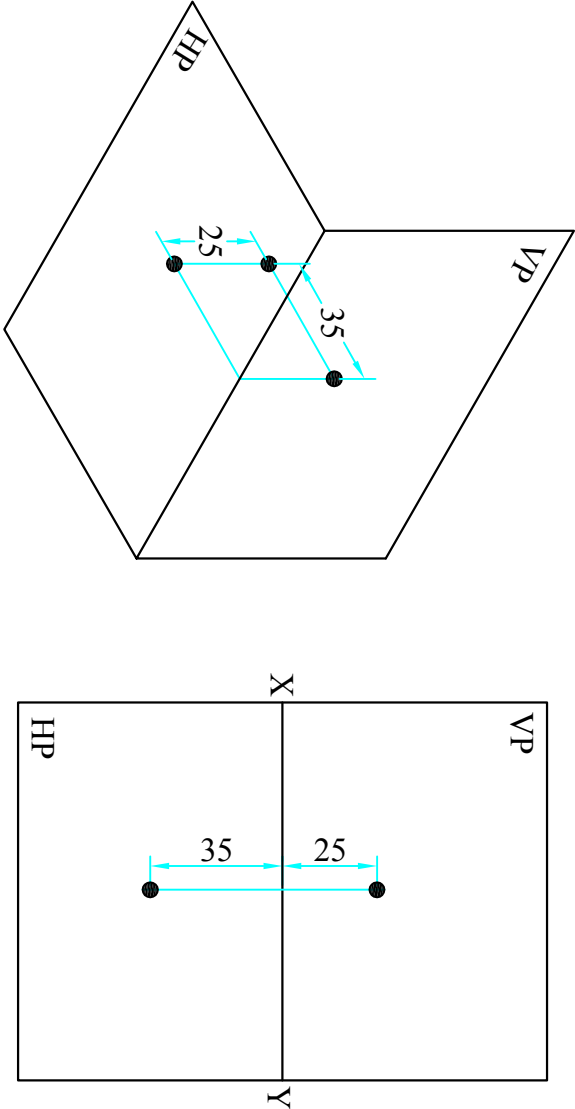# True Length and Angle of Lines

<u>Introduction</u>

<u>Projection of Points</u>

To determine the position of a point in space, planes of reference are made. These are the Vertical and Horizontal Plane. The point in space can be located exactly, by measurement from these planes. In this case the point is 35mm from the VP and 25mm from the HP.

In order to be precise when describing points they are referred to by letter. The actual point is a capital letter. For the plan a small case letter is used. In elevation the small letter has a 1 added.
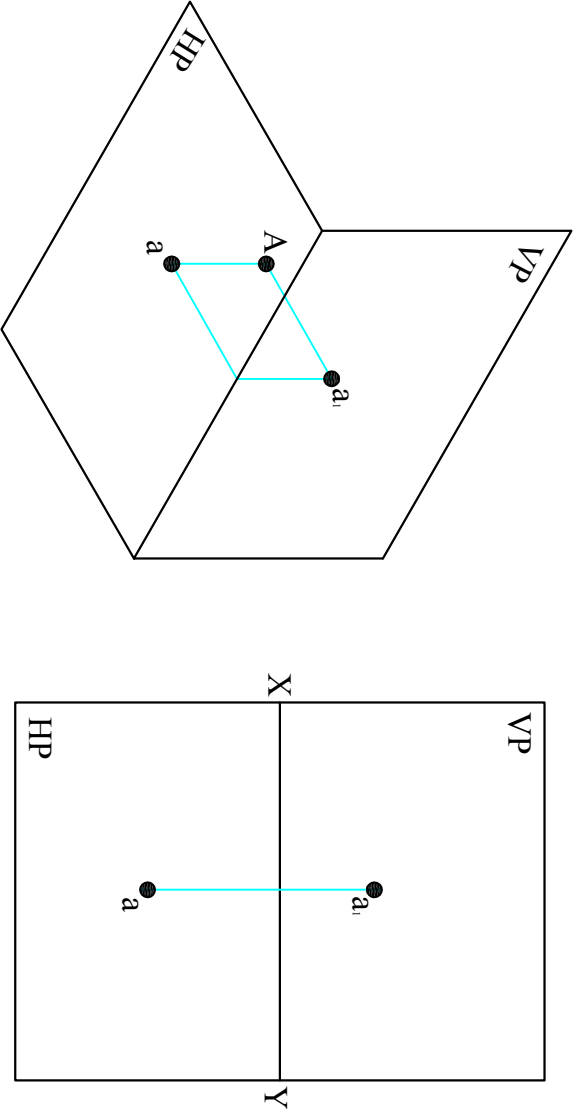
<u>Exercise 1</u>

a. Draw the plan and front elevation of a point A 25mm from the VP and 20mm from the HP.

b. Three point A, B and C are shown in plan. Complete the drawing if the elevations of the points are
A=40mm,
B=25mm and
C=30mm from the HP.
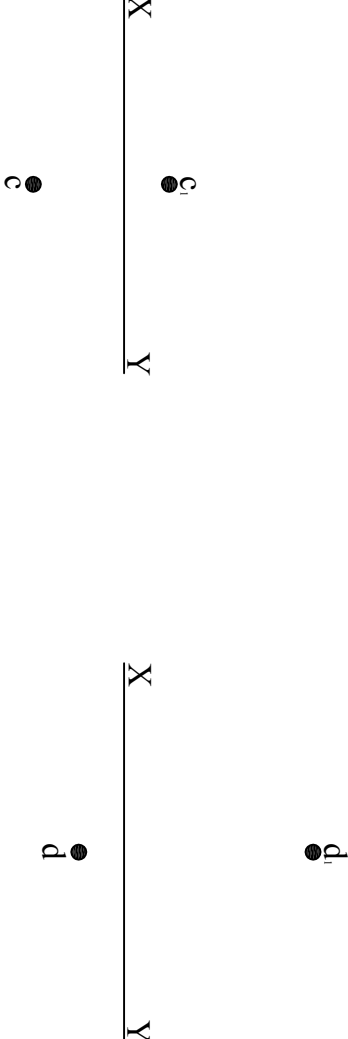What is the actual distance between A and B, and B and C?
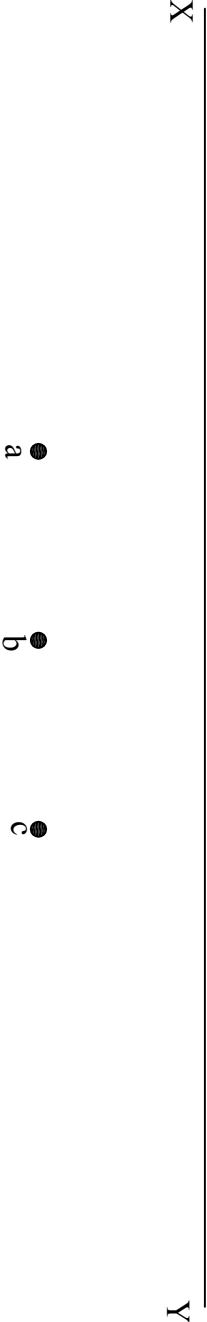
c. Describe in words the precise position of these points A, B, C, D in relation to the horizontal and vertical planes.

eg. Point A is --- mm from the HP, and --- mm from the VP.

X ——————— Y

•a₁

•a

Point A is _____ mm from the HP,

and _____ mm from the VP.

X ——————— Y

•b₁

•b
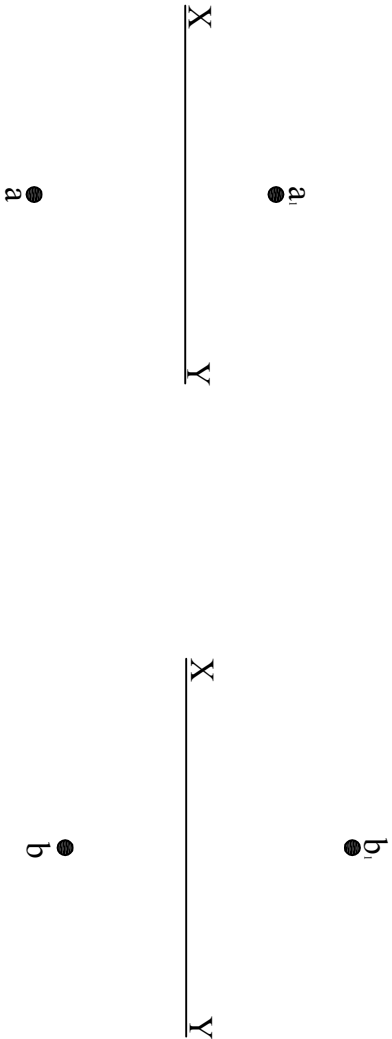
Point B is _____ mm from the HP,

and _____ mm from the VP.

X ——————— Y

•c₁

•c

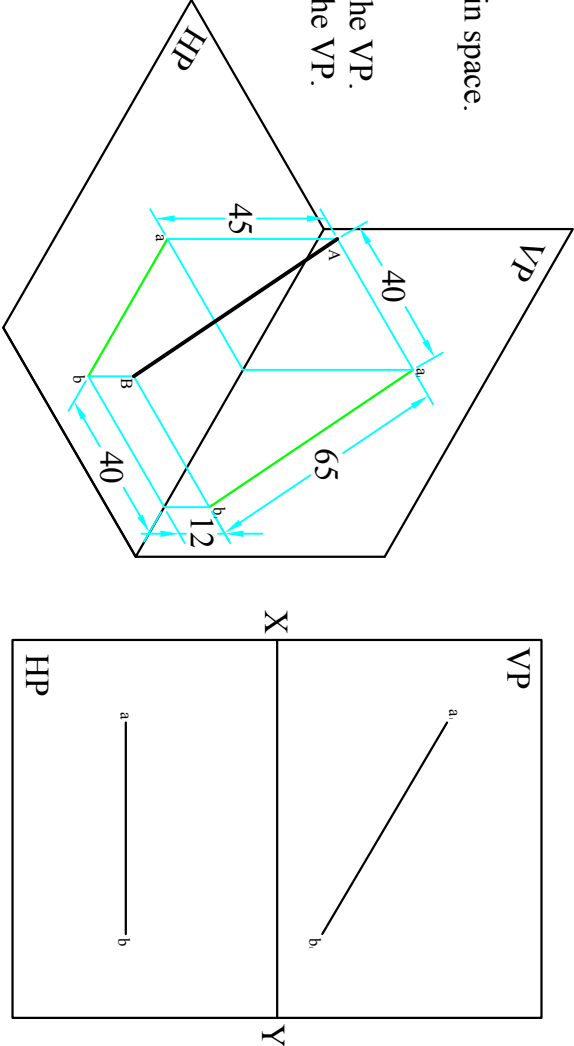Point C is _____ mm from the HP,

and _____ mm from the VP.

X ——————— Y

•d₁

•d

Point D is _____ mm from the HP,

and _____ mm from the VP.

Projection of Lines

The same system is used to position lines in space.

This line AB is 65mm long.
A is 45mm from the HP and 40mm from the VP.
B is 12mm from the HP and 40mm from the VP.

It will be seen that AB is parallel to the VP. Therefore the description of the line could be as follows:

AB is a line 65mm long, 40mm from and parallel to the VP with end A 45mm and end B 12mm from the HP.

Exercise 2

Five examples of lines in space are shown. State the relationship to the vertical and horizontal planes to their elevations and plans.
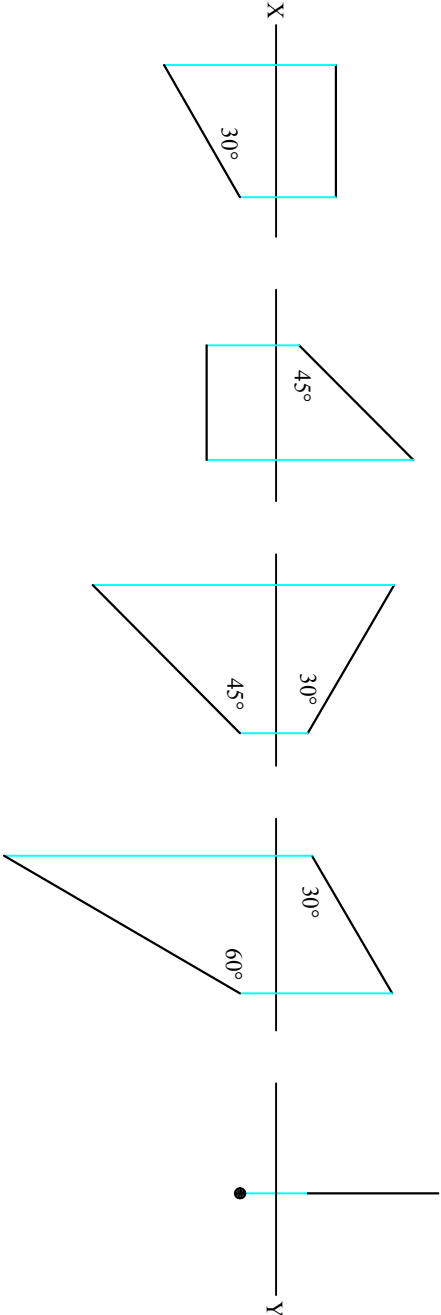
	Elevation	Plan
1	Parallel to HP	30° to VP
2		
3		
4		
5		

Exercise 3 - Draw a Plan and Front Elevation for each of these examples.

a) A line AB 65mm long parallel to the VP and 45mm from it. End B is 20mm from HP and inclined at 30° to it. What is the length of the plan?

b) A line AB 40mm long in plan lying on the HP and inclined at 30° to the VP. End A is 12mm from the VP. What is the length of the elevation?

St. Elias College

| Year 11 | True Length and Angle of Lines | Name : | Date : | Page 3 |

c) A line AB 49mm long, 36mm from and parallel to the VP. End A is 18mm and end B is 43mm from the HP. What is the length of the plan?
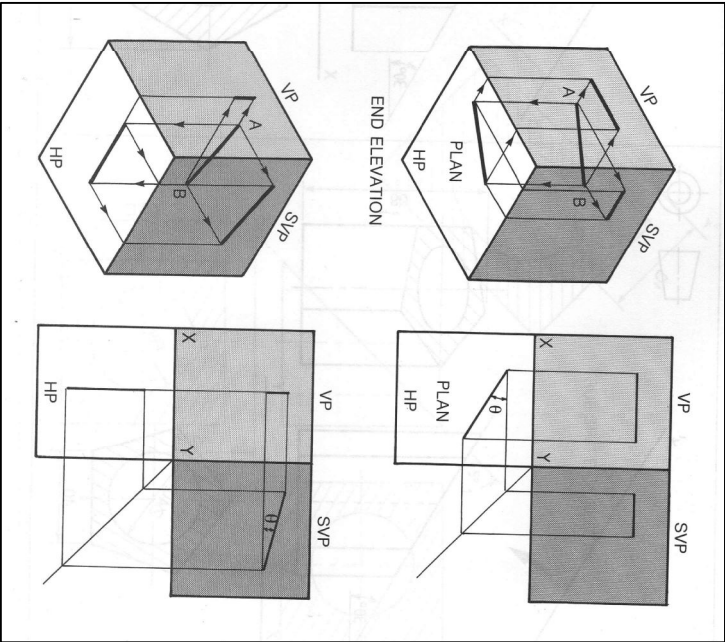
d) A line AB is 70mm long in elevation. End A is 45mm from the VP and 50mm from the HP. End B is 25mm from the VP and 20mm from the HP. State the length of the line in plan.
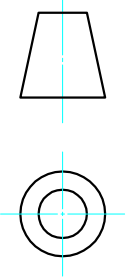
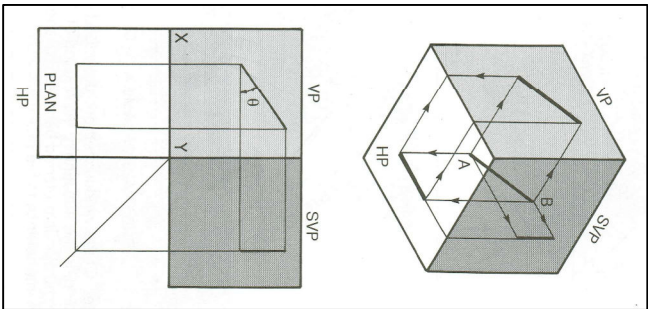## Angle of Inclination

In the top diagram, line AB is parallel to the HP and the plan is the true length of the line. Angle Ө is the true angle of inclination of the line to the vertical plane.

In the bottom diagram, line AB is parallel to the side vertical plane and the end elevation is the true length of the line. Angle Ө is the true angle of inclination to the vertical plane.

True Length of a Line.

In this chapter we shall learn how to find the true length of lines that are not parallel to any of the principal planes of projection, and their true angles of inclination to the planes.

This drawing shows views of a line AB which is not parallel to any of the principal planes of projection. To find the true length only two views are needed, the front elevation and the plan.
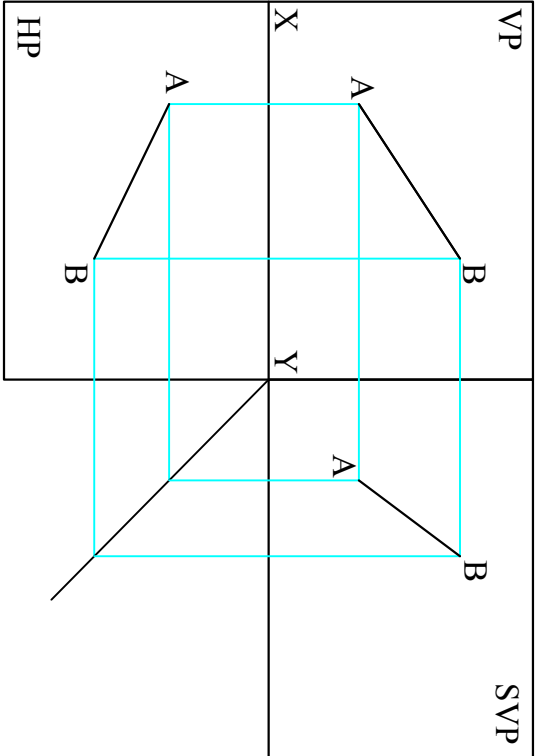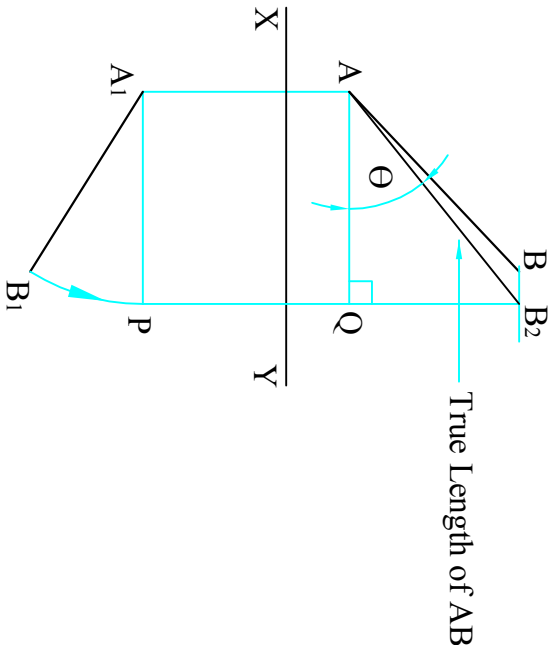
Method 1 - Revolution

With both views of the line drawn, the revolution could be done on one view and the true length found on the other.

a) Revolve the front elevation of the line about A until it assumes the horizontal position A1P. Then project P down vertically to meet the horizontal line through B1 and B2. Join A1 to B2. A1B2 is the true length of line. The angle Ө is the true angle of inclination of the line to the vertical plane.
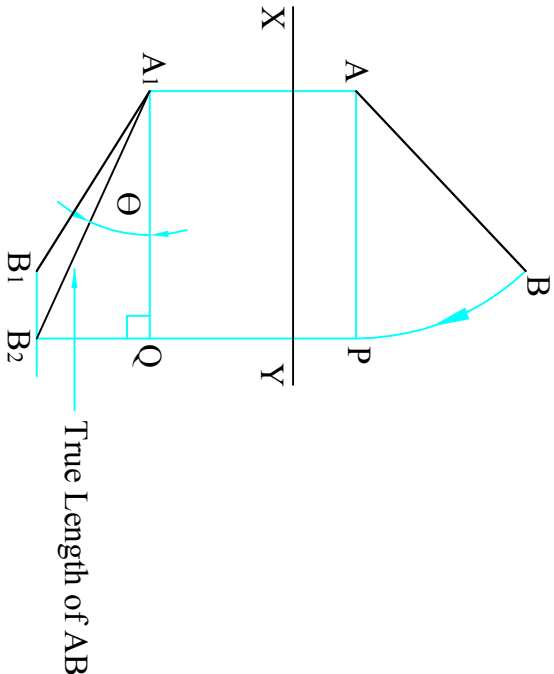
b) Revolve the plan of the line about A1 until it assumes the horizontal position A1P. Then project P up vertically to meet the horizontal line through B at B2. Join A to B2. AB2 is the true length of the line. The angle Ө is the true angle of inclination of the line to the horizontal plane.

Line AB is parallel to the vertical plane and the front elevation is the true length of the line. Angle Ө is the true angle of inclination of the line to the horizontal plane.

Method 2 - Triangulation

This method is closely related to the revolution method. Project A and B horizontally and draw vertical line KL.

Mark off LM equal to A₁B₁ (plan of line), and join M to K.

KM is the true length of the line.

The angle Θ is the true length of inclination to the horizontal plane.
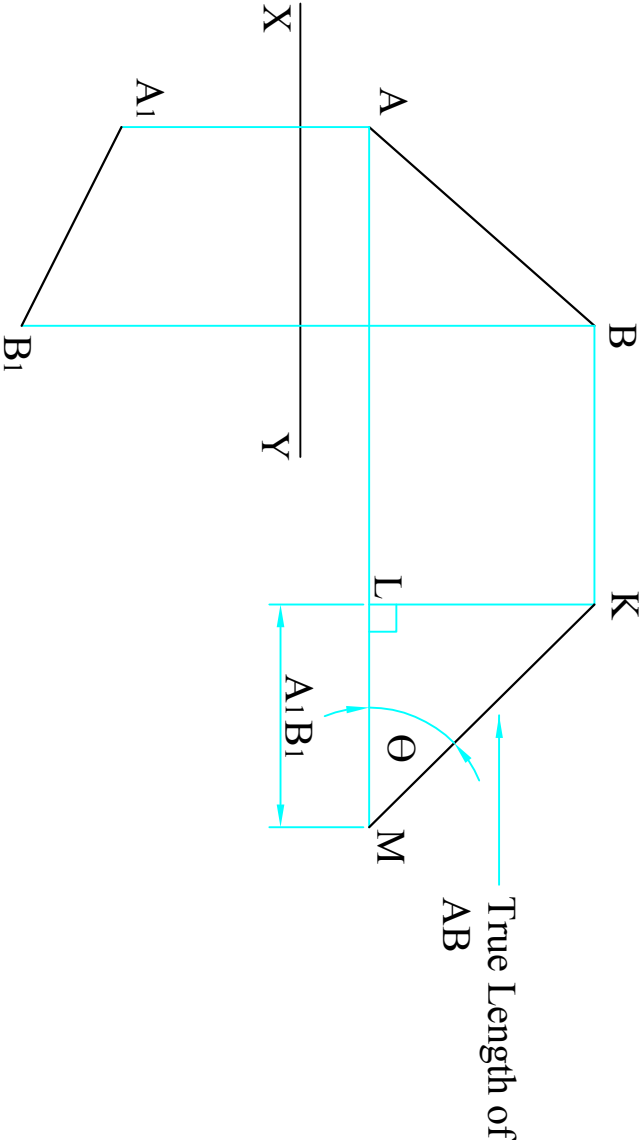

True Length of AB

To find the True Shape of Triangular Laminae

A lamina is a thin sheet of material. Often two orthographic views of the lamina are given, and the true shape of it is required. The true length of each side is found and the triangle is constructed as shown.

Of the two methods described for finding the true length, the method of triangulation is preferred because it causes less interference with the drawing.
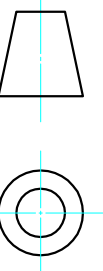

True Length of BC

True Length of AC

True Length of AB

True Length of AC

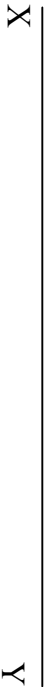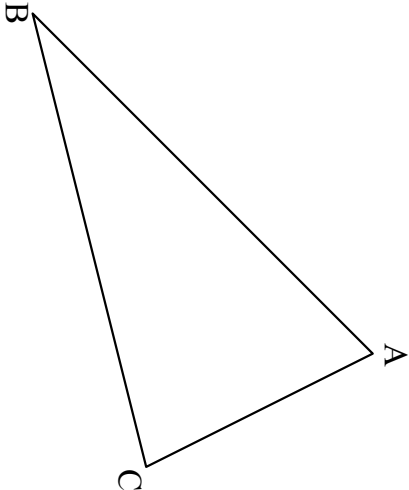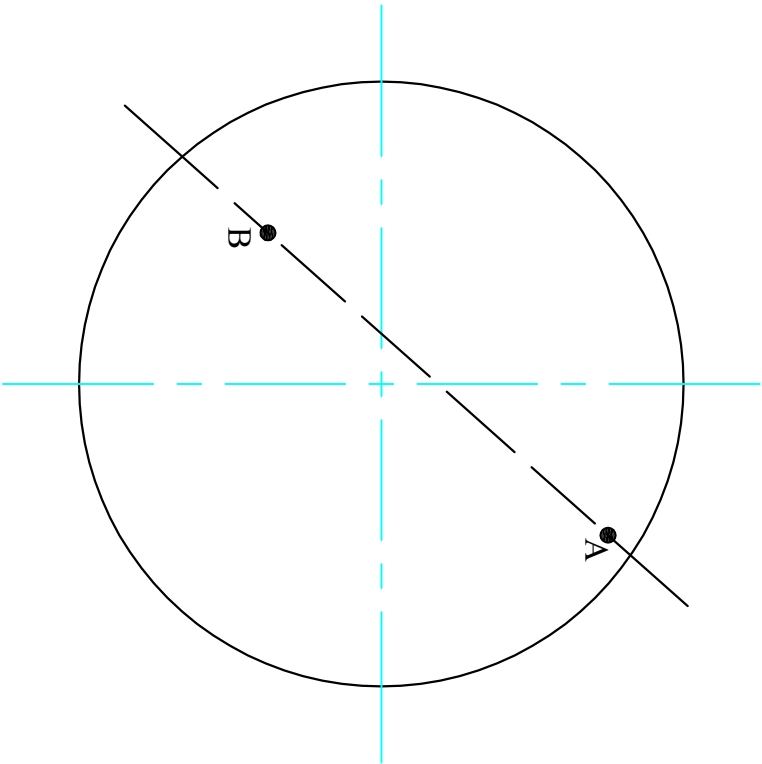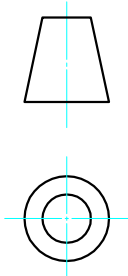True Length of AB
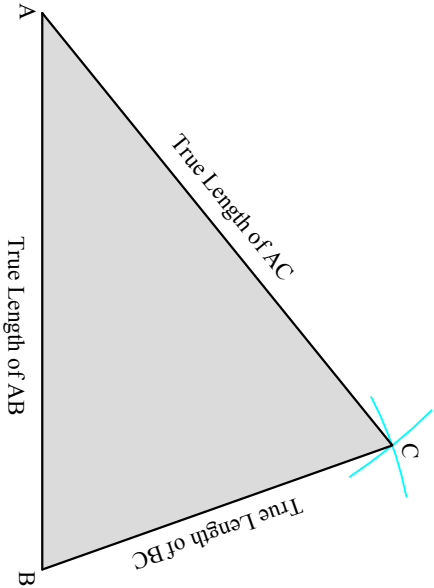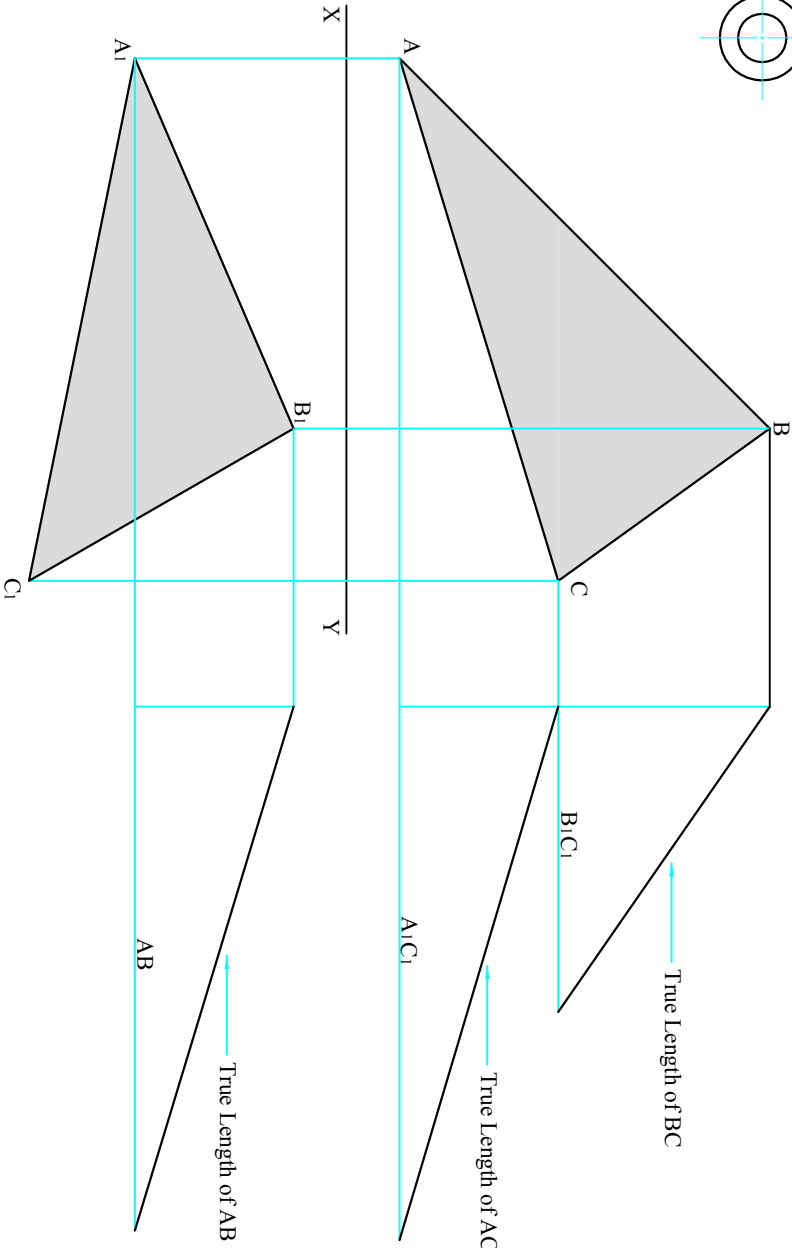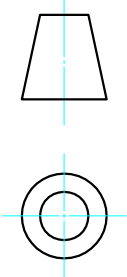
True Length of BC

Exercise 4

a) The plan of a line AB is given below. Its true length is 100mm. If A is located 20mm above the horizontal plane, find by construction the front elevation of the line and inclination to both the vertical and horizontal planes.
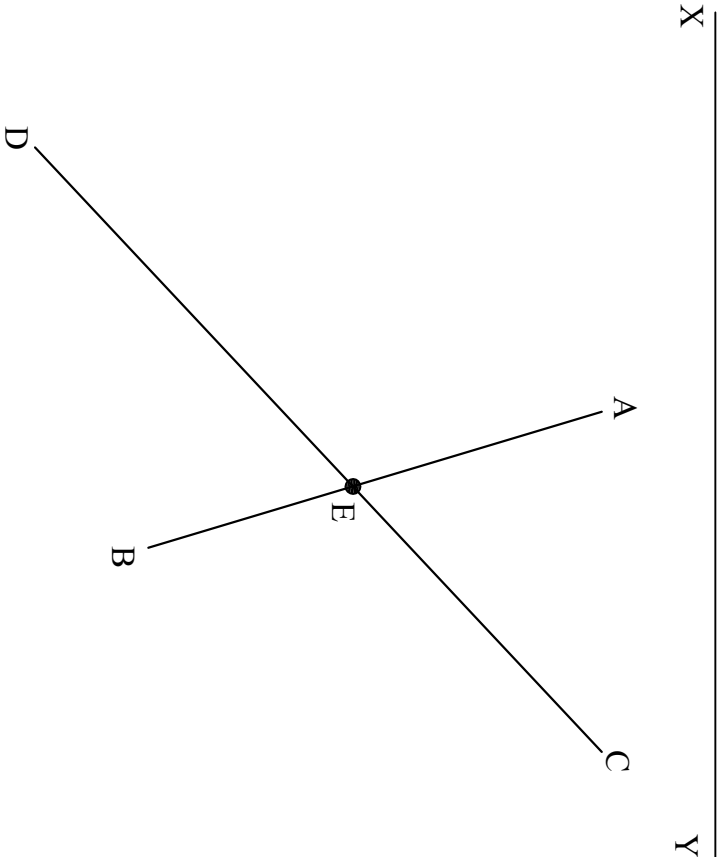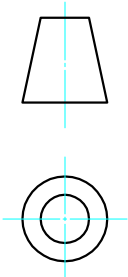
X ————— Y

A

B
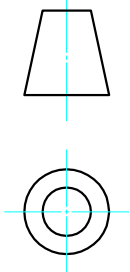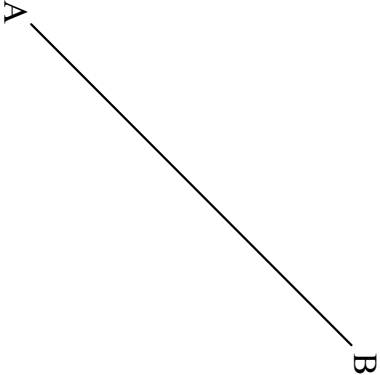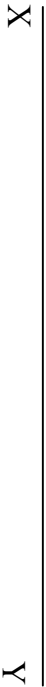
b) The drawing below shows the front elevation of a triangular lamina. A, B and C are located 40mm, 30mm and 20mm in front of the vertical plane. Project a plan and find the true shape of the lamina.

X ————— Y

B

A

C

St. Elias College	Year 11	True Length and Angle of Lines	Name :	Date :	Page 7

c) A length of straight wire is pushed through an orange which is spherical in shape. A is the point of entry and B is the exit point. Project a plan from the given front elevation and find the true length of AB.

d) The plan of two lines AB and CD which intersect at E is given. B and D rest on the horizontal plane. If A is 30mm above the horizontal plane, project the front elevation and find the true lengths of both lines.