LU 8.13 Can you map?

Overview

Humans have been using maps since ancient times. Nowadays, with advanced technology we use Google Maps for navigation which makes our day-to-day life even simpler. In this Learning Unit, students will learn the basics of map making. Using a given description, they will try to make a map and compare it with their classmates' maps. Class 8 students are familiar with the concept of ratio and proportion. Here, students will measure the area of the school campus using different measurement methods and make a map of the school by proportionately scaling down the distances. Students will also learn approximate but quicker methods of measuring distances like pacing.

This Learning Unit is a local-context learning unit which makes students use the concepts learned in their books to understand their local environments better. Such exploration of local contexts further helps students to discover textbook concepts in new ways. Although this unit is related to geography, it develops some basic skills which are highly useful in science, mathematics and engineering.

Minimum time required: Four sessions of 40 minutes each

Type of Learning Unit: Classroom and field

Unit-specific objectives

- To develop the ability to convert verbal instructions to pictorial representation
- To develop the ability to visualise directions and manipulate them mentally
- To learn to make a scaled down image on graph paper
- To learn about distance estimation and use of different units
- To learn to read and understand maps

Links to curriculum

1. NCERT Class 6 Geography Textbook, Chapter 4: Maps
2. NCERT Class 6 Mathematics Textbook, Chapter 12: Ratio and Proportion
3. NCERT Class 8 Mathematics Textbook, Chapter 4: Practical Geometry (some aspects may be used if non-rectangular spaces are drawn)
4. NCERT Class 8 Mathematics Textbook, Chapter 11: Mensuration (students may relate to some examples given in chapter)
5. NCERT Class 8 Mathematics Textbook, Chapter 13: Direct and Inverse Proportions
6. NCERT Class 8 Mathematics Textbook, Chapter 15: Introduction to graphs (aspects of scaling when using graph paper is useful here)

We have come across maps in our textbooks – maps of states, the country, and the world. We can also learn to make maps, as you have learned in geography (Class 6, Chapter 4). Many mobile phones have an application (app) called "Google Maps". This app shows the map of a locality and can show a larger area as you zoom out, and can even show the map of the whole world.

Have you ever made a map of any place on your own?

> If the teacher has a smart phone, he/she may show the Google Maps app to those students who have not seen it earlier.

Are you familiar with these ideas?

- Ratio and proportion
- Cartesian coordinate system

Materials

Graph paper, plain paper, rulers of different size (6 inch or 1 foot), measuring tape (5 m – 10 m, commonly used for measuring racing track), mobile phone (optional).

Task 1: From words to drawings

Joseph wanted to invite his friends to his home for a birthday party. He gave the following instructions to reach his home to his friends:

Our school gate faces east. As you come out of the gate on to Gandhi Road, turn left. At the second road crossing, there is a grocery shop on the left. Turn right here on to Ambedkar Road. You will see a Ganesh temple on your right after about five minutes of walking. At the temple, turn towards south on to Kalam Road. After crossing the bridge on the river, turn left on to Vivekananda Lane. My house is on the right just after a playground.

Q1. Can you draw a map as per these instructions? Assume all the roads to be straight and to intersect at right angles.

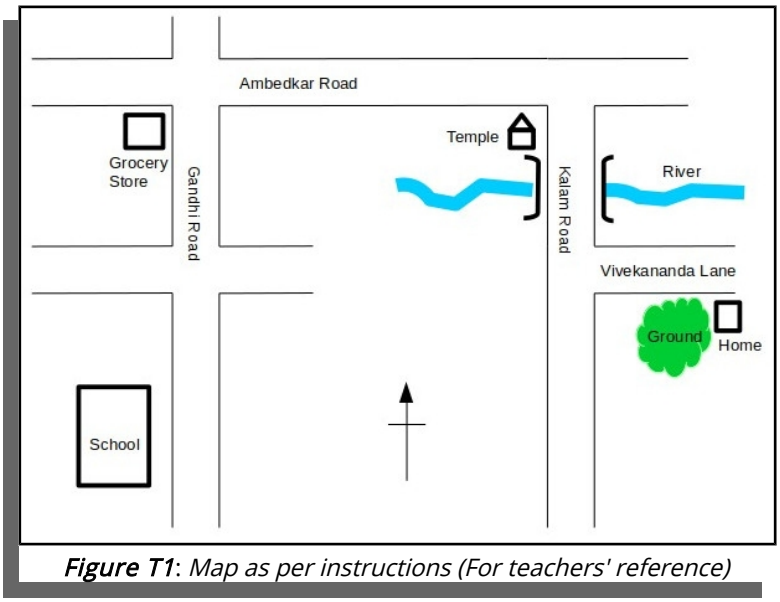


Figure T1: *Map as per instructions (For teachers' reference)*

Note: Before you starting making the map, you may want to draw the four cardinal directions (North, East, West, South) for reference on one part of the page.

Q2. Make a group with 4-5 friends. Compare the maps you have drawn. Discuss with each other and draw a common map on which everyone agrees.

Q3. Which of the following statements are true?

a) The school and grocery shop are on the same side of Ambedkar Road.

True / False / Can't be said

b) The school and grocery shop are on the same side of Gandhi Road.

True / False / Can't be said

c) The school and temple are on the same side of Gandhi Road.

True / False / Can't be said

d) The temple and grocery shop are on the same side of Ambedkar Road.

True / False / Can't be said

e) The school and Joseph's home are on the same side of the river.

True / False / Can't be said

f) The temple is to the west of the grocery store. True / False / Can't be said

g) The playground is to the west of Joseph's home. True / False / Can't be said

Answers

a) True, b) True, c) False, d) True, e) Can't be said, f) False, g) True.

Task 2: Walking to measure

Now we will use map drawing skills to draw a map of the school premises. In the first task, we did not use any measurements of length or distance. In this task, we will draw a 'scaled map' of the school boundary. That means the lengths on your map and the actual lengths/distances in the school are in proportion.

> It may be useful to help students understand the difference between distance and length, two of the terms used frequently here. The main difference between **distance and length** is that the **distance** is a numerical measurement of how far apart two points or objects are and **length** is a measured dimension of an object. **Distance** can also be associated with a line that connects two points in a measurable space or in an observable physical space.

Let us do this step by step.

Q1. What should be our ratio of length on the map to actual measurement, also known as the scale or scaling ratio? For example, if you represent a distance of 60 m in your school by a line segment of length 12 cm on the map, then the scaling ratio will be 12 cm: 6000 cm or 1:500.

> Find the school compound dimension from the school records or using Google Maps. Discuss the scaling question with students. Students should realise that they must be able to fit the school boundary within a graph paper (typically 18 cm × 24 cm). E.g., If the school plot size is 100 m × 200 m, then students may draw a 10 cm × 20 cm rectangle on the graph paper. Thus, the scaling ratio becomes 1:1000. For different sized plots, students may choose scales like 1:500 or 1:800. In principle, one can choose any scale. So, choosing some scale like 1:700 is not wrong, but it makes calculations more tricky and there are more chances of mistakes happening. Thus, students may also make more mistakes while filling the table below.
>
> It is possible that the school boundary is not rectangular. In that case, ask the students to work with a rectangular area which will encompass the entire boundary of the school. In the next task, students may plot an actual boundary.

Q2. Based on the scaling ratio you have chosen, complete the following table:

Actual length (in school)	Length on the graph paper
1 metre	
7 metres	
65 metres	

	1 millimetre

Q3. What is the length of the biggest ruler in your school? _____

Q4. What is the length of the measuring tape which your sports teacher has?_____

Q5. Use these measuring devices to measure the length and breadth of your classroom.

> Students may repeat this experiment 2-3 times to avoid errors due to carelessness.

Q6. What will be the size of your classroom on the graph paper? _____

Q7. Can you use the same devices to measure the distance from your classroom door to the school gate? Is it easy or tedious? Explain.

_____

_____

Q8. People have been measuring lengths using many different units. Some of these units are standard units and are accepted in formal documents. Some were standard units in earlier times, but are used less frequently these days. The standard units can denote precise measurements. There are also non-standard or informal units which people use to denote length approximately. These are not meant to be precise, but may be sufficient for many practical purposes. List the different length units you know under these three categories.

Current Standard Units	Old Standard Units	Informal Units
Metre, kilometre, millimetre, micron, nanometre, light year, astronomical unit, parsec, nautical mile	Mile, foot, inch, *kos* (कोस), furlong, yard/*waar* (वार)	*Haath* (हात), steps / paces, 't' minutes of walking

> At this point, teacher may also bring into the discussion about multiple units that belong to the same unit system. For example, metre and kilometre belong to the same unit system, whereas inch belongs to another unit system. Students can the group the units into different unit systems.

Let us use an informal unit to make our task easy. We will approximate the distance between any two points as number of steps needed by one of you to go from one point to another.

Q9. Take the measuring tape from your sports teacher and lay it on the ground / in a corridor. Walk normally from one end of the tape to another. Count how many steps you need to cover the distance. Ask a few of your friends to repeat the experiment.

Length of the measuring tape = _____

Repetition No.	Number of steps	Repetition No.	Number of steps
1		4	
2		5	
3		6	

If there is a wide variation, let students find out 4-5 participants who take roughly similar number of steps.

Average length of each step =_____

> In all these questions, students are expected to write answers including the units. If the students report just numbers without any accompanying units, hold a discussion on why the units are important.

Task 3: Making map by pacing

Now we will use this approximate unit and a graph paper to make an actual map. Start measuring different lengths within the school premises and plot them on the graph paper. Make teams of 4-5 students, and divide work among yourselves, such that each team gets reliable measurements of your school spaces. Following questions will give you some ideas about what all lengths you have to measure. The list is not complete. Think along these lines and draw a scaled map of the school premises.

How many steps do you have to walk in a straight line

a) from one corner of the compound to the school gate? _____

b) from the school gate to the school building? _____

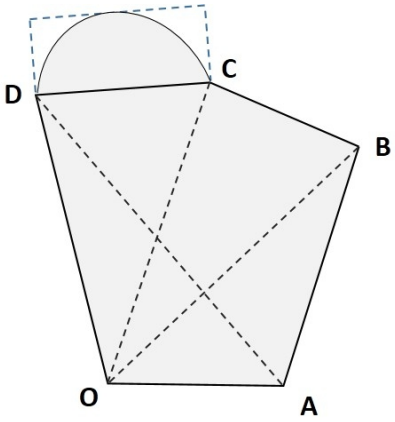
c) to cover the length of the school building? _____

d) to cover the breadth of school building? _____

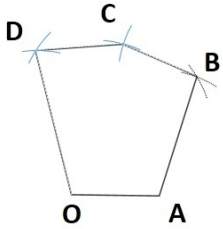
e) from one end of the school building to your classroom? _____

f) from the school building to the playground? _____

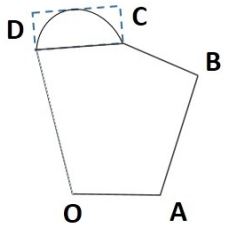
> Here, students need to think about the consistency of step size across different measurements. (Step is also known as pace, measured from heel to heel or toe to toe). If different students in a team are measuring different lengths, then it would be better if students of same "average step length" do the measurements in a team. If this is not possible, then appropriate multiplication of student's average step length to the number of steps they take should be done for each student separately, to obtain the distances.
>
> Students should be walking in two orthogonal directions (say X and Y axes). If they are not, then their drawing will have errors. Alternatively, students can uniquely determine relative positions of different points by measuring their distance from two separate known points, as is shown in figure T2. In that case, they can use a compass from their geometry boxes to mark the position on the graph paper. The teacher may optionally initiate a discussion in this regard.
>
> If any of the distance measurements involve a curve, then one can try to walk on a rectangular path surrounding that curve and use this rectangular path in the map to approximately draw the curve (also indicated in figure T2).



Non-rectangular lawn



Points **B**, **C** and **D** can be located using their distances from points **O** and **A** (or even from **B** once it is drawn).



Curved path from **C** to **D** can be drawn with the help of rectangular path around it.

Figure T2 *Two possible strategies for mapping non-rectangular spaces. Dashed lines indicate additional paths in and around the lawn that students may need to walk to do the construction on map.*

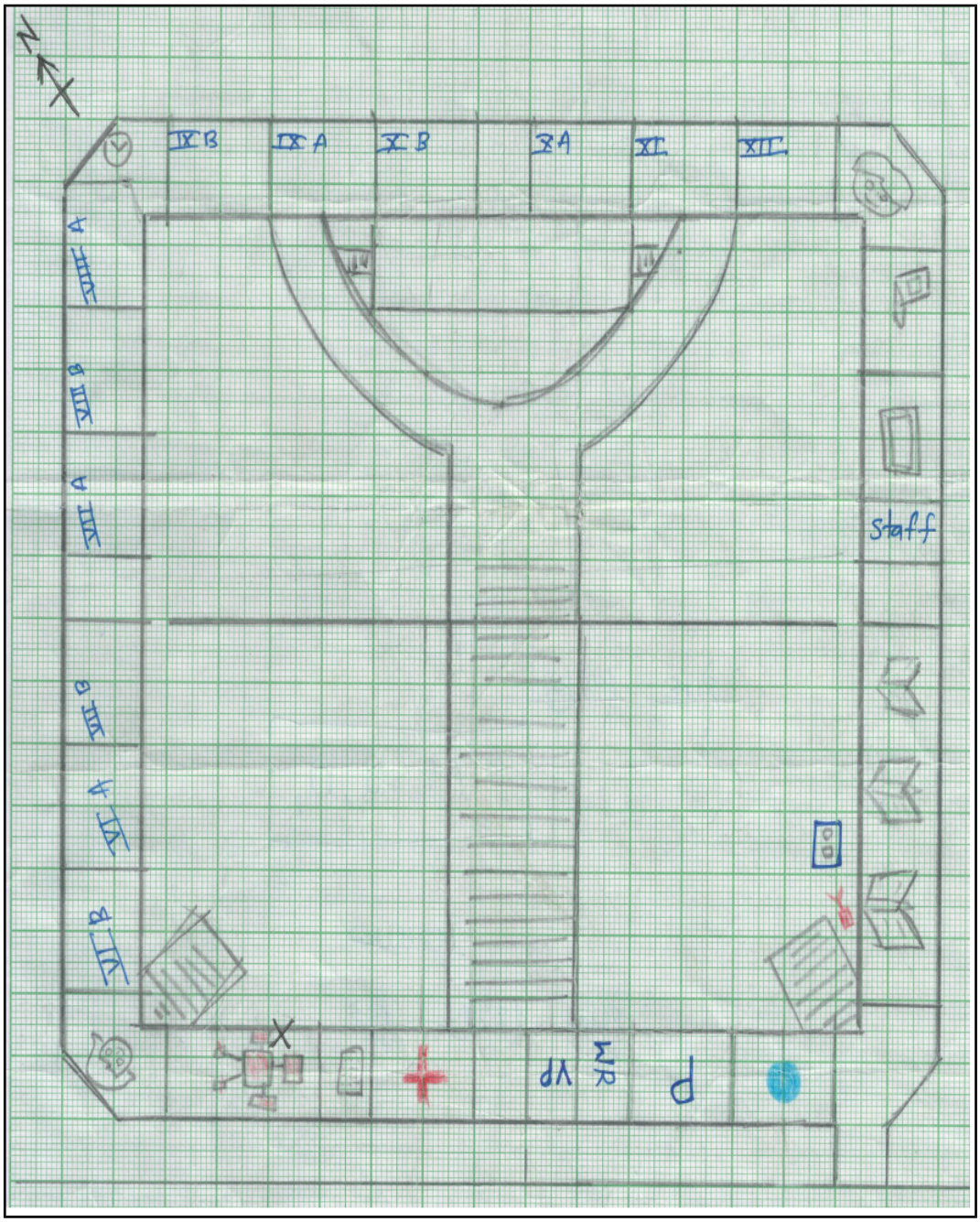


Figure T3 *A map of the academic block made by a group of students in one of the Jawahar Navodaya Vidyalayas. Note the marking of cardinal directions and creative use of various symbols to indicate various rooms. Noting of scaling ratio on the map itself could have been much helpful for readers (students might have written it in their writing sheets).*

If you have completed the Learning Unit on Shadows, you already know the cardinal directions (East, South, West, North) for your school campus. Mark them on your map. If you have not done that unit, you may use a magnetic compass to find approximate cardinal directions.

Task 4: Treasure Hunt (A possible extension)

Possible extension: This task will cover one full session, maybe even longer. So this may be considered only as an extension.

It is possible that students may have made mistakes in making the map (in task 3), such as incorrect counting of steps or incorrect multiplication of number of steps by step length. Such

mistakes would be easily discovered by these students if their friends are not able to follow the maps and reach the hidden treasure.

Let us play a game of finding a hidden treasure. Hide an object somewhere in the school premises and mark its position on the map you have drawn. Do not hide the object next to a major landmark (such as being the main gate, or exact corner of a building or wall), which makes searching it easier (and can be done without using map).

Now give this map to your friend who hasn't seen where the object is hidden, but only has the position marked on the map the location of the hidden object. Ask her/him to find the object by following the lengths and distances marked in the map. Your friends can also use their step lengths to follow the distances after reading from your map.

Q1. After you have played this game, try to understand what difficulties you and your friends faced in reading the map or in following directions. Can you identify if these difficulties could be related to any mistakes occurred in the previous task?

_____

_____

_____

Suggested Readings

1. Here you will find detailed information about measuring horizontal distances:
http://www.fao.org/fishery/static/FAO_Training/FAO_Training/General/x6707e/x6707e02.htm
2. Pacing used by hikers to measure distances:
https://sectionhiker.com/pacing-and-estimating-distance-by-blake-miller/
3. An US Army Study guide website which discuss how local geographic conditions may affects the pace counts, which must be corrected for:
www.armystudyguide.com/content/army_board_study_guide_topics/land_navigation_map_reading/how-to-use-pace-count-to-.shtml

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