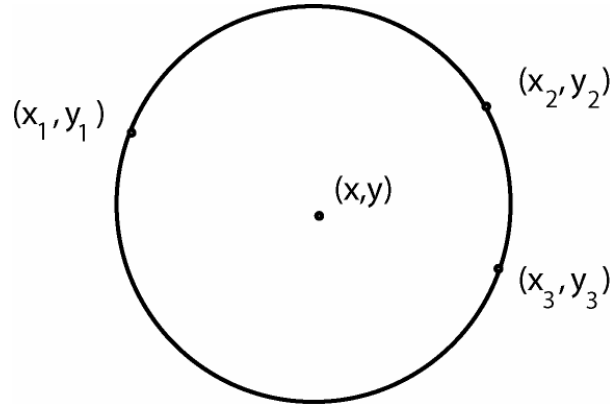


## Parameters of a Circle through Three Points

It is required to find the centre  $(x, y)$  and radius  $r$  of a circle passing through points  $(x_1, y_1)$ ,  $(x_2, y_2)$  and  $(x_3, y_3)$ .



The equations for tangentiality are,

$$(x_1 - x)^2 + (y_1 - y)^2 = r^2 \quad \dots(\text{i})$$

$$(x_2 - x)^2 + (y_2 - y)^2 = r^2 \quad \dots(\text{ii})$$

$$(x_3 - x)^2 + (y_3 - y)^2 = r^2 \quad \dots(\text{iii})$$

Subtracting (ii) from (i) and (iii) from (ii) gives,

$$y = \frac{2x(x_2 - x_1) + x_1^2 - x_2^2 + y_1^2 - y_2^2}{2(y_1 - y_2)} \quad \dots(\text{iv})$$

$$y = \frac{2x(x_3 - x_2) + x_2^2 - x_3^2 + y_2^2 - y_3^2}{2(y_2 - y_3)} \quad \dots(\text{v})$$

equating and solving for  $x$  gives,

$$x = \frac{(y_2 - y_3)(x_1^2 - x_2^2 + y_1^2 - y_2^2) - (y_1 - y_2)(x_2^2 - x_3^2 + y_2^2 - y_3^2)}{2((x_1 - x_2)(y_2 - y_3) - (x_2 - x_3)(y_1 - y_2))}$$

substitute for  $x$  in (iv) ( $y_1 \neq y_2$ ) or (v) to obtain  $y$ .

substitute for  $x$  and  $y$  in (i) to obtain  $r$ .