) $25\frac{99}{100}$ (iv) $108\frac{3}{10}$

Solution: (i) $6\frac{123}{1000} = 6.123$ (ii) $9\frac{6}{10} = 9.6$

(iii) $25\frac{99}{100} = 25.99$ (iv) $108\frac{3}{10} = 108.3$

1. Write as a decimal of the following :

(a) $\frac{8}{10}$ (b) $2\frac{4}{100}$ (c) $\frac{75}{100}$ (d) $\frac{39}{100}$ (e) $5\frac{11}{100}$

(f) $\frac{875}{1000}$ (g) $8\frac{279}{1000}$ (h) $6\frac{21}{100}$ (I) $3\frac{2}{100}$ (j) $8\frac{6}{10}$

(k) $3\frac{71}{100}$ (l) $\frac{61}{100}$ (m) $\frac{335}{1000}$ (n) $3\frac{125}{1000}$ (o) $3\frac{19}{100}$

(p) $8\frac{50}{100}$ (q) $515\frac{50}{100}$ (r) $345\frac{11}{100}$ (s) $\frac{239}{100}$ (t) $5\frac{11}{1000}$

2. Write as a decimal of the following:

(a) Three hundredths   (b) Eight hundredths

(c) Twenty-two thousandths   (d) Two tenths

3. Observe the pattern and find the missing numbers:

(a) 2.02, 3.03, 4.04, ..., ..., ..., ...

(b) 10.41, 10.42, 10.43, ..., ..., ..., ...

(c) 0.234, 0.235, 0.236, ..., ..., ..., ...

(d) 2.782, 2.786, 2.790, ..., ..., ..., ...

4. First write the following as fractions and, then as decimals:

(a) Twenty-two hundredths

(b) Six and nine thousandths

(c) Eight and fourteen hundredths

(d) Five and five tenths

Expanded form of Decimals

We know that $4983 = 4000 + 900 + 80 + 3$.

Study the following examples of expanded form of decimal numbers :

(I) $.85 = .8 + .05$

(ii) $.256 = .2 + .05 + .006$

(iii) $.3567 = .3 + .05 + .006 + .0007$

(iv) $.9756 = .9 + .07 + .005 + .0006$

(v) $.632 = .6 + .03 + .002$

Example 3:   Write 54.897 in the expanded form.

Solution: $54.897 = 50 + 4 + \dfrac{8}{10} + \dfrac{9}{100} + \dfrac{7}{1000} = 50 + 4 + .8 + .09 + .007$

Example 4:   Write .387 in the expanded form.

Solution: $.387 = .3 + .08 + .007$

Example 5:   Write in figures:

     (i)   Thirty-nine decimal zero, two, eight

     (ii)   Sixty-seven decimal two, three, four

     (iii)   One hundred twenty-two decimal one, zero, five

Solution:

     (i)   Thirty-nine decimal zero, two, eight = 39.028

     (ii)   Sixty-seven decimal two, three, four = 67.234

     (iii)   One hundred twenty-two decimal one, zero, five = 122.105

Example 6:   Write the expanded form of following numbers and also write the digits in place value chart:

$$5.783, \ 11.24, \ 196.68$$

Solution: $5.783 = 5 + \dfrac{7}{10} + \dfrac{8}{100} + \dfrac{3}{1000} = 5 + .7 + .08 + .003$

$$11.24 = 10 + 1 + \dfrac{2}{10} + \dfrac{4}{100} = 10 + 1 + .2 + .04$$

$$96.687 = 90 + 6 + \dfrac{6}{10} + \dfrac{8}{100} + \dfrac{7}{1000} = 90 + 6 + .6 + .08 + .007$$

Place Value Chart

Numerals	Tens	Ones	(.)	Tenths	Hundredths	Thousandths
	10	1	.			
5.789		5	.	7	8	9
25.24	2	5	.	2	4	
56.683	5	6	.	6	8	3

Example 7: Find the place value of each digit in 57. 453

Solution: $57.453 = 50 + 7 + .4 + .05 + .003$

$$= 5 \times 10 + 7 \times 1 + 4 \times \frac{1}{10} + 5 \times \frac{1}{100} + 3 \times \frac{1}{1000}$$

$$= 50 + 7 + \frac{4}{10} + \frac{5}{100} + \frac{3}{1000}$$
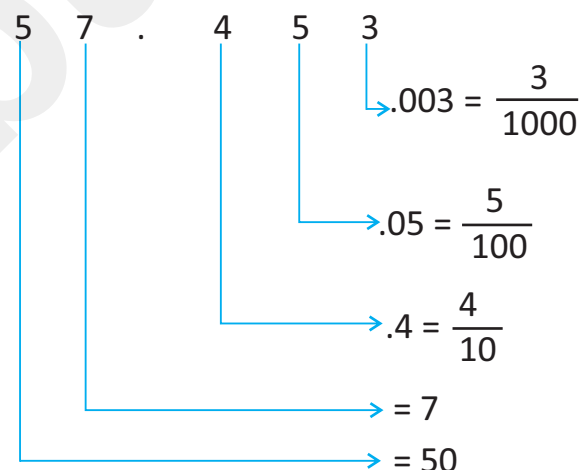
Hence, the place value of 5 = 50

the place value of 7 = 7

the place value of $4 = \frac{4}{10} = .4$

the place value of $5 = \frac{5}{100} = .05$

the place value of $3 = \frac{3}{1000} = .003$

Place Value chart of 57. 453

5   7   .   4   5   3

$.003 = \dfrac{3}{1000}$

$.05 = \dfrac{5}{100}$

$.4 = \dfrac{4}{10}$

$= 7$

$= 50$

Exercise 8.2

1.   Write the following in the expanded form:

(a) 23.675   (b) 7.803   (c) 3.281   (d) 8. 275

(e) 24.24   (f) 7.682   (g) 453.28   (h) 675. 28

2.   Read and write in words:

(a) 25.23   (b) 1.238   (c) 5.272   (d) 72.01

(e) 8.209   (f) 22.005   (g) 9.25   (h) 69.05

3. **For the number 275.389, write the digit in the :**

(a) Tens place (b) Tenths place (c) Hundreds place

(d) Hundredths place (e) Thousandths place (f) Ones place

4. **Give the next three numbers:**

(a) 2.2, 2.3, 2.4, ____ , ____ , ____ . (b) 4.92, 4.93, 4.94, ____ , ____ , ____ .

(c) 9.8, 9.9, 10.0, ____ , ____ , ____ . (d) 6.005, 6.006, 6.007, ____ , ____ , ____ .

(e) 13.02, 13.03, 13.04, ____ , ____ , ____ .

Think Tank

Gap Analyzer™

1.Tick (✓) the correct answer:

(a) The place value of 3 in 9. 358 is

(i) 30 ☐ (ii) 0.3 ☐ (iii) 0.03 ☐

(b) Which of the following is the greatest?

(i) 0.875 ☐ (ii) 0.81 ☐ (iii) 0.801 ☐

(c) On subtracting 0.609 from 1, we get

(i) 0.4 ☐ (ii) 1.609 ☐ (iii) 0.391 ☐

2. **Fill in the blanks with < , > or =:**

(a) 131.423 ◯ 145.408

(b) 0.1365 ◯ 0.3156

(c) 0.234 ◯ 0.324

(d) 2.762 ◯ 2.762

(e) 0.21 ◯ 0.124

(f) 0.579 ◯ 0.597

3. **Match the following:**

Column A	Column B
(a) 4 tenths	(i) 0.40
(b) 4 hundredths	(ii) $\dfrac{4}{1000}$
(c) 4 thousandths	(iii) 0.6
(d) Six tenths	(iv) $\dfrac{4}{100}$
(e) Forty hundredths	(v) $\dfrac{4}{10}$

Scan to Create Your Own Learning Path

3. **Represent the following decimals in the place value chart, then write the place value of 8 in each :**

(a) 23.826   (b) 8.271   (c) 81.756

(d) 28.469   (e) 45.287   (f) 2.258

Puzzle

Complete the Puzzle:

5	6	6	7	5
9	1	0	8	8
5	6	7	0	9
4	3	0	2	3
1	2	3	0	7

1. Six point zero seven zero
2. One point two three
3. Twelve point three zero seven
4. Five point six seven zero
5. Fifty eight point nine three seven

Mental Math

Write the fractions as decimals. One has been done for you.

(a) $\dfrac{8}{10}$ = 0.8

(b) $\dfrac{291}{100}$ = _____

(c) $\dfrac{614}{1000}$ = _____

(d) $\dfrac{44}{10}$ = _____

(e) $\dfrac{432}{10}$ = _____

(f) $\dfrac{207}{1000}$ = _____

**We will learn:** We will learn to perform the four operations using decimals.

We already know

- A fraction is a part of a whole number. We can express it as a decimal.

- A decimal number can be written with a whole number to show a complete whole and a fractional part. For example, to express 7 complete wholes and $\frac{6}{10}$ fractional part, we write 7.6 which is read as seven point six.
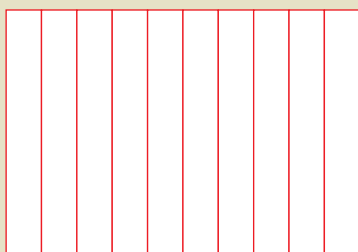
Material required: Colours

Procedure:

1. Some figures are given below. A fraction has been mentioned with each figure.

2. Colour the parts of the figures according to the fractions.

3. Then, note your observations in the table.

(a)

Colour $\frac{7}{10}$

(b)

Colour $\frac{2}{100}$
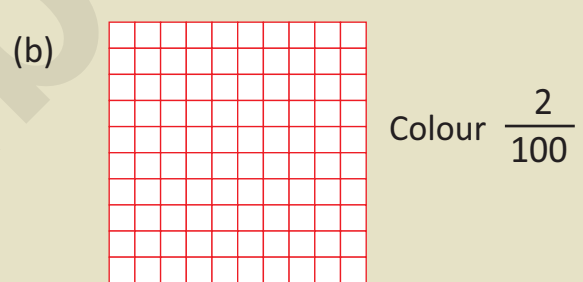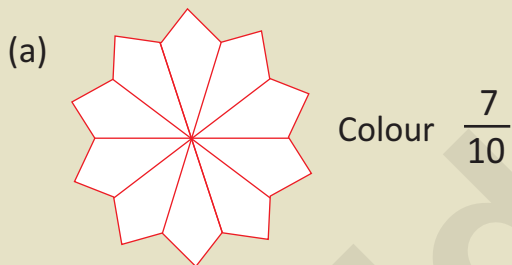
(c) If each part of the rectangle represents 100, the whole rectangle represents 1000. Now colour $\frac{400}{1000}$.

(d) If each part of the triangle represents 10, the whole triangle represents 100. Now, shade $\frac{60}{100}$.