

## 2.4 Equation of a circle with centre at the origin.

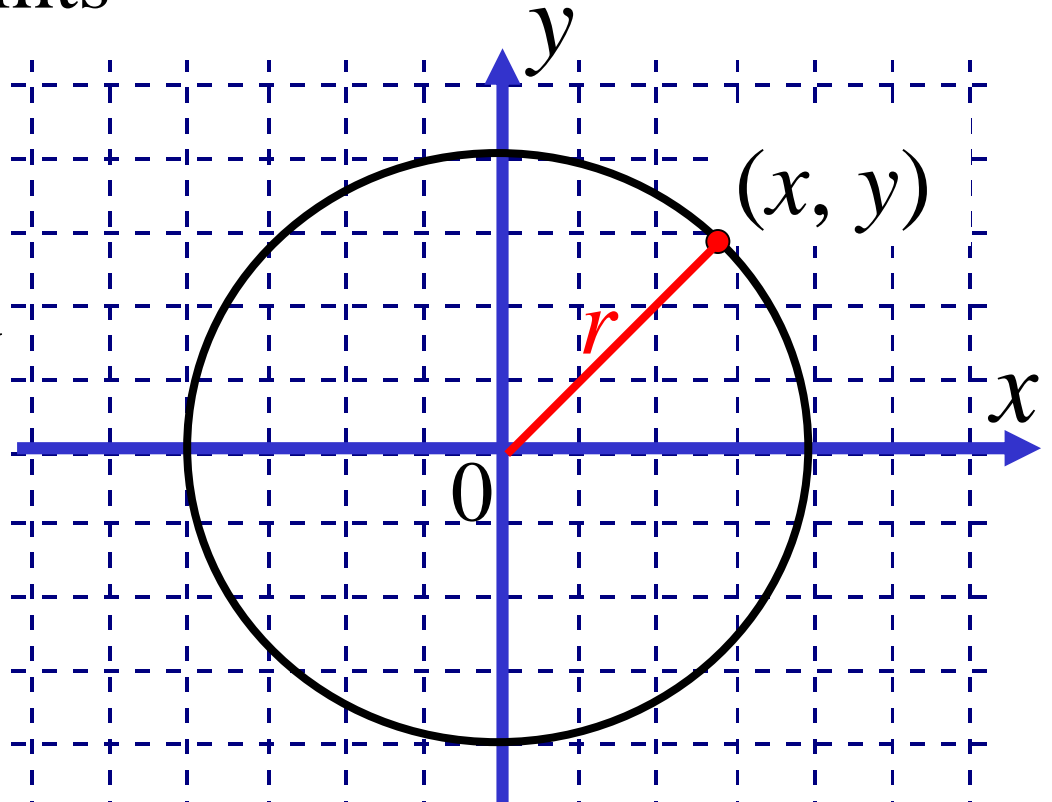
A circle is a set of points which are equidistant from a given point.

The distance is called the radius (  $r$  ).

$(x, y)$  represents any point on the circle.

$$r = \sqrt{x^2 + y^2}$$

$$r^2 = x^2 + y^2$$



$$x^2 + y^2 = r^2$$

$$x^2 + y^2 = r^2$$

Equation of a circle with centre at the origin and radius equal to  $r$ .

## Example 1

$$x^2 + y^2 = 100 \quad \text{centre } (0, 0) \quad \text{radius} = 10$$

$$x^2 + y^2 = 25 \quad \text{centre } (0, 0) \quad \text{radius} = 5$$

$$x^2 + y^2 = 12 \quad \text{centre } (0, 0) \quad \text{radius} = \sqrt{12}$$

$$x^2 + y^2 = \frac{16}{9} \quad \text{centre } (0, 0) \quad \text{radius} = \frac{4}{3}$$

## Example 2:

Determine the equation of the circle at right.

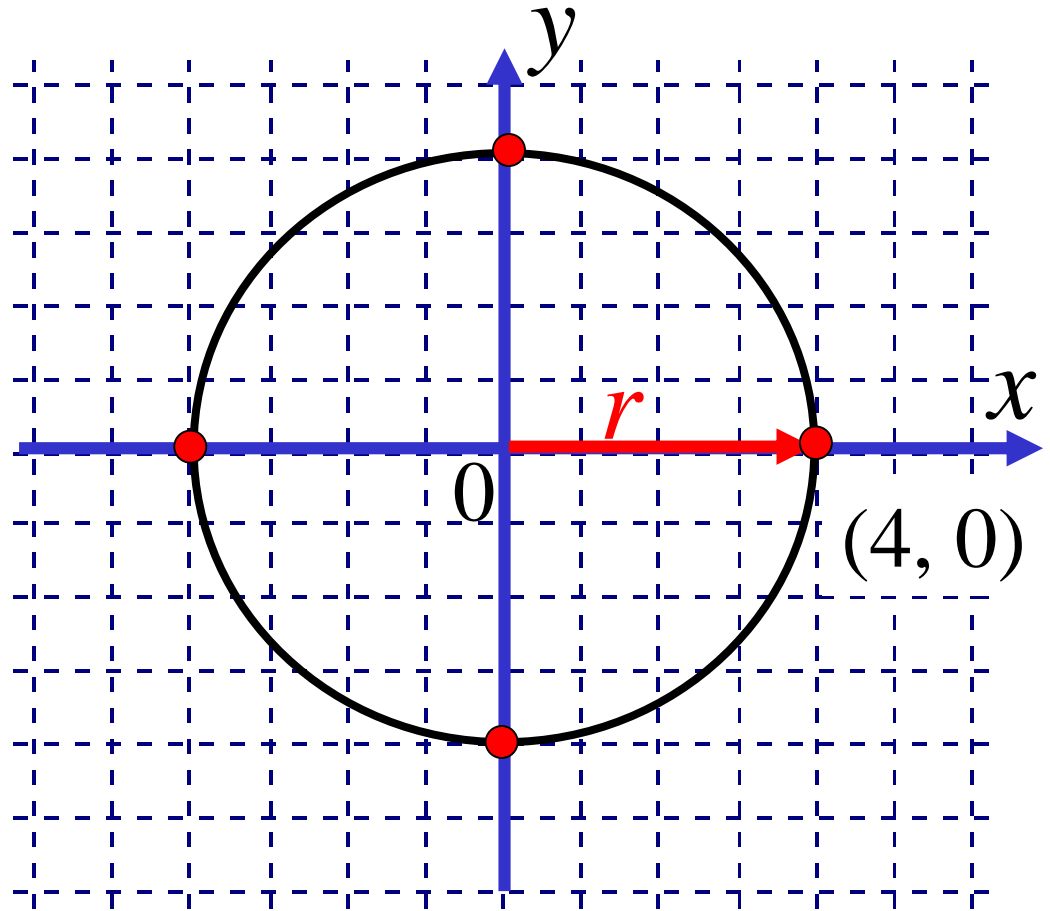
$x$ -intercept is 4.

radius is 4

$$x^2 + y^2 = r^2$$

$$x^2 + y^2 = 4^2$$

$$x^2 + y^2 = 16$$

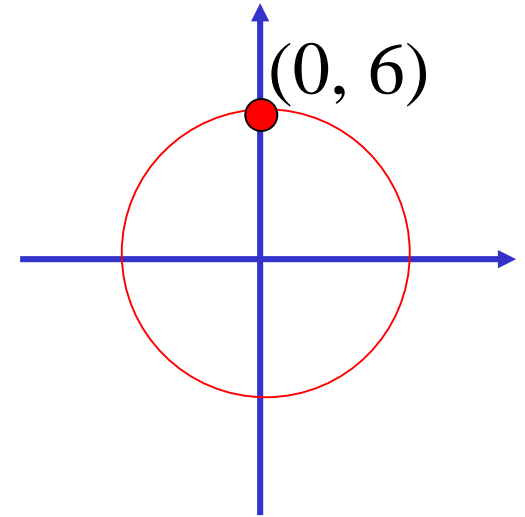


Name other points on the circle.

**Example 3:** Determine the equation of the circle with center at the origin and y-intercept of 6.

$$x^2 + y^2 = 6^2$$

$$x^2 + y^2 = 36$$



**Example 4:** Determine the center and radius of the circle whose equation is:  $x^2 + y^2 = 22$

centre is  $(0, 0)$       radius is  $\sqrt{22}$

### Example 5:

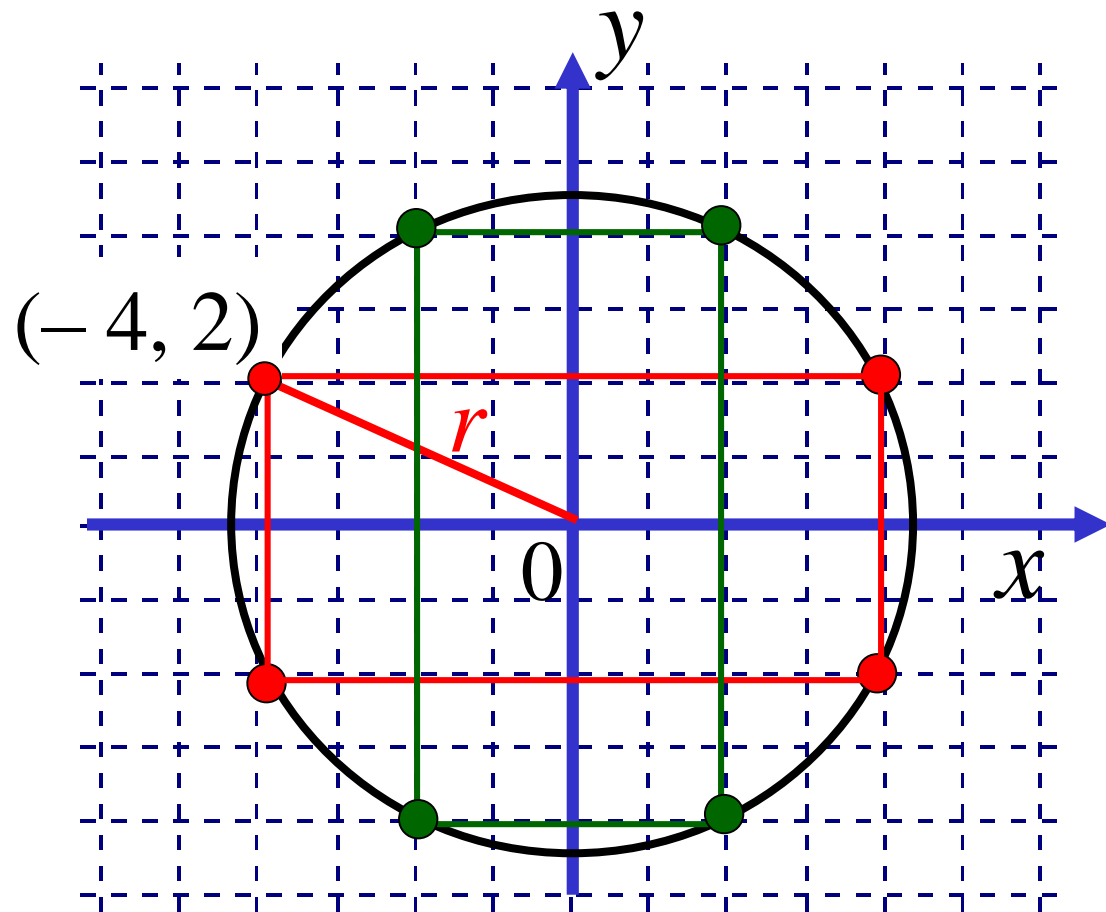
Determine the equation of the circle with center at the origin and passes through point  $(-4, 2)$ .

$$x^2 + y^2 = r^2$$

$$(-4)^2 + (2)^2 = r^2$$

$$16 + 4 = r^2$$

$$20 = r^2$$



$$x^2 + y^2 = 20$$

Name other points that lie on the circle.

**Ex 6.** If the diameter of a satellite dish is 54 cm, determine the equation that models this situation.

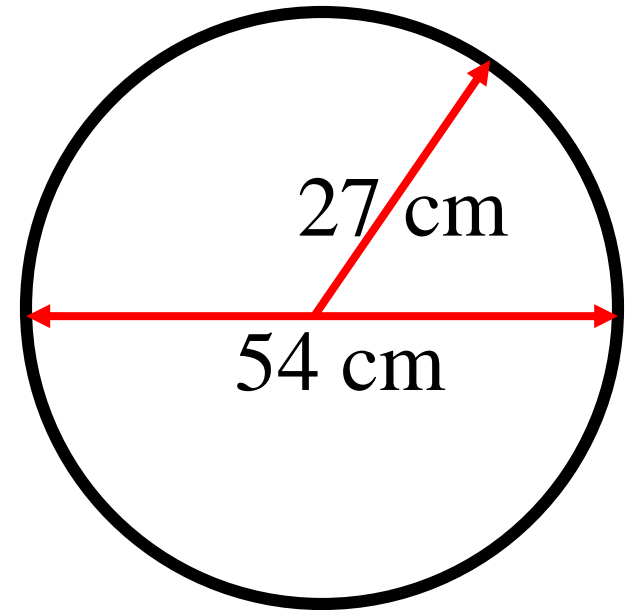
$$r = d \div 2$$

$$r = 54 \div 2$$

$$r = 27 \text{ cm}$$

$$x^2 + y^2 = 27^2$$

$$x^2 + y^2 = 729$$



**Ex. 7:** If the points  $(a, 5)$  and  $(3, b)$  are points that lie on the circle,  $x^2 + y^2 = 29$ , determine the values of  $a$  and  $b$ .

(i)  $x^2 + y^2 = 29$       substitute  $x = a$  and  $y = 5$ .

$$a^2 + 5^2 = 29$$

$$a^2 + 25 = 29$$

$$a^2 = 29 - 25$$

$$a^2 = 4$$

$$a = 2$$

(ii)  $3^2 + b^2 = 29$

$$3^2 + b^2 = 29$$

$$9 + b^2 = 29$$

$$b^2 = 29 - 9$$

$$b^2 = 20$$

$$b = \sqrt{20}$$

**Ex. 8:** Determine if the point (4, 6) is inside, outside or on the circle  $x^2 + y^2 = 49$

$$x^2 + y^2 = 49 \quad \text{sub } x = 4 \text{ and } y = 6$$

$$4^2 + 6^2$$

$$16 + 36$$

$$52$$

$$52 > 49$$



*(greater than)*

$\therefore$  The point lies *outside* the circle.



**Ex. 9:** Determine if the point  $(2, -5)$  is inside, outside or on the circle  $x^2 + y^2 = 30$

$$x^2 + y^2 = 30 \quad \text{sub } x = 2 \text{ and } y = -5$$

$$2^2 + (-5)^2$$

$$4 + 25$$

$$29$$

$$29 < 30$$



*(less than)*

$\therefore$  The point lies  
*inside* the circle.

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

$$x^2 + y^2 = 36$$

$$x^2 + y^2 = 121$$

