CHAPTER 7

Brainstorming 1

In groups

Aim: To determine the orthogonal projections of an object.
Materials: Dynamic software, drawing paper.

Steps:

1. Open *View* and select 3D *graphics*.
2. Select the shape of pyramid .
3. Basic display is formed (Diagram 1).
4. Drag the cursor to display and select the four points:
   (a) Point (–2, 0) on the red line.
   (b) Point (–2, 0) on the green line.
   (c) Point (2, 0) on the red line.
   (d) Point (2, 0) on the green line and connect it to the starting point (–2, 0) at the red line (Diagram 2).
5. The display will show a brownish shape (Diagram 3).
6. Drag the cursor up to the blue line (0, 4) (Diagram 4).
7. Select the *3D rotate icon*, select *view in front of* .
8. Place the arrow at the top end of the blue line to see the orthogonal projection on the horizontal plane (Diagram 5).

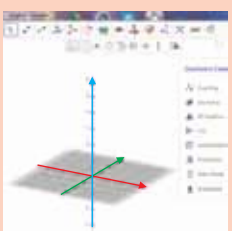


Diagram 1

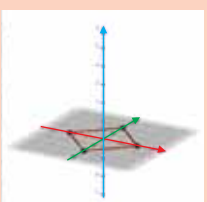


Diagram 2

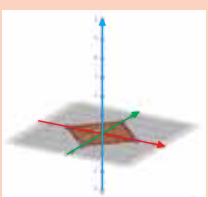


Diagram 3

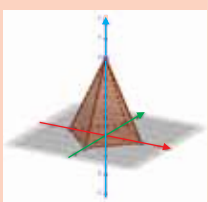


Diagram 4

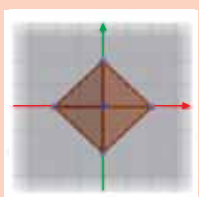
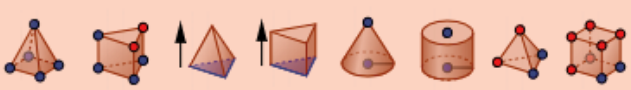


Diagram 5

9. Repeat step 8 on the red line and the green line to see various orthogonal projections on vertical planes.
10. Draw the resulting orthogonal projections as in steps 8 and 9 in the given table.
11. Select a new file. Build other 3D shapes and draw orthogonal projections from different perspectives.



Results of Findings

Pyramid 	**Orthogonal projection**
The view on the horizontal plane as seen from the blue line	
The view on the vertical plane as seen from the red line	
The view on the vertical plane as seen from the green line	

Discussion:

Discuss the resulting shape of the orthogonal projection as compared to the actual shape of the object.

From Brainstorming 1, it is found that:

Pyramid 	**Orthogonal projection**
The view on the horizontal plane as seen from the blue line	
The view on the vertical plane as seen from the red line	
The view on the vertical plane as seen from the green line	

Brainstorming 2

In groups

Aim: Compare and contrast an object with an orthogonal projection in terms of length of side and size of angle.

Materials: Cardboard, a pencil, a pair of scissors, adhesive tape and drawing paper.

Steps:

1. Draw the following shape according to the size given on a cardboard (Diagram 1).

2. Cut out the shape in Diagram 1 and use adhesive tape to build the shape in Diagram 2.

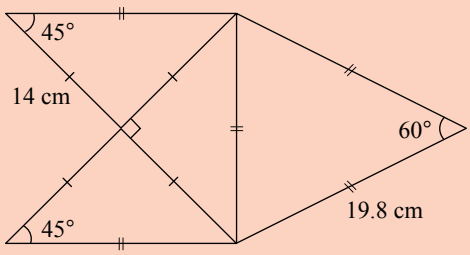


Diagram 1

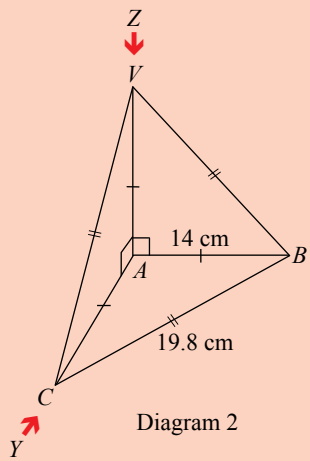
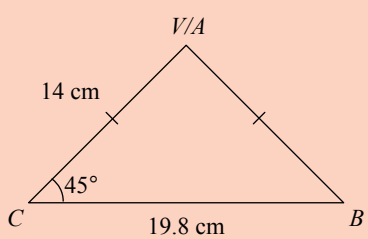


Diagram 2

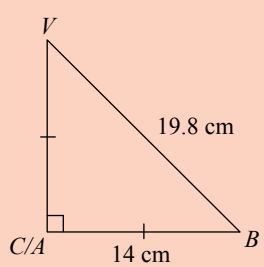
3. Draw an orthogonal projection for the shape that you built on a horizontal plane as viewed from direction *Z* and on a vertical plane as viewed from direction *Y*.

4. Produce the orthogonal projections on the horizontal plane and the vertical plane as follows:

Projection from *Z* direction (horizontal plane)



Projection from *Y* direction (vertical plane)



5. Measure each of the length of sides and angles of the two orthogonal projections you drawn. Complete the table below.

Side	Object	Projection from direction *Z*	Angle	Object	Projection from direction *Z*
AC	14 cm	14 cm	$\angle VCB$	60°	45°
AB			$\angle VBC$		
BC	19.8 cm	19.8 cm	$\angle BAC$	90°	90°
VC	19.8 cm	14 cm	$\angle CAB$		
VB					

Side	Object	Projection from direction *Y*	Angle	Object	Projection from direction *Y*
AV	14 cm	14 cm	$\angle VCB$	60°	90°
AB			$\angle VBC$	60°	45°
BC	19.8 cm	14 cm	$\angle CVB$		
VC			$\angle AVB$	45°	45°
VB	19.8 cm	19.8 cm			

Discussion:

Are all sides and angles of the orthogonal projection of the same size as those of the object? Discuss.

From Brainstorming 2, it is found that:

(a) For orthogonal projections on a horizontal plane from direction *Z*, the lengths of *AC, AB* and *BC*, and the size of $\angle BAC$, $\angle ACB$ and $\angle ABC$ remain unchanged.

(b) For orthogonal projections on a vertical plane from direction *Y*, the lengths of *AV, AB* and *VB*, and the size of $\angle AVB$ and $\angle ABV$ remain unchanged.

In general,

The **length of sides** and **size of angles** of the **orthogonal projections** of an object can remain unchanged or vary according to the **viewing direction**.