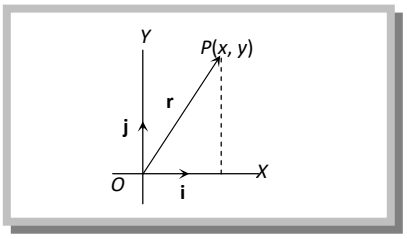
Rectangular resolution of a Vector in Two and Three dimensional systems.

(1) Any vector $\mathbf{r}$ can be expressed as a linear combination of two unit vectors $\mathbf{i}$ and $\mathbf{j}$ at right angle *i.e.,* $\mathbf{r} = x\mathbf{i} + y\mathbf{j}$



The vector $x\mathbf{i}$ and $y\mathbf{j}$ are called the perpendicular component vectors of $\mathbf{r}$. The scalars *x* and *y* are called the components or resolved parts of $\mathbf{r}$ in the directions of *x*-axis and *y*-axis respectively and the ordered pair (*x, y*) is known as co-ordinates of point whose position vector is $\mathbf{r}$.

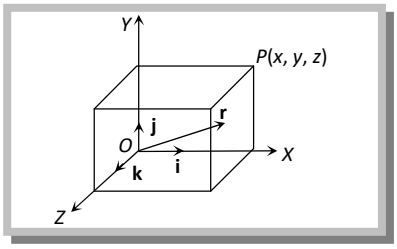
Also the magnitude of $\mathbf{r} = \sqrt{x^2 + y^2}$ and if θ be the inclination of $\mathbf{r}$ with the *x*-axis, then $\theta = \tan^{-1}(y/x)$

(2) If the coordinates of *P* are (*x, y, z*)then the position vector of $\mathbf{r}$ can be written as $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$.

The vectors $x\mathbf{i}, y\mathbf{j}$ and $z\mathbf{k}$ are called the right angled components of $\mathbf{r}$.

The scalars x, y, z are called the components or resolved parts of $\mathbf{r}$ in the directions of *x*-axis, *y*-axis and *z*-axis respectively and ordered triplet (*x, y, z*) is known as coordinates of *P* whose position vector is $\mathbf{r}$.

Also the magnitude or modulus of $\mathbf{r} \neq |\mathbf{r}| = \sqrt{x^2 + y^2 + z^2}$



Direction cosines of $\mathbf{r}$ are the cosines of angles that the vector $\mathbf{r}$ makes with the positive direction of *x, y* and *z*-axes. $\cos\alpha = l = \dfrac{x}{\sqrt{x^2 + y^2 + z^2}} = \dfrac{x}{|\mathbf{r}|}$,

$\cos\beta = m = \dfrac{y}{\sqrt{x^2 + y^2 + z^2}} = \dfrac{y}{|\mathbf{r}|}$ and $\cos\gamma = n = \dfrac{z}{\sqrt{x^2 + y^2 + z^2}} = \dfrac{z}{|\mathbf{r}|}$

Clearly, $l^2 + m^2 + n^2 = 1$. Here $\alpha = \angle POX$, $\beta = \angle POY$ $\gamma = \angle POZ$ and $\mathbf{i}, \mathbf{j}, \mathbf{k}$ are the unit vectors along OX, OY, OZ respectively.