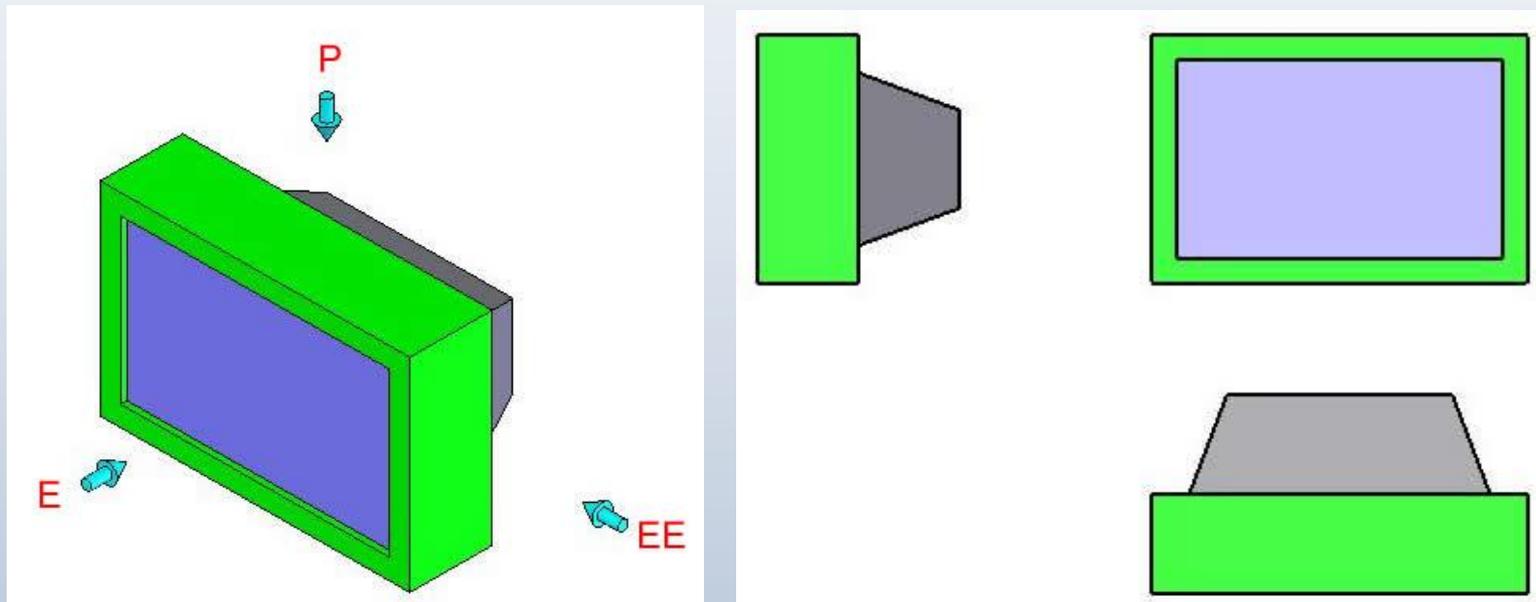


Orthographic Projection 1

What Is Orthographic Projection?

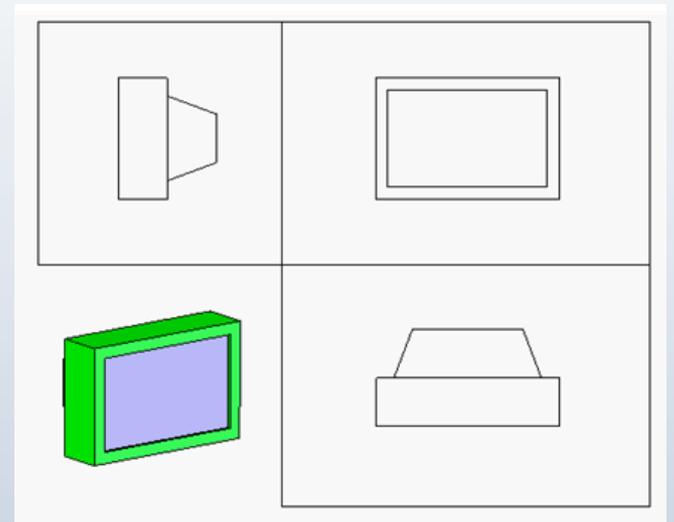
Basically it is a way a representing a 3D object on a piece of paper. This means we make the object becomes 2D. The difference between Orthographic Projection and any other drawing method is that we use several 2D views of the object instead of a single view.



Where?

Why?

By who?



Orthographic Projection 1

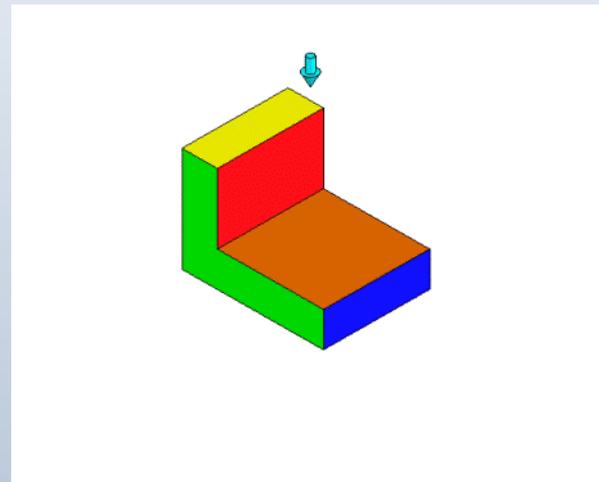
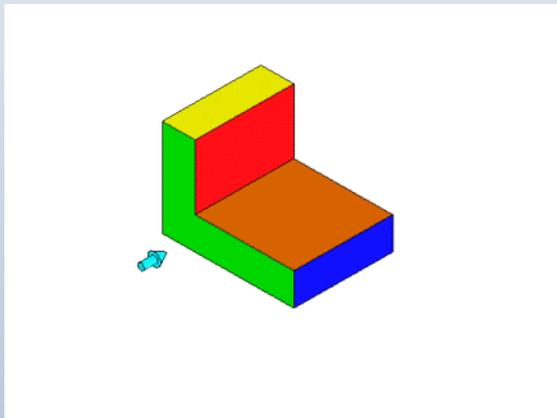
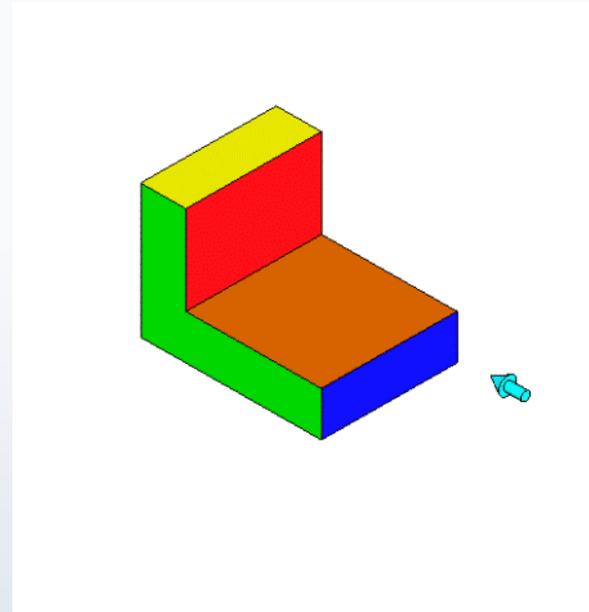
Where do we get the different views from?

To get 3 different views the observer must view the object from different locations as indicated by the blue arrows.

The views required are a:

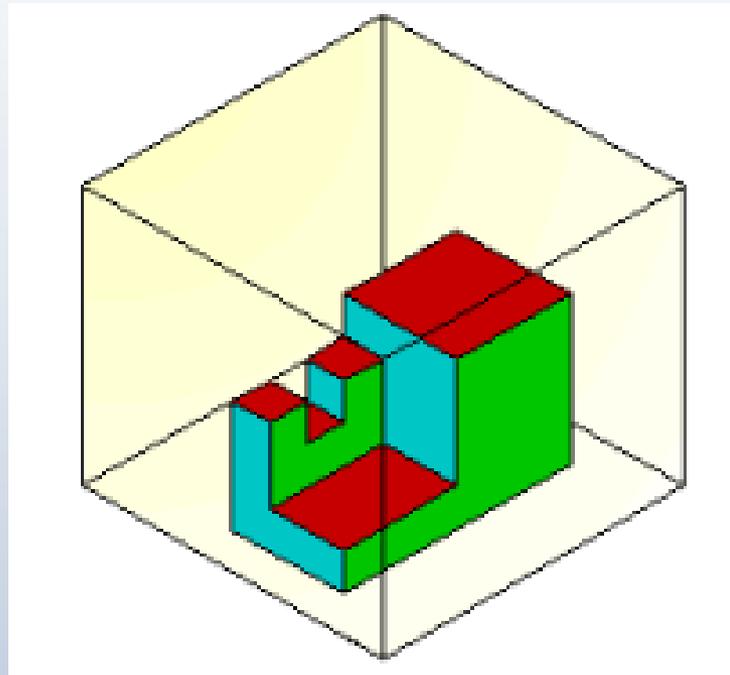
- **Front view (Elevation)**
- **End View (End Elevation)**
- **Top view (The Plan)**

Hands up: Name each of the views in the pictures.



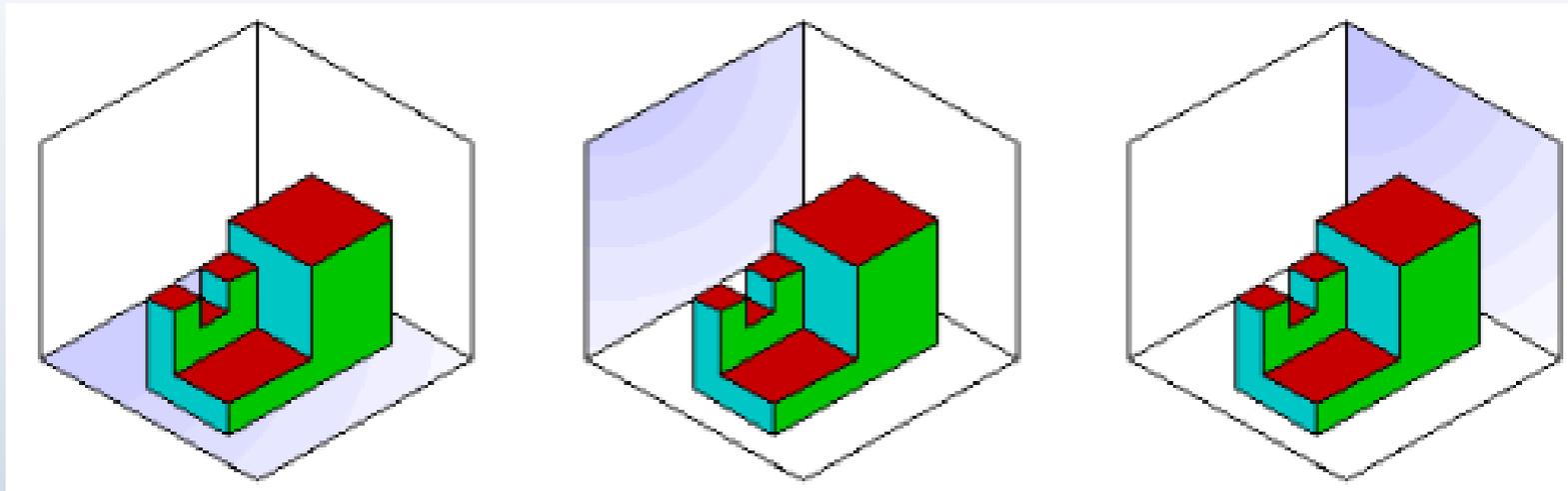
The Glass Box

"**The Glass Box**" is the name sometimes given to a theoretical see-through box that any object can fit inside. It is a very useful tool when it comes to trying to explain how Orthographic Projection works. Below you can see the box and the object we are going to use to show you how Orthographic Projection works.



The Planes of Reference

If we remove the exterior panes of "glass" that are slightly obstructing our view we will be left with 3 panes of glass, one underneath, one behind, and one to the side of the object. The surfaces that we are going to project the image of the object onto are at the far side of the object



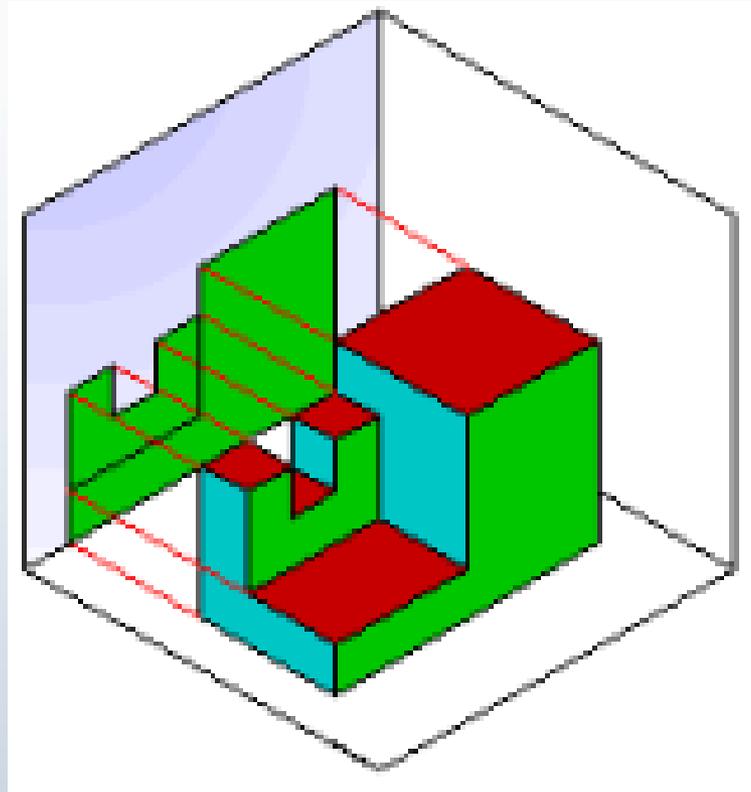
- The plane underneath the object is called the **Horizontal Plane (HP)**.
- The planes that are behind and beside the object are called **Vertical Planes (VP)**.

Projection of Views

First of all we are going to look from the right at the green portions of the object. We **project** the corners of the green portions onto the **Vertical Plane** on the left as you can see in the diagram opposite. Our lines of projection are parallel to the **Horizontal Plane**.

What we get is the exact shape of the green sections on the object.

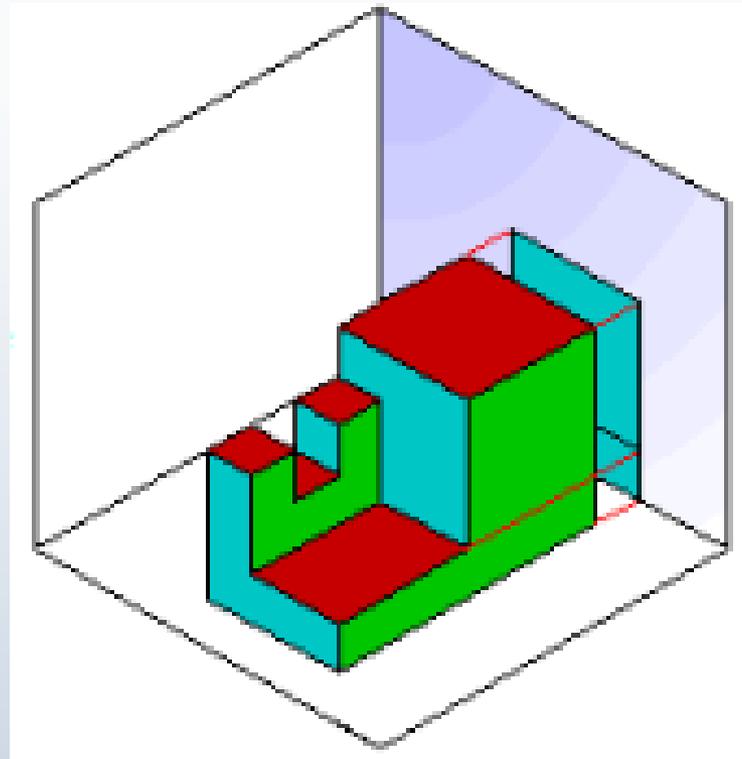
(Front Elevation)



Projection of Views

Next we will look from the left at the object and project what we see onto the Vertical Plane at the back. We can only see the blue sections and again we project parallel to the **Horizontal Plane**.

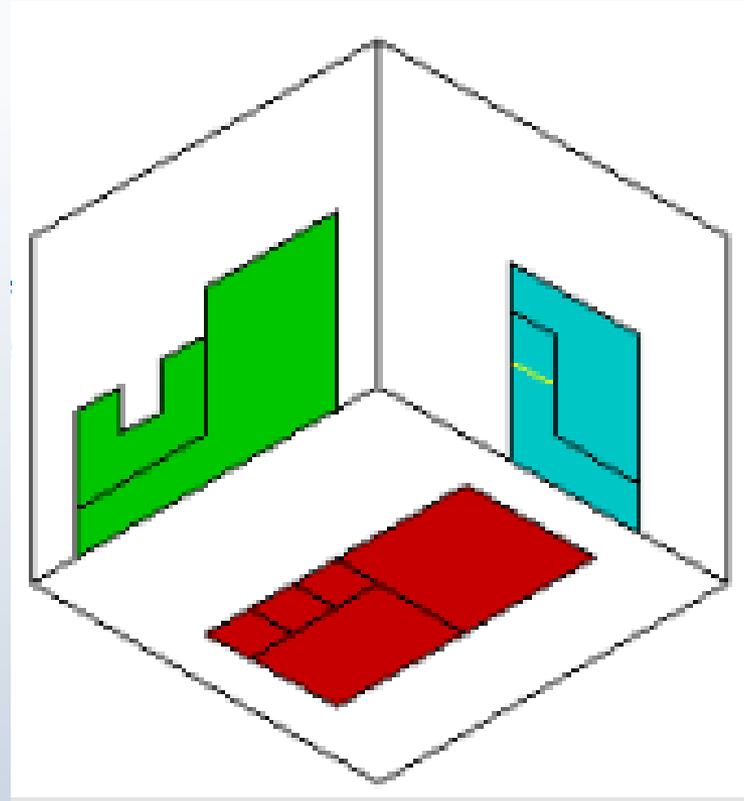
This is called the **End Elevation** or **End View**



Projection of Views

Finally we are going to look at the top of the object where we can see all of the red sections. This time we project the corners perpendicular to the **Horizontal Plane**, and our resulting image lies on it. (**The Plan**)

Opposite you can see the resulting panes after the object has been removed.

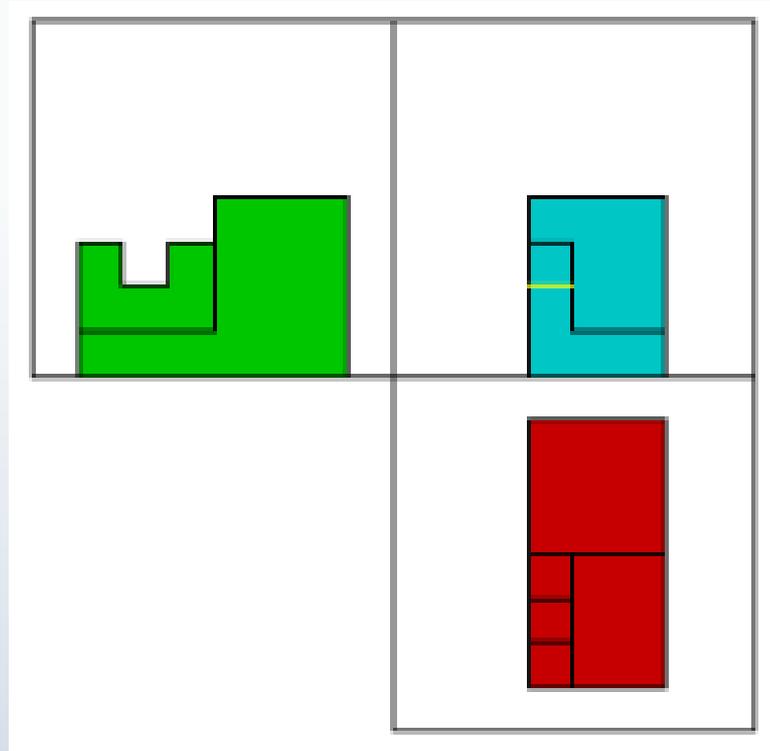


3D to 2D

If we were to flatten out the glass box we end up with the 3 projections on one flat surface (plane), and this is how a drawing in Orthographic Projection looks.

The drawing of the front of the object is called the **Elevation**, the drawing of the top of the object is called the **Plan**, and the drawing of the side of the object is called the **End Elevation**.

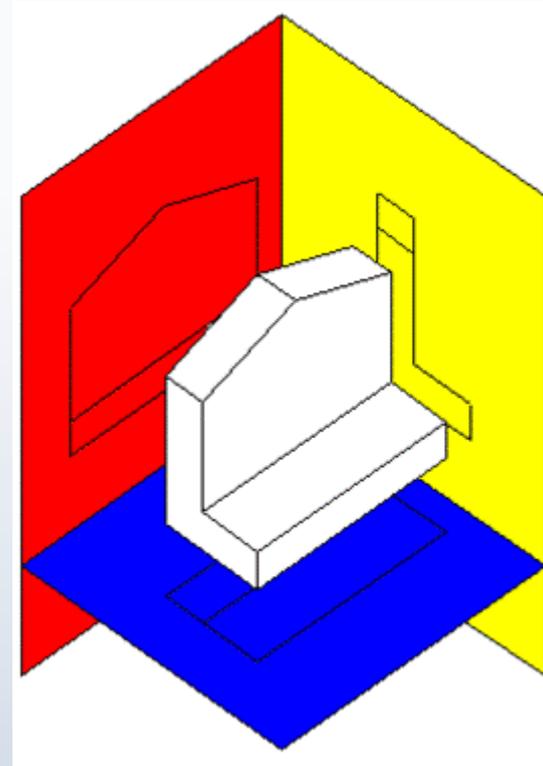
The Plan will always be drawn directly below the Elevation (1st Angle Projection)

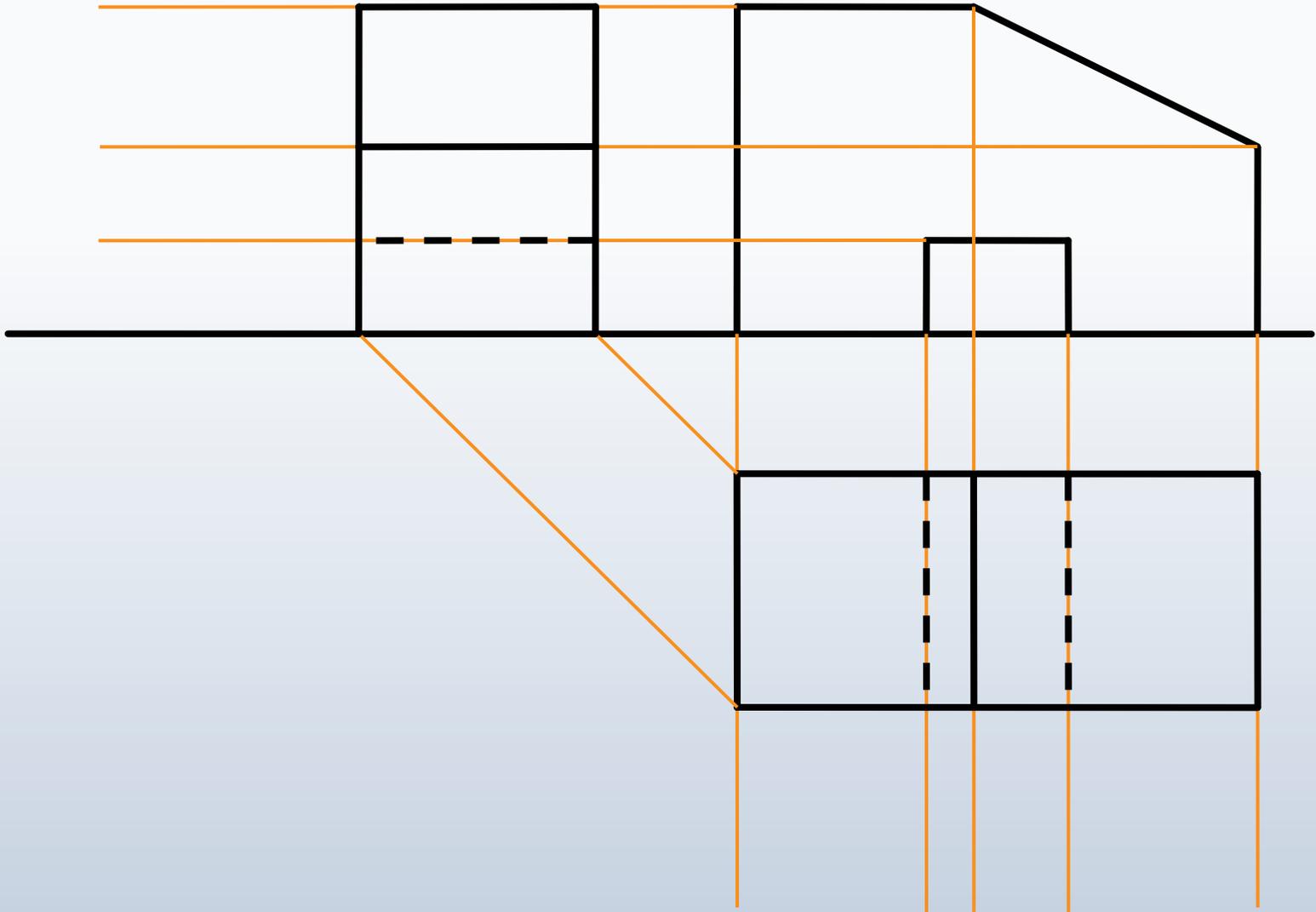


The glass Box

See how the three surfaces flatten out to show 3 views of the object.

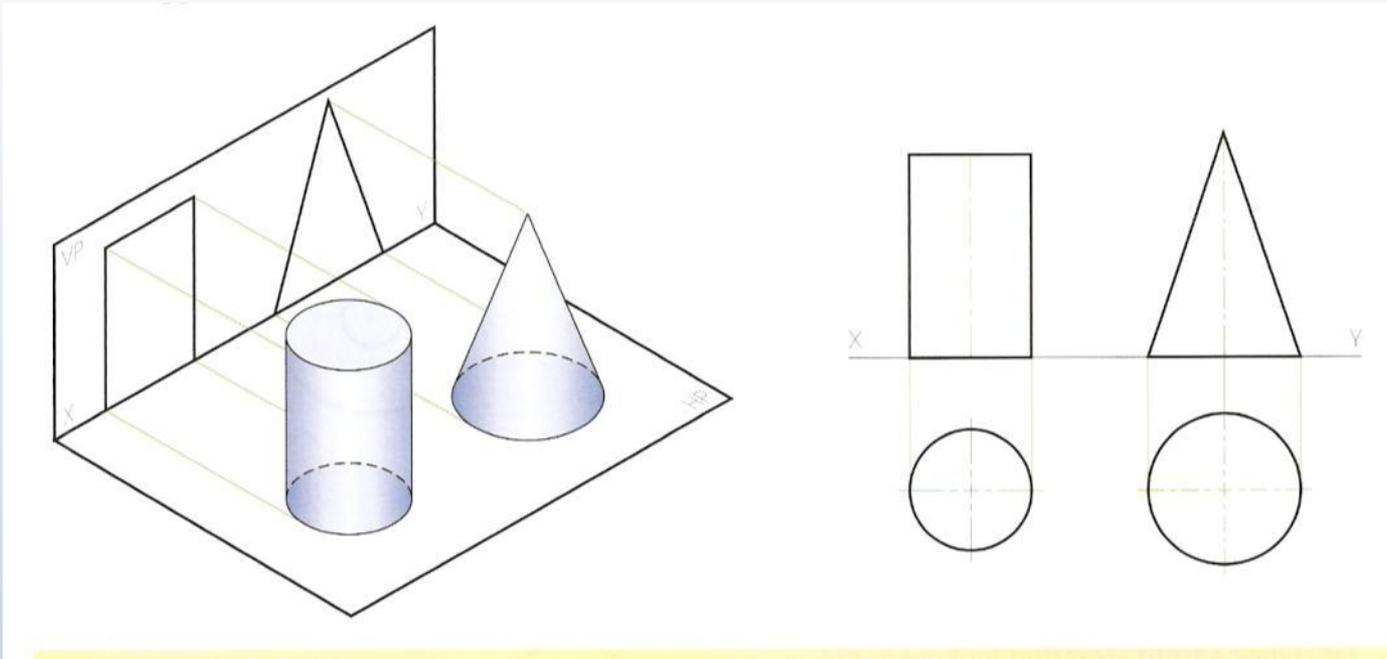
- **RED: Elevation**
- **YELLOW: End Elevation**
- **BLUE: Plan**





Orthographic Projection 2

You have already learned about Orthographic Projection in 1st Year and how to represent a three-dimensional object on a plane surface. This new chapter shows you how to do this with different shaped objects, like the cone and cylinder below.



Notice how the curved surface of the cylinder appears as a rectangle in the elevation and the curved surface of the cone appears as a triangle.

Orthographic Projection 2

Example: A Ribena Bottle is shown below.

What will the plan look like?

What will the elevation look like?

Draw a plan and elevation of the bottle.



Orthographic Projection 2

Sheet 1 - Title: School Bag

The figure over shows a pictorial view of a **school bag**.
A thumb-sketch of the front elevation is shown below.

- Draw the **front elevation** looking in the direction of arrow **A**.
- Draw an **end elevation** looking in the direction of arrow **B**.
- Draw a **plan** projected from (a) above.



Blackwater Community School

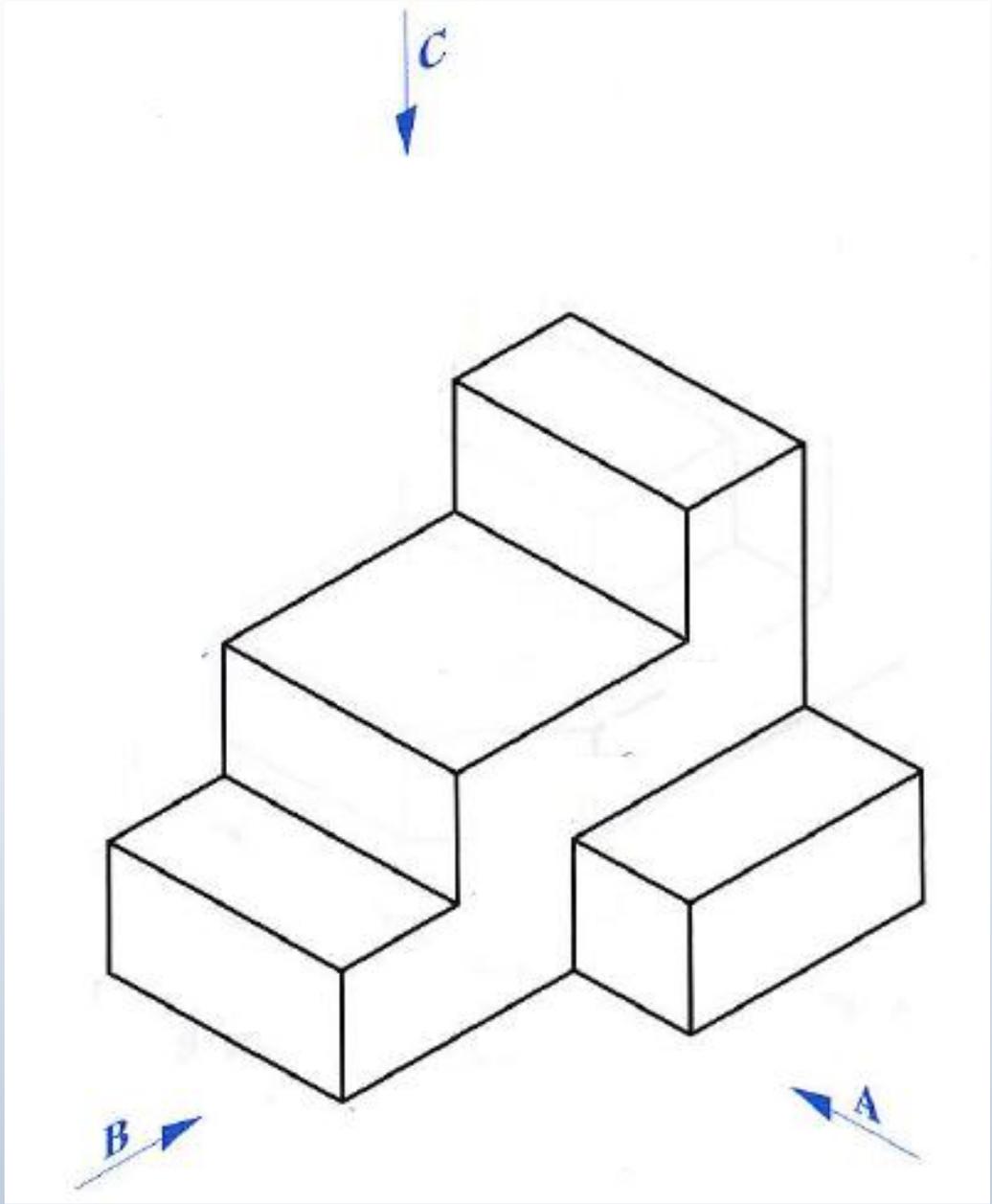
Name:

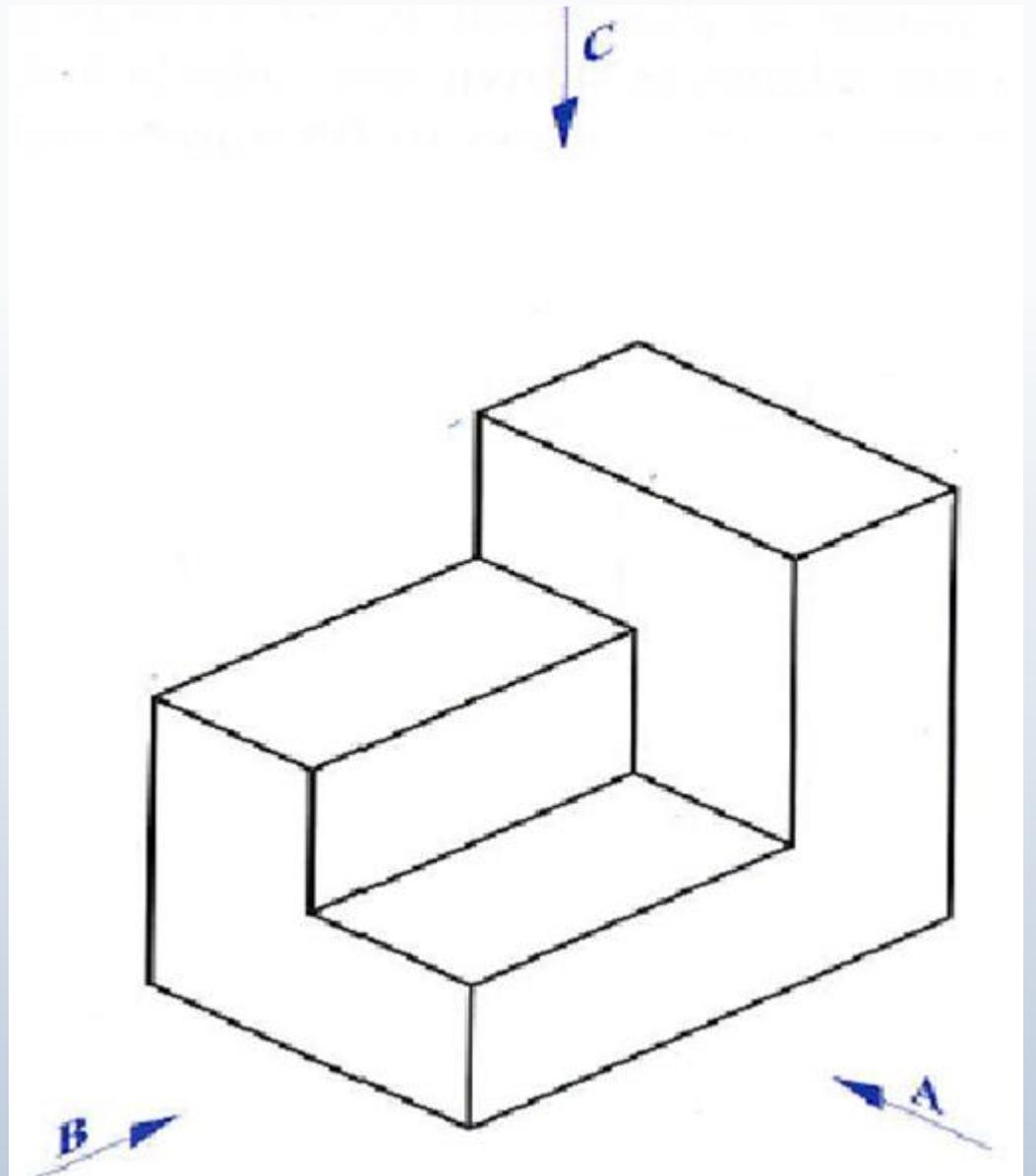
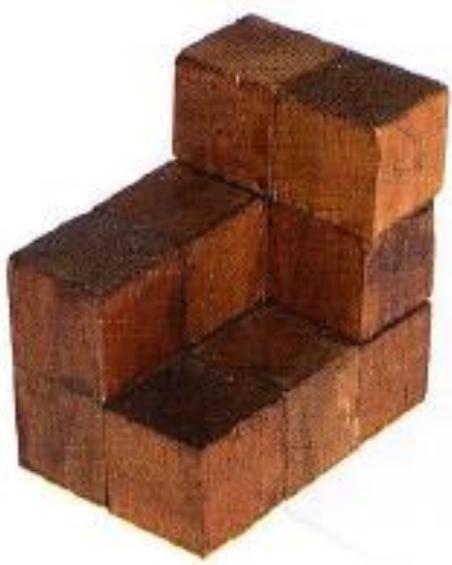
Title:

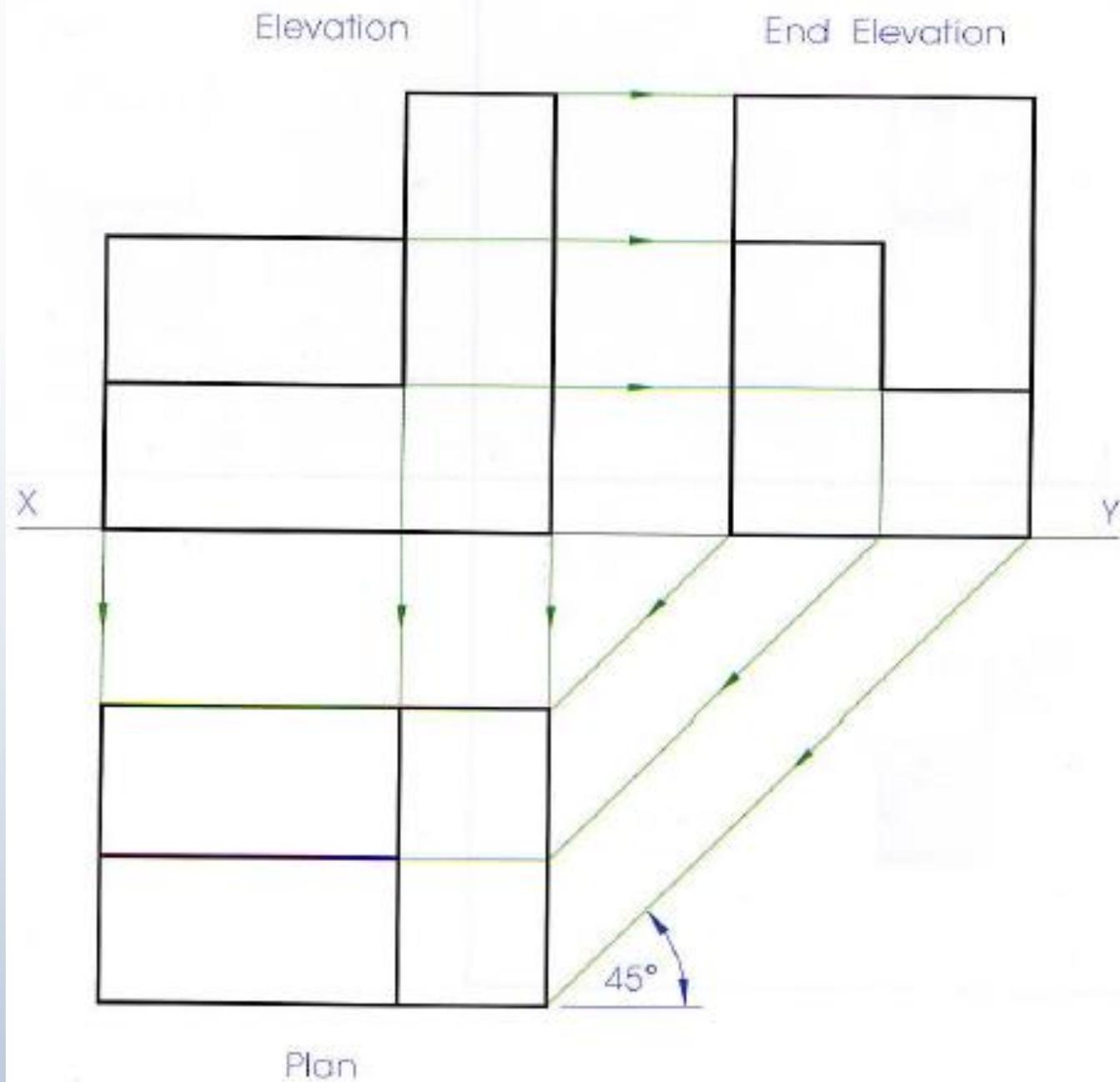
Date:

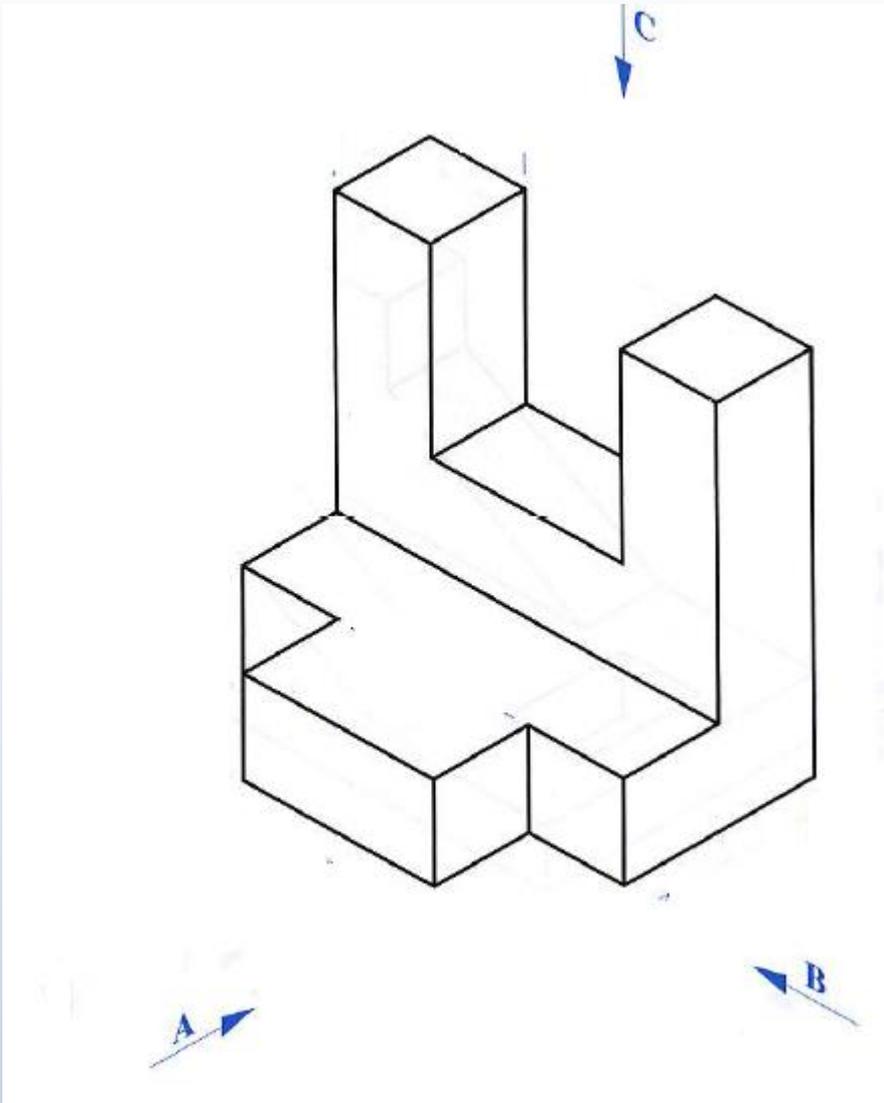
Sheet No:





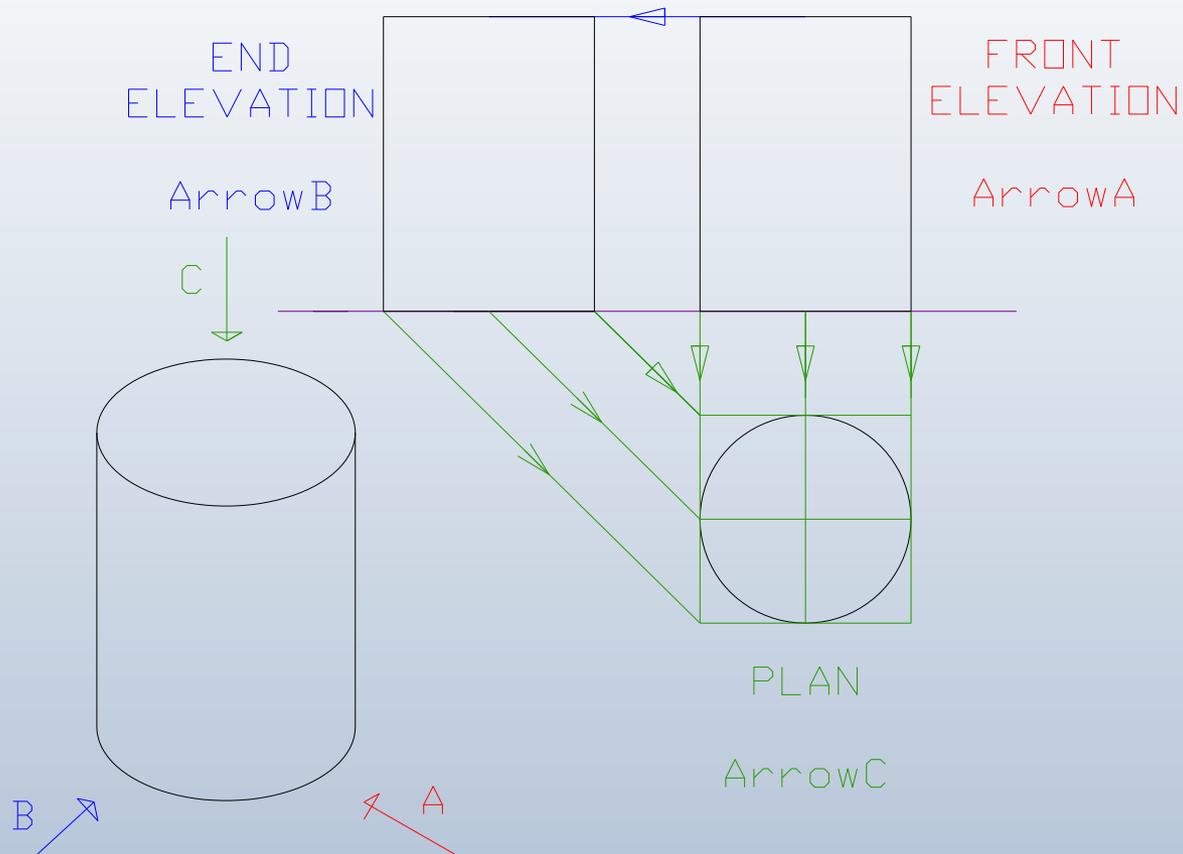






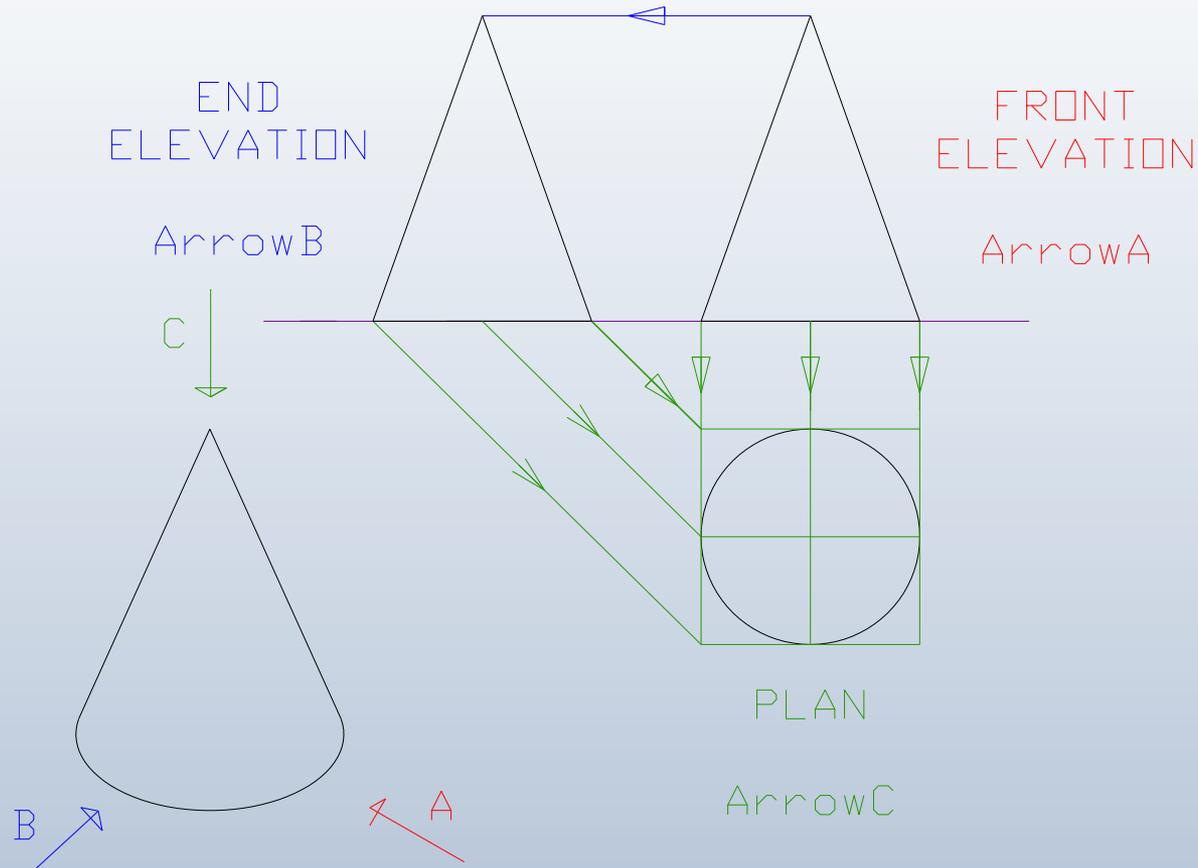
Orthographic Projection

- The curved surface of a cylinder appears as a rectangle in elevation.
- In plan it appears as a circle.



Orthographic Projection

- The curved surface of a cone appears as a triangle in elevation.
- In plan it appears as a circle.

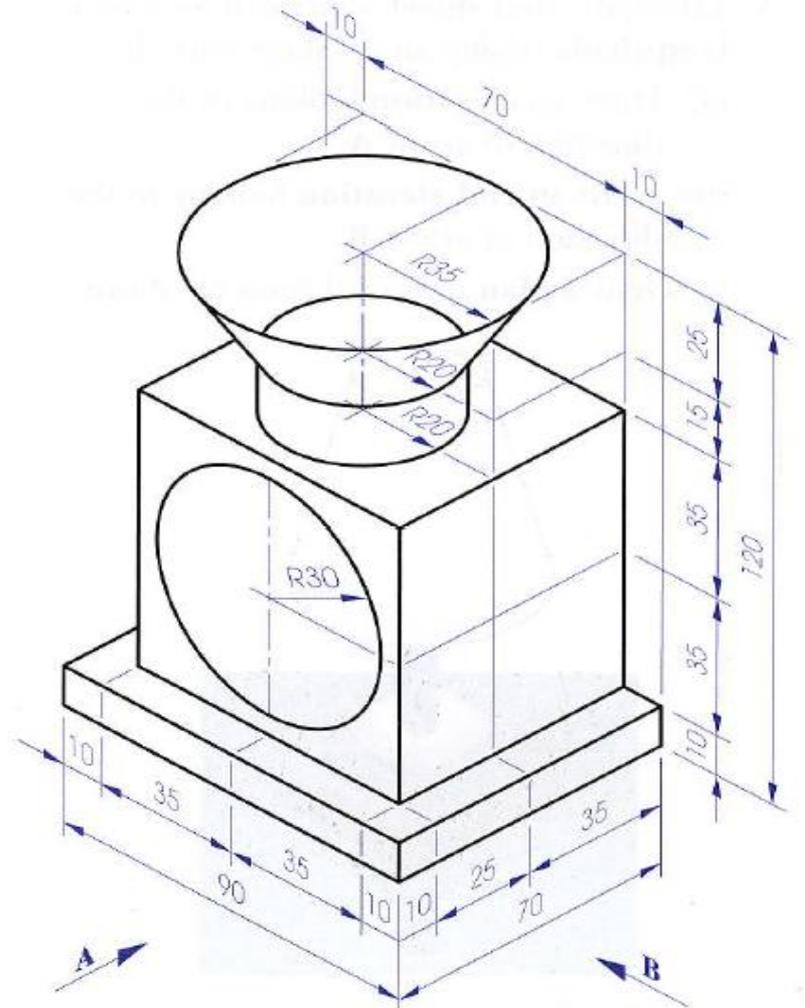
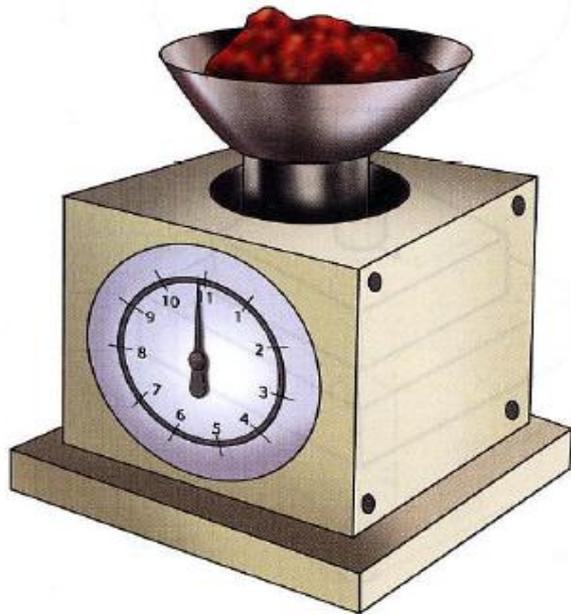


Orthographic Projection 2

Sheet 2 - Title: Kitchen Scales

A pictorial view of some **kitchen scales** is shown across.

- Draw an **elevation** looking in the direction of arrow **A**.
- Draw an **end view** looking in the direction of arrow **B**.
- Draw a **plan** projected from (a) above.



Orthographic Projection 2

Rule: The point of intersection between a line and a plane can be determined in a view in which the plane appears as an edge.

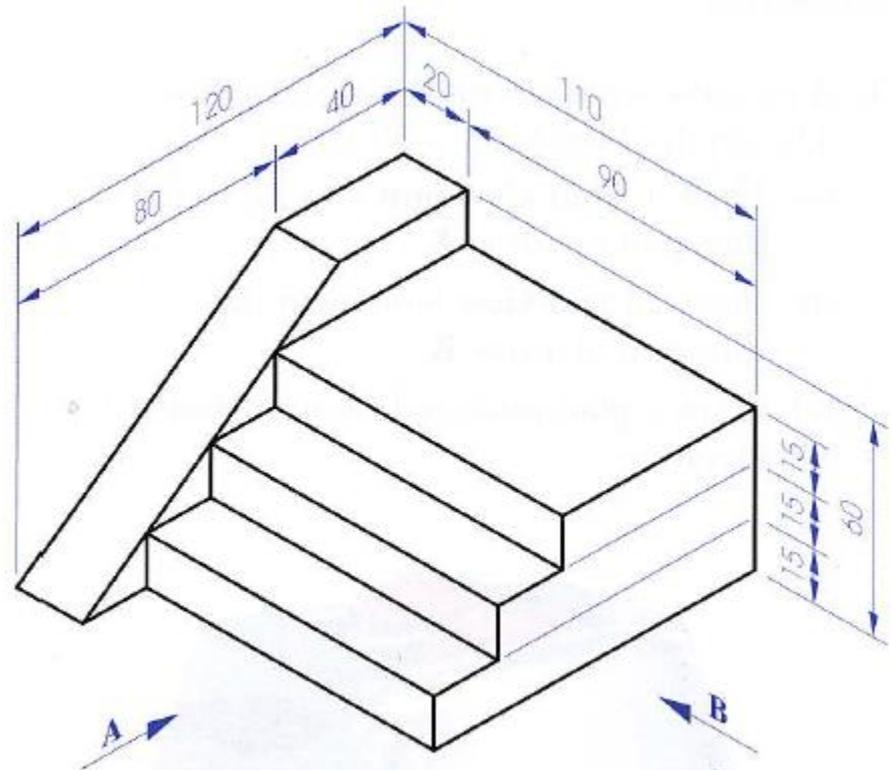
Using this rule we will complete the following drawing.

Example

The figure over shows a pictorial view of a **flight of steps**.

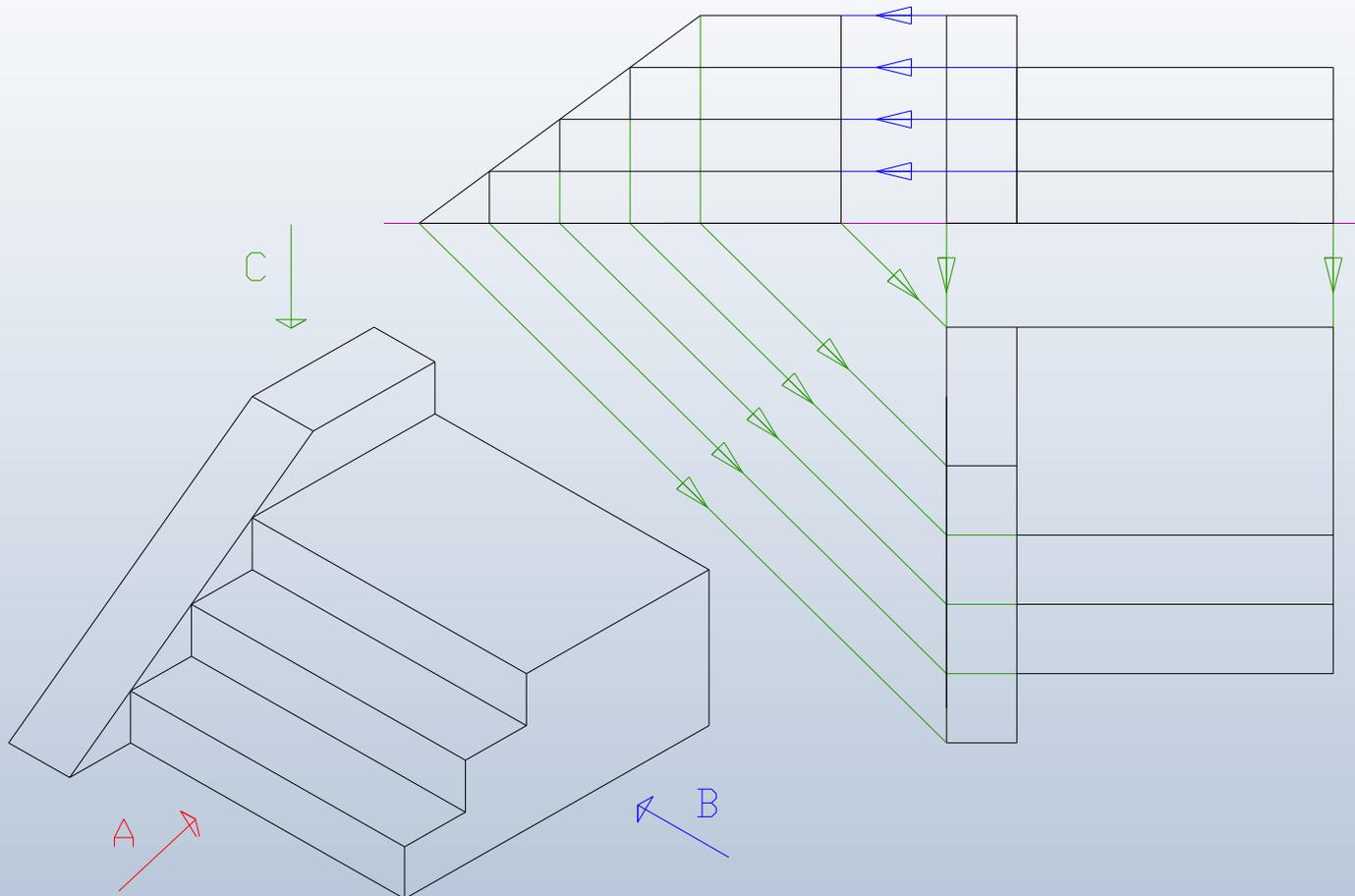
- Draw an **elevation** looking in the direction of arrow **A**.
- Draw an **end view** looking in the direction of arrow **B**.
- Draw a **plan** projected from (a) above.

- The elevation and outline of the end view are drawn as shown below.
- The sloped surface appears as an edge (line) in the end view. Therefore the height of each step can be projected to intersect this surface (line) in the end view.
- Now that the depth of each step has been determined the plan can be projected in the normal manner.



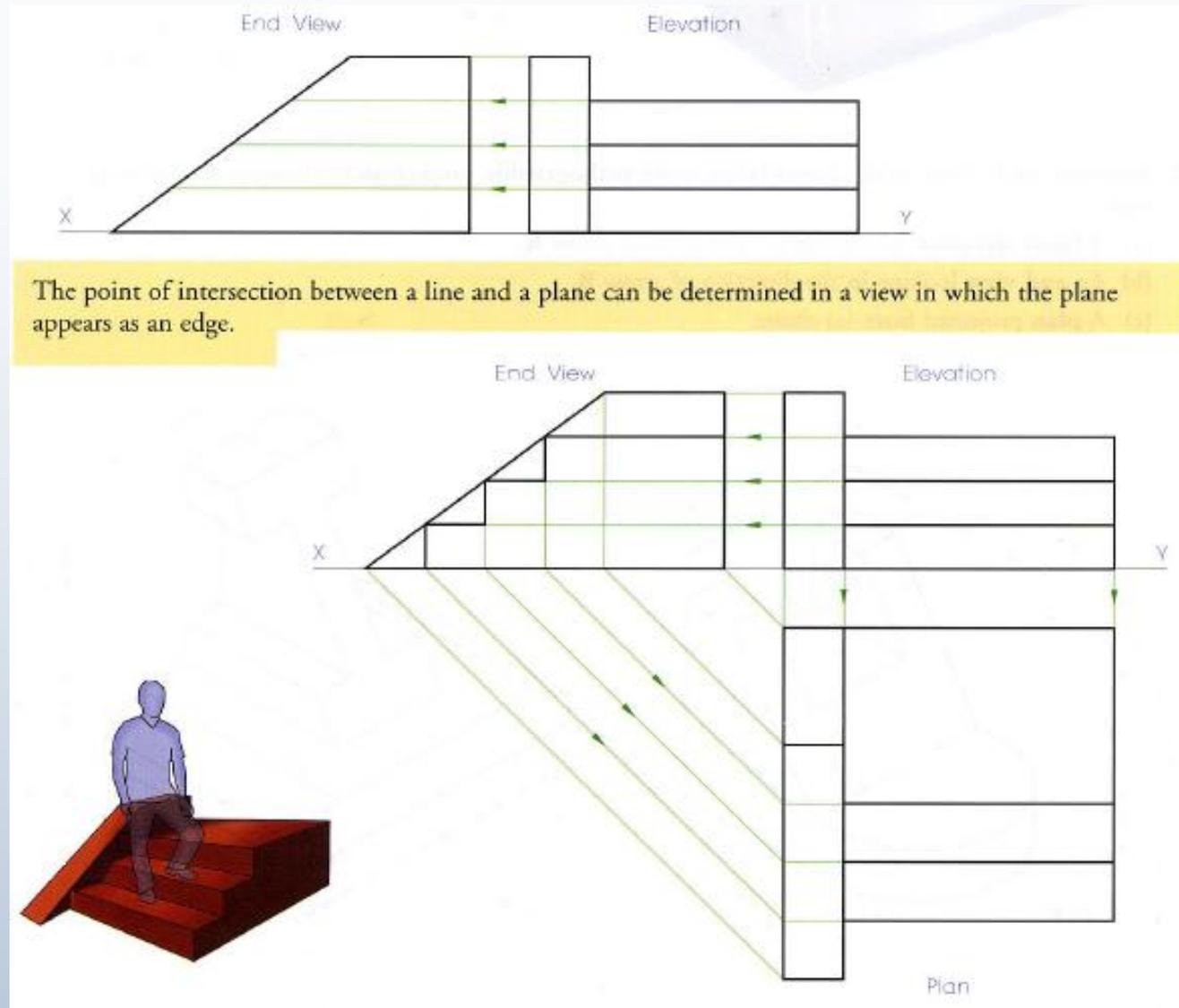
Orthographic Projection

- The point of intersection between a line and a plane can be determined in a view in which the plane appears as an edge.



Orthographic Projection 2

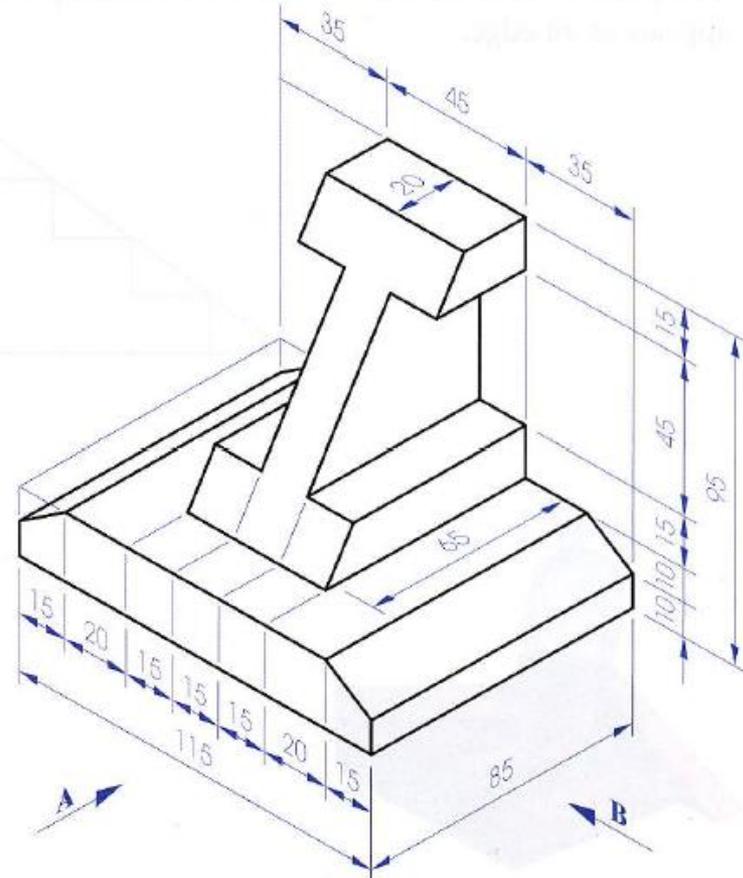
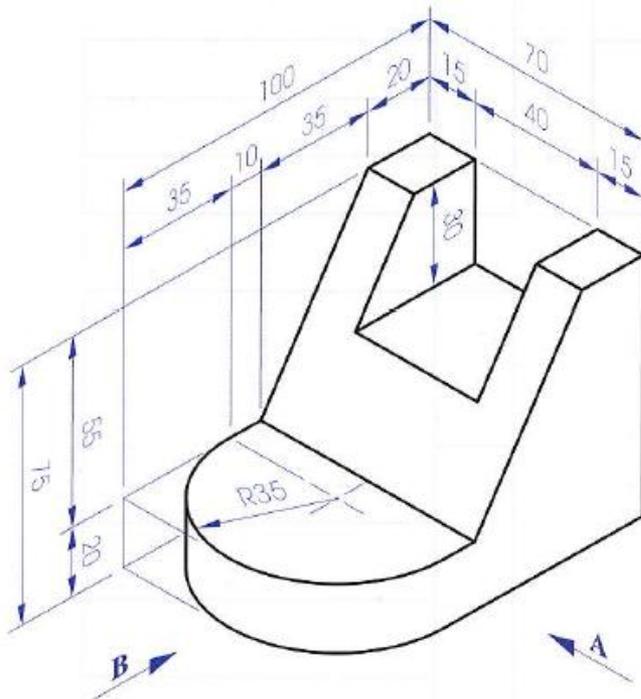
1. The elevation and outline of the end view are drawn.
2. The sloped surface appears as an edge or line in the end view. Therefore the height of each step can be projected to intersect this surface in the end view.
3. Now that the depth of each step has been determined the plan can be projected as usual.



Orthographic Projection 2

Sheets 3 & 4- Title: Edge View Orthographics

2. Represent each of the solids shown below using **orthographic projection** by drawing the following views:
- A **front elevation** looking in the direction of arrow **A**.
 - An **end view** looking in the direction of arrow **B**.
 - A **plan** projected from (a) above.



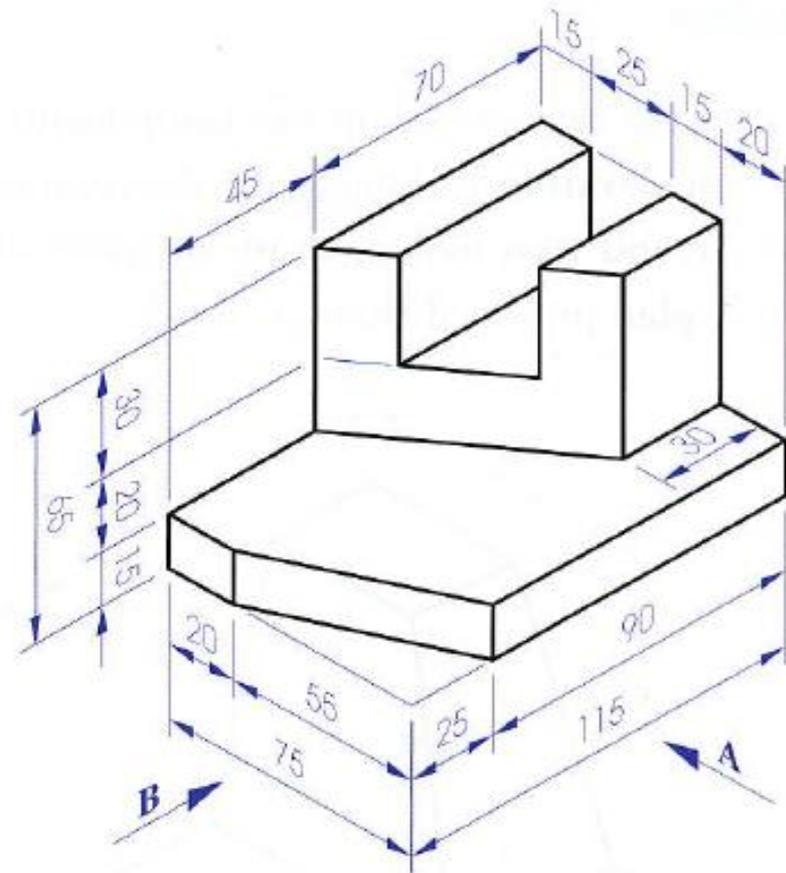
- <http://eddiesnotes.blogspot.ie/search/label/2nd%20Year%20TG%20Orthographic%20Projection>

Orthographic Projection 2

The following example shows how to complete a plan, elevation and end view when a view cannot be completed in full to begin with.

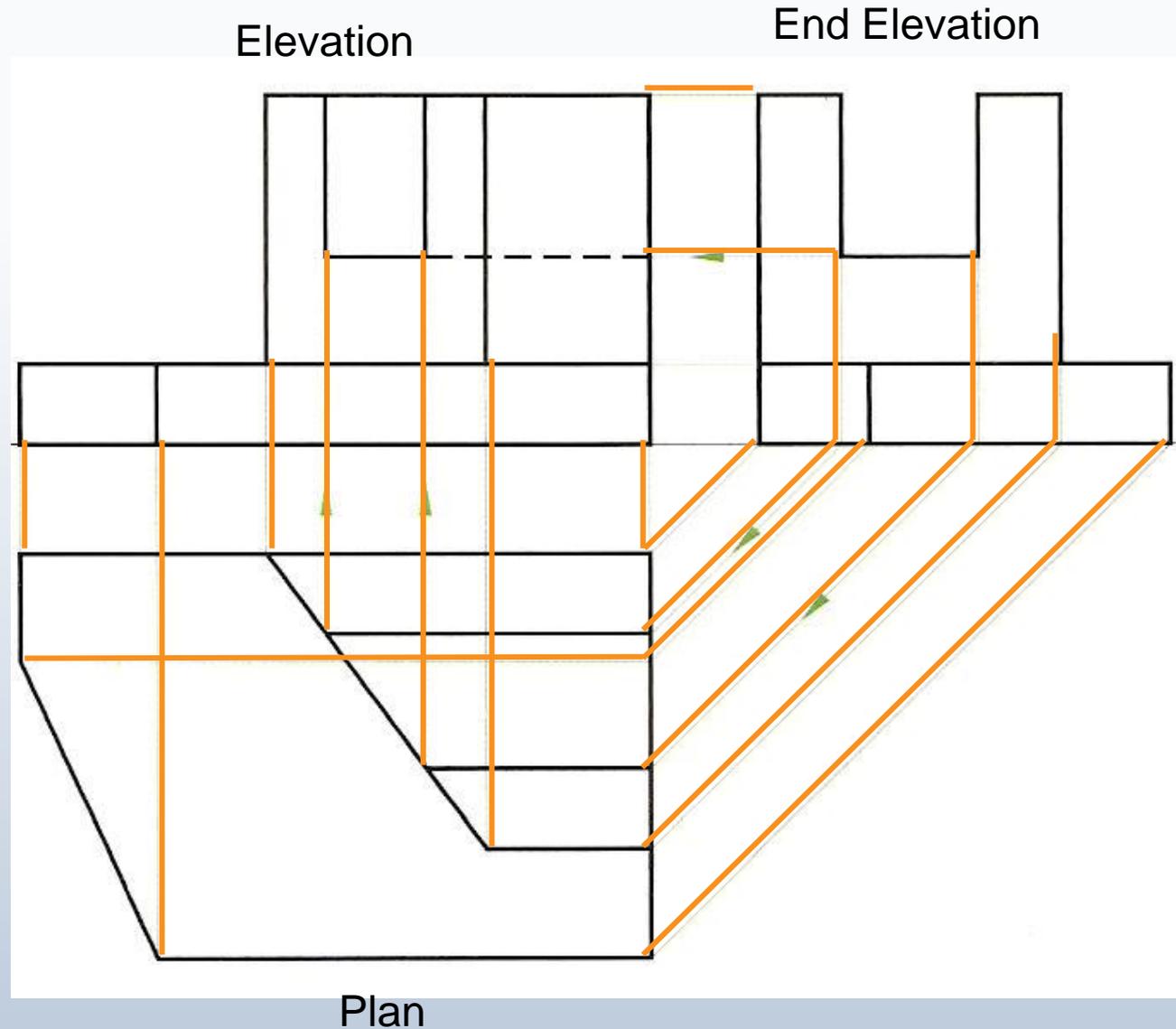
A pictorial view of a **solid** is shown over.

- Draw an **elevation** looking in the direction of arrow **A**.
- Draw an **end view** looking in the direction of arrow **B**.
- Draw a **plan** projected from (a) above.



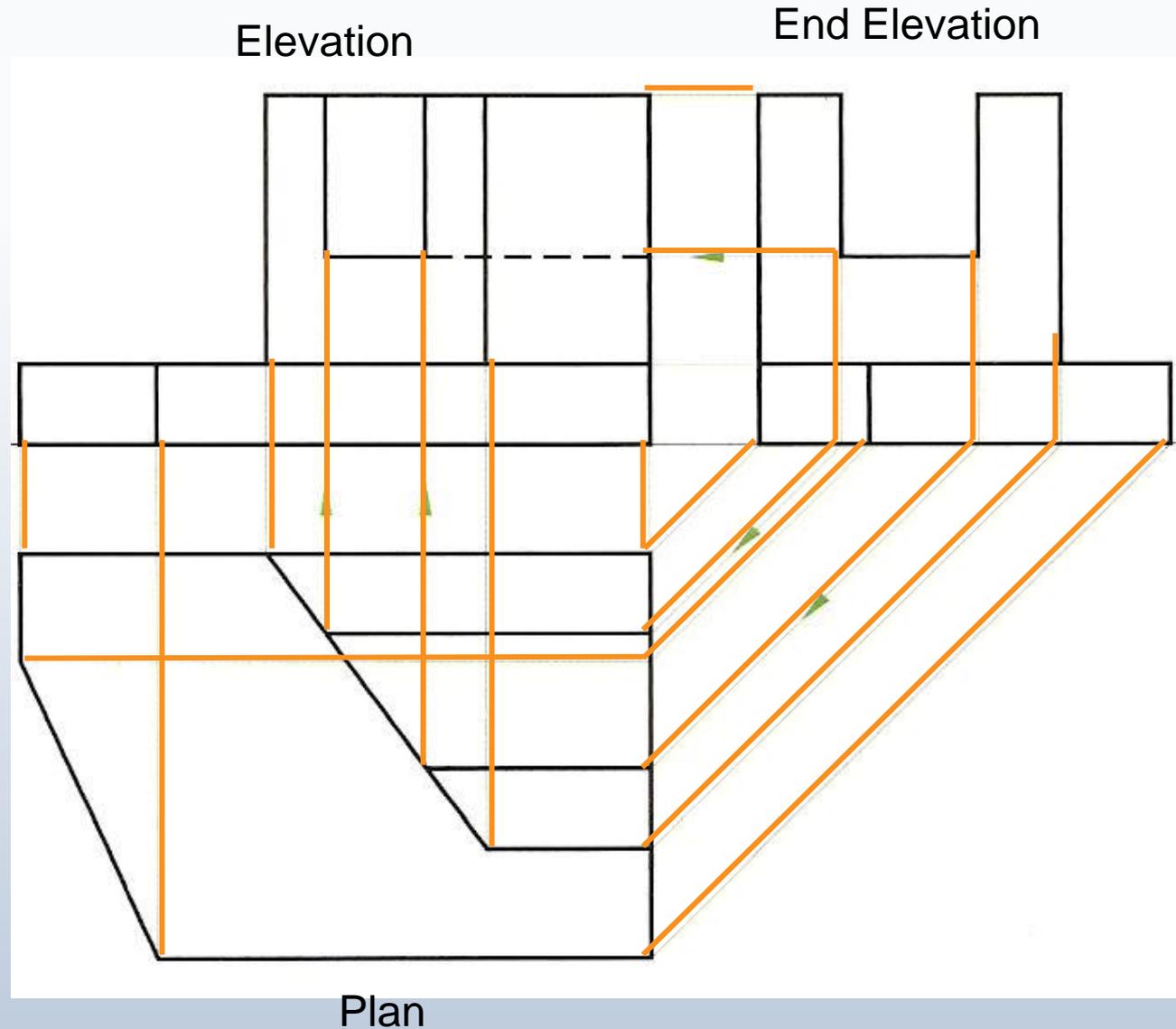
Orthographic Projection 2

1. The incomplete elevation and the entire end view are drawn.
2. The plan is then projected as normal.
3. The upper inclined surface appears as an edge in the plan. Then the remaining lines on the object can be projected from the end view to intersect this line in the plan.
4. Now that the lengths of these lines have been determined they can be projected to the elevation and the drawing completed.



Orthographic Projection 2

1. The incomplete elevation and the entire end view are drawn.
2. The plan is then projected as normal.
3. The upper inclined surface appears as an edge in the plan. Then the remaining lines on the object can be projected from the end view to intersect this line in the plan.
4. Now that the lengths of these lines have been determined they can be projected to the elevation and the drawing completed.

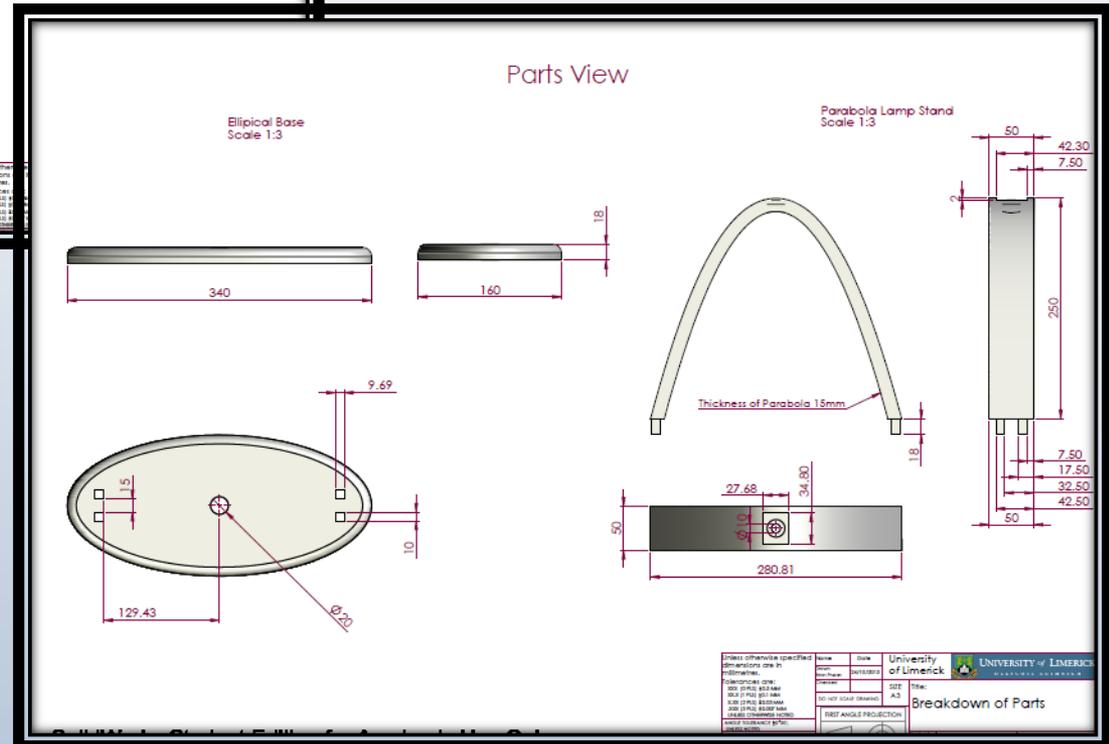
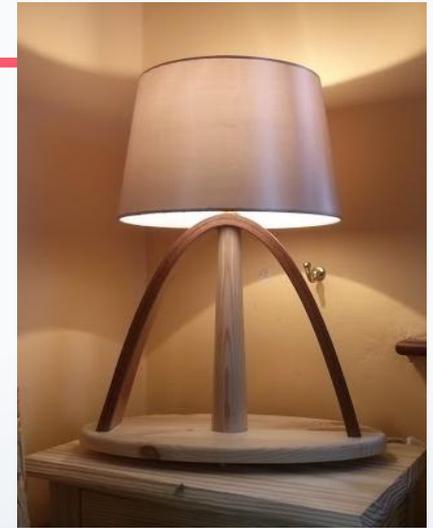
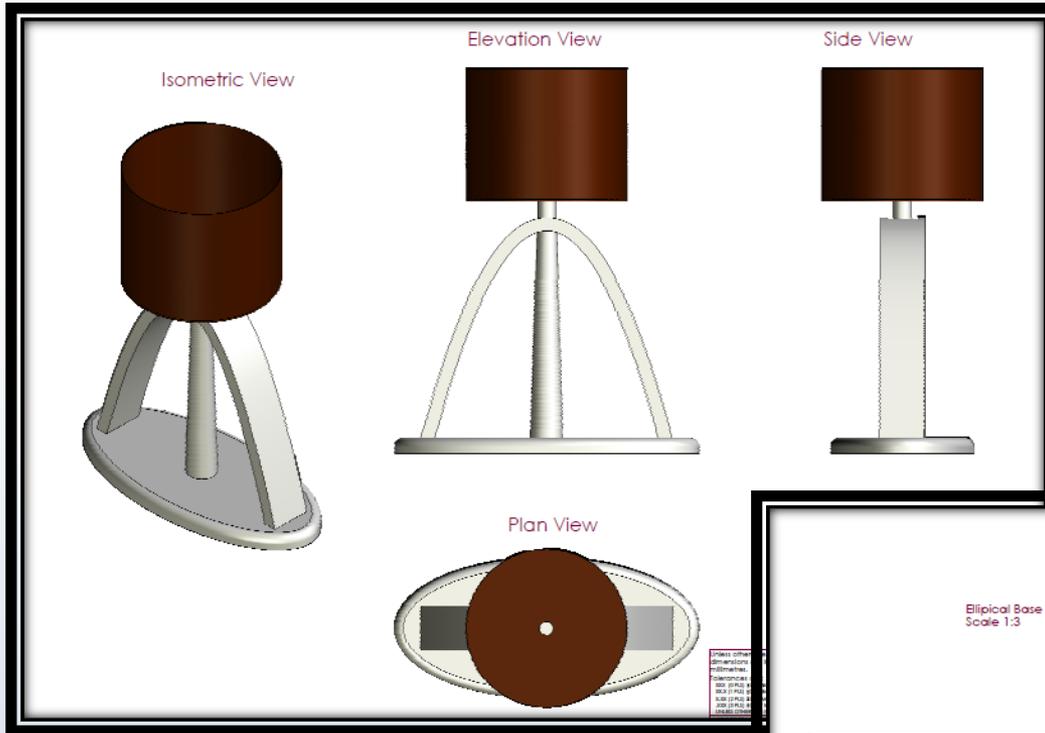


Orthographic Projection 2

These lads will do a recap on Orthographic Projection for us!

<http://www.youtube.com/watch?v=HDv3NEyuYAY>

Orthographic Projection 2

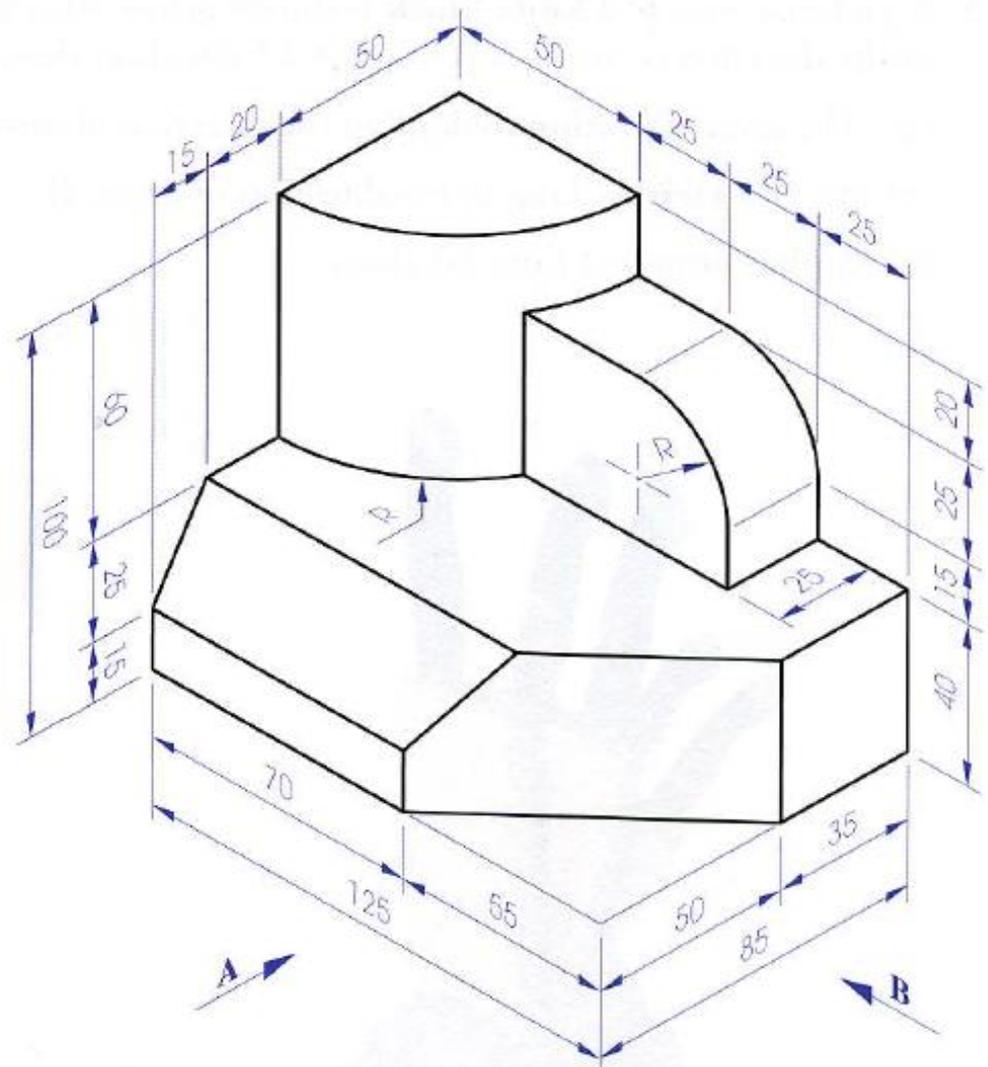
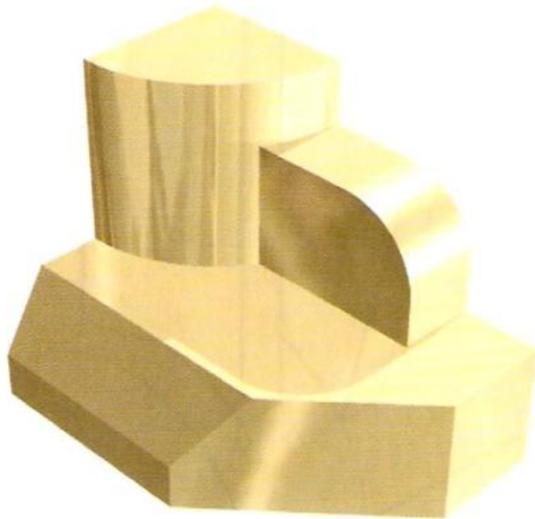


Orthographic Projection 2

Sheet 5 - Title: Component

The figure over shows a pictorial view of a **component**. A photo-realistic image of the component is also shown. Draw full-size:

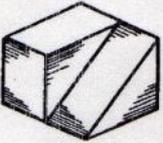
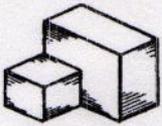
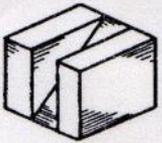
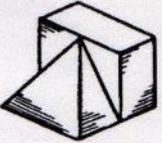
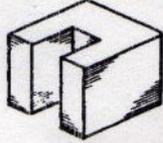
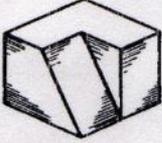
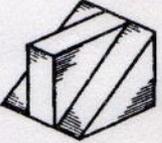
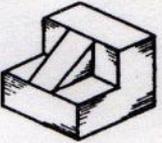
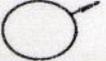
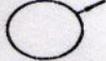
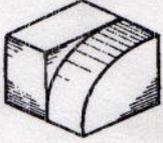
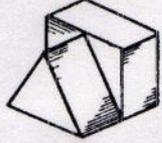
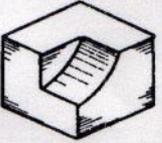
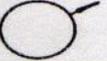
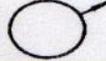
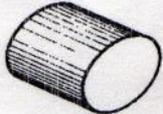
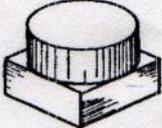
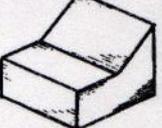
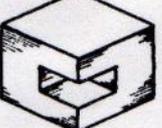
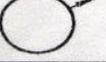
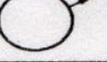
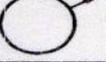
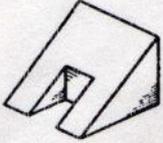
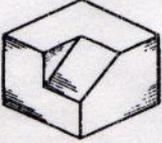
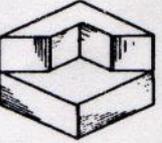
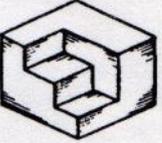
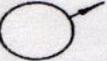
- An **elevation** looking in the direction of arrow **A**.
- An **end view** looking in the direction of arrow **B**.
- A **plan** projected from (a) above.



STUDENT _____

GROUP _____

SCORE _____

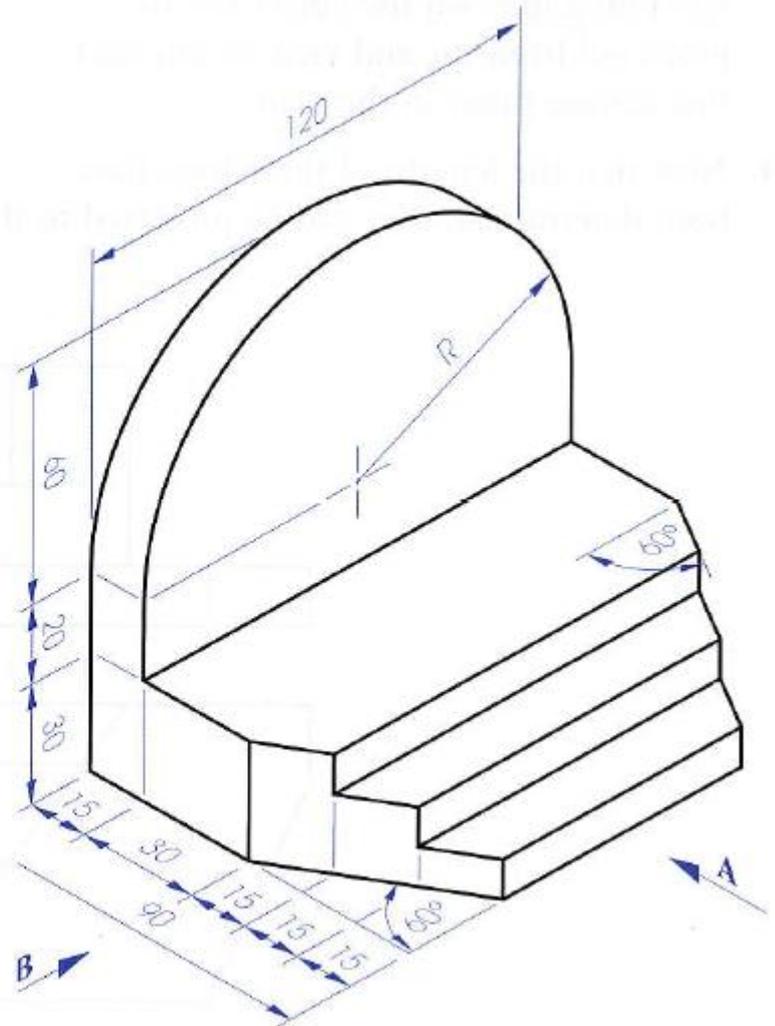
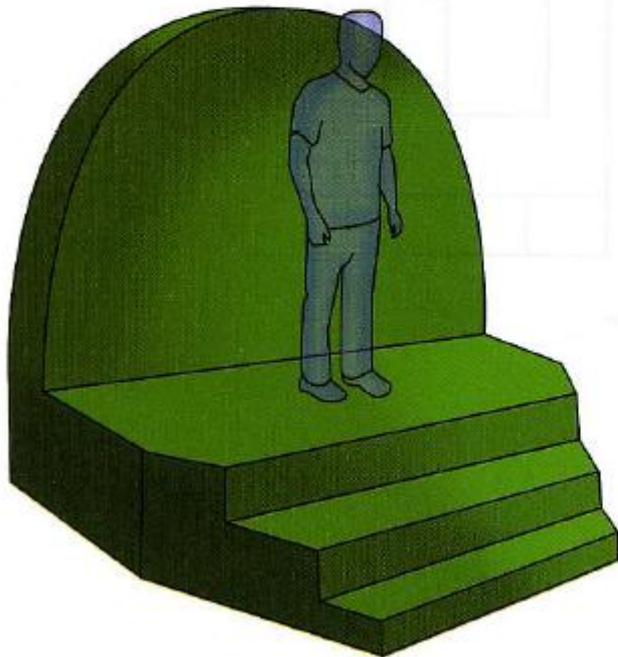
STUDENT _____		GROUP _____		SCORE _____			
A		B		C		DD	
							
E		F		G		H	
							
I		J		K		L	
							
M		N		O		P	
							
Q		R		S		T	
							
1	2	3	4	5	6	7	8
							
9	10	11	12	13	14	15	16
							
17	18	19	20	21	22	23	24
							

Orthographic Projection 2

Homework 1 - Title: Platform

The figure below shows a pictorial view of a **platform**. *Each step is of equal height.* Draw full-size:

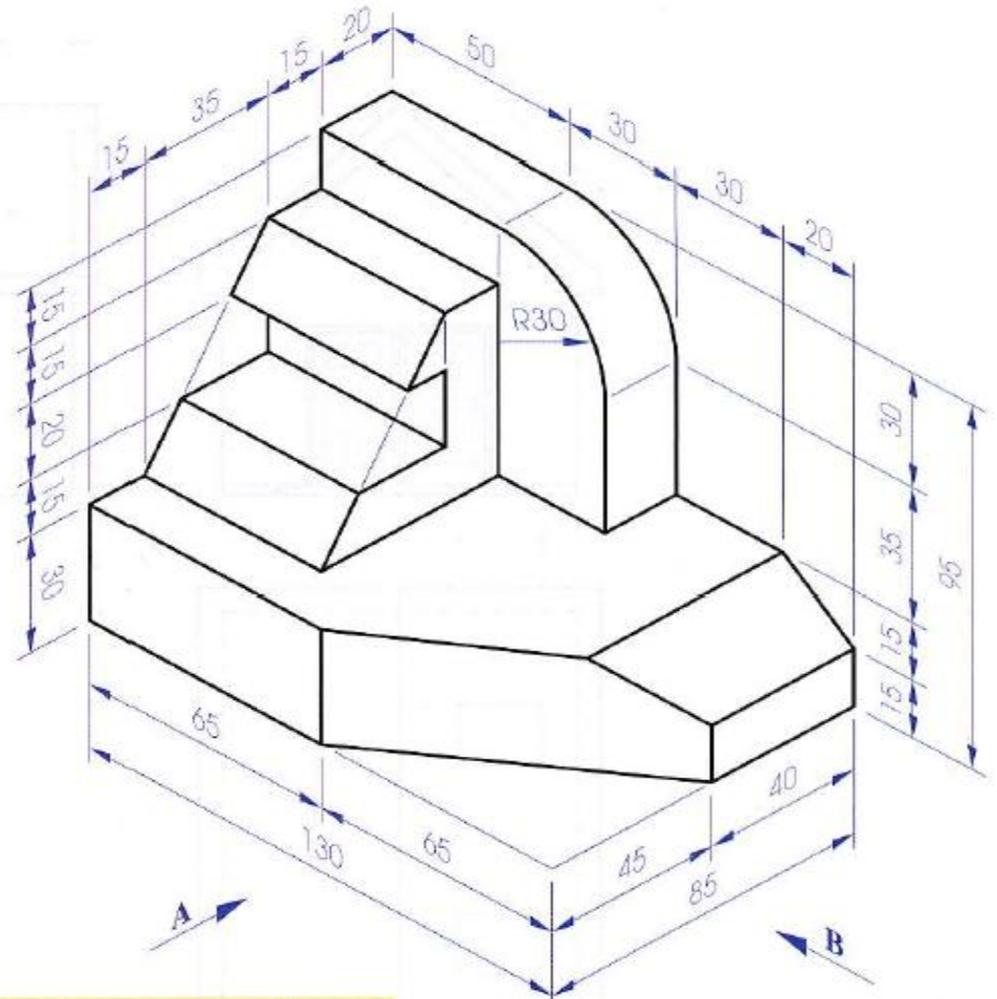
- An **elevation** looking in the direction of arrow **A**.
- An **end elevation** looking in the direction of arrow **B**.
- A **plan** projected from (a) above.



Orthographic Projection 2

7. A pictorial view of a **component** is shown below. Draw full-size:

- (a) An **elevation** looking in the direction of arrow **A**.
- (b) An **end view** looking in the direction of arrow **B**.
- (c) A **plan** projected from (a) above.



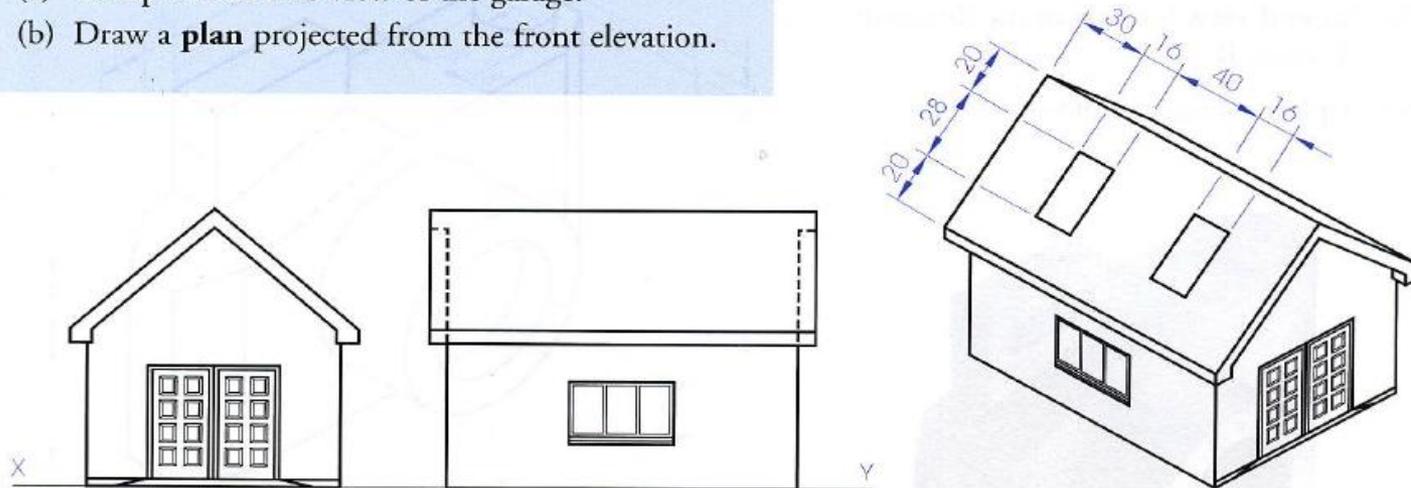
Orthographic Projection 2

This slide deals with the topic of **True Lengths** and how we find them in Orthographic Projection. What is a true length? Take a look at the drawing below and see if you can spot where you need to find the true length in order to complete the drawing.

Example

The figure below shows a pictorial view of a **garage**. Also shown are the front elevation and incomplete end elevation of the garage.

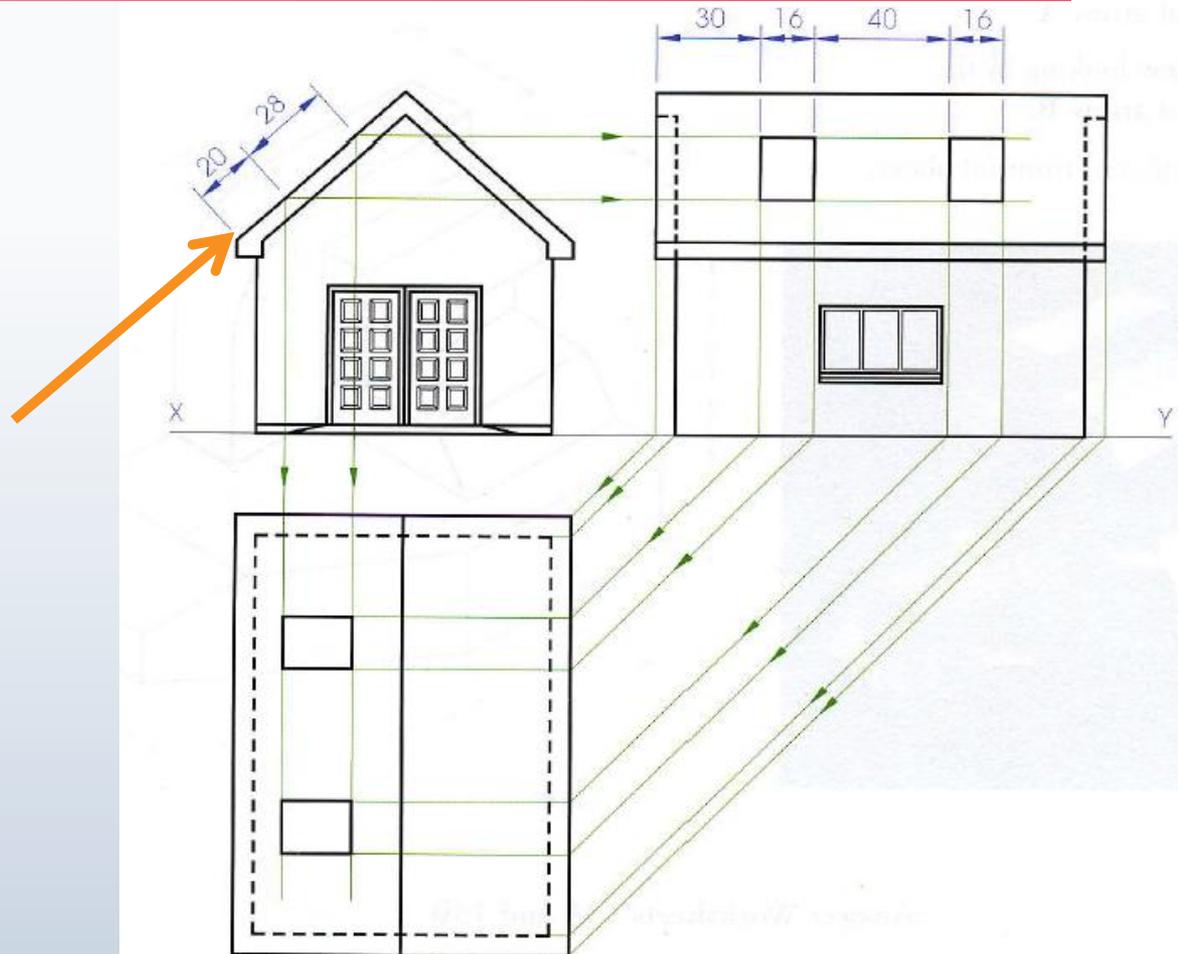
- Complete the **end view** of the garage.
- Draw a **plan** projected from the front elevation.



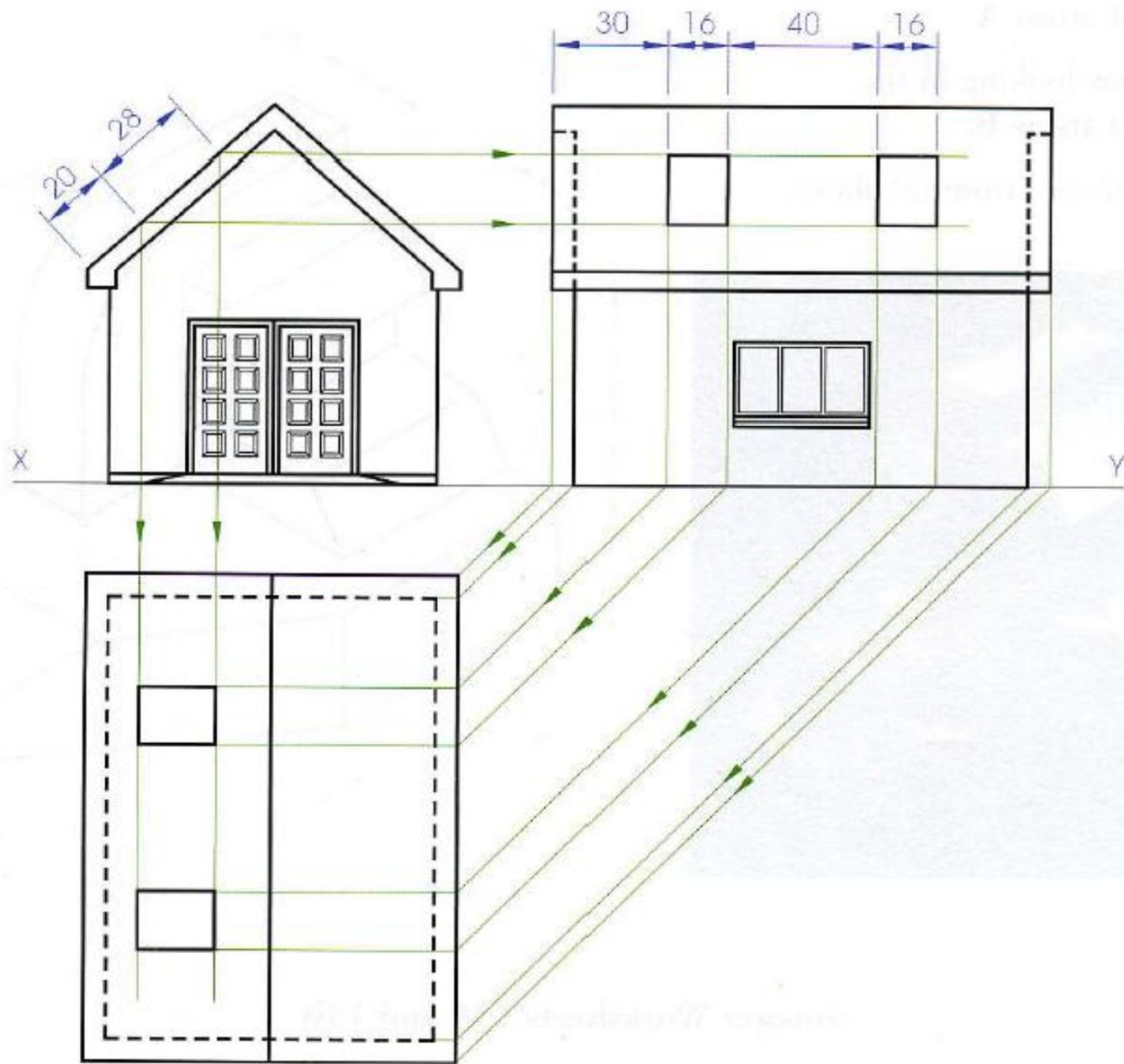
1. The true distances (20 and 28) can be marked-off along the roof surface, which appears as an edge, in elevation as shown below. This establishes the heights for the roof windows.
2. These heights can be projected to the end elevation where the appropriate widths can be marked-off.
3. The plan is then projected in the normal manner.

Orthographic Projection 2

1. The true lengths (20 and 28) can be marked off along the roof surface, which appears as an edge, in elevation as is shown. This establishes the heights for the roof windows.
2. These heights can now be projected to end view and plan where relevant widths and heights can be marked off.



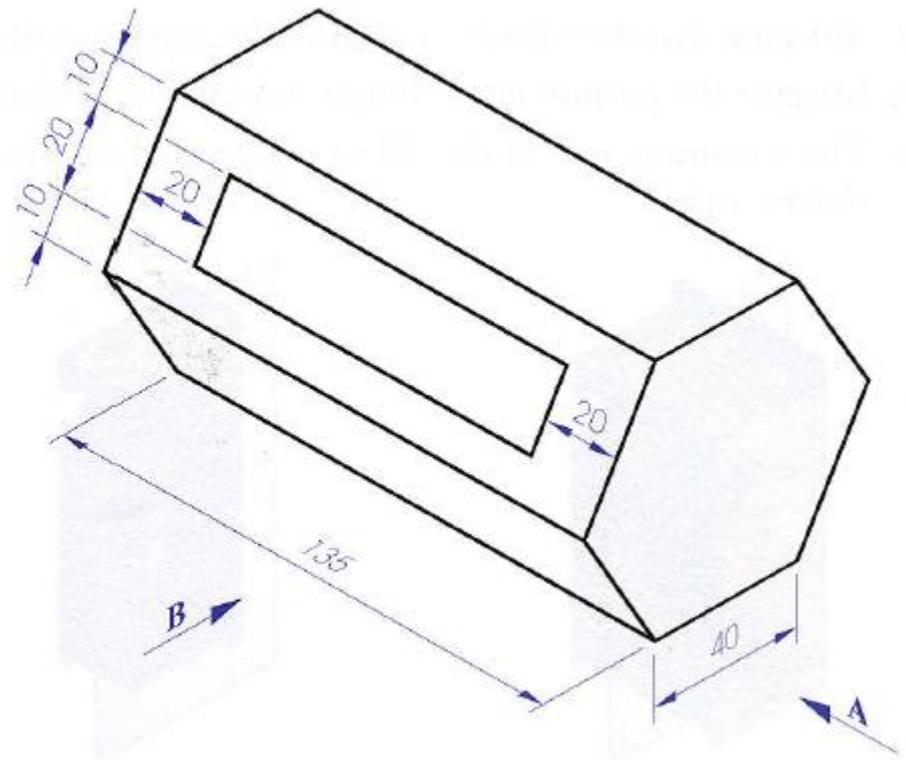
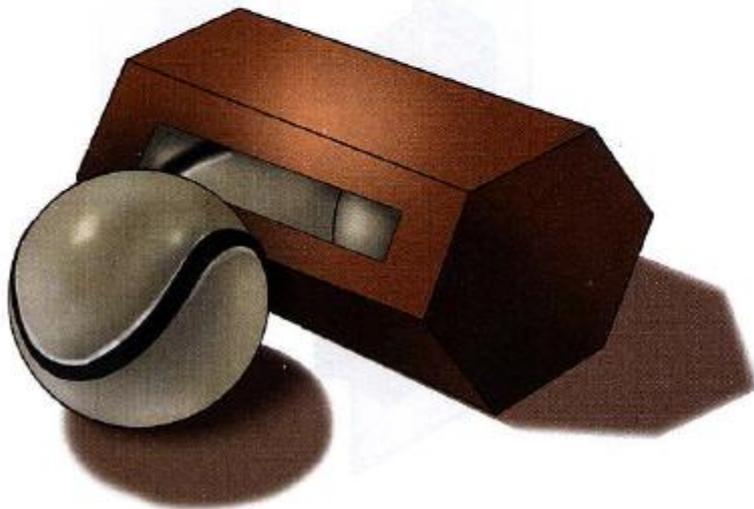
The true length of any line can be determined if we look at 90° to that line



Orthographic Projection 2

Sheet 6 - Title: Package

1. The figure below, right shows a pictorial view of a **package for slottars**. It is based on a **regular hexagonal prism**. Draw full-size:
 - (a) The **front elevation** looking in the direction of arrow **A**.
 - (b) An **end view** looking in the direction of arrow **B**.
 - (c) A **plan** projected from the front elevation.

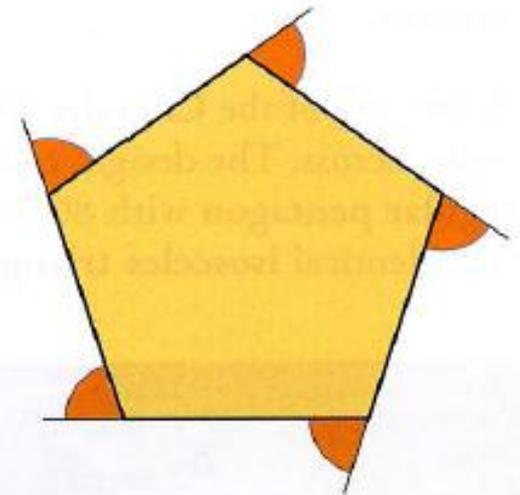


Exterior Angle of a Polygon

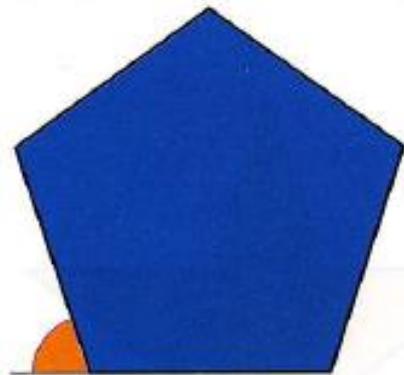
An **exterior angle** of a polygon is formed when one of its sides is extended through a vertex. The figure over shows a pentagon with an exterior angle at each of its five vertices. The five turns add up to 360° .

The sum of the exterior angles of any polygon is 360° . To calculate the exterior angle of any regular polygon, we use the following formula:

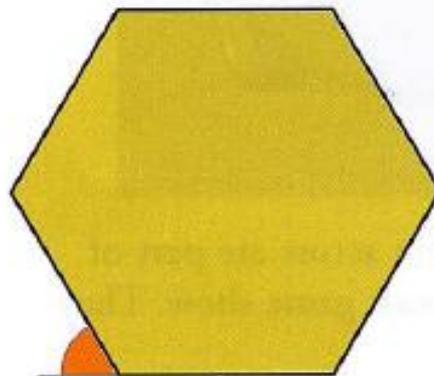
$$\text{Exterior Angle} = 360^\circ \div \text{number of sides.}$$



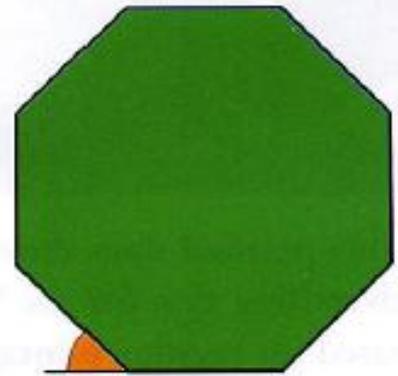
The figure below shows how to calculate the **exterior angle** for a **regular pentagon**, a **regular hexagon** and a **regular octagon**.



$$360^\circ \div 5 = 72^\circ$$



$$360^\circ \div 6 = 60^\circ$$



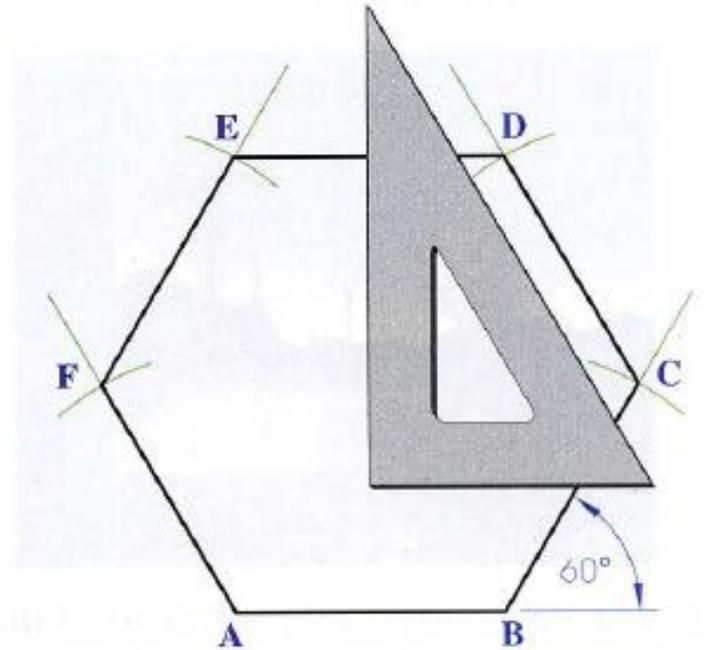
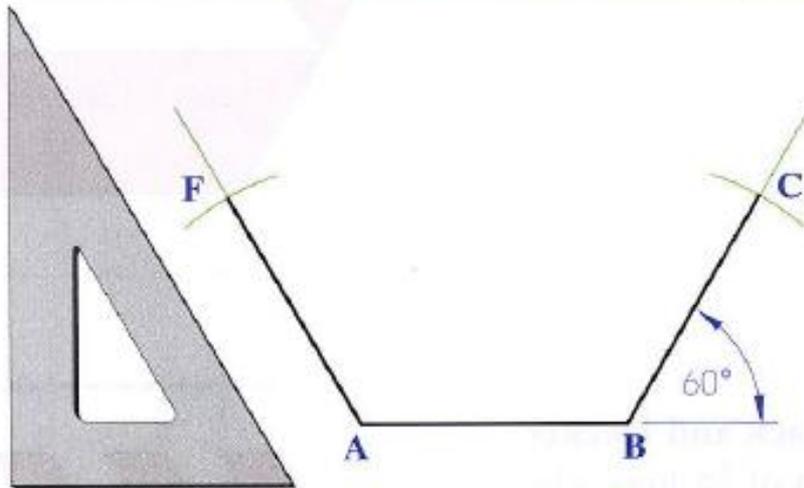
$$360^\circ \div 8 = 45^\circ$$

Example 1

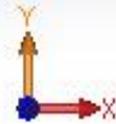
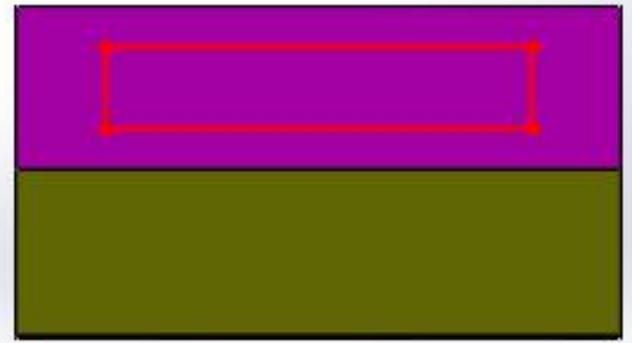
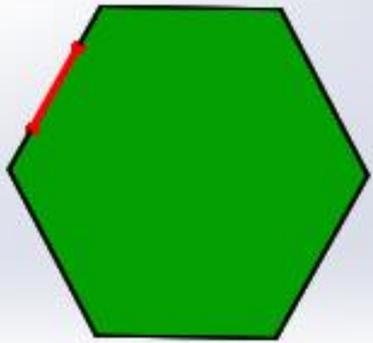
Construct a **regular hexagon** of side 70 mm.

A **regular hexagon** has six equal sides and six equal angles.

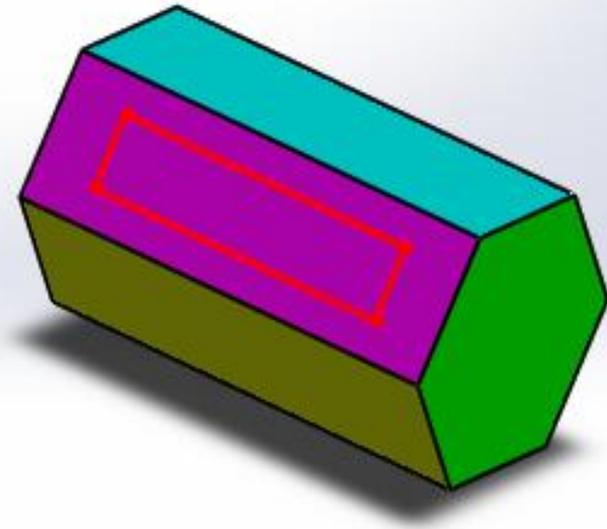
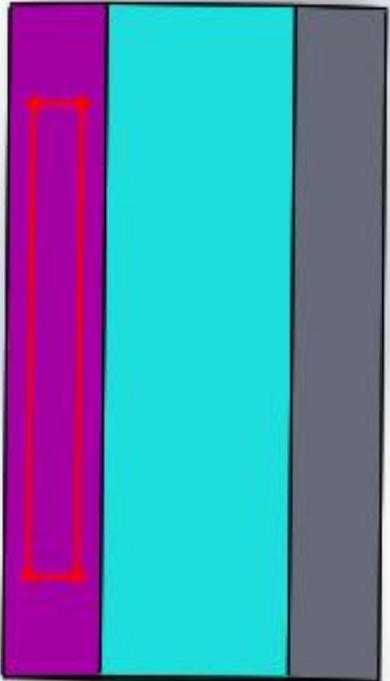
The **exterior angle** for a regular hexagon is $360^\circ \div 6 = 60^\circ$.



1. Draw the base AB of length 70 mm.
2. Using the 30°/60° set square, draw 60° lines from A and B. Mark off the two sides of length 70 mm from A and B, respectively.
3. Complete the hexagon using the 30°/60° set square to draw the two inclined sides of length 70 mm and the ruler to draw the horizontal side.



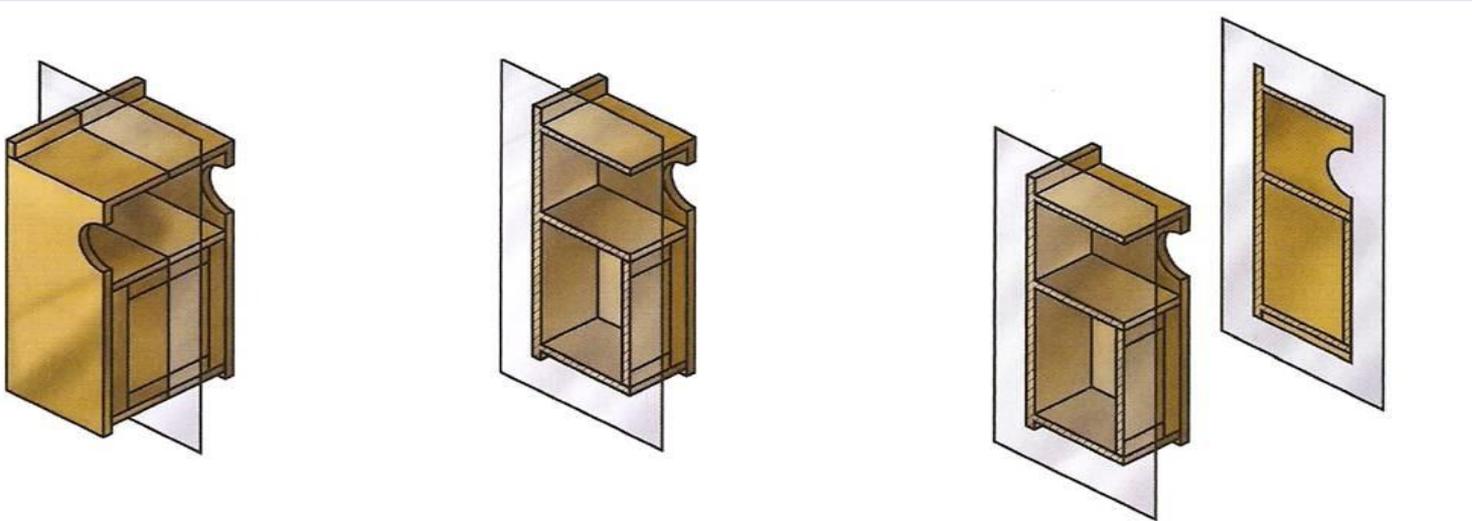
☞ *Front



Orthographic Projection 2

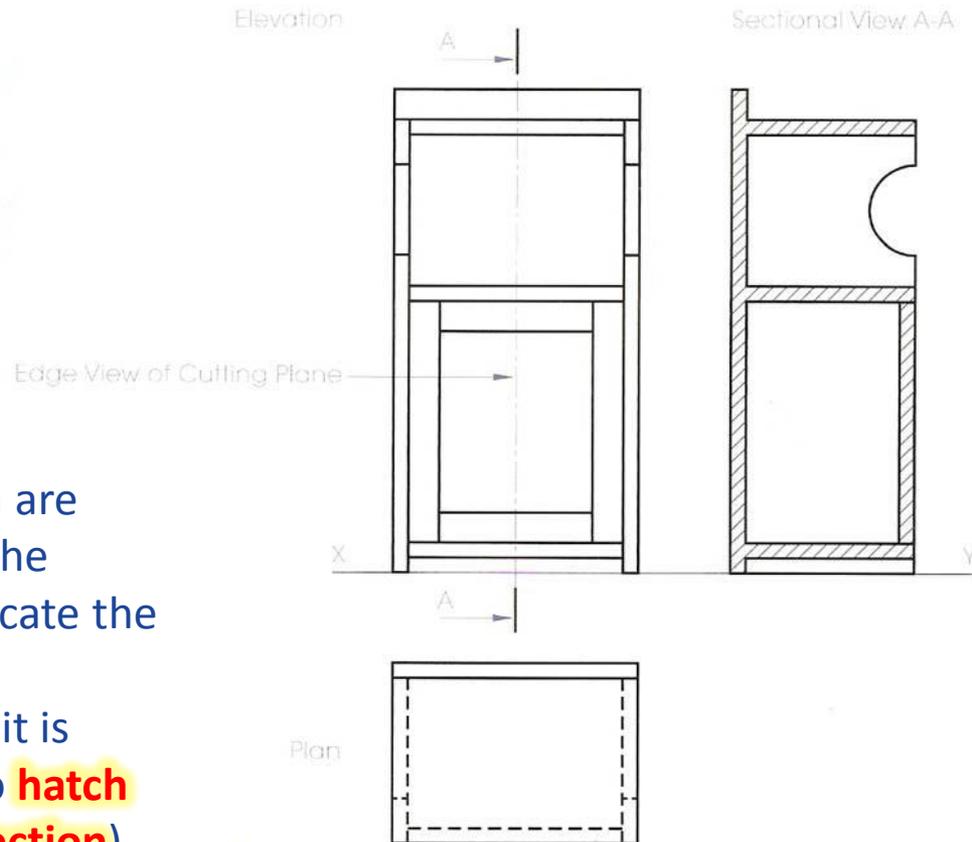
Sectional Views: An object with internal detail can be shown more clearly if a sectional view is drawn.

1. Imagine that the object is cut by an imaginary cutting plane, below left.
2. Imagine the portion of the object nearest you is removed, below centre,
3. The remaining part of the object is projected in the normal manner to show a sectional view, below right.



Orthographic Projection 2

The elevation and plan of a **locker** are shown over. The **Sectional View A-A** which results from the cutting plane AA is also shown.

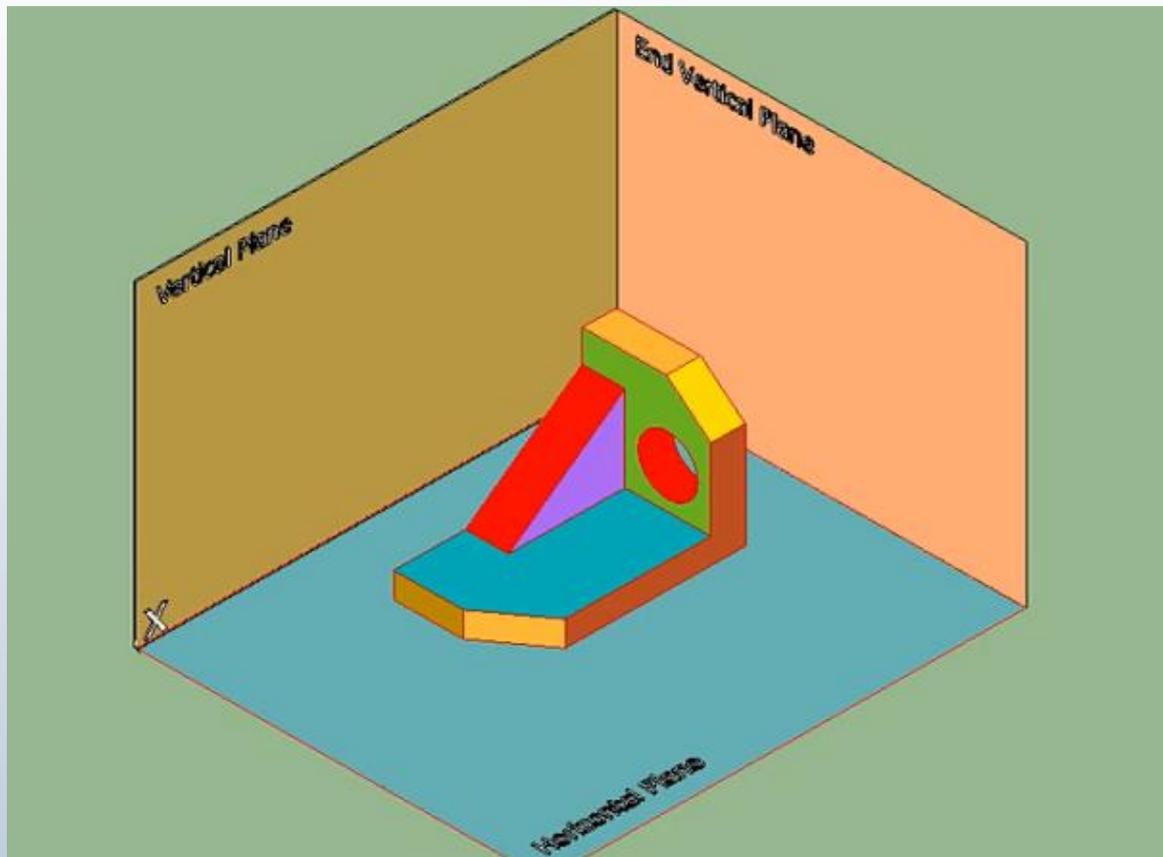


The arrows, which are perpendicular to the cutting plane, indicate the viewing direction.

In sectional views it is normal practice to **hatch** the cut surface (**section**) with equally spaced lights lines at 45°

Orthographic Projection 2

Recap on Orthographic Projection



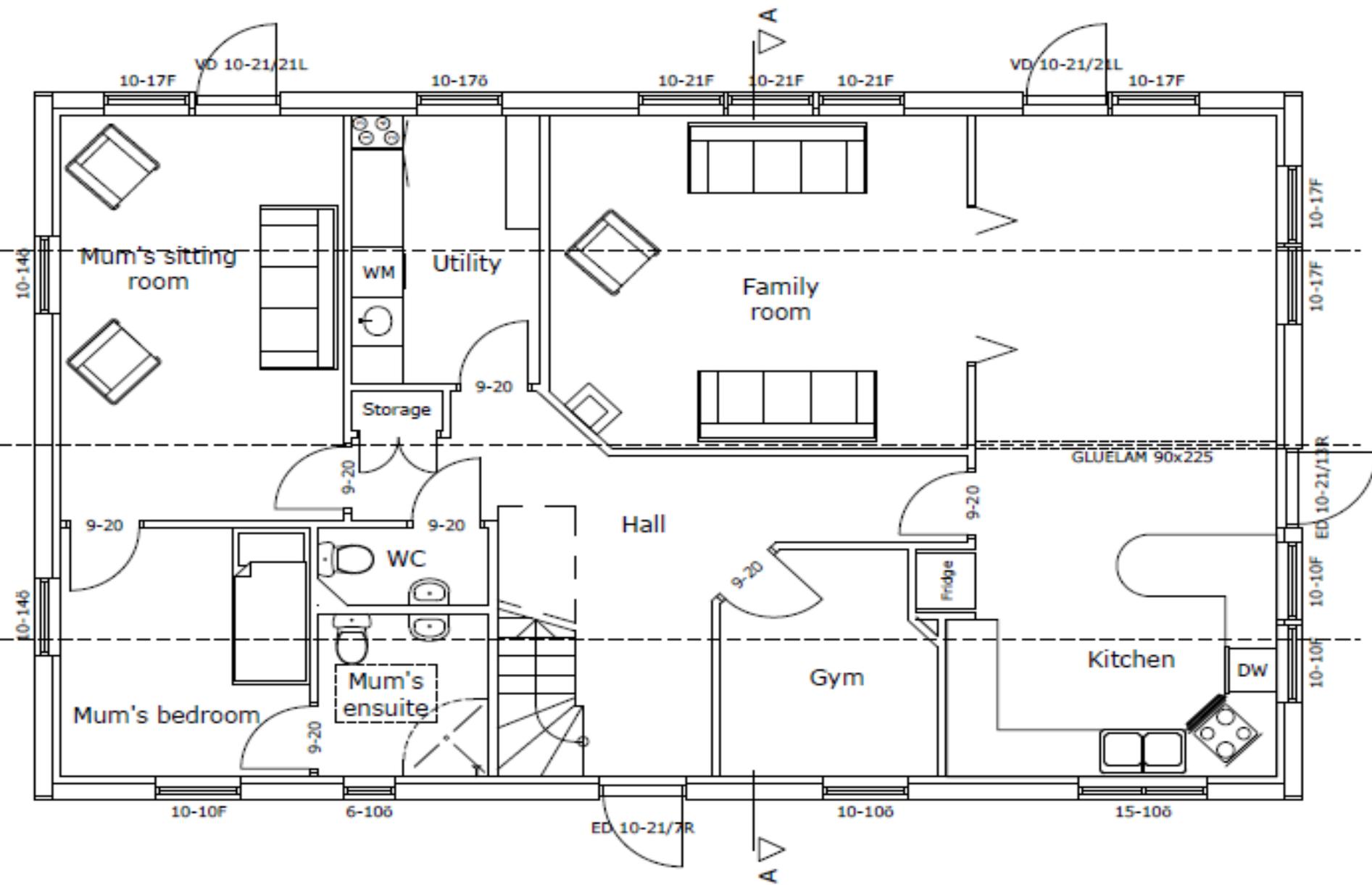
Orthographic Projection 2

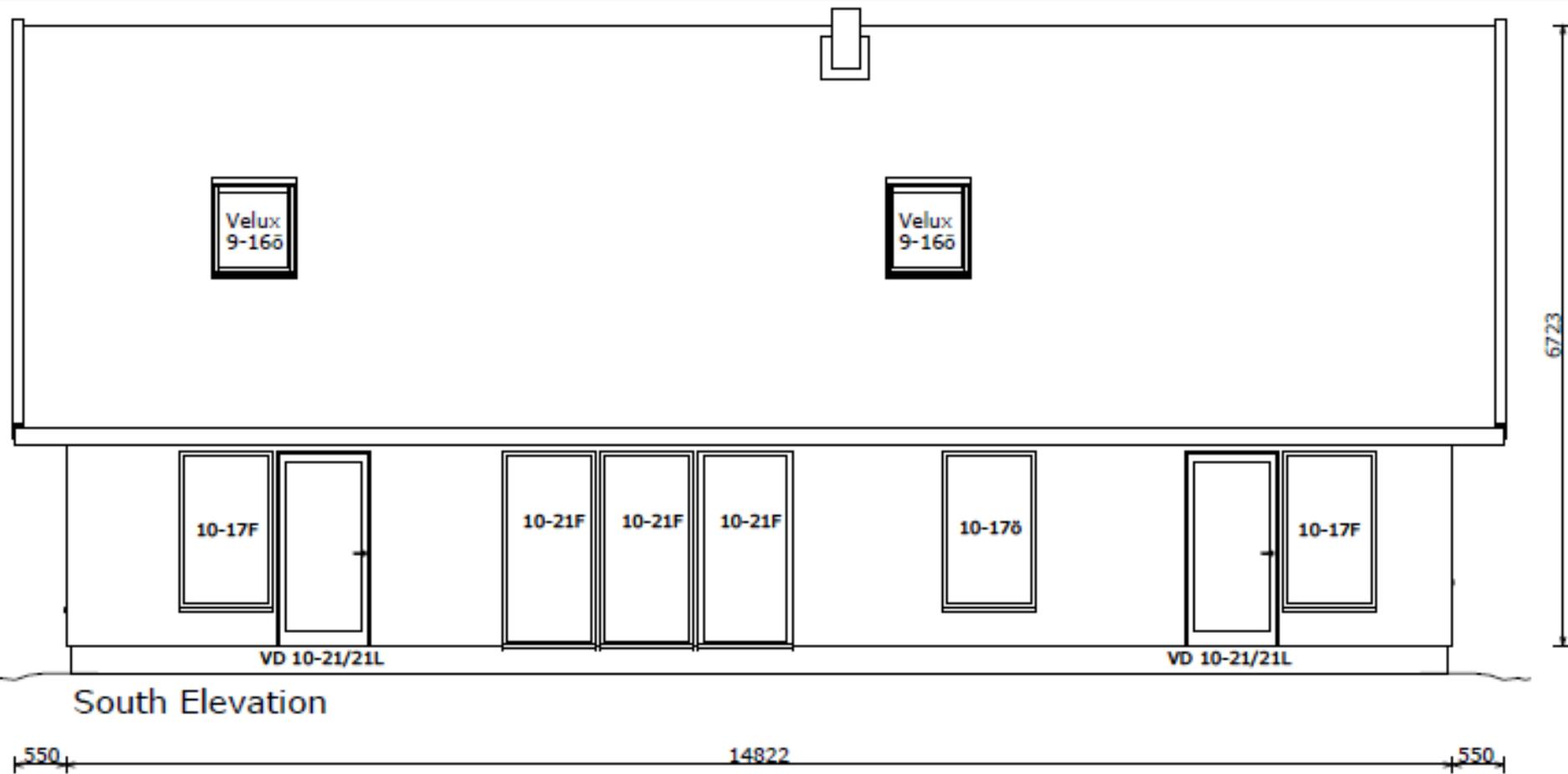
Where is it used?

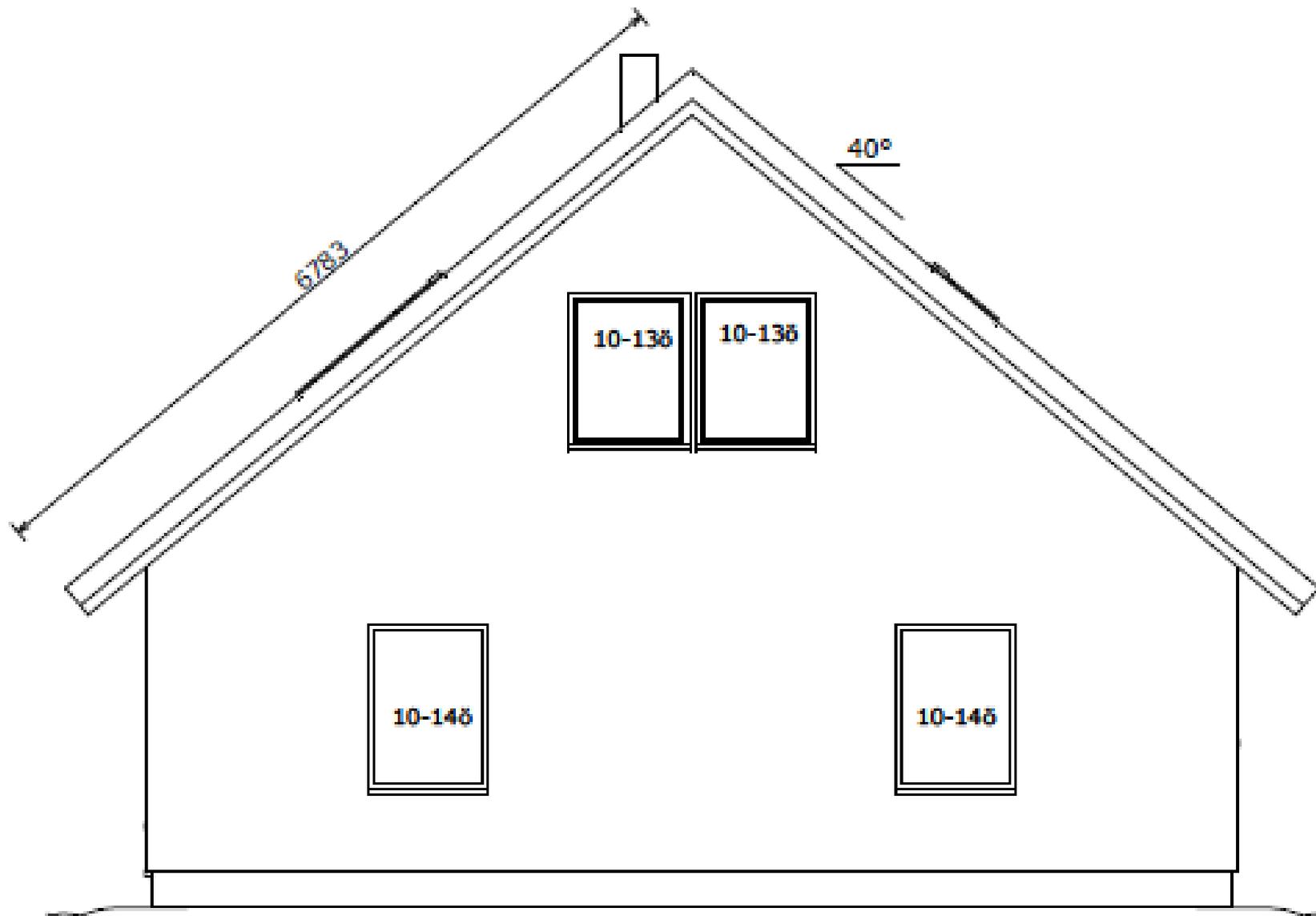
Why is it used?

Who used it?







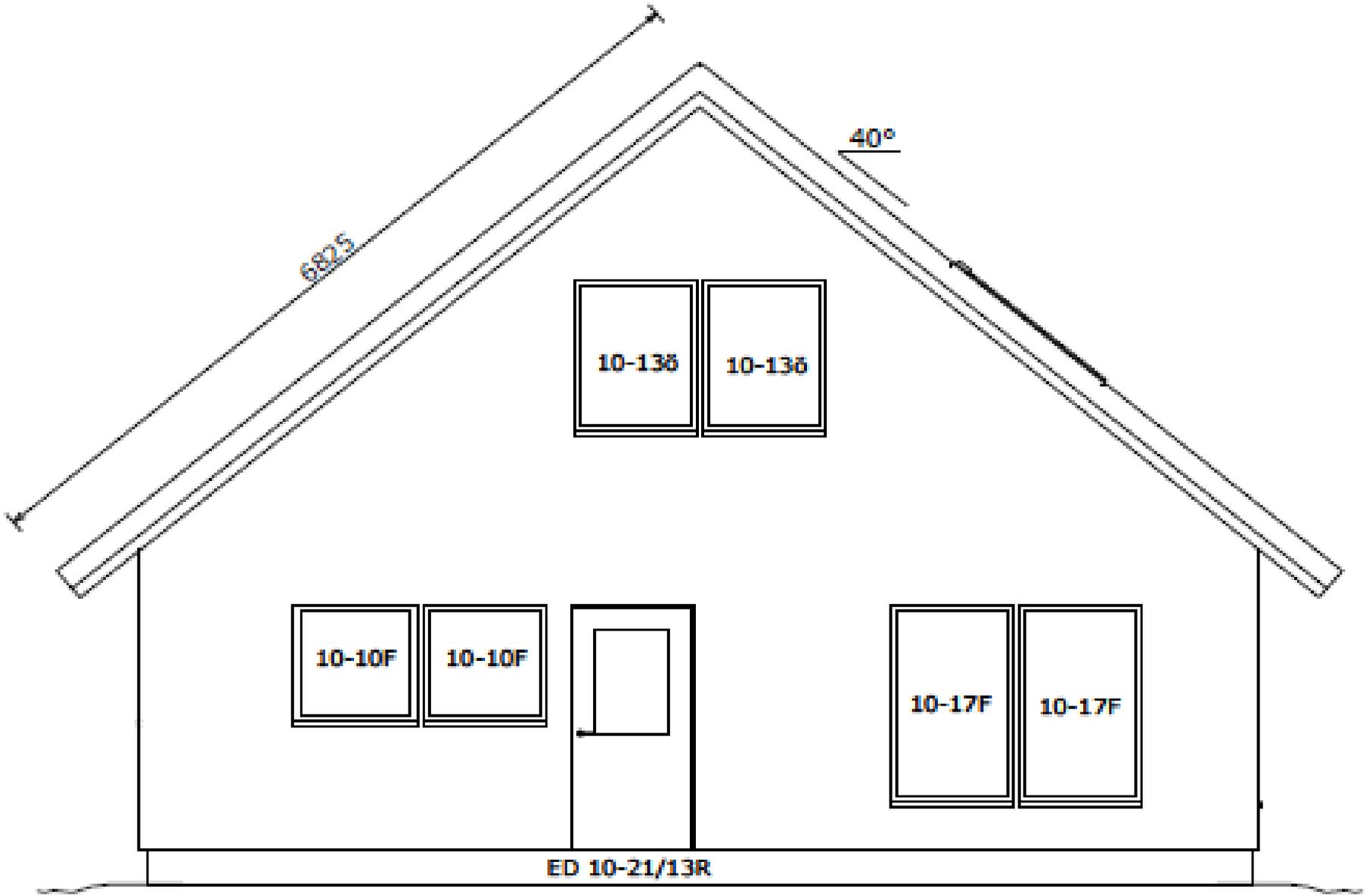


East Elevation

550

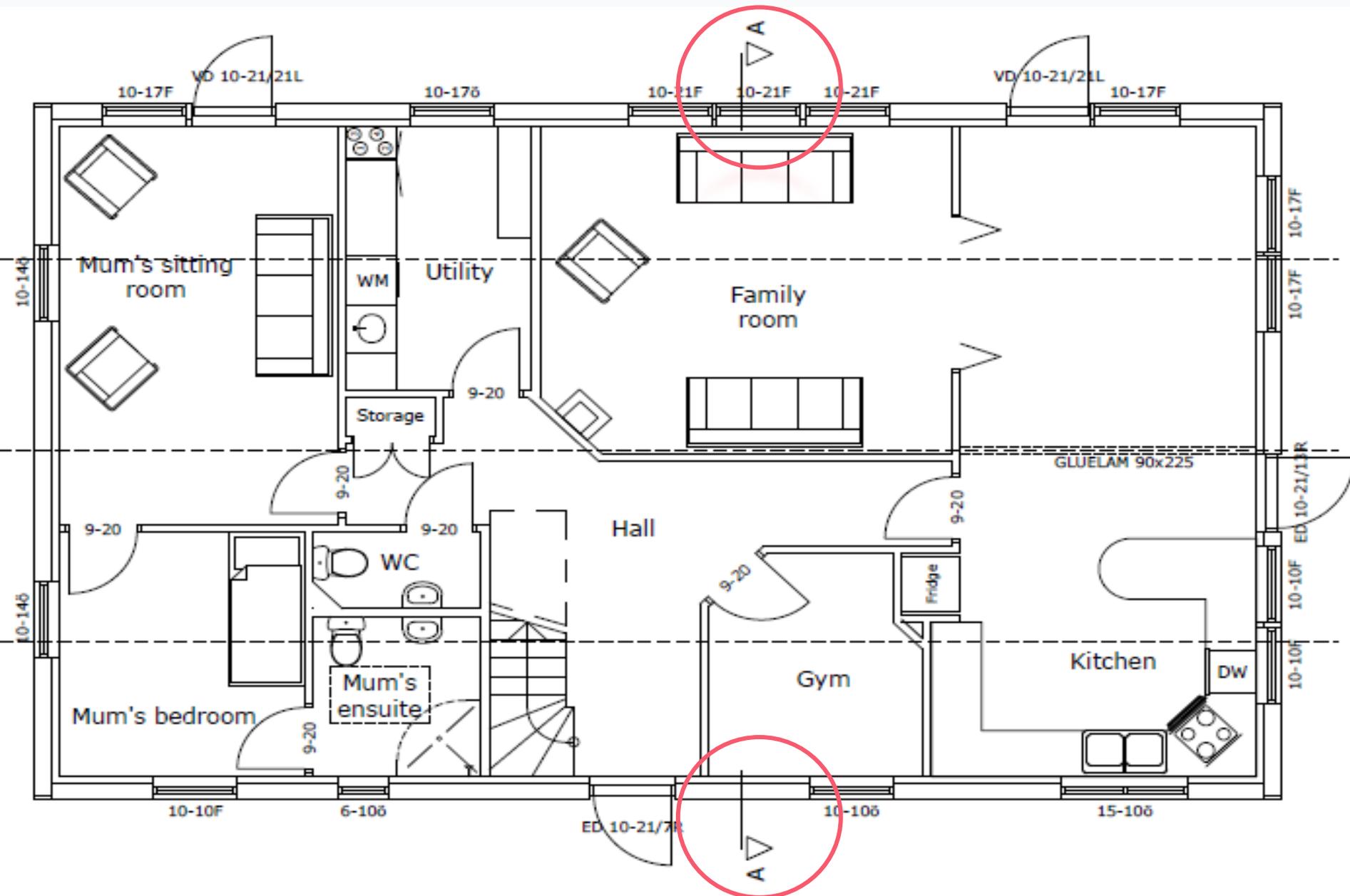
9106

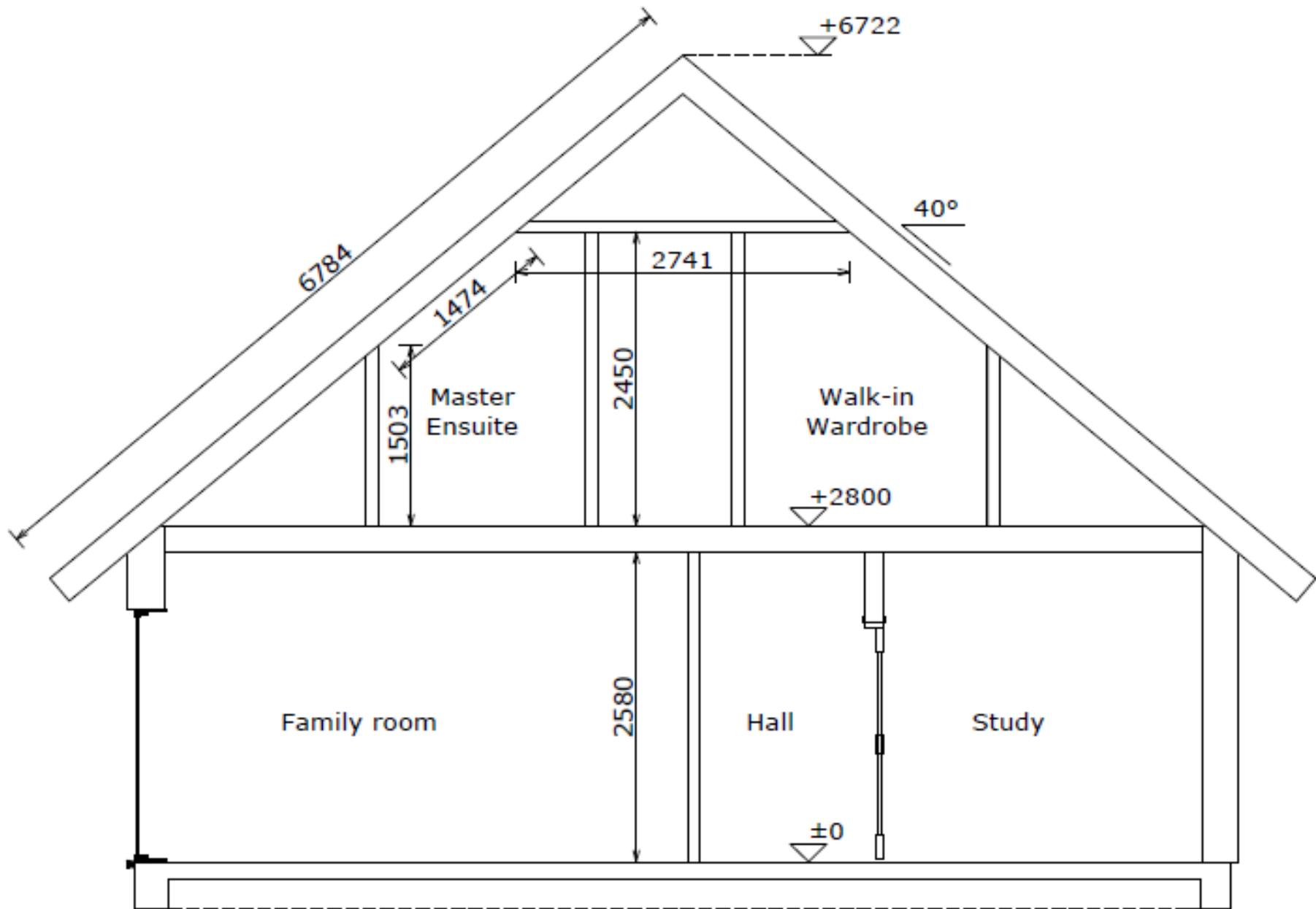
550



West Elevation





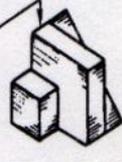
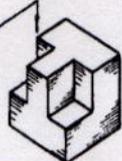
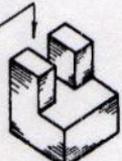
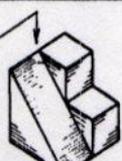
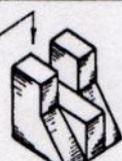


Section A-A

STUDENT _____

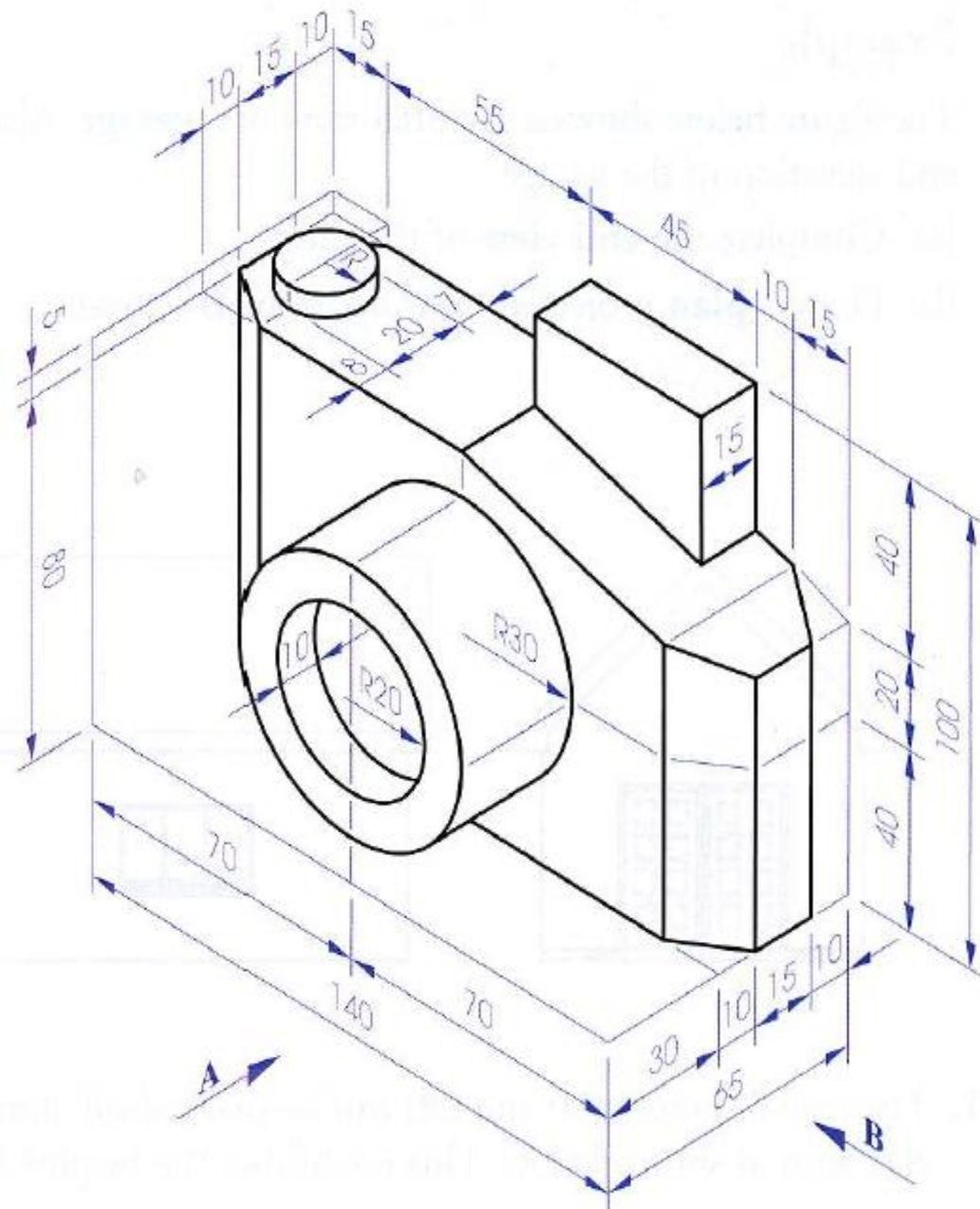
GROUP _____

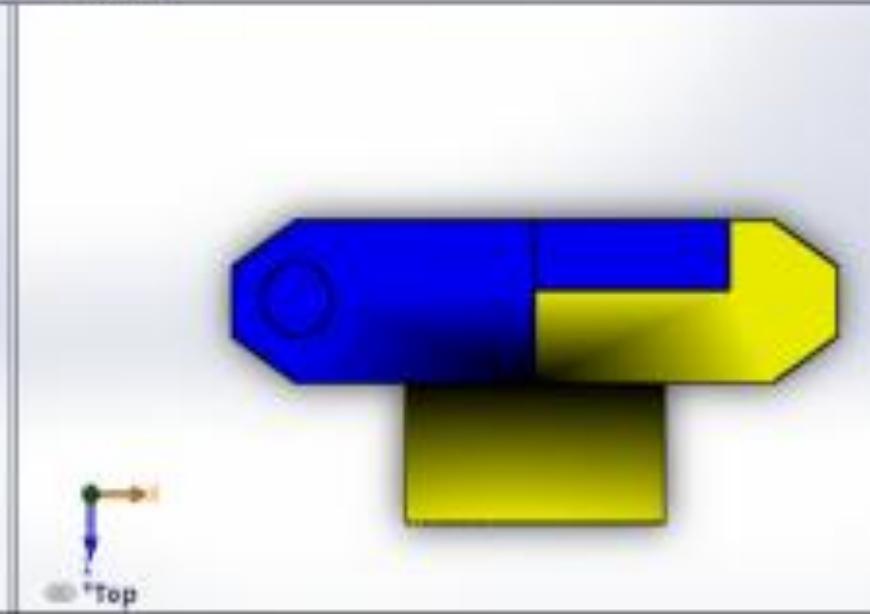
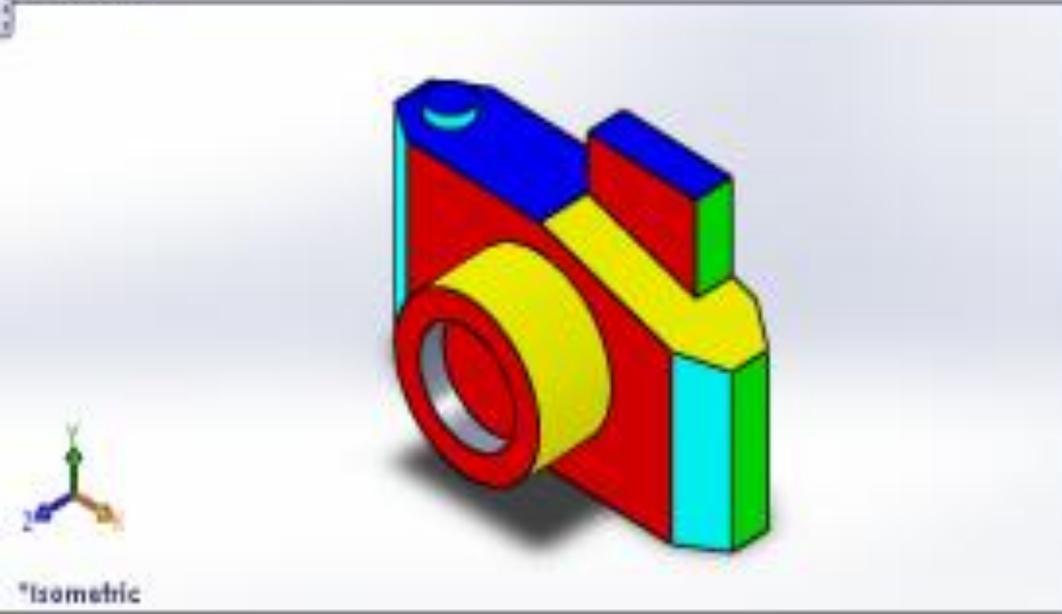
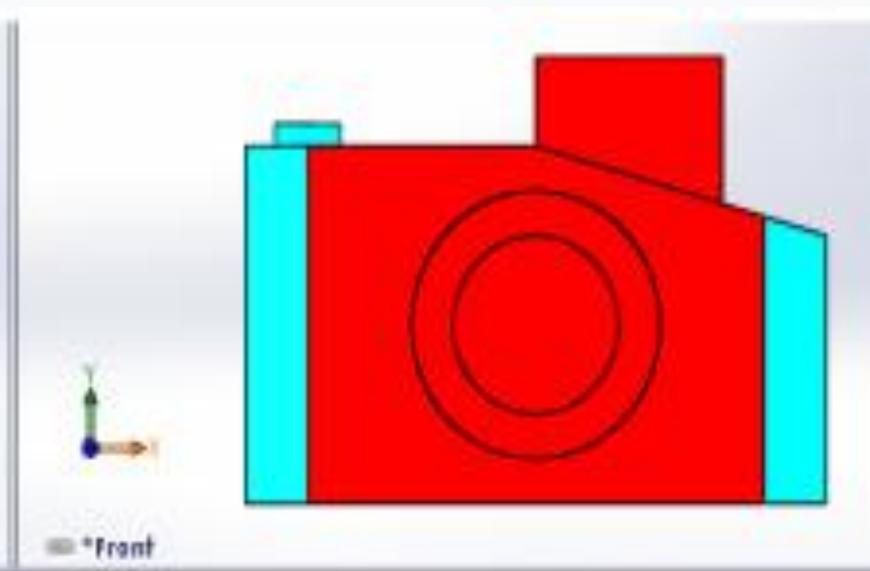
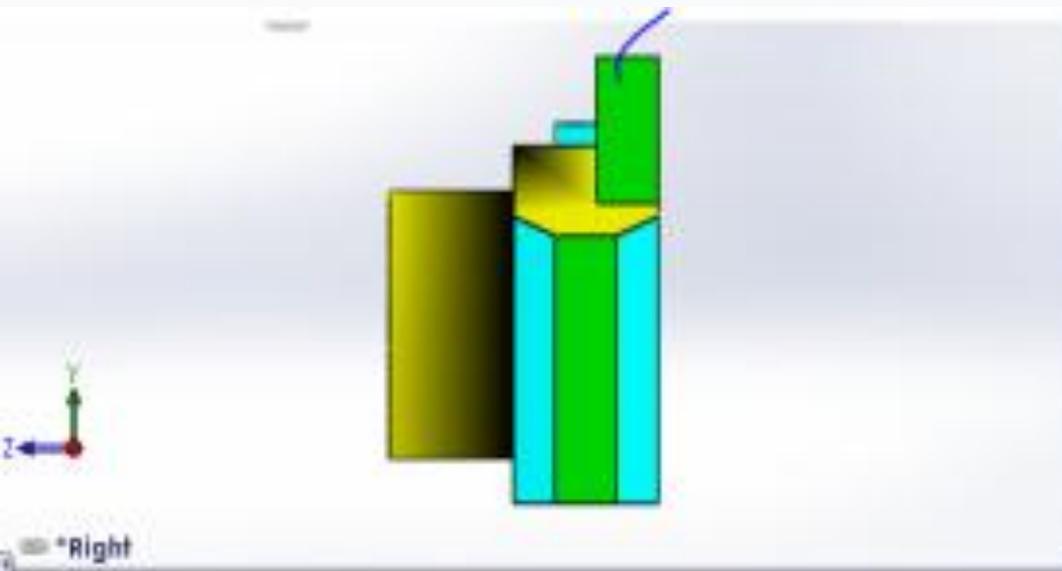
SCORE _____

A		B		C		D									
E		F		G		H									
I		J		K		L									
M		N		O		P									
Q		R		S		T									
1		2		3		4		5		6		7		8	
9		10		11		12		13		14		15		16	
17		18		19		20		21		22		23		24	

The figure over shows a pictorial view of a camera. Draw full-size:

- (a) An **elevation** looking in the direction of arrow **A**.
- (b) An **end view** looking in the direction of arrow **B**.
- (c) A **plan** projected from (a) above.



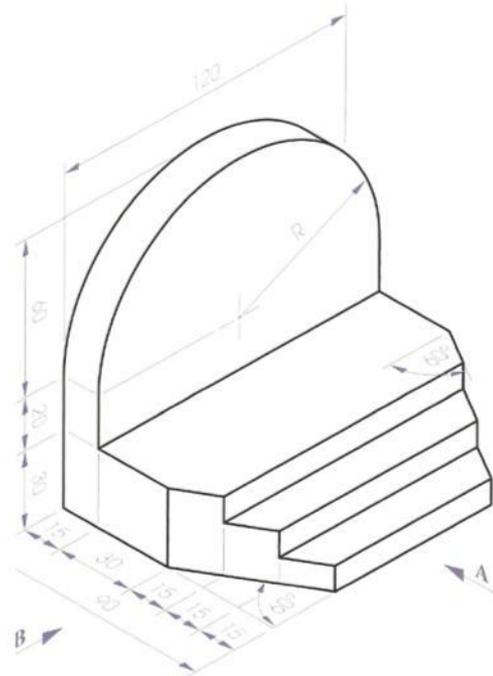
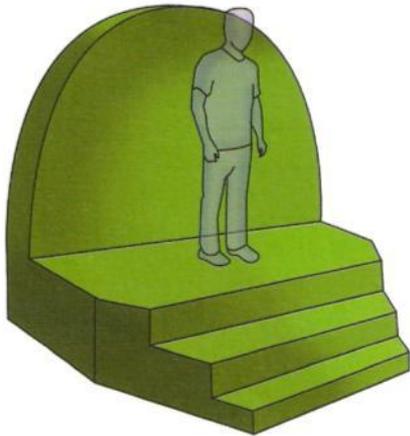


Orthographic Projection 2

Title: Platform

The figure below shows a pictorial view of a **platform**. *Each step is of equal height.* Draw full-size:

- (a) An **elevation** looking in the direction of arrow **A**.
- (b) An **end elevation** looking in the direction of arrow **B**.
- (c) A **plan** projected from (a) above.



Blackwater Community School

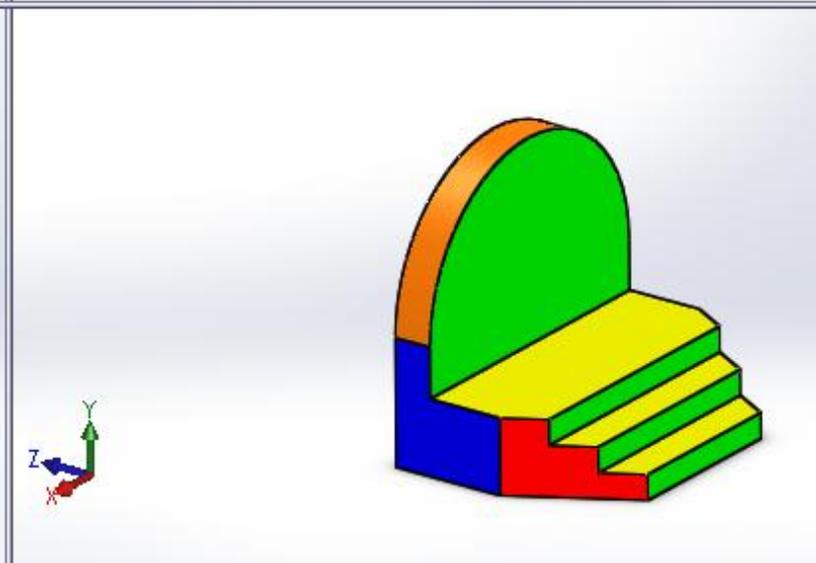
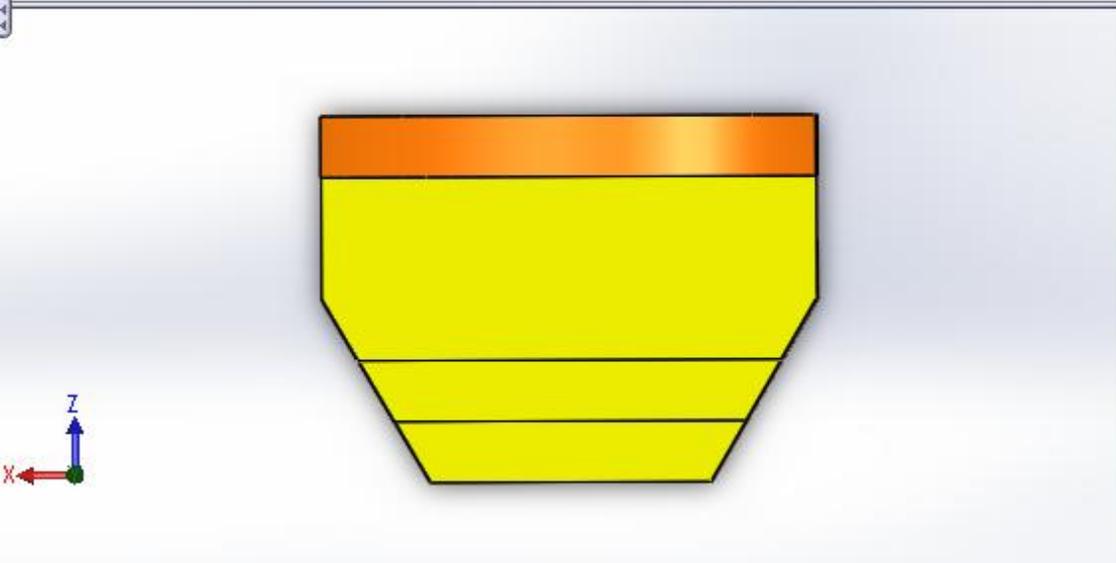
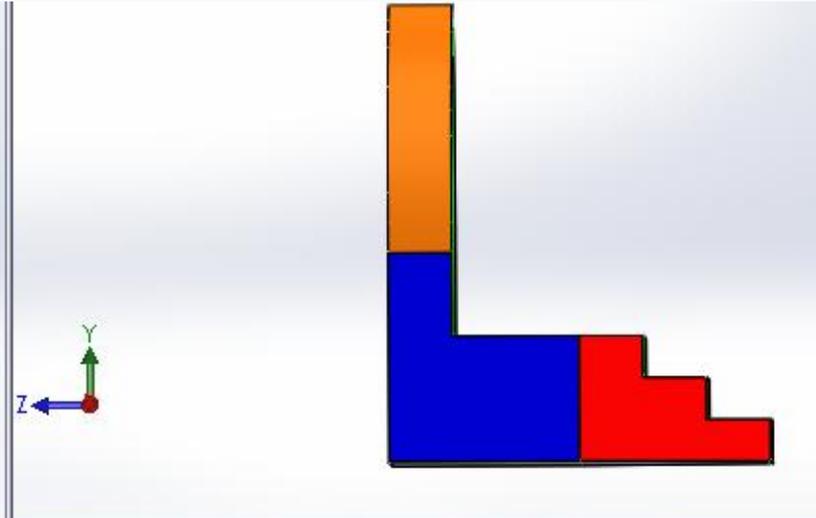
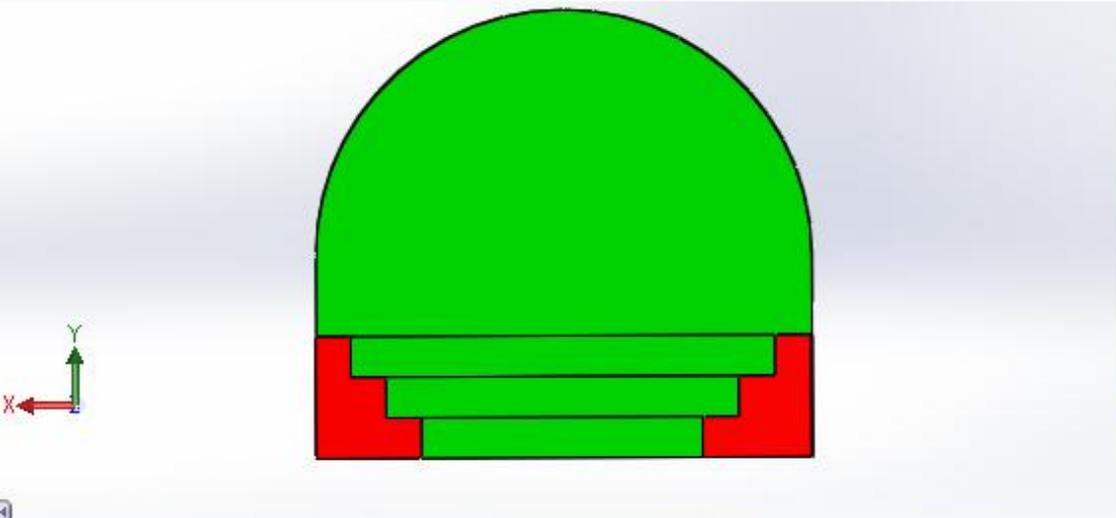
Name:

Title:

Date:

Sheet No:

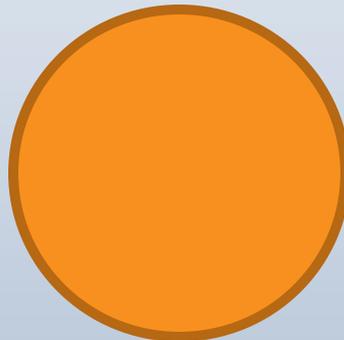




Orthographic Projection Cylinders



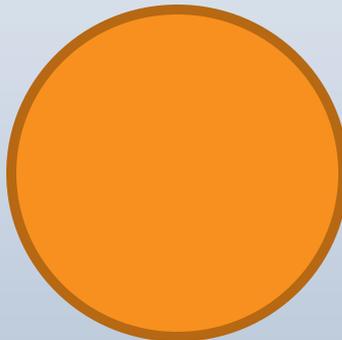
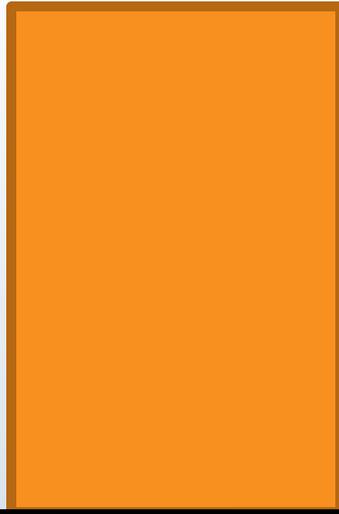
If the plan of a cylinder is a circle, what does the elevation look like?



PLAN



If the plan of a cylinder is a circle, what does the elevation look like?



PLAN

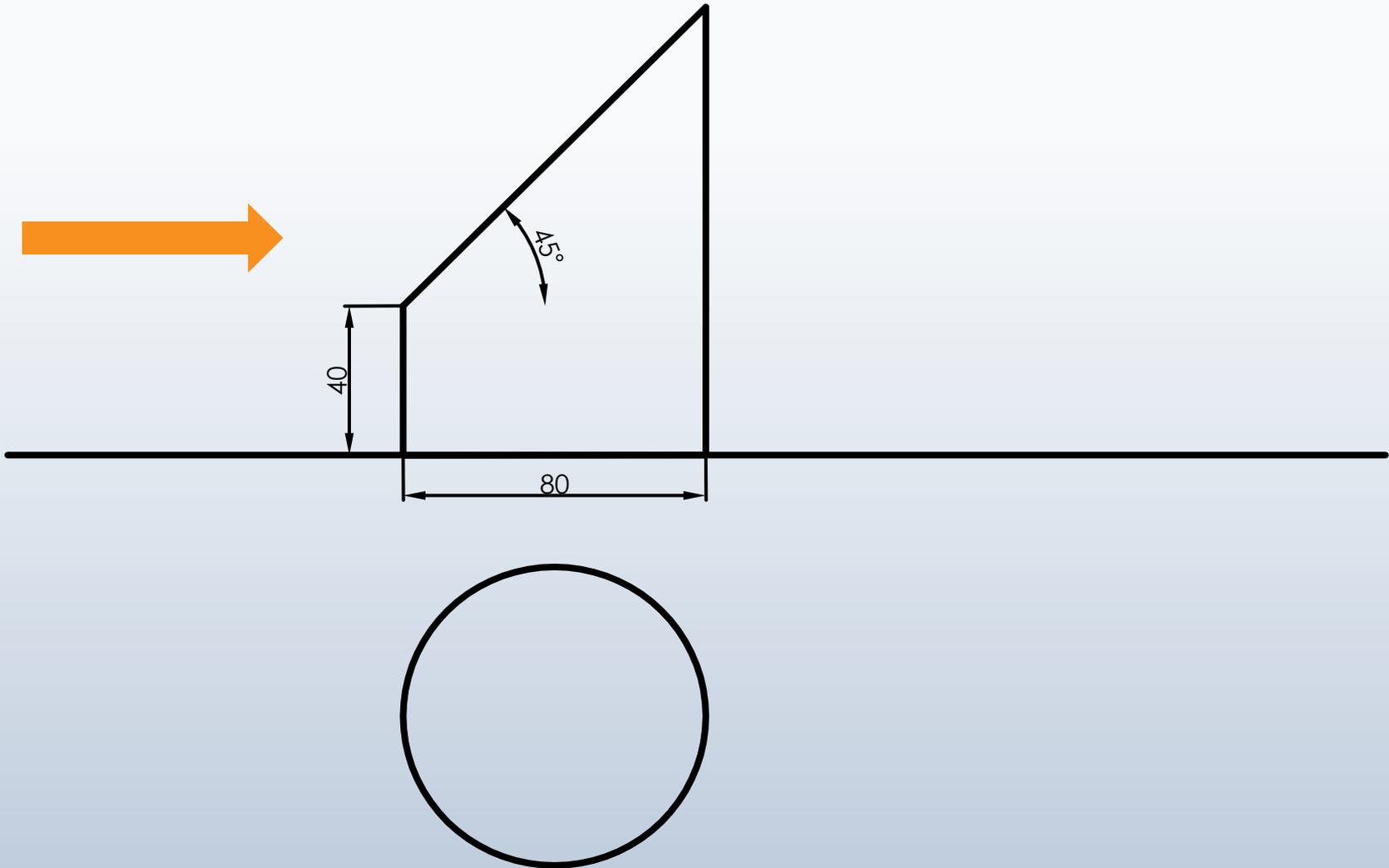
**Examples of
cylinders?**

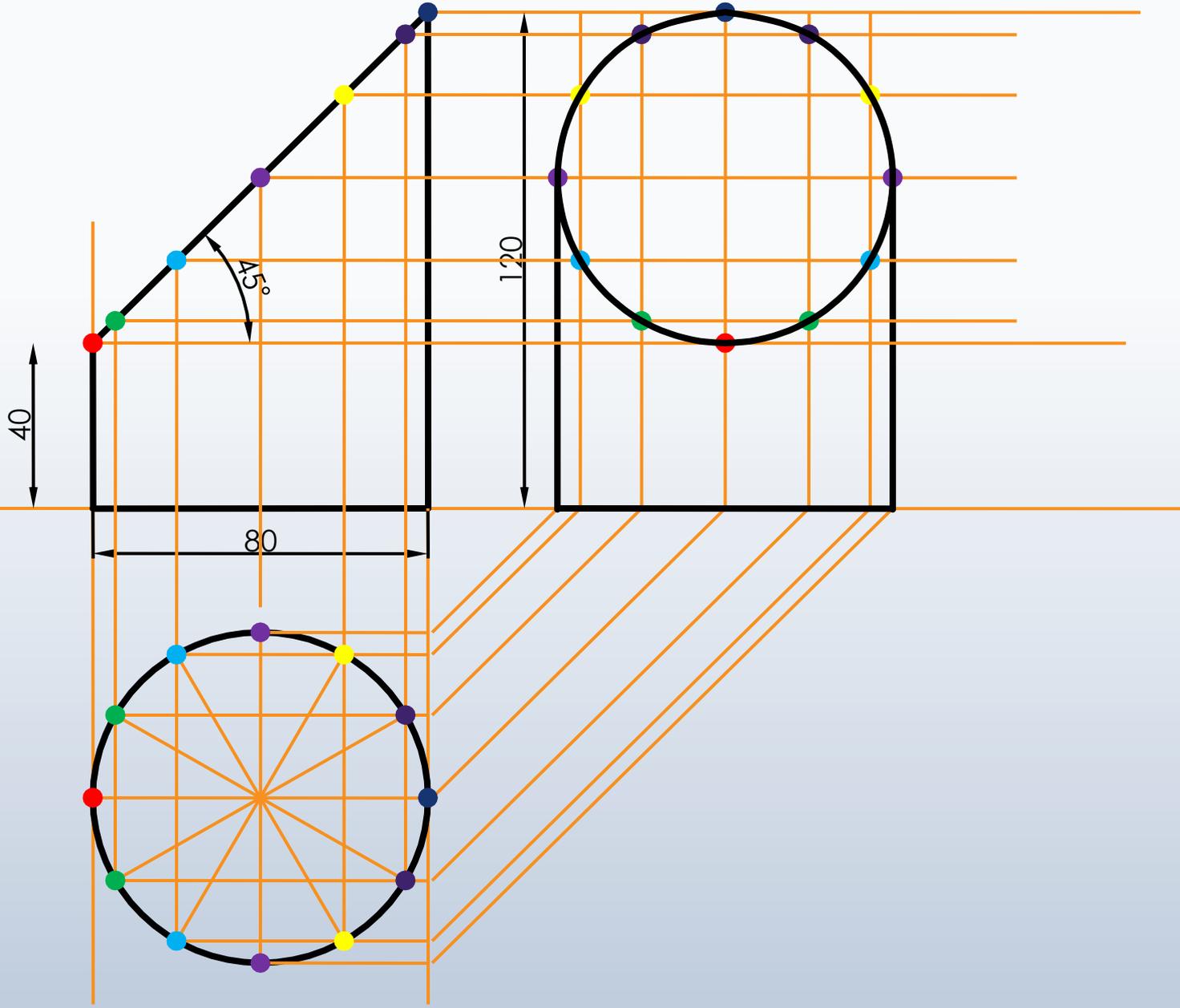
Hotel Roof - Cylinder cut at an angle.





1. Draw the plan and elevation of the cut cylinder.
2. Draw the **End View** looking in the direction of the arrow





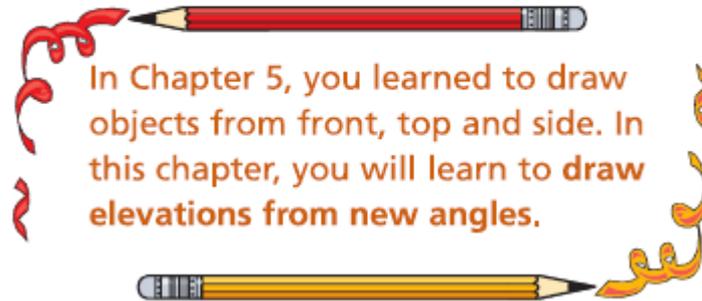
Brief Recap over orthographic projection exercise

Sketch the model of the house you see on the table



Auxiliary Views

What will you learn?

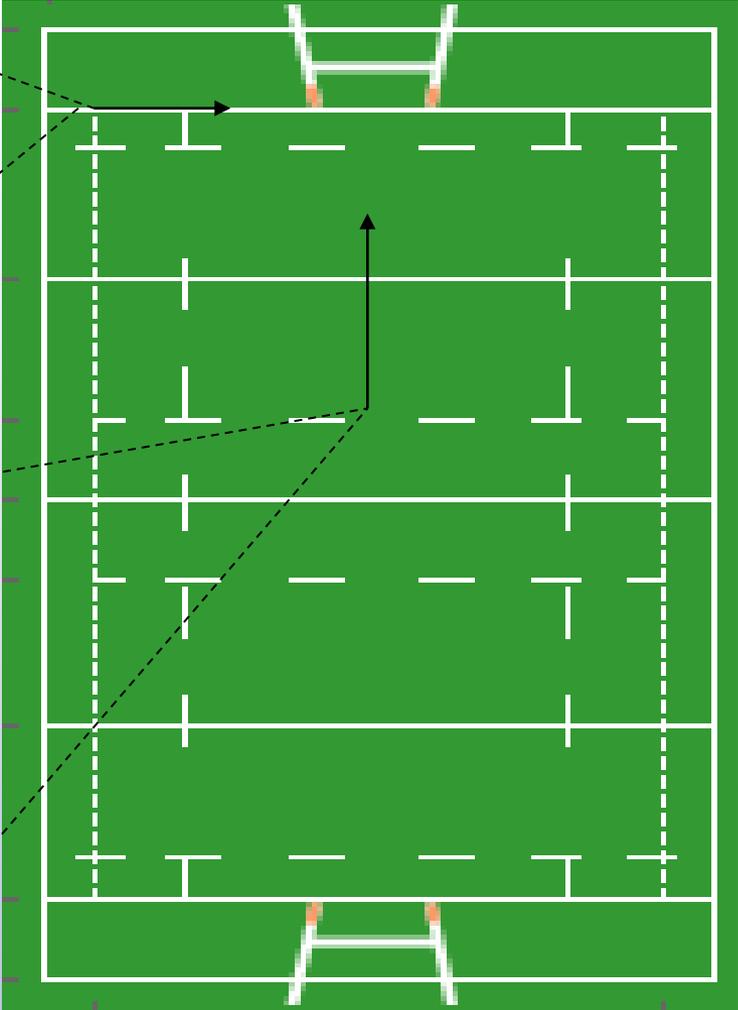
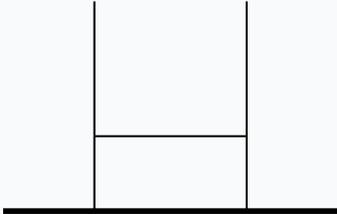


What do you think the word Auxiliary means?

https://www.google.ie/search?q=Auxiliary+Views&oq=Auxiliary+Views&aqs=chrome..69i57j0l5.3559j0j7&sourceid=chrome&espv=210&es_sm=93&ie=UTF-8#q=what+does+auxiliary+mean

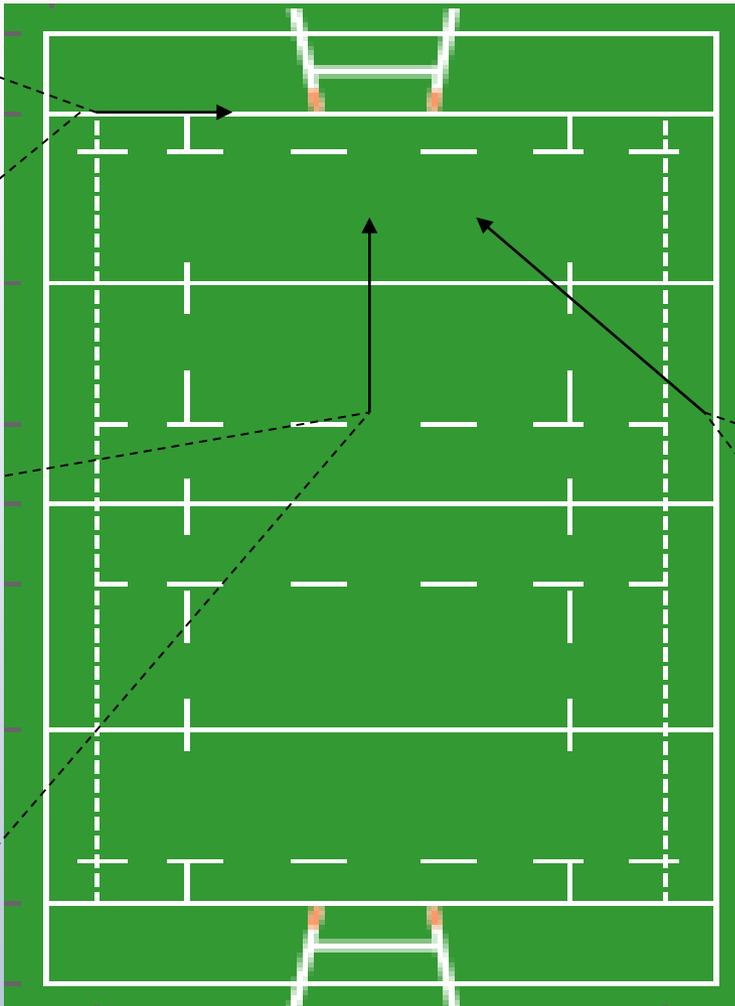
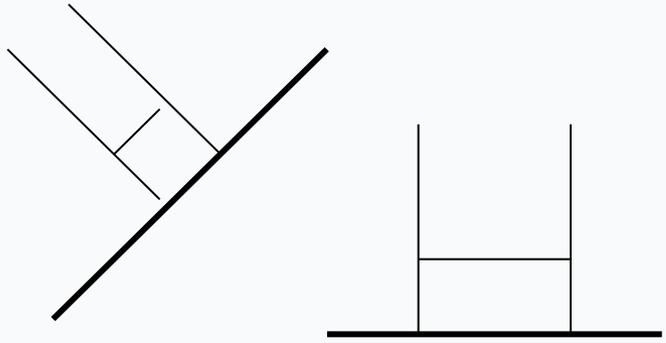
Elevation views

Are these plan or elevation views?

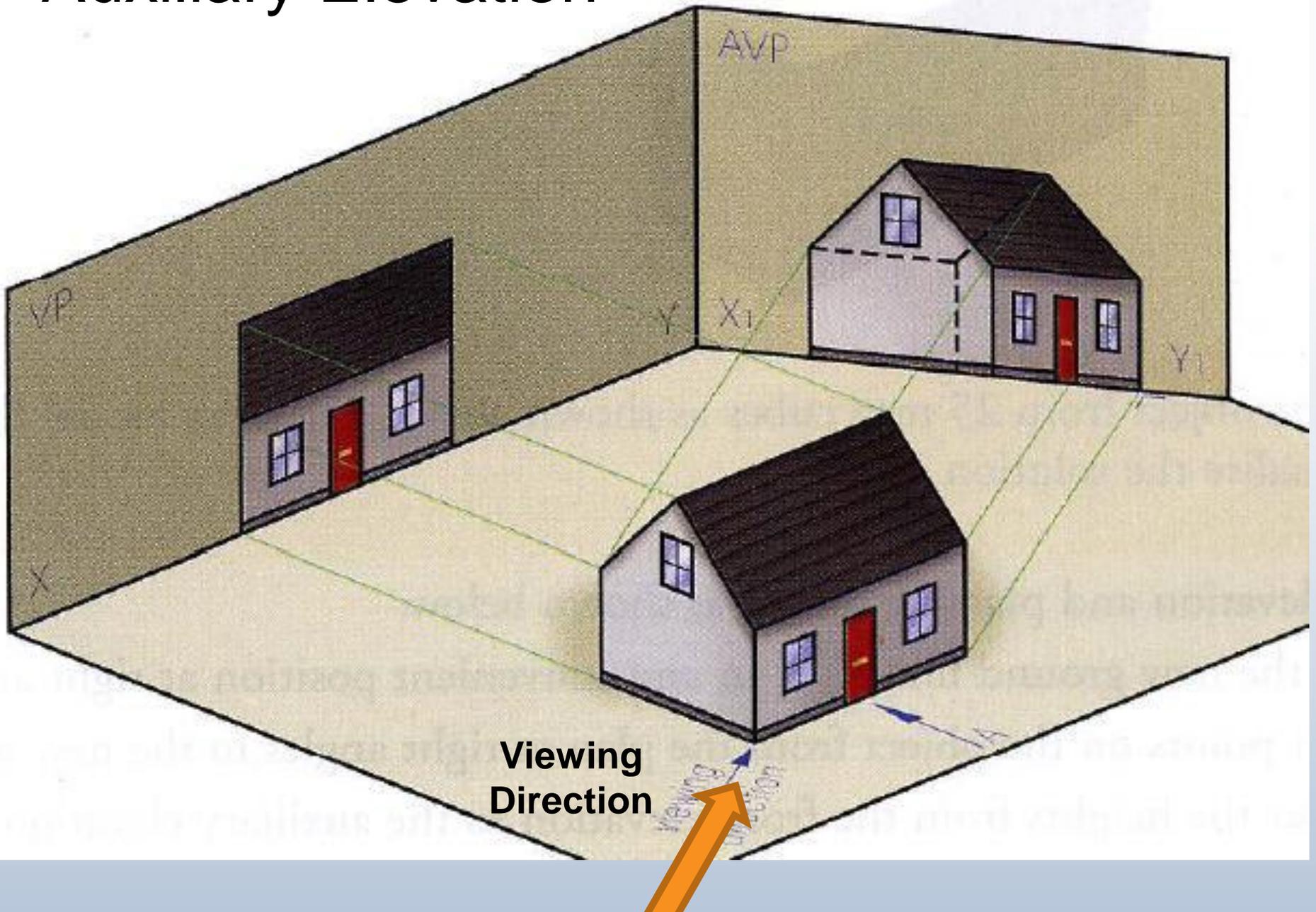


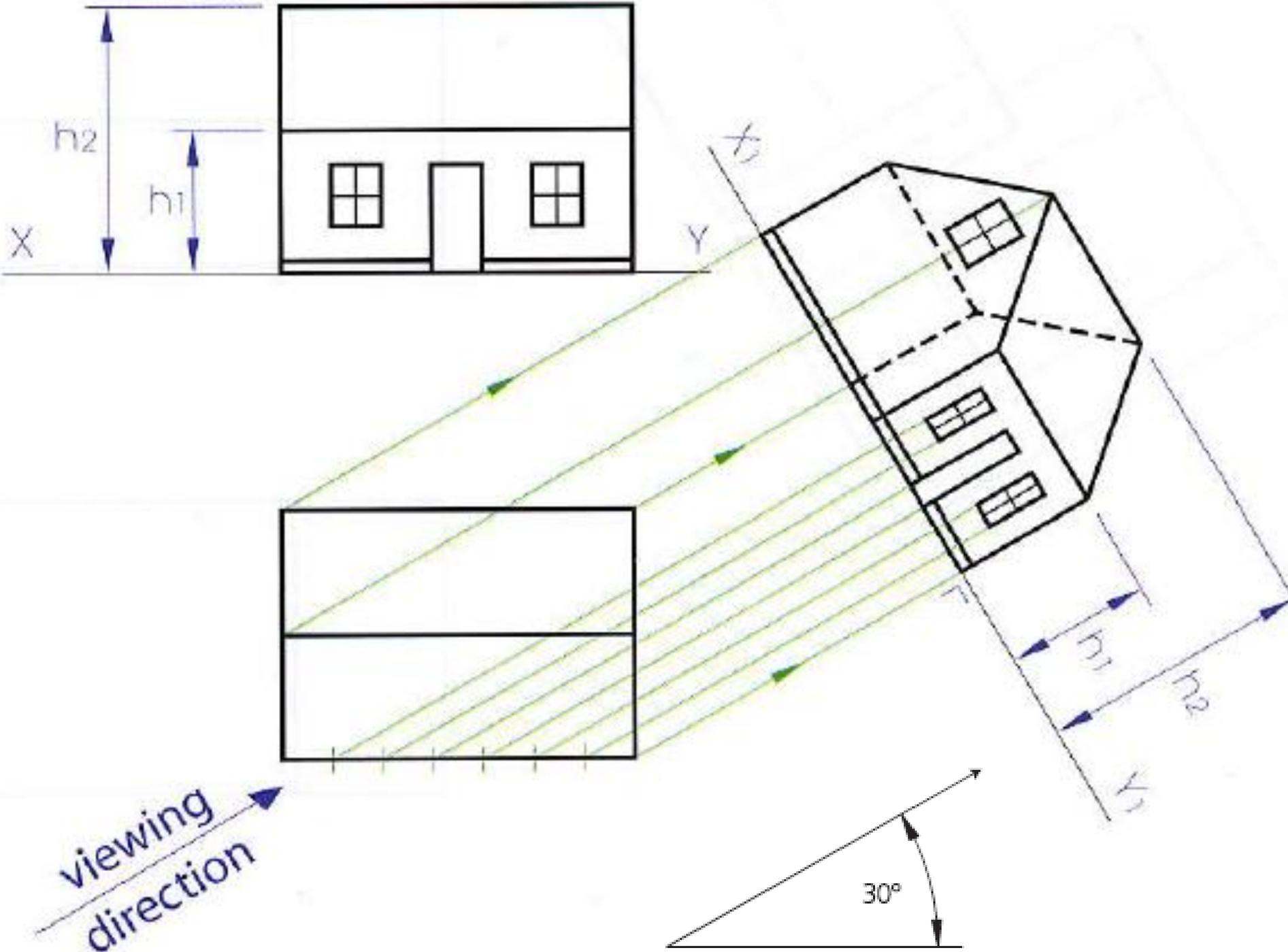
Auxiliary Elevation View

Are these plan or elevation views?



Auxiliary Elevation



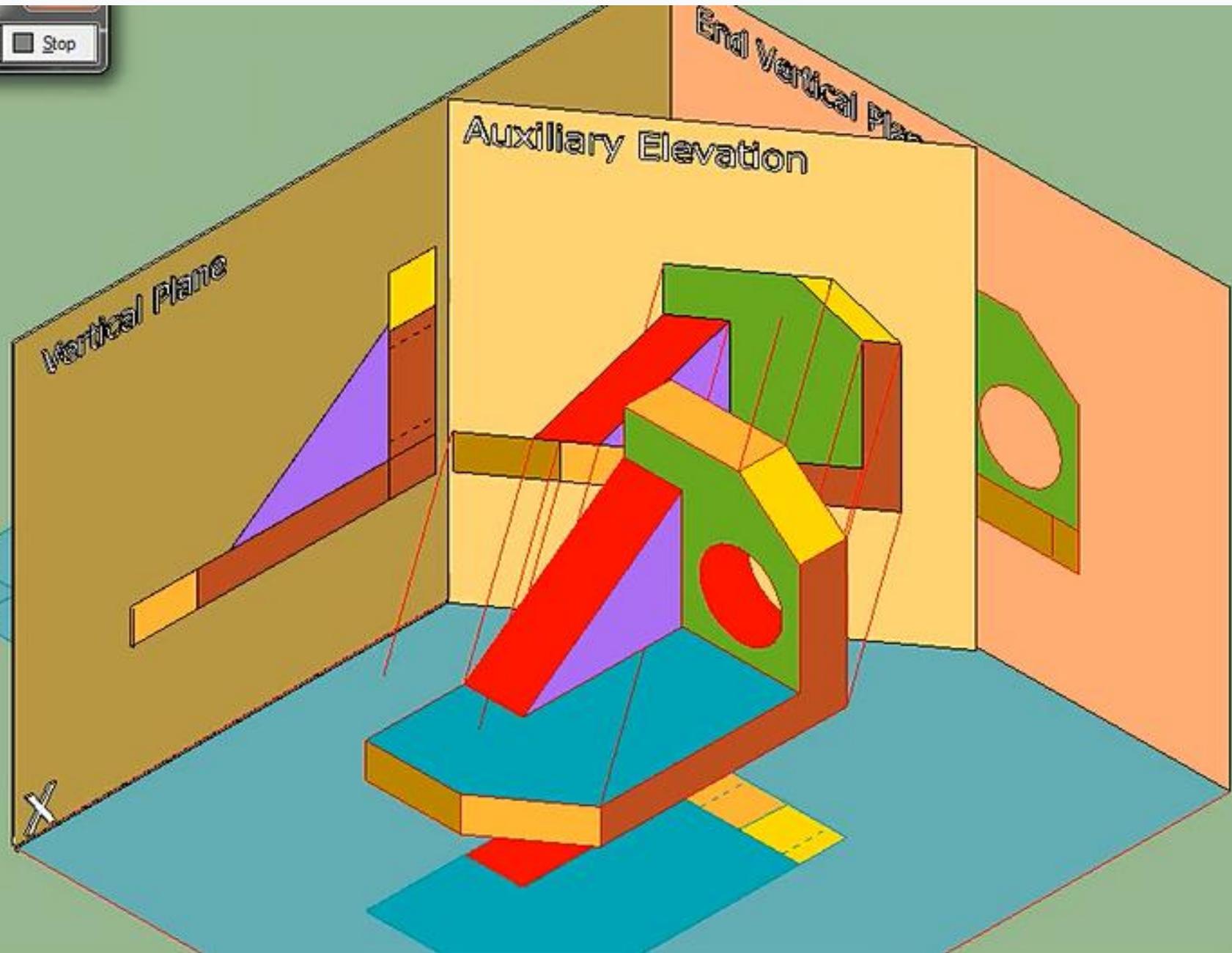


Pause Stop

End Vertical Plane

Auxiliary Elevation

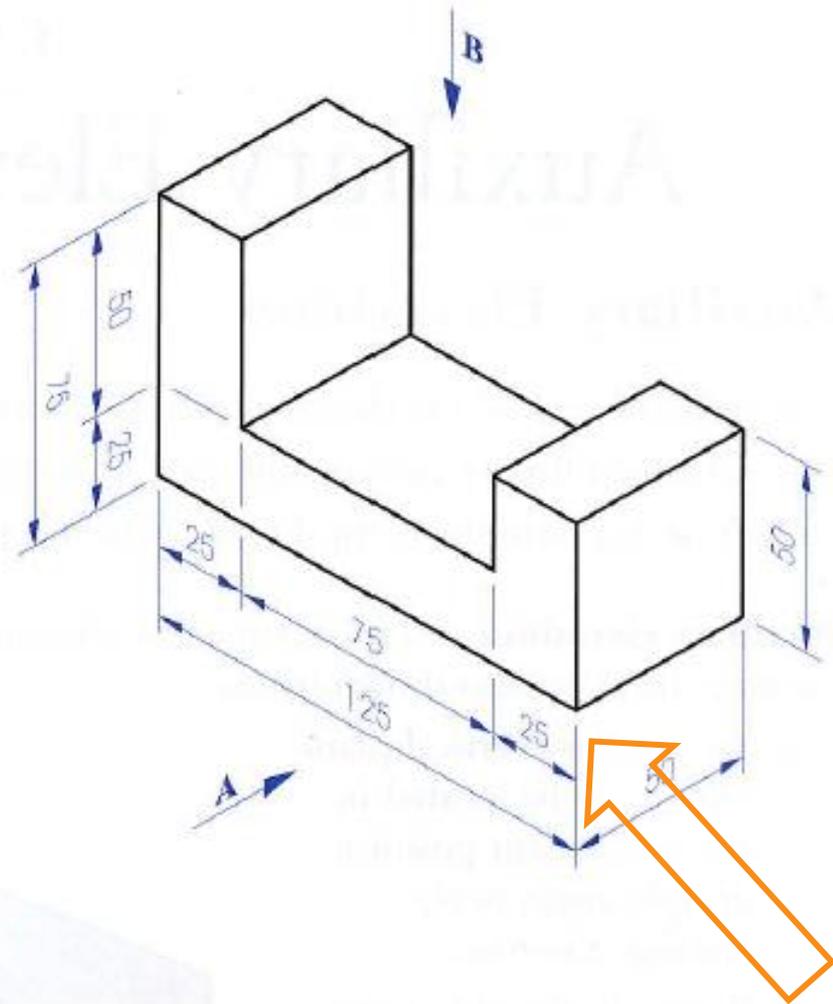
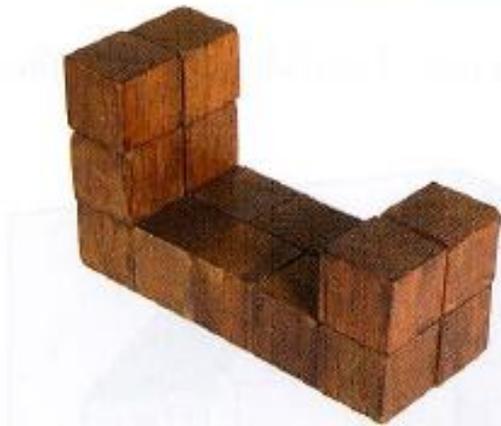
Vertical Plane



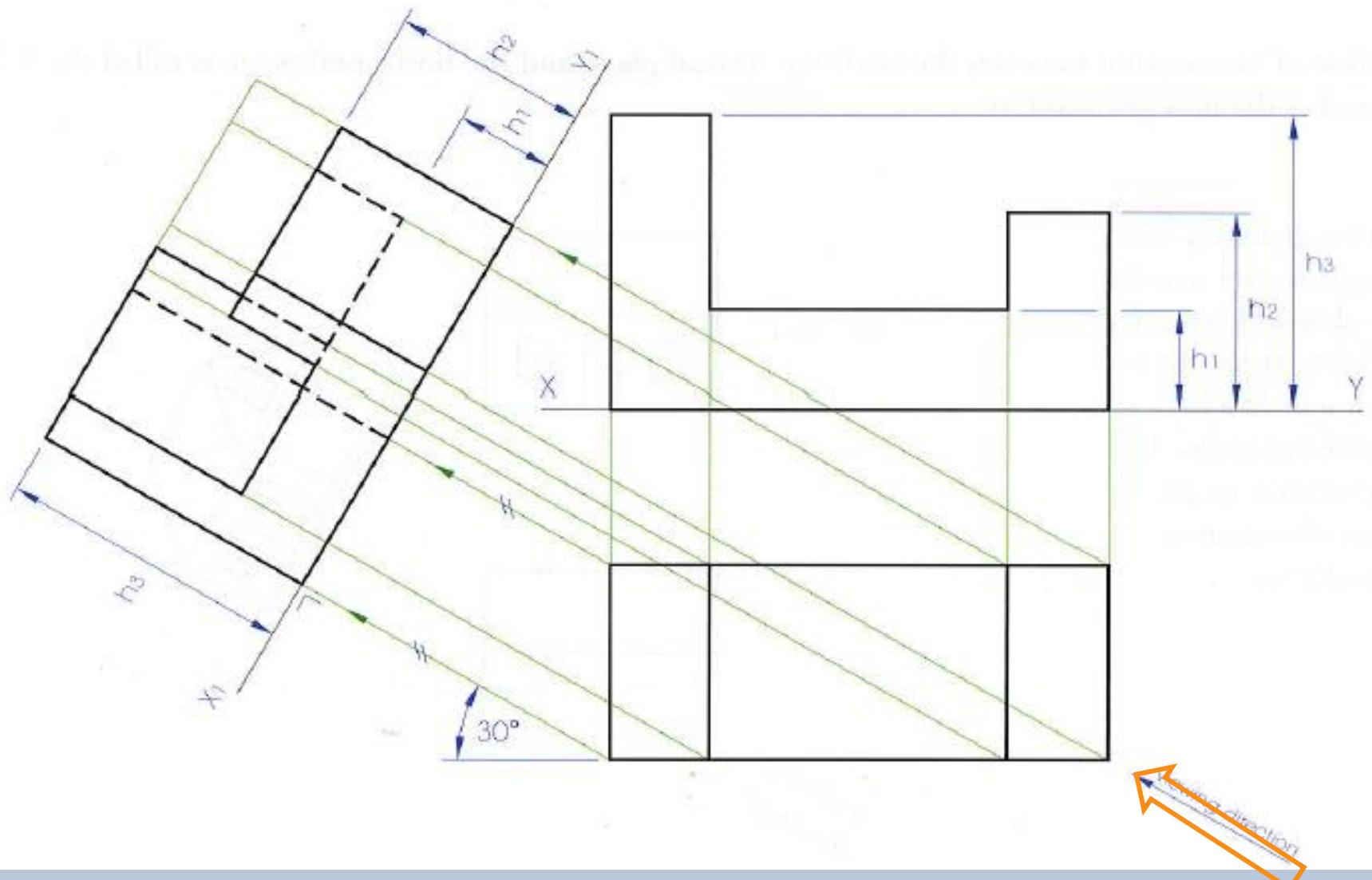
Example

Represent the object shown over by drawing the following views:

- (a) An **elevation** looking in the direction of arrow **A**.
- (b) A **plan** looking in the direction of the arrow **B**, projected from the elevation.
- (c) An **auxiliary elevation** with the viewing direction at 30° from the right-hand side.



1. The elevation and plan are drawn as shown below.
2. Draw the new ground line X_1Y_1 in any convenient position at right angles to the viewing direction.
3. Project points on the object from the plan at right angles to the new ground line.
4. Transfer the heights from the front elevation to the auxiliary elevation.
5. Line in the auxiliary elevation as appropriate.



Represent each of the objects shown below by drawing the following views:

- An **elevation** looking in the direction of arrow **A**.
- A **plan** looking in the direction of the arrow **B**, projected from the elevation.
- An **auxiliary elevation** with the viewing direction at 30° from the right-hand side.

