

## Equation in sphere in various forms.

### (1) Equation of sphere with given center and radius

(i) **Cartesian form** :The equation of a sphere with center  $(a, b, c)$  and radius  $R$  is

$$(x - a)^2 + (y - b)^2 + (z - c)^2 = R^2 \quad \dots\dots(i)$$

If the centre is at the origin, then equation (i) takes the form  $x^2 + y^2 + z^2 = R^2$ , which is known as the standard form of the equation of the sphere.

(ii) **Vector form**:The equation of sphere with center at  $C(\mathbf{c})$  and radius 'a' is  $|\mathbf{r} - \mathbf{c}| = a$ .

### (2) Diameter form of the equation of a sphere

(i) **Cartesian form**:If  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are the co-ordinates of the extremities of a diameter of a sphere, then its equation is  $(x - x_1)(x - x_2) + (y - y_1)(y - y_2) + (z - z_1)(z - z_2) = 0$ .

(ii) **Vector form**:If the position vectors of the extremities of a diameter of a sphere are  $\mathbf{a}$  and  $\mathbf{b}$ , then its equation is  $(\mathbf{r} - \mathbf{a}) \cdot (\mathbf{r} - \mathbf{b}) = 0$  or  $|\mathbf{r}|^2 - \mathbf{r} \cdot (\mathbf{a} + \mathbf{b}) + \mathbf{a} \cdot \mathbf{b} = 0$ .