Let's learn.

Average

The following table shows how many minutes Asmita took to cycle to school every morning, from Monday to Saturday.

Day	Mon	Tue	Wed	Thu	Fri	Sat
Minutes	20	20	22	18	18	20

We see from the table that she takes 18 minute on some days, 20 on others and even 22 minutes on one day. If we consider these six school days, what would you say is the approximate time she takes to cycle to school?

In mathematics, to make such an estimate, we find the 'average'. If we add together the number of minutes required on each day and divide the sum by six, the number we get is, approximately, the time required every day. It is the 'average' of all six numbers.

$$\text{Average} = \frac{\text{Sum of the number of minutes taken to cycle to school on each of six days}}{\text{Total days}}$$

$$= \frac{20 + 20 + 22 + 18 + 18 + 20}{6} = \frac{118}{6} = 19\frac{2}{3}$$

On an average, Asmita takes $19\frac{2}{3}$ minutes to cycle to school every day.

Example A school conducted a survey to find out how far their students live from the school. Given below is the distance of the houses of six of the students from the school. Let us find their average distance from the school.

950 m, 800 m, 700 m, 1.5 km, 1 km, 750 m

Solution : To find the average, we must first express all the distances in the same units.

$$\text{Average} = \frac{\text{Sum of the distance between home and school for six students}}{\text{Total number of students}}$$

| 1 km = 1000 m |
| 1.5 km = 1500 m |

$$= \frac{950 + 800 + 700 + 1500 + 1000 + 750}{6} = \frac{5700}{6} = 950 \text{ m}$$

The average distance at which the students live from the school is 950 m.

Example Rutuja practised skipping with a rope all seven days of a week. The number of times she jumped the rope in one minute every day is given below.

60, 62, 61, 60, 59, 63, 58

$$\text{Average} = \frac{\text{Sum of the number of jumps on seven days}}{\text{Total number of days}}$$

$$= \frac{\Box + \Box + \Box + \Box + \Box + \Box + \Box}{7} = \frac{\Box}{\Box}$$

Average number of jumps per minute = 60.42

The samples that we have of the quantity we are measuring are called 'readings' or 'scores'.

We know that the number of jumps will be counted in natural numbers. Never will there be a fractional number of jumps. However, their average can be a fractional number.

Now I know!

$$\text{Average} = \frac{\text{Sum of all scores in the given data}}{\text{Total number of scores}}$$

Activity : ✶ Make groups of 10 children, in your class. Find the average height of the children in each group.

✶ With the help of your class teacher, note the daily attendance for a week and find the average attendance.

Practice Set 54

1. The daily rainfall for each day of a week in a certain city is given in millimetres. Find the average rainfall during the week.
   9, 11, 8, 20, 10, 16, 12

2. During the annual function of a school, a Women's Self-helf Group had set up a snacks stall. Their sales every hour were worth ₹ 960, ₹ 830, ₹ 945, ₹ 800, ₹ 847, ₹ 970 respectively. What was the average of the hourly sales?

3. The annual rainfall in Vidarbha in five years is given below. What is the average rainfall for those 5 years ?
   900 mm, 650 mm, 450 mm, 733 mm, 400 mm

4. A farmer bought some sacks of animal feed. The weights of the sacks are given below in kilograms. What is the average weight of the sacks ?
   49.8, 49.7, 49.5, 49.3, 50, 48.9, 49.2, 48.8

Frequency Distribution Table

Sometimes, in collected data, some scores appear again and again. **The number of times a particular score occurs in a data is called the frequency of that score.** In such cases a frequency table is made with three columns, one each for the score, the tally marks and the frequency.

1. In the first column, scores are entered in ascending order. For example, enter 1, 2, 3, 4, 5, 6 in order one below the other.

2. Read the scores in the data in serial order and enter a tally mark 'I' for each in the second column of the table in front of that score, e.g. if you read the score '3', make a tally mark in front of 3 in the second column. Place four tally marks like this IIII, but make the fifth one like this ⊁⊬⊬. It makes it easier to count the total number of tally marks.

3. Count the total number of tally marks in front of each score and enter the number in the next, i.e. third, column. This number is the frequency of the score.

4. Lastly, add all the frequencies. Their sum is denoted by the letter N. This sum is equal to the total number of scores.

<p align="center">**Making a Frequency Table of the Given Information/ Data**</p>

Example The distance at which some children live from their school is given below in kilometres.
1, 3, 2, 4, 5, 4, 1, 3, 4, 5, 6, 4, 6, 4, 6
Let us see how to make a frequency table of this data.

Scores	Tally marks	Frequency
1	II	2
2	I	1
3	II	2
4	⊁⊬⊬	5
5	II	2
6	III	3
	Total frequency N = 15	

We strike off a score to indicate that it has been counted. The list of scores below shows that the first three scores have already been counted.
(1̶, 3̶, 2̶, 4, 5, 4, 1, 3, 4, 5, 6, 4, 6, 4, 6)

Priya's mother bought some peas and began to shell them. Priya was sitting nearby studying her maths lesson and she observed that some of the peapods had just 4 peas while some had 7. So, she took 50 of the pods and, as she shelled them, she noted down the number of peas in each of the pods.

She also made a frequency table of the peas in the pods.

Number of peas in a pod	Tally marks	Frequency
2	ꙮꙮ |||	8
3	ꙮꙮ ꙮꙮ ꙮꙮ	15
4	ꙮꙮ ꙮꙮ ||	12
5	||	2
6	ꙮꙮ ||	7
7	|||	3
8	|||	3
	Total frequency	N = 50
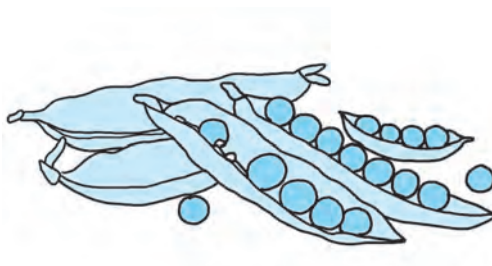
4, 3, 2, 4, 3, 4, 3, 3, 2, 8
2, 3, 3, 4, 3, 4, 4, 5, 2, 8
8, 2, 5, 3, 4, 4, 3, 6, 2, 3
4, 4, 3, 3, 2, 6, 4, 4, 7, 2
3, 6, 3, 6, 6, 6, 7, 6, 7, 3

Mother : Can you find out the average number of peas in a pod?

Priya : I will have to add 50 numbers and then divide their sum by 50. It will be tedious work.

Mother : Let's make it easier. You can tell from the frequency table how many pods had 2 peas, how many had 3 and so on, right?

Priya : Yes! 8 pods had 2 peas each, 15 had 3, 12 had 4.... Oh, now I see. If I multiply and find the products like 2 × 8, 3 ×15, 4 × 12 and then add all the products I will get the sum of all those 50 numbers.

Mother : It is easier to do seven simple multiplications and add them up, isn't it? This is how the frequency table proves useful when we have a huge amount of data.

Priya : The sum of all scores was 206. So, their average = $\frac{206}{50}$ = 4.12.

Mother : Peas in a pod are always found in whole numbers, but the average can be a fraction. In this case, we can say that there were about 4 peas in every pod.

Now I know!

- A simple way to tabulate scores is by using tally marks.
- A table in which the number of tally marks indicates the frequency is called a frequency table.
- When the number of scores is very large, a frequency table is used to find their average.
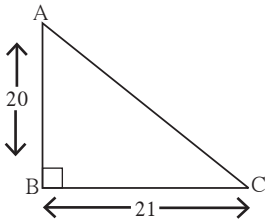

Practice Set 55

1. The height of 30 children in a class is given in centimetres. Draw up a freqency table of this data.
    131, 135, 140, 138, 132, 133, 135, 133, 134, 135, 132, 133, 140, 139, 132, 131, 134, 133, 140, 140, 139, 136, 137, 136, 139, 137, 133, 134, 131, 140

2. In a certain colony, there are 50 families. The number of people in every family is given below. Draw up the frequency table.
    5, 4, 5, 4, 5, 3, 3, 3, 4, 3, 4, 2, 3, 4, 2, 2, 2, 2, 4, 5, 1, 3, 2, 4, 5, 3, 3, 2, 4, 4, 2, 3, 4, 3, 4, 2, 3, 4, 5, 3, 2, 3, 2, 3, 4, 5, 3, 2, 3, 2

3. A dice was cast 40 times and each score noted is given below. Draw up a frequency table for this data.
    3, 2, 5, 6, 4, 2, 3, 1, 6, 6, 2, 3, 5, 3, 5, 3, 4, 2, 4, 5, 4, 2, 6, 3, 3, 2
    4, 3, 3, 4, 1, 4, 3, 3, 2, 2, 5, 3, 3, 4

4. The number of chapatis that 30 children in a hostel need at every meal is given below. Make a frequency table for these scores.
    3, 2, 2, 3, 4, 5, 4, 3, 4, 5, 2, 3, 4, 3, 2, 5, 4, 4, 4, 3, 3, 2, 2, 2, 3, 4, 3, 2, 3, 2

> The 'average' is a useful figure in the study of all branches of science including medicine, geography, economics, social science, etc.

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Miscellaneous Problems : Set 2

1. Angela deposited 15000 rupees in a bank at a rate of 9 p.c.p.a. She got simple interest amounting to 5400 rupees. For how many years had she deposited the amount?

2. Ten men take 4 days to complete the task of tarring a road. How many days would 8 men take?

3. Nasruddin and Mahesh invested ₹ 40,000 and ₹ 60,000 respectively to start a business. They made a profit of 30%. How much profit did each of them make?

4. The diameter of a circle is 5.6 cm. Find its circumference.

5. Expand.
   (i) $(2a - 3b)^2$ (ii) $(10 + y)^2$ (iii) $\left(\dfrac{p}{3} + \dfrac{q}{4}\right)^2$ (iv) $\left(y - \dfrac{3}{y}\right)^2$

6. Use a formula to multiply.
   (i) $(x - 5)(x + 5)$ (ii) $(2a - 13)(2a + 13)$
   (iii) $(4z - 5y)(4z + 5y)$ (iv) $(2t - 5)(2t + 5)$

7. The diameter of the wheel of a cart is 1.05 m. How much distance will the cart cover in 1000 rotations of the wheel?

8. The area of a rectangular garden of length 40 m, is 1000 sqm. Find the breadth of the garden and its perimeter. The garden is to be enclosed by 3 rounds of fencing, leaving an entrance of 4 m. Find the cost of fencing the garden at a rate of 250 rupees per metre.

9.

From the given figure, find the length of hypotenuse AC and the perimeter of $\triangle$ABC.

10. If the edge of a cube is 8 cm long, find its total surface area.

11. Factorise. $365y^4z^3 - 146y^2z^4$

Multiple Choice Questions

Choose the right answers from the options given for each of the following questions.

1. If the average of the numbers 33, 34, 35, x, 37, 38, 39 is 36, what is the value of x ?
   (i) 40   (ii) 32   (iii) 42   (iv) 36

2. The difference of the squares, $(61^2 - 51^2)$ is equal to ....
   (i) 1120   (ii) 1230   (iii) 1240   (iv) 1250

3. If 2600 rupees are divided between Sameer and Smita in the proportion 8 : 5, the share of each is .... and .... respectively.
   (i) ₹ 1500, ₹ 1100   (ii) ₹ 1300, ₹ 900
   (iii) ₹ 800, ₹ 500   (iv) ₹ 1600, ₹ 1000