

6

Decimals

A decimal consists of two parts : a **whole number** part and a **decimal number** part. Both the parts are separated by a dot (.), called decimal point. In 11.43, the whole number part is 11, while decimal number part is 43. In .3, .03, .43, .003, .043 and .143, there is no whole number part. Whereas in 1324, 114, 34, 6 there is no decimal number part. The whole number part is read as whole, while decimal number part is read as in separate digits. **For example** : We read 429.81 as four hundred twenty nine point eight one. To understand the decimal, let us study the place value chart for the numerals 6789, 7698, 8967 and 9876.

Thousands (1000)	Hundreds (100)	Tens (10)	Ones (1)
6	7	8	9
7	6	9	8
8	9	6	7
9	8	7	6

- The place value of digit 9 in the 1st numeral = $9 \times 1 = 9$.
- The place value of digit 9 in the 2nd numeral = $9 \times 10 = 90$.
- The place value of digit 9 in the 3rd numeral = $9 \times 100 = 900$.
- The place value of digit 9 in the 4th numeral = $9 \times 1000 = 9000$.

Therefore, it is observed from the place value chart that the place value of a digit '9' becomes 10 times as this digit moves from right to left by one place. The place value of digit '9' becomes 100 times as it moves from right to left by two places. The place value of digit '9' becomes 1000 times as it moves right to left by three places.

Now, study the place value chart for the numerals 5381, 538, 53, 5.

One Thousands 1000	Hundreds 100	Tens 10	Ones 1
5	3	8	1
	5	3	8
		5	3
			5



The place value of the digit 5 in the 1st numeral is 5000.

The place value of the digit 5 in the 2nd numeral is 500, i.e. $5000 \div 10$.

The place value of the digit 5 in the 3rd numeral is 50, i.e. $500 \div 10$.

The place value of the digit 5 in the 4th numeral is 5, i.e. $50 \div 10$.

Therefore, it is observed from place value chart that the place value of a digit becomes one-tenth as the digit moves from left to right by one place.

Now, we can find the place value of 5 if it moves further from left to right by one place,

i.e. $5 \div 10$, which means $\frac{5}{10}$ and is read as five-tenths. If the digit '5' further moves

by one more place, i.e. $5 \div 100$, which means $\frac{5}{100}$. It is read as five-hundredths and if

the digit 5 moves further more by one more place, i.e. $5 \div 1000$, which means $\frac{5}{1000}$ and

is read as five-thousandths.

The Place Value Chart upto Thousandths

Hundreds 100	Tens 10	Ones 1	Tenths $\frac{1}{10}$	Hundredths $\frac{1}{100}$	Thousandths $\frac{1}{1000}$	
5						5 Hundreds
	5					5 Tens
		5				5 Ones
			5			5 Tenths
				5		5 Hundredths
					5	5 Thousandths

Consider a number, say 475.396.

H **T** **O**
4 7 5

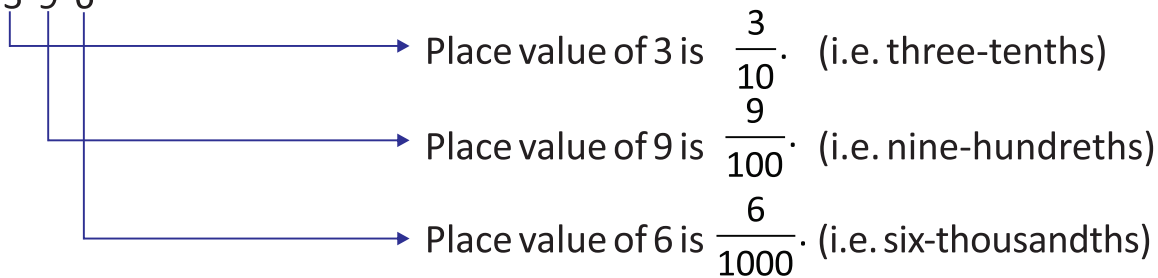
- Place value of 4 is 400. (i.e. 4×100)
- Place value of 7 is 70. (i.e. 7×10)
- Place value of 5 is 5. (i.e. 5×1)





On moving further to the right, the place value of becomes one-tenth, one-hundredth and one-thousandth.

i.e. 4 7 5 . 3 9 6

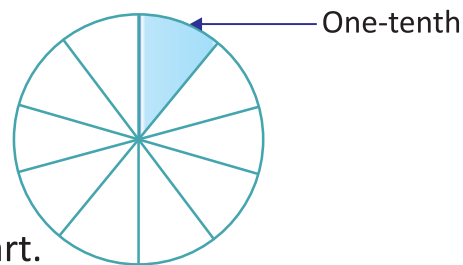


Tenths

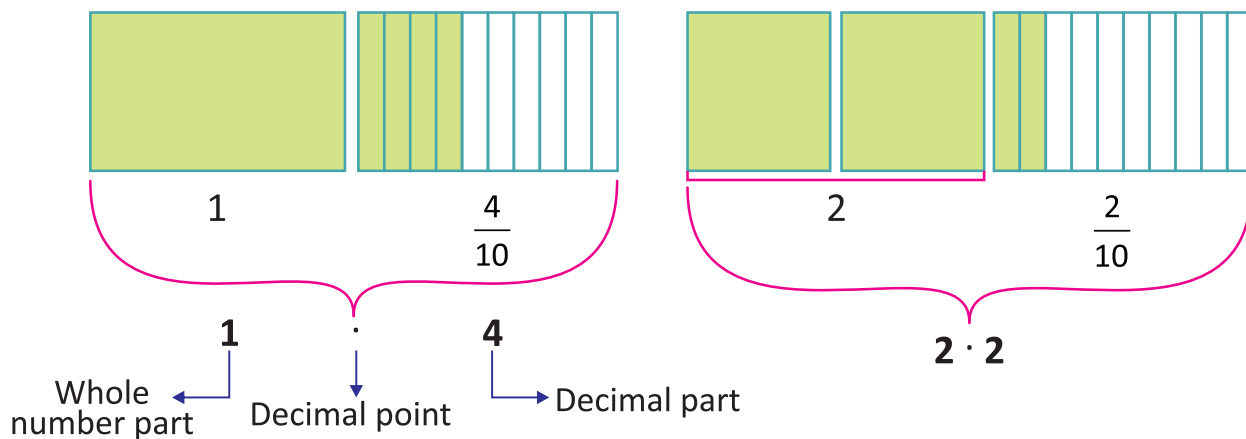
When we divide a complete one into 10 equal parts, each part is called **one-tenth** or **tenth**.

The fractional form is $\frac{1}{10}$.

The decimal form is **0.1**.



For Example : Write the decimal for the coloured part.



Hundredths

On moving still further right in place value chart, we get hundredth place.

$\frac{1}{100}$ can be written as 0.01 and is read as one-hundredth.

For Example : $472.38 \rightarrow \frac{8}{100}$ or 0.08

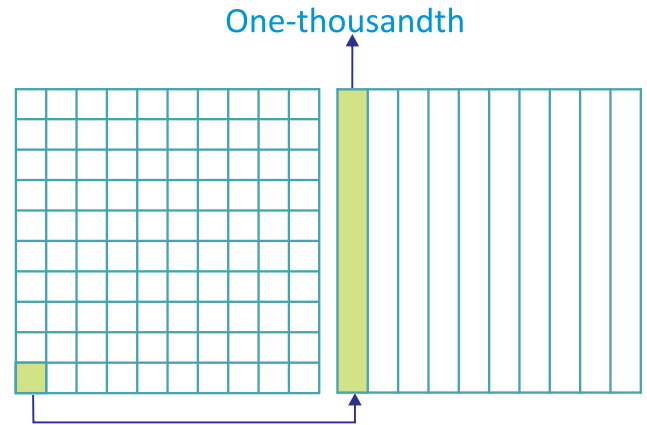




Thousandths

When one-hundredth is divided into 10 equal parts, each part is called one-thousandths.

1 hundredth = 10 thousandths
 The fractional and decimal form of one thousandths is $\frac{1}{1000}$ and 0.001 respectively.



Let us now solve a few examples.

Example I : Convert the following into decimal.

- a. $\frac{7}{10}$ b. $\frac{65}{10}$ c. $12\frac{3}{10}$ d. Five-tenths

- Solution** : a. $\frac{7}{10} = 0.7$ b. $\frac{65}{10} = 6.5$
 c. $12\frac{3}{10} = \frac{123}{10} = 12.3$ d. Five-tenths = $\frac{5}{10} = 0.5$

Example II : Change the following in decimal.

- a. $\frac{12}{1000}$ b. $\frac{3745}{1000}$ c. $4\frac{13}{1000}$

- Solution** : a. $\frac{12}{1000} = 0.012$ b. $\frac{3745}{1000} = 3.745$
 c. $4\frac{13}{1000} = \frac{4013}{1000} = 4.013$



Exercise 6.1

1. Write the following fractions into decimals.

- a. $\frac{6}{10}$ b. $3\frac{1}{10}$ c. $\frac{6}{100}$ d. $6\frac{14}{100}$ e. $8\frac{3}{100}$ f. $42\frac{52}{100}$

2. Write the following decimals into fractions.

- a. .8 b. .75 c. .326 d. .098 e. 2.3 f. 5.6





3. Write the following decimals figures.

- a. Seven-tenths =
- b. Six-hundredths =
- c. Two and one-tenth =
- d. One and three-hundredths =

4. In the number 48.72, the digit is in the TENTHS place, is in the ONES place, 4 is in the place and 2 is in the place.

5. Write the following into decimals.

- a. Seven-tenths
- b. Five-tenths
- c. Three and two-tenths
- d. Forty and two-tenths

6. Write the following fractions into decimals.

- a. $\frac{4}{1000}$
- b. $\frac{6}{1000}$
- c. $\frac{18}{1000}$
- d. $\frac{242}{1000}$
- e. $7\frac{11}{1000}$
- f. $91\frac{50}{1000}$
- g. $3\frac{171}{1000}$

7. Write the following into decimals.

- a. Sixty three and six-hundredths =
- b. Five and forty-thousandths =
- c. Thirty three-thousandths =
- d. Seven and two hundred fifty seven-thousandths =
- e. Forty three and thirty six-thousandths =

8. Make a place-value chart and show the decimals.

- a. 0.009
- b. 43.09
- c. 9.990
- d. 0.999
- e. 2.34
- f. 47.09
- g. 29.735



Expanded form of Decimals

Example III : Express the given decimal fraction in the expanded form :

- a. 839.654
- b. 3246.932



Solution

a. $839.654 = 800 + 30 + 9 + 0.6 + 0.05 + 0.004$
 $= 8 \times 100 + 3 \times 10 + 9 \times 1 + 6 \times \frac{1}{10} + 5 \times \frac{1}{100} + 4 \times \frac{1}{1000}$
 $= 800 + 30 + 9 + \frac{6}{10} + \frac{5}{100} + \frac{4}{1000}$

b. $3246.932 = 3000 + 200 + 40 + 6 + 0.9 + 0.03 + 0.002$
 $= 3 \times 1000 + 2 \times 100 + 4 \times 10 + 6 \times 1 + 9 \times \frac{1}{10}$
 $+ 3 \times \frac{1}{100} + 2 \times \frac{1}{1000}$
 $= 3000 + 200 + 40 + 6 + \frac{9}{10} + \frac{3}{100} + \frac{2}{1000}$

Given numbers in the above example can also be represented in place value chart as follows :

Thousands 1000	Hundreds 100	Tens 10	Ones 1	Tenths $\frac{1}{10}$	Hundredths $\frac{1}{100}$	Thousandths $\frac{1}{1000}$
	8	3	9	6	5	4
3	2	4	6	9	3	2

Example IV : Write the short form of the following decimal :

$$200 + 60 + 3 + \frac{4}{10} + \frac{2}{100} + \frac{7}{1000}$$

Solution : $200 + 60 + 3 + \frac{4}{10} + \frac{2}{100} + \frac{7}{1000}$

2 hundreds + 6 tens + 3 ones + 4 tenths + 2 hundredths + 7 thousandths

Placing the numbers under place-value chart :

Hundred 100	Tens 10	Ones 1	Tenths $\frac{1}{10}$	Hundredths $\frac{1}{100}$	Thousandths $\frac{1}{1000}$
2	6	3	4	2	7

Therefore, $200 + 60 + 3 + \frac{4}{10} + \frac{2}{100} + \frac{7}{1000} = 263.427$





Comparison of Decimals

While comparing two decimal numbers, first compare the whole number parts. If the digits at the extreme left of the whole numbers are equal, then we compare the next digit and so on. We also adopt the same rule while comparing decimals.

The decimal number having the greater whole number part is greater than the other decimal number.

Example V : Compare 9.5 and 6.8.

Solution : $9.5 = 9 \text{ ones} + 5 \text{ tenths}$, the whole number = 9

$6.8 = 6 \text{ ones} + 8 \text{ tenths}$, the whole number = 6

Since, $9 \text{ ones} > 6 \text{ ones}$, therefore, $9.5 > 6.8$.

If two decimal number have the same whole number, then the decimal number which has a greater digit at tenths place is greater than the other decimal number.

Example VI : Compare 94.35 and 94.46.

Solution : Both the decimal numbers have the same whole number parts (94).

Since, $0.4 > 0.3$, therefore, $94.46 > 94.35$.

Example VII : Compare the following numbers.

a. 32.49 and 32.47 b. 0.635 and 0.631

Solution : a. In 32.49 and 32.47, the whole number parts 32 and 32 are equal, tenths parts 0.4 and 0.4 are also equal but hundredths parts 0.09 and 0.07.

Since, $0.09 > 0.07$, therefore, $32.49 > 32.47$.

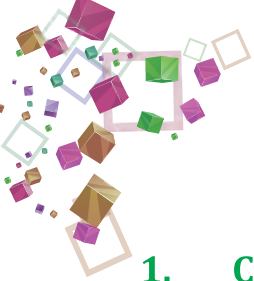
b. In 0.635 and 0.631, tenth places 0.6 and 0.6 are equal, hundredth places 0.03 and 0.03 are equal and thousandths places are 0.005 and 0.001.

Since, $0.005 > 0.001$, therefore, $0.635 > 0.631$.

Equivalent Fraction

The value of decimal number does not change when zeros are added to the right end of the decimal digits. For example, $0.6 = 0.60 = 0.600 = 0.6000$ and so on.

$0.016 = 0.0160 = 0.01600$ and so on are the equivalent fractions.



Exercise 6.2

1. Complete each of the following.

a. $32.425 = 30 + 2 + \frac{4}{\square} + \frac{2}{\square} + \frac{5}{\square}$

b. $0.828 = \frac{8}{\square} + \frac{2}{\square} + \frac{8}{\square}$

c. $7.046 = 7 + \frac{4}{\square} + \frac{6}{\square}$

d. $915.356 = 900 + 10 + 5 + \frac{3}{\square} + \frac{5}{\square} + \frac{6}{\square}$

2. Write the place value of 6 in each of the following.

a. 39.658

b. 57.426

c. 13.369

d. 139.006

e. 45.601

f. 54.060

3. Write the following in standard numerals.

a. $5 + \frac{4}{10} + \frac{3}{100} + \frac{7}{1000}$

b. $2 + \frac{4}{100} + \frac{1}{1000}$

c. $80 + 9 + \frac{2}{100} + \frac{7}{1000}$

d. $60 + 3 + \frac{6}{1000}$

4. Write the following in expanded forms.

a. 14.258

b. 6.29

c. 432.07

d. 7.005

e. 8.303

5. Arrange the following decimal numbers in ascending order.

a. 0.63, 0.805, 0.703, 0.49, 0.59, 0.38

b. 8.605, 6.29, 0.232, 2.031, 3.563, 0.05

c. 6.05, 3.19, 0.323, 0.631, 2.030, 0.009

d. 4.312, 3.723, 7.217, 2.731, 1.321, 2.130

6. Arrange the following decimal numbers in descending order.

a. 8.133, 7.101, 9.010, 6.678, 4.987, 5.910

b. 0.553, 0.543, 0.532, 0.563, 0.578, 0.581

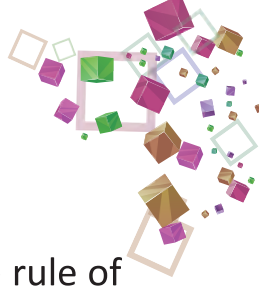
c. 0.970, 0.90, 0.981, 0.699, 0.998, 0.917

d. 0.130, 0.013, 0.031, 0.310, 0.039, 0.003





Addition and Subtraction of Decimal



Like number system, the addition and subtraction of decimal have the same rule of addition and subtraction. In addition of decimal the addends are put one below the other so that decimal points of all the addends are exactly in the same column.

Example VIII : Add 2.7, 4.3 and 9.5.

Solution :

$$\begin{array}{r}
 \textcircled{1} \\
 2.7 \\
 4.3 \\
 + 9.5 \\
 \hline
 16.5
 \end{array}$$

Therefore, $2.7, 4.3$ and $9.5 = 16.5$.

Example IX : Add $24.6 + 1.72 + 0.65$.

Solution : 24.6 is written as 24.60 as an equivalent decimal, since the other two numbers have two decimal digits.

$$\begin{array}{r}
 \textcircled{1} \\
 24.60 \\
 1.72 \\
 + 0.65 \\
 \hline
 26.97
 \end{array}$$

Therefore, $24.6 + 1.72 + 0.65 = 26.97$.

Example X : Subtract 49.5 from 115.432.

Solution : Put the subtrahend below the minuend so that decimal point come in the same column. Write $49.5 = 49.500$ as an equivalent fraction.

$$\begin{array}{r}
 \textcircled{10} \textcircled{14} \textcircled{14} \\
 \cancel{1} \cancel{1} \cancel{5} . \cancel{4} 3 2 \\
 - 49.500 \\
 \hline
 65.932
 \end{array}$$

Therefore, $115.432 - 49.5 = 65.932$.





Example XI : Subtract 2.003 from 4.

Solution : Write $4 = 4.000$, then subtract.

Therefore, $4 - 2.003 = 1.997$

3	9	9	10
4	.	0	0
-2	.	0	0
1	.	9	9
		7	



Converting a Decimal Fraction into a Common Fraction

For changing decimal number into a simple fraction, first remove the decimal point from it. After putting 1 as the denominator of the decimal number and introduce as many zero to its right as the number of digits after the decimal point are in given decimal number. Then, obtain fraction to reduce in its lowest form.

Example XII : Change the following decimals into simple fraction.

a. 0.4 b. 8.425

Solution : a. $0.4 = \frac{4}{10}$ (Removing the decimal and write 10 as denominator)

$= \frac{2 \times 2}{2 \times 5} = \frac{2}{5}$ (Reducing into its lowest form)

b. $8.425 = \frac{8425}{1000}$ (Removing the decimal and write 1000 as denominator)

$= 8 \frac{425}{1000}$ (Converting into mixed numeral)

$= 8 \frac{25 \times 17}{25 \times 40} = 8 \frac{17}{40}$ (Reducing into its lowest form)



Exercise 6.3

1. Find the sum of the following.

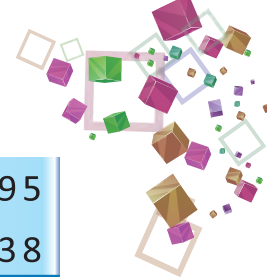
a.	0.54
	+ 0.08

b.	0.34
	+ 0.58

c.	1.75
	+ 2.03

d.	4.125
	+ 3.275





e.
$$\begin{array}{r} 0.624 \\ + 1.612 \\ \hline \end{array}$$

f.
$$\begin{array}{r} 3.87 \\ + 5.53 \\ \hline \end{array}$$

g.
$$\begin{array}{r} 10.3 \\ + 13.8 \\ \hline \end{array}$$

h.
$$\begin{array}{r} 21.095 \\ + 19.538 \\ \hline \end{array}$$

2. Subtract the following.

a.
$$\begin{array}{r} 9.5 \\ - 7.8 \\ \hline \end{array}$$

b.
$$\begin{array}{r} 15.8 \\ - 4.5 \\ \hline \end{array}$$

c.
$$\begin{array}{r} 9.768 \\ - 4.63 \\ \hline \end{array}$$

d.
$$\begin{array}{r} 6.13 \\ - 5.75 \\ \hline \end{array}$$

e.
$$\begin{array}{r} 15.25 \\ - 14.10 \\ \hline \end{array}$$

f.
$$\begin{array}{r} 32.4 \\ - 15.8 \\ \hline \end{array}$$

g.
$$\begin{array}{r} 34.87 \\ - 24.98 \\ \hline \end{array}$$

h.
$$\begin{array}{r} 56.056 \\ - 37.137 \\ \hline \end{array}$$

3. Convert the following into fractions.

a. .9

b. .03

c. .009

d. 6.4

e. .28

f. 0.13

g. 7.3

h. 4.85

4. Change the following decimals into simple fraction.

a. 0.16

b. 103.4

c. 99.25

d. 7.345

e. 0.75

f. 1.65

g. 53.3

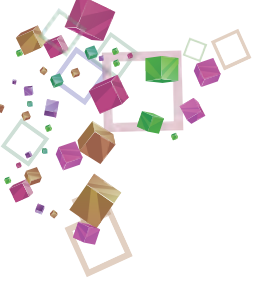
h. 39.45

Points to Remember



- ❖ A decimal consists of two parts : a whole number part and a decimal number part. Both the parts are separated by a dot (.), called decimal point.
- ❖ When we divide a complete one into 10 equal parts, each part is called one-tenth or tenth.
- ❖ The fractional and decimal form of one-thousandth is $\frac{1}{1000}$ and 0.001 respectively.
- ❖ While comparing two decimal numbers, first compare the whole number parts. The decimal number having the greater whole number part is greater than the other decimal number.
- ❖ The value of decimal number does not change when zeros are added to the right end of the decimal digits.





EXERCISE

(CCE Pattern)

1. Multiple Choice Questions (MCQs)

Tick () the correct option:

a. $\frac{3286}{1000}$ is equal to

(i) 32.86

(ii) 3.286

(iii) 328.6

(iv) 0.3286

b. $3\frac{15}{100}$ is equal to

(i) 31.5

(ii) 3.25

(iii) 3.15

(iv) 315

c. 22.31 is equal to

(i) $22\frac{31}{1000}$

(ii) $22\frac{31}{10}$

(iii) $22\frac{31}{100}$

(iv) none of these

d. $600 + 40 + 9 + \frac{5}{10} + \frac{3}{100} + \frac{2}{1000}$ is equal

(i) 649.532

(ii) 694.325

(iii) 6493.25

(v) none of these

e. $32.4 + 3.309 + 0.678$ is equal

(i) 35.387

(ii) 36.287

(iii) 35.287

(iv) 36.387

2. Convert following into decimal fractions.

a. $\frac{6}{10}$

b. $\frac{65}{10}$

c. $12\frac{3}{10}$

d. 6 tenths

e. 2 and 9 tenths

f. $\frac{4}{100}$

g. $\frac{11}{100}$

h. $8\frac{5}{100}$

i. $3\frac{15}{100}$





3. Write the following decimals into fractions.

- a. .7
- b. .9
- c. 4.5
- d. 2.78
- e. 4.04
- f. 0.03
- g. 0.31
- h. 134.32
- i. 13.19

4. Write the following decimals into fractions or mixed numerals.

- a. 0.035
- b. 0.057
- c. 0.009
- d. 0.342
- e. 5.147
- f. 7.03
- g. 16.13
- h. 75.008
- i. 6.67

5. Write the following in expanded form.

- a. 19.279
- b. 7.35
- c. 132.08
- d. 9.007
- e. 4.207
- f. 77.23
- g. 435.23
- h. 87.459
- i. 5.538

6. Make a place value chart and show the decimals.

- a. 0.075
- b. 23.67
- c. 0.008
- d. 9.991
- e. 9.09
- f. 55.135
- g. 0.007
- h. 0.022

7. Find the sum of the following.

- a. $8.675 + 9.485$
- b. $64.275 + 18.897$
- c. $52.428 + 77.152 + 19.73$
- d. $4.75 + 85.325 + 43.823$

8. Subtract the following.

- a. $5.678 - 2.995$
- b. $64.387 - 39.199$
- c. $9.62 - 7.898$
- d. $39.821 - 18.698$



HOTS

Gaurav covered a distance of 131.425 km by bus, 65.678 km by car and 7.008 km by scooter. How much distance did he cover in all ?





Objective

: Understanding conversion of decimals to fractions and vice-versa.

Materials Required : Cards of 4 cm × 8 cm

Activities :

- ❖ Some decimals and fractions have been given below. Fill up the cards using these decimals and fractions. Students should play in pairs with one complete set of 20 cards.

$$\frac{1}{10}, 0.1, \frac{1}{10}, 0.01, \frac{2}{10}, 0.2, \frac{2}{100}, 0.02, 0.3, 0.30$$

$$0.03, \frac{3}{100}, 0.4, \frac{4}{10}, 0.04, 0.5, 0.50, \frac{5}{100}, 0.05, \frac{4}{100}$$

- ❖ Any one student may shuffle all the 20 cards and then spread them out and place them face down.
- ❖ Now they take turns to turn over any two cards at a time.
- ❖ If the cards match, the students can keep the cards. If the cards do not match, they should be put back in the same place.
- ❖ The game is over when all the cards are collected. The student with most cards wins the game.

It is a match.

