11.1.2 Circle A circle is the set of all points in a plane which are at a fixed distance from a fixed point in the plane. The fixed point is called the centre of the circle and the distance from centre to any point on the circle is called the radius of the circle.

The equation of a circle with radius r having centre (h, k) is given by $(x - h)^2 + (y - k)^2 = r^2$

The general equation of the circle is given by $x^2 + y^2 + 2gx + 2fy + c = 0$, where g, f and c are constants.

(a) The centre of this circle is $(- g, - f)$

(b) The radius of the circle is $\sqrt{g^2 + f^2 - c}$

The general equation of the circle passing through the origin is given by $x^2 + y^2 + 2gx + 2fy = 0$.

Fig. 11.4

General equation of second degree i.e., $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represent a circle if (i) the coefficient of x^2 equals the coefficient of y^2, i.e., $a = b \neq 0$ and (ii) the coefficient of xy is zero, i.e., $h = 0$.

The parametric equations of the circle $x^2 + y^2 = r^2$ are given by $x = r\cos\theta$, $y = r\sin\theta$ where θ is the parameter and the parametric equations of the circle $(x - h)^2 + (y - k)^2 = r^2$ are given by

$$x - h = r\cos\theta, \quad y - k = r\sin\theta$$

or

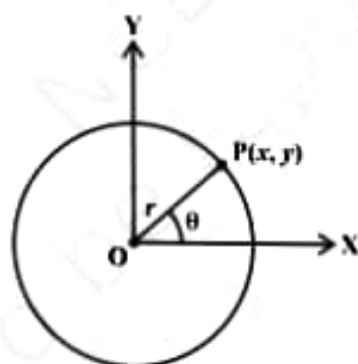$$x = h + r\cos\theta, \quad y = k + r\sin\theta.$$

Fig. 11.5

Note: The general equation of the circle involves three constants which implies that at least three conditions are required to determine a circle uniquely.

11.1.3 Parabola

A parabola is the set of points P whose distances from a fixed point F in the plane are equal to their distances from a fixed line l in the plane. The fixed point F is called focus and the fixed line l the **directrix** of the parabola.
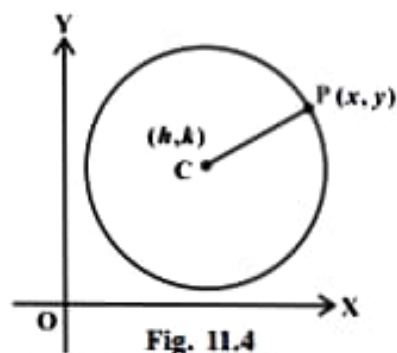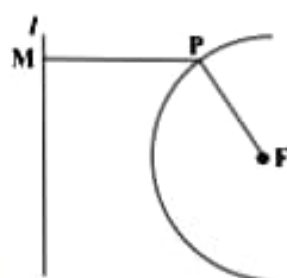

Fig. 11.6