

11. Measurement



Length



The length I have measured is more than 5 centimetres but less than 6 centimetres. How do I measure this length?

Here, take this ruler. There are smaller markings between two adjacent centimetre markings. You will find them useful.



The length I have measured is 5 centimetres and 3 small parts.



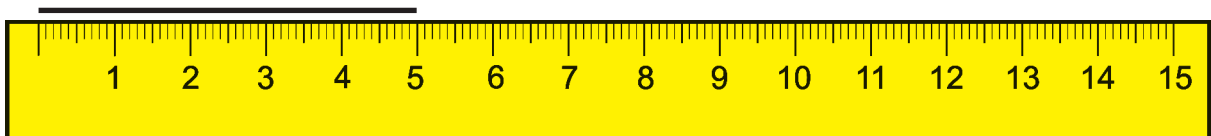
Tai : One centimetre is divided into 10 equal parts. Each part is called a millimetre.

Sudha: It means that the length I have measured is 5 centimetres and 3 millimetres.

1 centimetre = 10 millimetres.

Centimetre is written in short as 'cm'.

Millimetre is written in short as 'mm'.



The length of this line is 5 cm. That is, $5 \times 10 = 50$ mm.

When a ruler is held along a line with its first marking at one end of the line, then the number at the other end of the line shows the length of the line.

How many mm is 7 cm?

$7 \times 10 = 70$. So, 7cm = 70 mm.

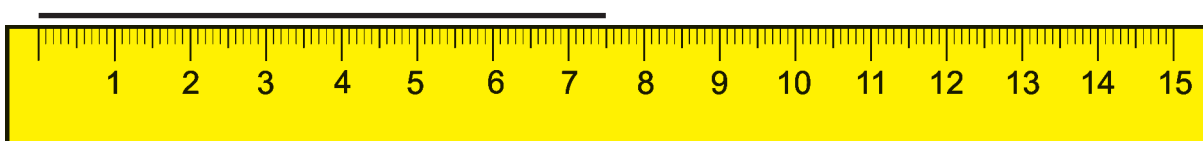
Exercise

Measure the length of the lines shown below and convert into millimetres.

(1) _____ cm $\times 10 =$ mm

(2) _____ cm $\times$ = mm

Measuring the length of a line in centimetres and millimetres



The length of the line shown above is 7 centimetres and 5 millimetres.

◆ **Measure the length of each line below and write how many centimetres and millimetres.**

(1) _____
 cm mm

(2) _____
 cm mm

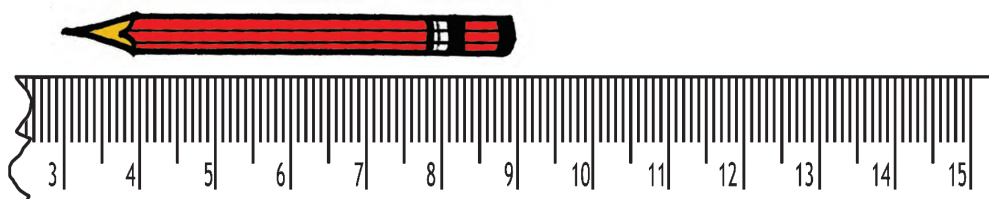
◆ **Measure and write.**

Length of a book	Thickness of an eraser	Length of a pencil	Length of the edge of a notebook	Length of a table

Vivek : I have an old ruler which shows centimetres and millimetres. But, the first end is broken. Will I be able to use it to measure centimetres?

Tai : Oh, yes! Your ruler has a 3 centimetre mark and every centimetre mark after that. So you can start at 3 and measure the length from there. Can you do that?

Vivek : Yes. The length of this pencil is from 3 centimetres to 9 centimetres.



Meera : If it is from 3 cm to 9 cm, you must subtract 3 from 9. The pencil is 6 centimetres long.

◆ **Try this.**

- ❖ Guess the length of the pencil you have. Measure it with a ruler and see if your guess was right.
- ❖ Draw two dots on a piece of paper and measure the distance between them.

Guessing the distance between two places

Tai : We measured the length of the table with a ruler and the distance between two gateposts with a measuring tape. Now let us see how to measure a longer distance.

Dilip : Shall we measure the distance between the school gate and our classroom?

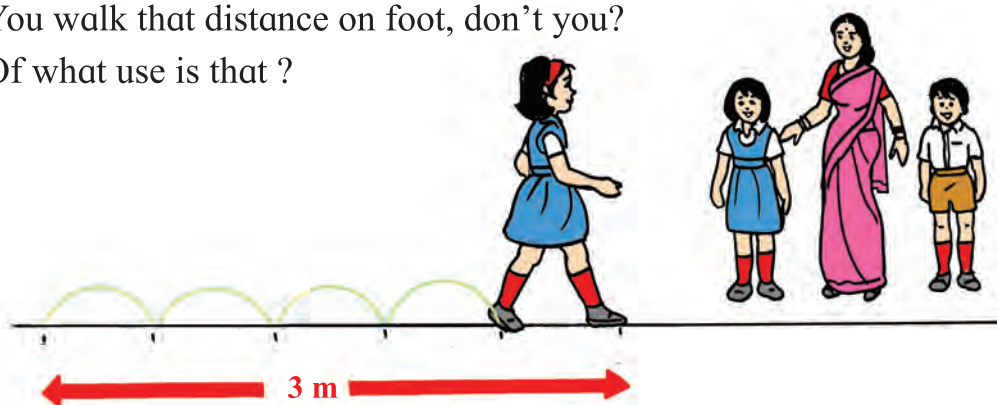
Meera : It will be a little difficult to measure with the tape.

Tai : We can measure the length of the path that you walk from the gate to the classroom.

Dilip : Where will we find such a long tape?

Tai : You walk that distance on foot, don't you?

Dilip : Of what use is that ?



Tai : Come, Meera. Walk 5 steps along this line. Now, Dilip, you measure the distance with the tape.

Dilip : The distance is 3 metres.

Tai : Meera, now walk from the school gate to the classroom. Tell us how many steps you take.

Meera : I took 95 steps till the classroom.

Tai : When we divide 95 by 5, the answer is 19. This means that 95 steps have 19 stages of 5 steps each. One stage of 5 steps is equal to 3 metres. Therefore, 19 stages make $19 \times 3 = 57$ metres.

Vivek : That means the distance from the gate to the classroom is about 57 metres.

Tai : You can use this method to measure the distance between your house and other places that you walk to, such as a friend's house, a shop or a garden nearby.

Introducing 'kilometre'



Varsha : I saw a signboard a while ago. It said, 'Tunnel 500 metres ahead'. I understood that. Now, this stone says 'Satara 25 km'. What does it mean?

Mother : The '25 km' on the stone means that Satara is at a distance of 25 kilometres from the point marked by the stone.

Varsha : But, what does kilometre mean?

Mother : 'Kilo' means thousand. 1 kilometre is equal to 1000 metres.

Varsha : It means that Satara is at a distance of 25000 metres, is that right?

Mother : Yes. 25 kilometres is equal to 25 thousand metres. Kilometre is written in short as 'km'. It is inconvenient to measure long distances in metres. So, they are measured in stages of one thousand metres, that is, in kilometres.

Did you notice, if the units for measuring distance are bigger, the number showing the measurement becomes shorter?

Varsha : Yes, Mother!

1 kilometre = 1000 metres

2 kilometres = 2000 metres

6 kilometres = 6000 metres

10 kilometres = 10000 metres

13 kilometres = 13000 metres

Exercise

The timetable below lists the places between Wardha and Nagpur and their distances in kilometres. Study it and answer the following questions.

Wardha	Varud	Selu Road	Tuljapur	Sindhi	Gumgaon	Ajani	Nagpur
0	7	14	24	32	60	76	79

- ❖ From which place have the distances of all the other places been measured?
- ❖ How far is Tuljapur from Wardha?
- ❖ What is the distance between Sindhi and Nagpur?
- ❖ What is the distance between Selu Road and Ajani?

Half, quarter and three-quarters of a kilometre and a metre

$$\begin{array}{r}
 + \quad 50 \text{ cm} \\
 + \quad 50 \text{ cm} \\
 \hline
 100 \text{ cm}
 \end{array}$$

50 cm taken twice is 100 cm, that is 1 metre.

Half of 1 metre is 50 centimetres.

Half of a metre is 50 centimetres.

$$\begin{array}{r}
 + \quad 25 \text{ cm} \\
 + \quad 25 \text{ cm} \\
 \hline
 50 \text{ cm}
 \end{array}$$

25 cm taken twice is 50 cm. Half of 50 cm is 25 cm.

Half of half is one quarter metre.

One quarter of 1 metre is 25 cm.

$$\begin{array}{r}
 + \quad 50 \text{ cm} \\
 + \quad 25 \text{ cm} \\
 \hline
 75 \text{ cm}
 \end{array}$$

half a metre.
one quarter of a metre.
three quarters of a metre.

One half and one quarter makes three quarters.

Three quarters of a metre is 75 cm.

$$1000 \text{ m} = 1 \text{ km}$$

$$500 \text{ m} + 500 \text{ m} = 1000 \text{ m}$$

$$\text{Half of } 1000 \text{ is } 500$$

Therefore, 500m = half a km

$$250 \text{ m} = \text{a quarter km}$$

$$750 \text{ m} = \text{three quarters of a km}$$

Exercise

Match the following.

- Half a metre 25 cm
- Three quarter kilometres 500 m
- Quarter metre 75 cm
- Quarter kilometre 50 cm
- Half a kilometre 250 m
- Three quarter metres 750 m

Match the following.

- 3 metres 40 millimetres
- 3 kilometres 200 centimetres
- 2 metres 300 centimetres
- 4 centimetres 20 millimetres
- 4 kilometres 3000 metres
- 2 centimetres 4000 metres

Activity : Each one jumps as far as they can. Then measure and write down the length of each one's jump.

Conversion of units

❖ Convert 5 km into metres.

$$1 \text{ km} = 1000 \text{ m}$$

$$\begin{aligned} \text{Therefore, } 5 \text{ km} &= 1000 \times 5 \text{ metres} \\ &= 5000 \text{ metres} \end{aligned}$$

$$\text{Similarly, } 5 \text{ km } 40 \text{ m} = 5040 \text{ m.}$$

❖ Convert 2 metres into centimetres.

$$1 \text{ metre} = 100 \text{ cm}$$

$$\begin{aligned} 2 \text{ metres} &= 100 \times 2 \text{ cm} \\ &= 200 \text{ cm} \end{aligned}$$

$$\text{Similarly, } 2 \text{ metres } 12 \text{ cm} = 212 \text{ cm.}$$

❖ Convert 6 centimetres into millimetres

$$1 \text{ centimetre} = 10 \text{ millimetres}$$

$$\begin{aligned} 6 \text{ centimetres} &= 10 \times 6 \text{ millimetres} \\ &= 60 \text{ millimetres} \end{aligned}$$

$$\text{Similarly, } 6 \text{ cm } 5 \text{ mm} = 65 \text{ mm}$$

❖ Convert one and a half metres into centimetres.

$$1 \frac{1}{2} \text{ metre} = 1 \text{ m} + \frac{1}{2} \text{ m}$$

$$= 100 \text{ cm} + 50 \text{ cm}$$

$$= 150 \text{ cm}$$

❖ 712 centimetres consist of 700 centimetres and 12 centimetres.

712 centimetres are equal to 7 metres and 12 centimetres.

❖ 5465 metres consist of 5000 metres and 465 metres.

Hence, 5465 metres are equal to 5 kilometres and 465 metres.

Exercise

1. Convert.

(1) 7 metres into centimetres.

(2) 8 kilometres into metres.

(3) 9 centimetres into millimetres.

(4) $5 \frac{1}{2}$ metres into centimetres.

(5) 11 kilometres into metres.

(6) 4 centimetres into millimetres.

(7) 8 metres into centimetres.

(8) 7 kilometres into metres.

2. Match the following.

- 2 km 50 mm
- 5 cm 800 cm
- 8 m 2000 m
- 11 cm 900 cm
- 9 m 12000 m
- 12 km 110 mm

3. Fill in the blanks.

- 530 centimetres = m centimetres
- 1240 metres = km metres
- 845 centimetres = m centimetres
- 1250 centimetres = m centimetres
- 2275 metres = km metres
- 4090 metres = km metres

Mass (Weight)

Rahul, take this list of groceries to the grocer's shop.



Rice - 4 kg
Sugar - 2 kg
Toordal - 1 kg
Pohe - $\frac{1}{2}$ kg
Tea - $\frac{1}{4}$ kg
Masala - 50 gm
Cardamom - 20 gm

Rahul : The short form for 'kilogram' is kg, right? Also, how much is twenty grams?

Mother: Yes, 'kg' is short for 'kilogram'. Gram is a unit for measuring weights much smaller than a kilogram. We buy items such as sugar, pulses and rice in kilograms. However, since cardamom, cloves, masalas and other such items are bought in small quantities, they are measured in grams.

Rahul : How many grams of *pohe* will the shopkeeper give us when we ask for half a kilogram?

Mother: 1 kilogram is 1000 grams. Now tell me, how many grams will half a kilogram be?

Rahul : 500 grams.

Mother: How is that?

Rahul : $500 + 500 = 1000$. So, half of 1000 is 500.

Therefore, half a kilogram = 500 grams.

But, Mom, how will the shopkeeper give 500 grams of *pohe*?

Mother: The shopkeeper has different weights.



Rahul : That means the shopkeeper will use the 500 grams weight to give the *pohe* and the 200 gram and 50 gram weights to give the tea.

Mother: Correct! How did you work this out?

Rahul : $250 + 250 = 500$. Half of 500 is 250. 500 grams is equal to half a kilogram. Half of half is one quarter. This means a quarter kilogram is equal to 250 grams.

Mother: Excellent!

Rahul : But how will he give 20 grams of cardamom?

Mother: The shopkeeper has weights of 10 grams and 20 grams, too. He also keeps 10 gram and 20 gram packets of cardamom ready. Since you are going to the shop, have a look at those weights.

Conversion of units

❖ **How many grams is 4 kilograms?**

1 kilogram = 1000 grams

4 kilograms = 1000×4
= 4000 grams

Therefore, 4 kilograms
= 4000 grams

4 kg 500 grams = 4500 grams

4 kg 250 grams = 4250 grams

❖ **How many grams is one and three quarter kilograms?**

One and three quarter kilograms means 1 kilogram and half a kilogram and a quarter kilogram.

$1000 \text{ grams} + 500 \text{ grams} + 250 \text{ grams}$
= 1750 grams.

Therefore, one and three quarter kilograms are 1750 grams.

Exercise

1. Answer the following questions.

- (1) How many grams is 3 kilograms ?
- (2) How many grams is one and a half kilograms ?
- (3) How many grams is one and a quarter kilograms?
- (4) How many grams is three and three quarter kilograms?
- (5) Which weights will the shopkeeper use to measure three and a half kilograms of wheat?

2. Fill in the blanks.

- (1) weights of 100 grams is 1000 grams.
- (2) weights of 200 grams is 1000 grams.
- (3) weights of 500 grams is 1000 grams.

◆ **Study the various packets of groceries bought from the market. Weigh each packet and compare its weight with the weight stated on the packet.**

Name of the object	Weight that you measured	Weight stated on the packet	Possible reason for difference, if any

◆ **Weigh the fruits and vegetables and write the weight in kilograms and grams.**

Vegetable	One bag of brinjals	One small basket of onions	A pumpkin	15 bitter gourds
Weight				

◆ **Try this out.**

- ❖ Take 3 identical 1-litre plastic bottles. Measure the weight of one while it is empty. Fill the bottles with different liquids : (1) drinking water (2) nimbu pani with sugar (3) very salty water.

Now, weigh each of the filled bottles.

Can you now tell the weight of one litre of each liquid ?

Which one is the heaviest ? Which one is the lightest ?

◆ **Find out.**

- ❖ The story of 'How they weighed the elephant'.
- ❖ Weights less than 50 grams used by the shopkeeper.

Volume and Capacity



Amit : Mom, have you divided 1 litre of milk equally among all the cups?

Mother : Yes!

Amit : How do I measure the milk in each cup?

Mother : A liquid less than 1 litre is measured in millilitres.



This is a bag of milk. It has '1 litre' written on it.

1 litre is 1000 millilitres

Amit : If 1000 millilitres of milk is divided equally between 10 cups, each cup will have 100 millilitres, is that right?

Mother : Right, millilitre is a very small unit used to measure the volume of liquids.

Amit : How small is that?

Mother : Look at this bottle of medicine. It comes with a measure. The measure has marks for 5 ml and 10 ml. 1 teaspoonful of a liquid is approximately 5 ml.

Amit : Mom, when I go to the dairy, I see several small measures kept there to pour milk. Are they used in the same way?

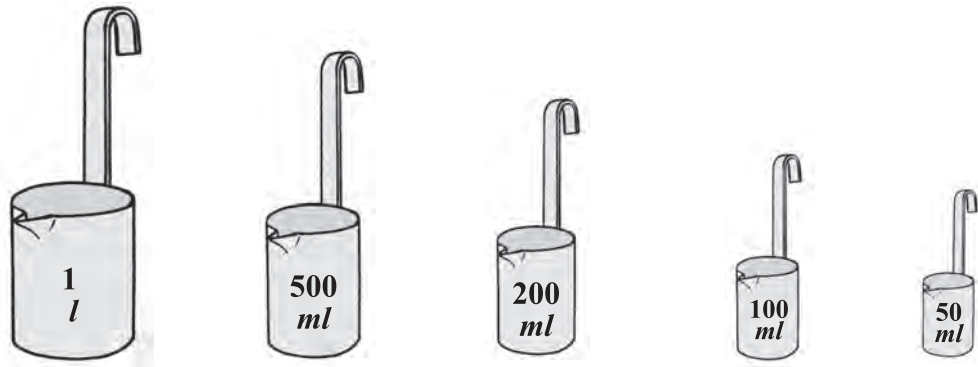
Mother : Yes! Two full 500-millilitre measures of milk add up to 1 litre of milk. This means that 500 millilitres is half of 1 litre. Therefore,
half a litre = 500 millilitres.



Amit : One quarter is half of half, so a quarter litre is 250 millilitres. A half and a quarter make three quarters.

Therefore, three quarters of a litre = $500\text{ ml} + 250\text{ ml} = 750$ millilitres

Mother : Litre is written as 'l' and milliliter is written as 'ml'.



Exercise

1. Fill in the blanks.

1 litre = 1000 millilitres

2 litres = $2 \times 1000 = 2000$ millilitres

4 litres = millilitres

15 litres = millilitres

2. How many millilitres are there in three and three quarter litres?

3. How many millilitres are there in one and a half litre?

4. How many millilitres are there in one and a quarter litre?

5. Which measures will be used to pour three and a half litres of milk and how many times will they be used?

6. Write how many times the following measures will have to be used to fill a 1-litre measure.

Measure	200 ml	50 ml	100 ml	500 ml
How many times	5			

◆ **Try this out.**

- ❖ Measure how many millilitres there are in one cupful of water. Based on that, guess how many cups will make 1 litre of water.
- ❖ Take a measure that comes with a medicine bottle. Fill it drop by drop with a dropper and count how many drops make 5 *ml* of water.
- ❖ Use a 1-litre and a 100-*ml* measure, to fill different vessels with water and find out how many litres and millilitres of water the vessels can hold.

Measurement : Word problems

- Tai** : If a bus that leaves Sangamner at 45 minutes past 6 in the morning reaches Malegaon at 10 past 10 the same morning, how much time did the journey take?
- Sanjay** : From 45 minutes past 6 to 7 o'clock there are 15 minutes. The time between 7 am and 10 am is three hours. From 10 o'clock to 10 past 10, there are ten minutes. That means the total time taken for the journey is 15 minutes + 3 hours + 10 minutes or 3 hours and 25 minutes.
- Tai** : Roshni had half a litre of milk delivered every day during the month of June. If one litre of milk costs ₹40, how much was the total milk bill ?
- Swati** : June has 30 days. Half a litre every day means 30 times half a litre. Half of 30 is 15, so she took 15 litres of milk. Therefore, the total milk bill was $₹40 \times 15 = ₹600$.

Exercise

Solve the following problems.

- (1) One round of the walking track in the park is 250 metres long. Ajit's grandfather walks that path 4 times every morning. How many kilometres does he walk every day?
- (2) Sulabha bought four and a half metres of cloth. She divided it into five equal lengths and gave them to five friends. How much cloth did each friend get?
- (3) If 1 litre of petrol costs ₹70, how much do two and a half litres of petrol cost?
- (4) Jenny bought a quarter kilogram of *barfi*, half a kilogram of *chivda*, a quarter kilogram of *shev* and three quarter kilograms of *jalebi* from a shop. What was the total weight of her purchases?
- (5) Wasim's school started at a quarter past twelve in the afternoon and finished at half past five in the evening. If the break was for half an hour, how much time did the children spend in the classroom?
- (6) Sharad went to his friend's place on a motorcycle. When he started, the reading was 19,235 kilometres. When he reached his friend's place, it was 19,301 kilometres. How many kilometres did Sharad travel?