

**RD Sharma**  
**Solutions**  
**Class 11 Maths**  
**Chapter 24**  
**Ex 24.3**

### The Circle Ex 24.3 Q1

We will use equation in diameter form.

$$(x-2)(x+2) + (y+3)(y-4) = 0$$

$$x^2 - 4 + y^2 - y - 12 = 0$$

$$x^2 + y^2 - y - 16 = 0 \dots\dots\dots(1)$$

$$2g=0, 2f=-1 \dots\dots\dots[\text{From (1)}]$$

$$g = 0, f = -\frac{1}{2}$$

Centre of the circle is  $(0, \frac{1}{2})$

$$r = \sqrt{0 + \frac{1}{4} + 16}$$

$$r = \frac{\sqrt{65}}{2}$$

### The Circle Ex 24.3 Q2

Centre of the circles

$$x^2 + y^2 + 6x - 14y - 1 = 0$$

is  $(-3, 7)$

and  $x^2 + y^2 - 4x + 10y - 2 = 0$

is  $(2, -5)$

Equation of the circle is

$$(x - x_1)(x - x_2) + (y - y_1)(y - y_2) = 0$$

$$\Rightarrow (x + 3)(x - 2) + (y - 7)(y + 5) = 0$$

$$\Rightarrow x^2 + 3x - 2x - 6 + y^2 - 7y + 5y - 35 = 0$$

$$\Rightarrow x^2 + y^2 + x - 2y - 41 = 0$$

### The Circle Ex 24.3 Q3

Let the sides  $AB$ ,  $BC$ ,  $CD$  and  $DA$  of the square  $ABCD$  be represented by the equations

$$y = 3, \quad x = 6, \quad y = 6 \text{ and } x = 9 \text{ respectively.}$$

Then, coordinates are

$$A(6, 3), \quad B(9, 3), \quad C(9, 6) \text{ and } D(6, 6).$$

The equation of the circle with diagonal  $AC$

$$(x - 6)(x - 9) + (y - 3)(y - 6) = 0$$

$$\Rightarrow x^2 - 6x - 9x + 54 + y^2 - 3y - 6y + 18 = 0$$

$$\Rightarrow x^2 + y^2 - 15x - 9y + 72 = 0$$

The equation of the circle with diagonal  $BD$  as diameter is

$$(x - 9)(x - 6) + (y - 3)(y - 6) = 0$$

$$\Rightarrow x^2 - 9x - 6x + 54 + y^2 - 3y - 6y + 18 = 0$$

$$\Rightarrow x^2 + y^2 - 15x - 9y + 72 = 0$$

$$x^2 + y^2 - 15x - 9y + 72 = 0$$

### The Circle Ex 24.3 Q4

The given equation are

$$x - 3y = 4 \dots\dots\dots (i)$$

$$3x + y = 22 \dots\dots\dots (ii)$$

$$x - 3y = 14 \dots\dots\dots (iii)$$

$$3x + y = 62 \dots\dots\dots (iv)$$

Let  $A, B, C$  &  $D$  are the points of intersection of the lines (i)&(ii), (ii)&(iii), (iii)&(iv) and (iv)&(i)

$$\therefore A = (7, 1), \quad B = (8, -2), \quad C = (20, 2) \text{ \& } D = (19, 5)$$

$AC$  will be the diameter of the circle

so,

the equation of circle is

$$(x - 7)(x - 20) + (y - 1)(y - 2) = 0$$

$$\Rightarrow x^2 + y^2 - 27x - 3y + 142 = 0$$

### The Circle Ex 24.3 Q5

The line  $3x + 4y = 12$

will meet the axis at  $A(0, 3)$  &  $B(4, 0)$

Since the circle passes through origin &  $A$  and  $B$

$\therefore AB$  is a diameter

Thus the equation of circle is

$$(x - 0)(x - 4) + (y - 3)(y - 0) = 0$$

$$\Rightarrow x^2 + y^2 - 4x - 3y = 0$$

### The Circle Ex 24.3 Q6

Since the circle is passes through origin and cut intercept  $a$  and  $b$  on  
 $x$  - axis &  $y$  - axis

$\therefore$  Coordinate of circle  $A = (0, b)$  and  $B = (a, 0)$

$AB$  is the diameter of circle

$\therefore$  The equation of circle is

$$(x - a)(x - 0) + (y - 0)(y - b) = 0$$

$$\Rightarrow x^2 + y^2 \pm ax \pm by = 0$$

### The Circle Ex 24.3 Q7

Equation of circle in diameter form is,

$$(x+4)(x-12) + (y-3)(y+1) = 0$$

$$x^2 - 8x - 48 + y^2 - 2y - 3 = 0$$

$$x^2 - 8x - 2y + y^2 - 51 = 0 \dots\dots\dots(1)$$

To find  $y$ -intercept, put  $x=0$  in (1),

$$y^2 - 2y - 51 = 0$$

$$y = \frac{2 \pm \sqrt{4 + 204}}{2}$$

$$y = \frac{2 \pm \sqrt{208}}{2}$$

$y$  intercepts are  $1 \pm 4\sqrt{13}$

### The Circle Ex 24.3 Q8

The given equations are

$$x^2 + 2ax - b^2 = 0 \dots\dots (i)$$

$$x^2 + 2px - q^2 = 0 \dots\dots (ii)$$

We have, the roots of (i) will give the abscissae and the roots of (ii) will give the ordinate of A & B respectively.

Now roots of (i)

$$x = \frac{-2a \pm \sqrt{4a^2 + 4b^2}}{2} = -a \pm \sqrt{a^2 + b^2}$$

Roots of (ii)

$$x = \frac{-2p \pm \sqrt{4p^2 + 4q^2}}{2} = -p \pm \sqrt{p^2 + q^2}$$

$$\text{Coordinates of } A = \left(-a + \sqrt{a^2 + b^2}, -p + \sqrt{p^2 + q^2}\right)$$

$$B = \left(-a - \sqrt{a^2 + b^2}, -p - \sqrt{p^2 + q^2}\right)$$

so, the equation of circle is

$$\left(x + a - \sqrt{a^2 + b^2}\right)\left(x + a + \sqrt{a^2 + b^2}\right) + \left(y + p - \sqrt{p^2 + q^2}\right)\left(y + p + \sqrt{p^2 + q^2}\right) = 0$$

$$\Rightarrow x^2 + y^2 + 2ax + 2py - (a^2 + b^2 + p^2 + q^2) + a^2 + p^2 = 0$$

$$\Rightarrow x^2 + y^2 + 2ax + 2py - (b^2 + q^2) = 0$$

The radius is

$$\begin{aligned} r &= \sqrt{g^2 + f^2 - c} \\ &= \sqrt{a^2 + p^2 - (b^2 + q^2)} \\ &= \sqrt{a^2 + b^2 + p^2 + q^2} \end{aligned}$$

### The Circle Ex 24.3 Q9

Here AB and AD are taken as x – axis and y – axis respectively.

Since ABCD is a square thus the coordinate of

$$A = (0, 0)$$

$$B = (a, 0) \quad C = (a, a)$$

$$D = (0, a)$$

$\therefore$  BD is a diameter

so, the equation of circle is

$$(x - a)(x - 0) + (y - 0)(y - a) = 0$$

$$\Rightarrow x^2 + y^2 - ax - ay = 0$$

so,

$$x^2 + y^2 - a(x + y) = 0$$

### The Circle Ex 24.3 Q10

The given equation of line & circle in

$$2x - y + 6 = 0 \dots\dots\dots (i)$$

$$x^2 + y^2 - 2y - 9 = 0 \dots\dots (ii)$$

The point of intersection of (i) & (ii) is

$$x^2 + (2x + 6)^2 - 2(2x + 6) - 9 = 0$$

$$\Rightarrow x^2 + 4x^2 + 24x + 36 - 4x - 12 - 9 = 0$$

$$\Rightarrow 5x^2 + 20x + 15 = 0$$

$$\Rightarrow x^2 + 4x + 3 = 0$$

$$\Rightarrow (x + 3)(x + 1) = 0 \quad \Rightarrow x = (-3, -1)$$

$$\therefore y = (0, 4)$$

$$\therefore A = (-3, 0) \& B = (-1, 4)$$

$\therefore AB$  is a diameter, so the equation of circle is

$$(x + 3)(x + 1) + (y - 0)(y - 4) = 0$$

$$\Rightarrow x^2 + y^2 + 4x - 4y + 3 = 0$$

### The Circle Ex 24.3 Q11

The triangle is formed by

$$x = 0 \dots\dots\dots (i)$$

$$y = 0 \dots\dots\dots (ii) \&$$

$$lx + my = 1 \dots\dots\dots (iii)$$

The line (iii) cuts the axis at

$$A = \left(0, \frac{1}{m}\right) \text{ and at } B = \left(\frac{1}{l}, 0\right)$$

Now,  $AB$  will be the diameter of circle.

$\therefore$  equation of circle will be,

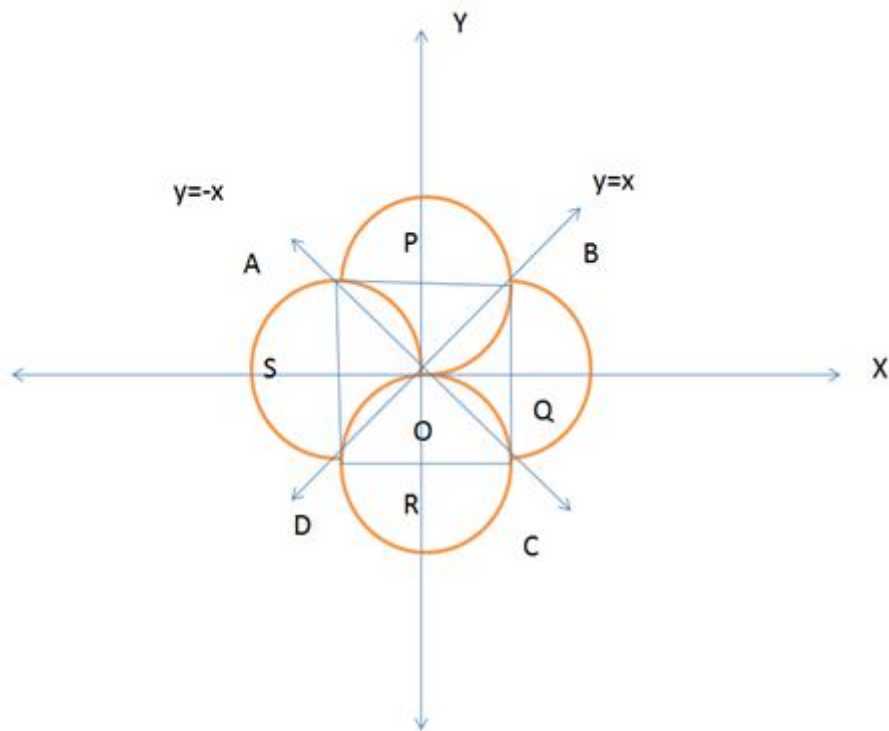
$$\left(x - \frac{1}{l}\right)(x - 0) + (y - 0)\left(y - \frac{1}{m}\right) = 0$$

$$\Rightarrow x^2 + y^2 - \frac{x}{l} - \frac{y}{m} = 0$$

$$\Rightarrow x^2 + y^2 - \frac{x}{l} - \frac{y}{m} = 0$$

### The Circle Ex 24.3 Q12

Figure shows four such circles.



Angle between  $y=x$  and  $y=-x$  is  $\frac{\pi}{2}$ .

$\therefore$  Angle between  $OB$  and  $OA = \frac{\pi}{2}$

Hence,  $AB$ ,  $BC$ ,  $CD$  and  $AD$  are diameters of circles.

$$\angle BOQ = \frac{\pi}{4}$$

$$\sin \angle BOQ = \frac{BQ}{OB}$$

$$\sin \frac{\pi}{4} = \frac{BQ}{\sqrt{2}}$$

$$\frac{1}{\sqrt{2}} = \frac{BQ}{\sqrt{2}}$$

$$BQ=1$$

Radius of circles=1=OQ

Coordinates of B is (1,1).

Similarly, coordinates of A(-1,1), C (1,-1), D(-1,-1)

Equation of circle with diameter AB is

$$(x+1)(x-1)+(y-1)(y-1)=0$$

$$x^2 - 1 + y^2 - 2y + 1 = 0$$

$$x^2 + y^2 - 2y = 0$$

Equation of circle with diameter BC is

$$(x-1)(x-1)+(y-1)(y+1)=0$$

$$x^2 - 2x + 1 + y^2 - 1 = 0$$

$$x^2 + y^2 - 2x = 0$$

Equation of circle with diameter CD is

$$(x+1)(x-1)+(y+1)(y+1)=0$$

$$x^2 - 1 + y^2 + 2y + 1 = 0$$

$$x^2 + y^2 + 2y = 0$$

Equation of circle with diameter AD is

$$(x+1)(x+1)+(y-1)(y+1)=0$$

$$x^2 + 2x + 1 + y^2 - 1 = 0$$

$$x^2 + y^2 + 2x = 0$$