# Solids in Contact

In this chapter we shall start by considering how to determine the **projections** (elevation and plan) of points on the cone, sphere and cylinder. Then we will progress to drawing the projections of these and other solids in contact.

The Cone

We saw on page 266 that the curved surface of a cone is made up of an infinite number of straight lines called *elements*. Imagine moving along the elements OA and OB as illustrated over.

The **elevation** of the path is represented by the elements denoted o_1a_1 and o_1b_1.

The **plan** of the path is represented by the same elements denoted oa and ob.
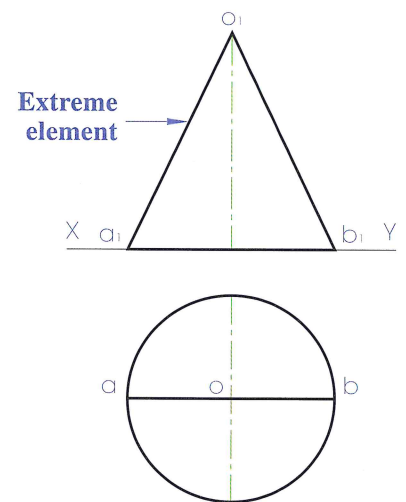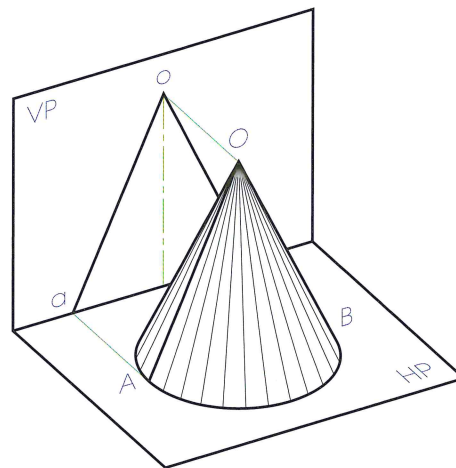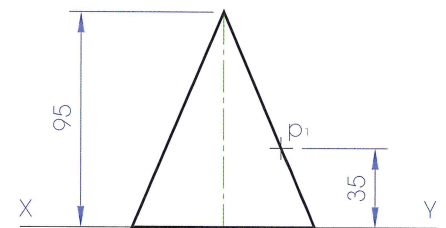
The extreme elements of a cone in elevation are represented by the diameter parallel to the XY line in plan.
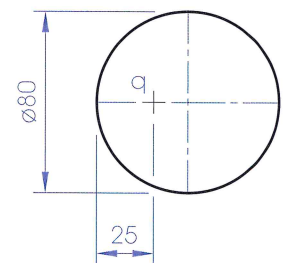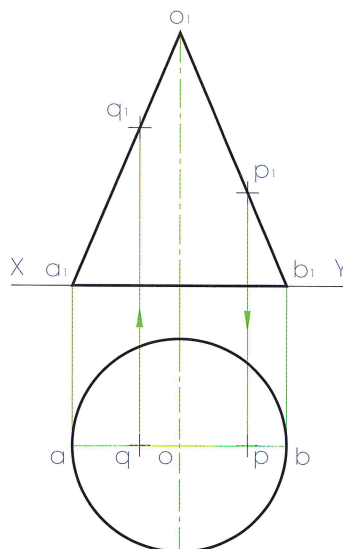
Example 1

The elevation and plan of a **cone** are shown over. The location of two points **P** and **Q** on the curved surface of the cone are also shown in the **elevation** and **plan** respectively.

(a) Locate point **P** in the **plan**.

(b) Locate point **Q** in the **elevation**.

1. Point **P** is on an extreme element of the cone in elevation. As a result, it will be located on the diameter parallel to the XY line in plan and can be projected to the plan as shown over.

2. Point **Q** is on the diameter parallel to the XY line in plan. Accordingly, it will lie on an extreme element of the cone in elevation and can be projected to the elevation as shown.

Example 2

The elevation and plan of a **cone** are shown over. The location of two points **P** and **Q** on the curved surface of the cone are also shown in plan and elevation respectively.

(a) Show the position of point **P** in **elevation**.

(b) Show the position of point **Q** in **plan**.
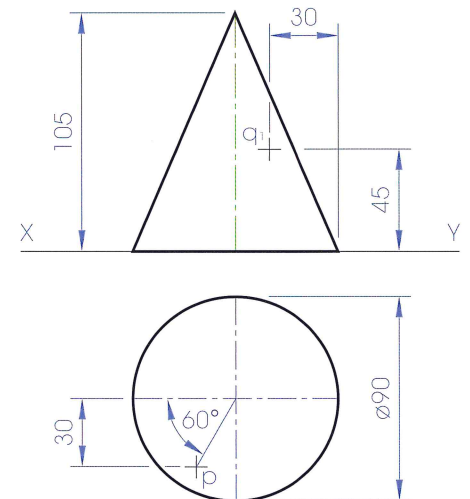
1. Point **P** can be rotated about the axis of the cone until it lies on an extreme element as illustrated below, middle. In doing so, point **P** will move in an arc of a circle in plan as shown below, left.

2. This rotated position of point **P** in plan can be projected to the extreme element in elevation as shown. This determines the height of point **P** as its height remains the same during rotation.

3. Imagine point **Q** is rotated about the axis of the cone until it lies on an extreme element. As point **Q** rotates it moves horizontally in elevation until it lies on an extreme element as shown below, left.

4. In this rotated position point **Q** will lie on the diameter parallel to the XY line in plan. This point can be rotated in an arc of a circle to give the plan of point **Q** as shown.
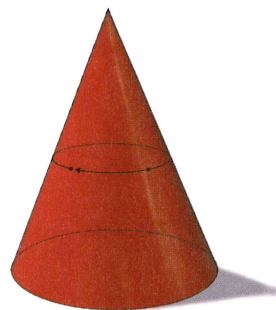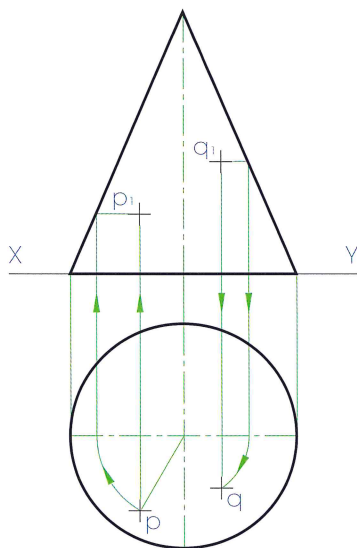
If a point rotates about the axis of an upright cone:
It moves horizontally in elevation.
It travels in a circular path in plan.
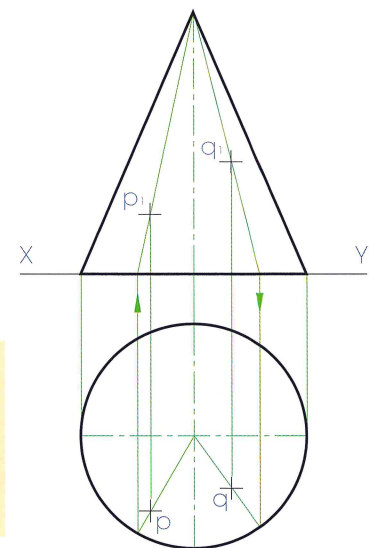
Alternative solution

Determining the projections of elements that contain points P and Q as shown above, right can also solve this problem.

Exercise

The elevation and plan of **two cones** are shown over. In each case:

(a) Locate point **P** in the **plan**.

(b) Locate point **Q** in the **elevation**.