Grade 10

MATHEMATICS

Competency –Uses scale diagrams in practical situations by exploring various methods.

Competency level– Investigates various locations in the environment using scale diagrams.

## Scale Diagrams

Introduction

In this lesson, you will learn how to find the position of a point on a vertical plane
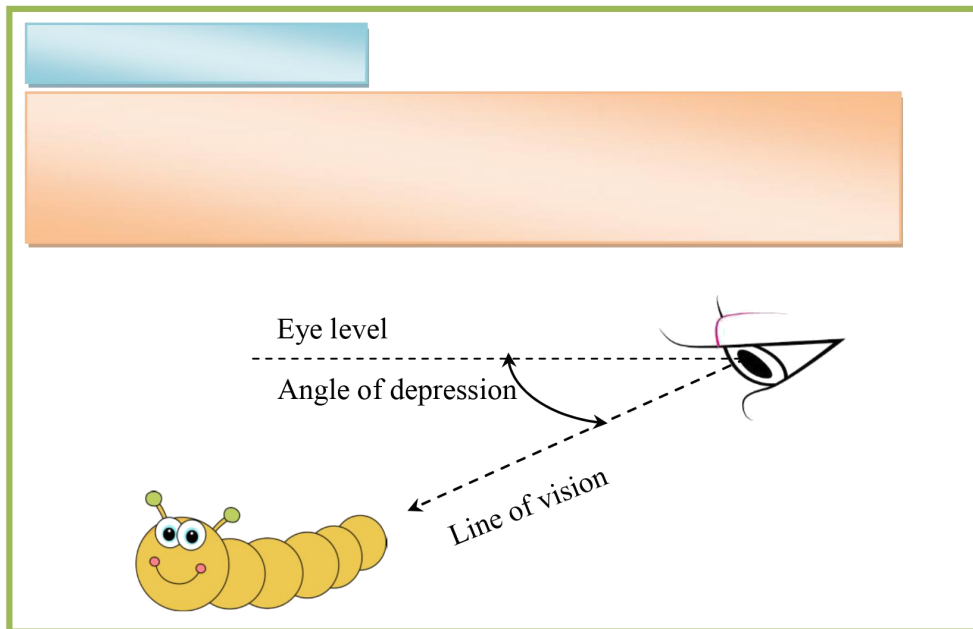

Two important terms of this lesson are angle of depression and angle of elevation
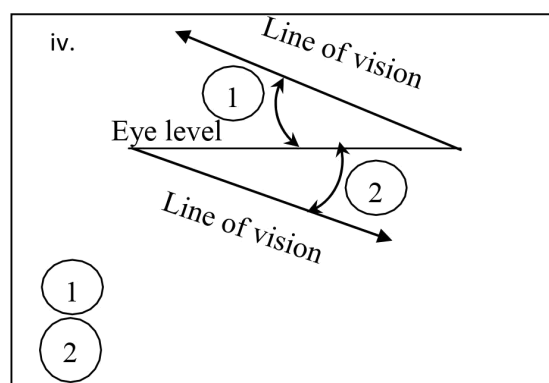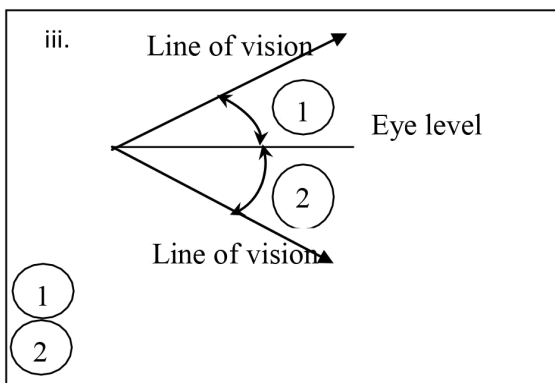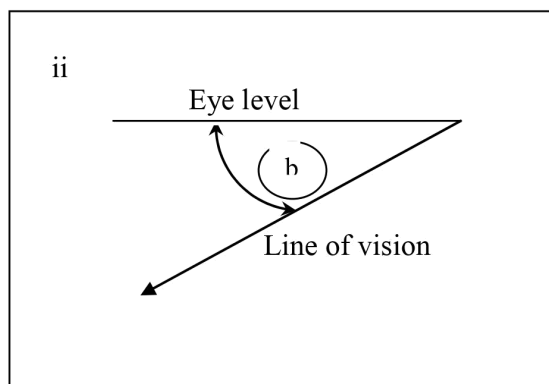
Angle of elevation

An angle of elevation is defined as the angle formed between the line of vision and the eye level (horizontal level) of an observer when the observer is looking at an object above the eye level.

Eye level

Angle of depression

Line of vision
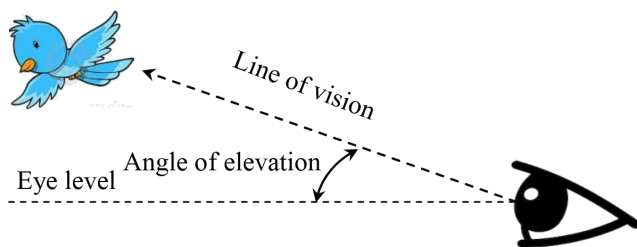
Exercise 1

1. Write down whether the angle marked with a letter or a number in each picture is an angle of elevation or an angle of depression.

i

Line of vision

a

Eye level

ii

Eye level

b

Line of vision

iii.

Line of vision

1

Eye level

2

Line of vision

1

2

iv.

Line of vision

1

Eye level

2

Line of vision

1

2
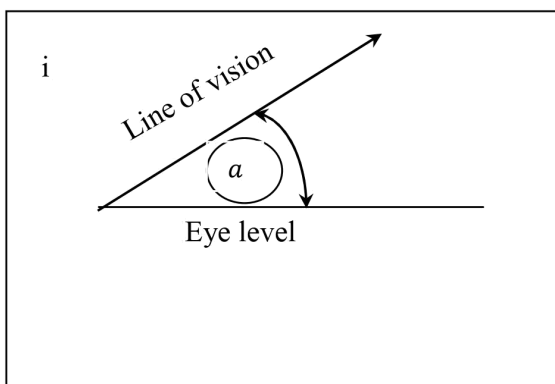
2. Write the angle described by each instance given below
   i. Krishan is sitting on the bench at school ground and can see the flag on the flag post of the same horizontal ground which is far away from the bench
   State the type of angle in between eye level and line of vision

   ii. Vihangi who is on the third floor of the building, can see the class teacher standing under the temple tree. State the type of angle in between eye level and line of vision

When stating the position of an object in a vertical plane, we need to state the magnitude of the angle of elevation or depression. We may use a clinometer for the purpose of measuring these angles.
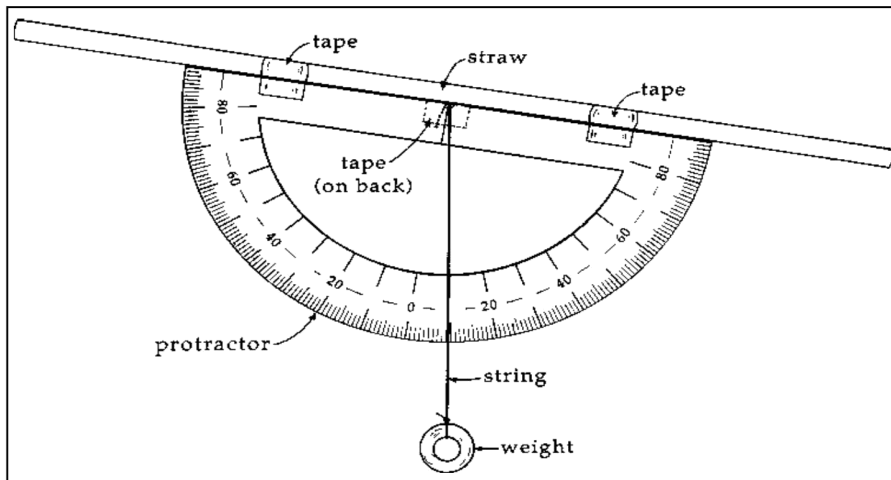
To make a simple clinometer,

Follow the instructions under the clinometer given in the page 191 of text book to make a own clinometer.

From a suitable position find the angle of elevation of each of the points given below using the clinometer you made.

   (i) The top of a building.
   (ii) The top of a tree in your school.

Scale diagrams in a vertical plane

Scale diagrams are used to represent information in a vertical plane.

If the scale is not mentioned then we have to choose a suitable scale for drawing.

let's prepare scale

When start drawing a scale diagram first attention should be on selecting appropriate size to diagram.

Excersise 2

1. The height of the coconut tree is 6m from the ground. Select a suitable scale to draw the scaler diagram of the coconut tree,
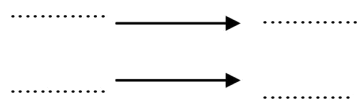
      A length of 1cm in the scale diagram represents 100cm of actual length

      1cm $\longrightarrow$ 1m

      1cm $\longrightarrow$ 100cm

    Therefore, the scale is 1:100

2. The height of the lightning post is 100m from the ground. Select a suitable scale to draw the scaler diagram of the lightning post,

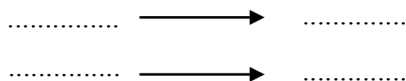   A length of 1cm in the scale diagram represents 10m of actual length

      .... $\longrightarrow$ ....

      .... $\longrightarrow$ ....

      ($\therefore$)Therefore ,the scale is.............

2. Select a suitable scale to draw the scaler diagram of the straight mountain of 1000m in height from the ground.

      A length of 1cm in the scale diagram represents ....m of actual length

      Hence,

      .... $\longrightarrow$ ....

      .... $\longrightarrow$ ....

    Therefore, the scale is...........

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4. Select a suitable scale to draw the scaler diagram of the lighthouse of 75m in height from the ground.

5. Select a suitable scale to represent 1m

   A length of 1cm in the scale diagram represents ....m of actual length

   Hence,

   10 cm ⟶ 1m

   10 cm ⟶ 100 m

(∴) Therefore, the scale is 1:10

6. Select a suitable scale to represent 2.5m

7. Select a suitable scale to represent 3m

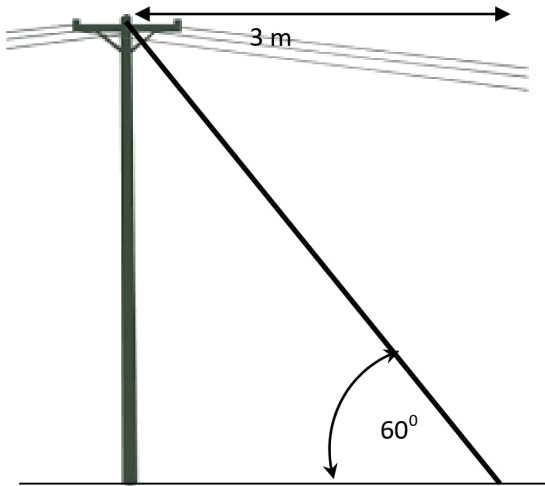8. Select a suitable scale to represent 200m

Obtaining actual measurements from scale diagrams

Exercise 3

1. The image below shows a cable attached to the top of the light post and the other end is fixed to the flat ground which is three meters away from the base of the light post.

   Find the height of the light post using the given information

First, select and prepare a suitable scale to draw the scale diagram

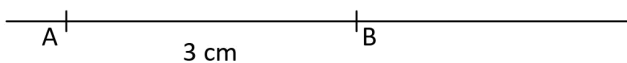A length of 1cm in the scale diagram represents 1m of actual length

1cm	⟶	1m
1cm	⟶	100cm

Therefore the scale is 1:100.

(Draw the scaler diagram on your book as per instructions given below and model diagrams)
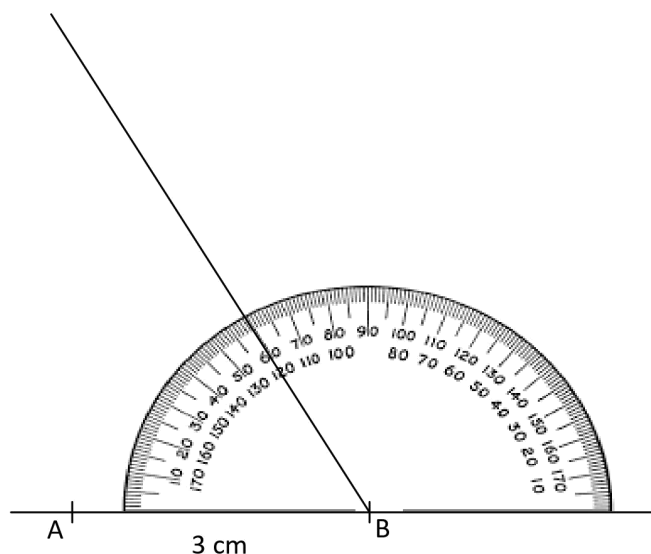
Therefore length of 3cm in the scale diagram represents 3m of actual length

First, draw a horizontal line to present the ground. Then mark the distance between utility post and cable which is fixed to the ground as 3cm. Next, mark the bottom of the light post as A and the end of the cable fixed to the ground as B

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Mark an angle of $60°$ at B using the protractor and draw the line

A   3 cm   B

Mark an angle of $90°$ at A using the protractor and draw the line. Then mark the intersection point of the lines drawn from A and B as C

A   3 cm   B
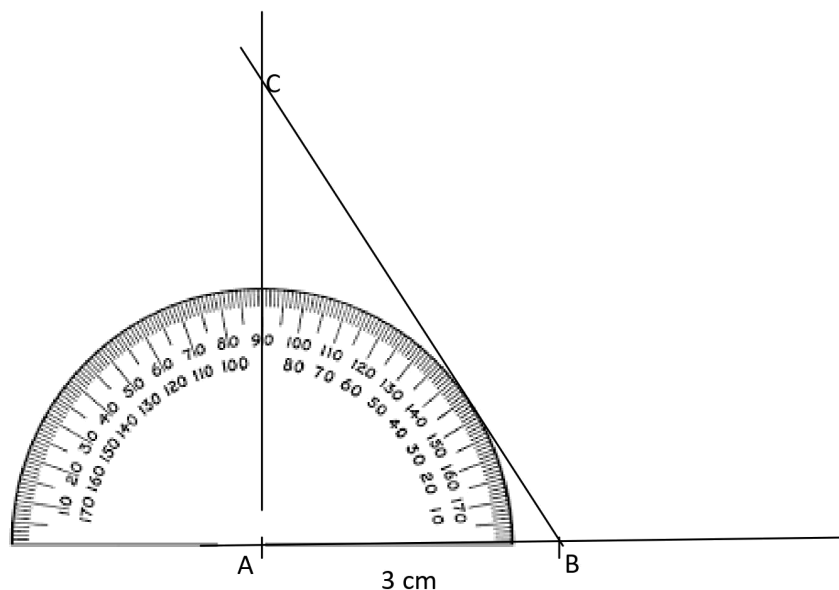
AC represents the height of the light post. Then measure the length of the AC line you have drawn according to the above instructions.

Hence find the actual length of the light post by converting the length of AC in to meters

2. From a 70m tall building, vehicle A is observed at the road with an angle of depression of 45^0 and another vehicle B with an angle of depression of 35^0. Draw scale diagram depicting the above information and find the distance between the vehicles A and B.
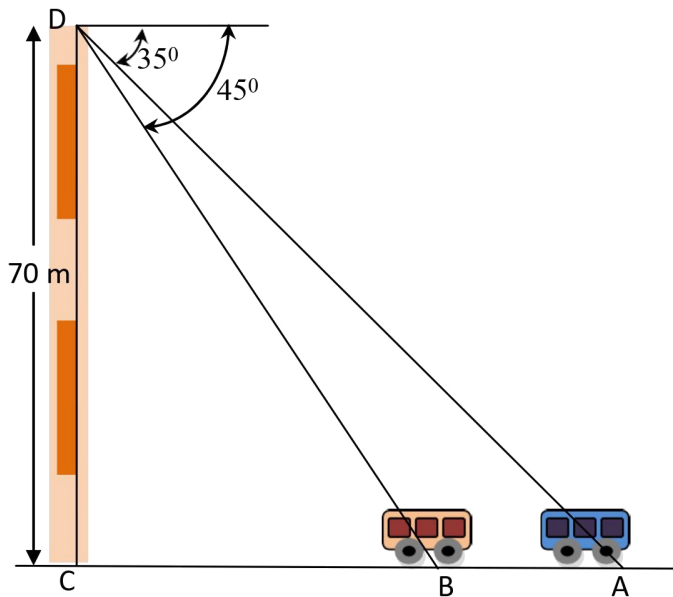
When drawing scale diagrams involving objects with height great, a man's height being comparatively small can be ignored.

(Draw scaler diagrams in your book using the instructions and model diagrams given below.)

Step 1 ➡ Read the question well and draw a rough diagram

Step 2 ➡ let's choose a suitable scale

Arrange the length of 1cm in the scale diagram to represent 10m of the actual length

| 1cm | ⟶ | 10m |
| 1cm | ⟶ | 1000cm |

Therefor, the scale is 1:1000

Step 3 → According to the scale, a 7 cm straight line segment must be drawn to represent the height of the building. Denote this line segment by CD.

Step 4 → Draw two perpendiculars to CD at C and D points. Perpendiculars represents the eye level and ground level.

Step 5 → By considering the eye level draw an angle of depression of 35^0 at D. Extend this line to the point where it meets the line perpendicular to CD at C and label this point as A.

Step 6 → Draw another angle of depression of 45^0 at D. Extend this line to the point where it meets the line perpendicular to CD at C and label this point as B.
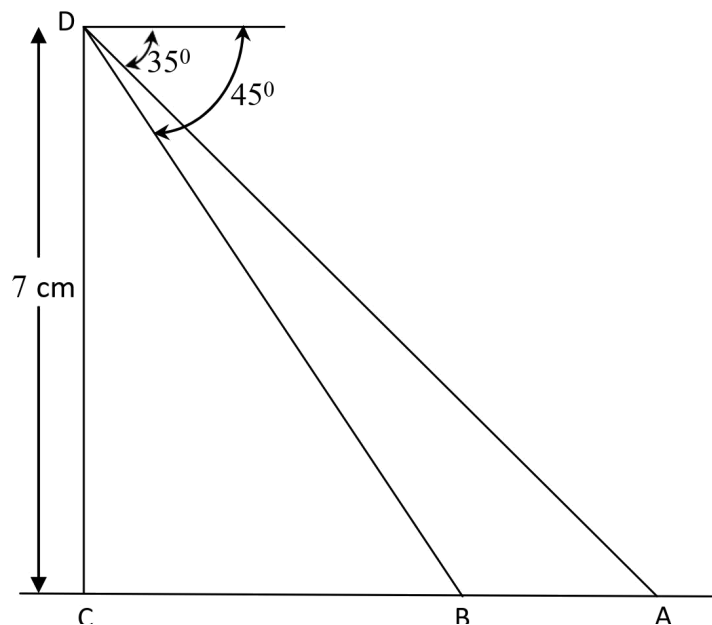

Step 7 → Now measure the length of AB and calculate the distance between two according to the vehicles.

3. In a horizontal ground, Ravindra is standing at the garden of his house which is 6m away from wall of the house. He can see top of the wall of an angle of elevation of 25^0 from his eye level and the base of the wall from the same position of an angle of depression of 15^0. Draw the suitable scale diagram and find the height of the wall and height of Ravindra

Draw the diagram by considering the observer's height

(Draw scaler diagrams in your book using the instructions and model diagrams given below.)

Step 1   Read the question well and draw a rough diagram
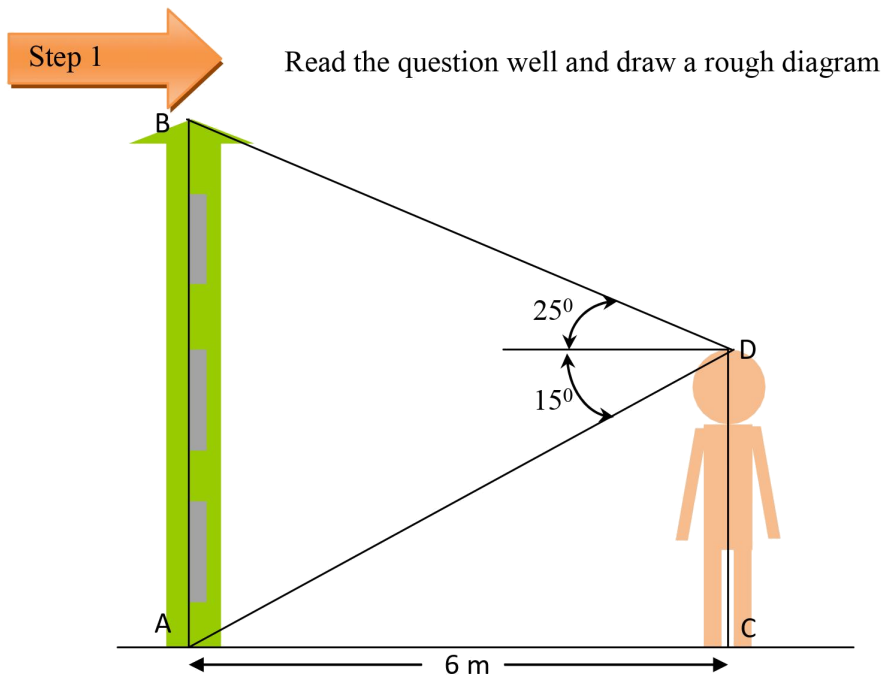
To easily understand take the height of the building as AB and Ravindra's height as CD

Step 2   Let's make a suitable scale
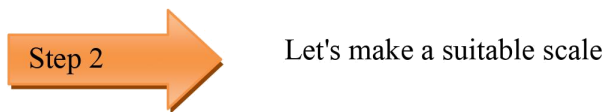
A length of 1cm in the scale diagram represents 100cm of actual length

1cm $\longrightarrow$ 100cm   Therefor the scale is,1:100

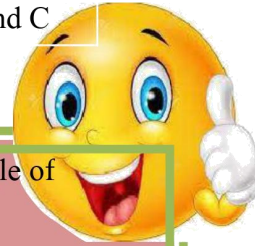| 1 cm $\longrightarrow$ 100 cm	
? $\longrightarrow$ 600cm	___

Real length of AC is 6m, and it is represented by 6cm in scale diagram

Step 3 → Draw a line segment AC which has 6cm long

Step 4 → Draw two perpendicular heights from A and C

- Without knowing the height of CD exactly we cannot mark angle of depression at the location D
- The floor level and eye level are parallel lines, So the angle of depression at point D and angle $C\hat{A}D$ are alternating with each other
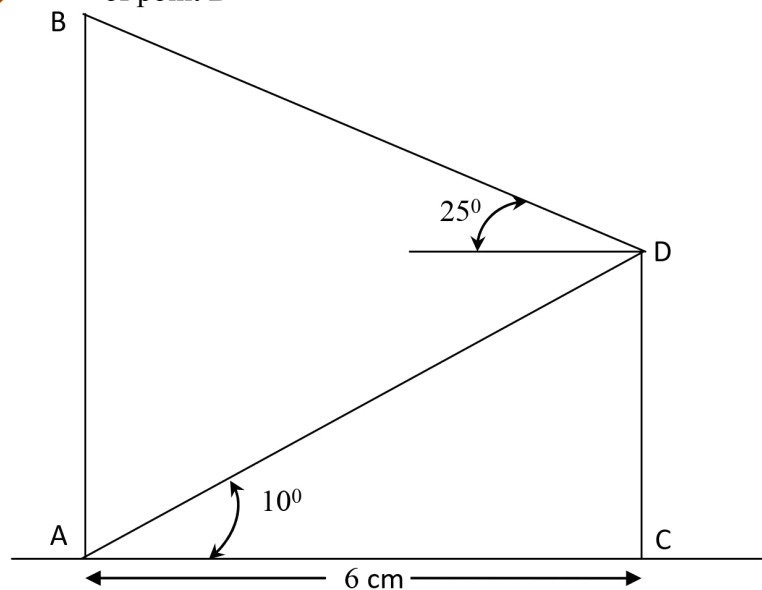
Step 5 → Mark $C\hat{A}D = 10^0$ from point A

Step 6 → Then the point D can be clearly marked (Now the place of D point is exactly know.) So draw the eye level perpendicular to CD from D point

Step7 → Draw the line DB taking the angle of elevation of 25^0 at the of point D

Step 08 → By measuring the length of AB and CD of the scale diagram you have drawn, calculate the actual height of the building and height of Ravindra.

4. A ladder has being leaning against to the top of the wall of an angle of elevation of 35^0 in a flat ground. Distance between foot of the ladder and wall is 3.5m.Find the height of the wall using the scale diagram.

5. Nalani is on the top of 100 m tall building. She can see the top of another building that is 50 m away from her place an angle of elevation 31^0 and bottom has an angle of depression 64^0.Find the height of the building. (Neglect the height of the observer).

6. Sisira, who's on a wall can observe a tower which is 70m away from horizontally to the ground. Top of the tower can see an angle of elevation of 38^0 and the bottom of the tower has an angle of depression of 23^0. Draw a scale diagram and find the heights of the wall and the post.(Neglect the height of the observer).

Keep in mind

Before you start to draw the scale diagrams,

- Sharpen your pencil well
- Use a ruler and a protractor where the scale is visible
- Read the question well
- Read it again and draw a rough sketch
- If it is not given, use a suitable scale by your own
- Draw the scale diagram with accurate measurement
- Answer all the questions.

Answers

Exercise 1

1.
    i.   Angle of elevation
   ii.   Angle of depression
  iii.

     (1)   Angle of elevatic n

     (2)   Angle of depress on

  iv.

     (1)   Angle of elevation

     (2)   Angle of depression

2.
    i.   Angle of elevation
   ii.   Angle of depression

Exercise 2

2.   1 cm $\longrightarrow$ 10 cm
     1 cm $\longrightarrow$ 1000cm
     Scale is 1:1000

3.   1 cm $\longrightarrow$ 100 cm
     1 cm $\longrightarrow$ 10000cm
     Scale is 1:10000

4.   1 cm $\longrightarrow$ 50 cm
     1 cm $\longrightarrow$ 5000cm
     Scale is 1:5000

6.   1 cm $\longrightarrow$ 0.5 cm
     1 cm $\longrightarrow$ 50cm
     Select the scale as 1:50 or any other suitable scale

7.   1 cm $\longrightarrow$ 1cm
     1 cm $\longrightarrow$ 50cm
     Select the scale as 1:50 or any other suitable scale

8. 1 cm $\longrightarrow$ 50m

   1 cm $\longrightarrow$ 5000cm

   Select the scale as 1:5000 or any other suitable scale

Exercise 3

1. Height of light post 5 1 m
2. Distance between two
   vehicles 30m
3. Height of wall 4m

   Height of Ravindra 1m
4. Height of wall 5m
5. Height of building 70 m
6. Height of wall 30m

    Height of right post 85m