Direction cosines

$$\cos a = \frac{F_x}{|\boldsymbol{F}|} = \frac{F_x}{\sqrt{F_x^2 + F_y^2 + F_z^2}}\ ,\ \cos b = \frac{F_y}{|\boldsymbol{F}|} = \frac{F_y}{\sqrt{F_x^2 + F_y^2 + F_z^2}}\ ,\ \cos g = \frac{F_z}{|\boldsymbol{F}|} = \frac{F_z}{\sqrt{F_x^2 + F_y^2 + F_z^2}}$$

Prove:

$$\cos^2(a) + \cos^2(b) + \cos^2(g) = 1$$

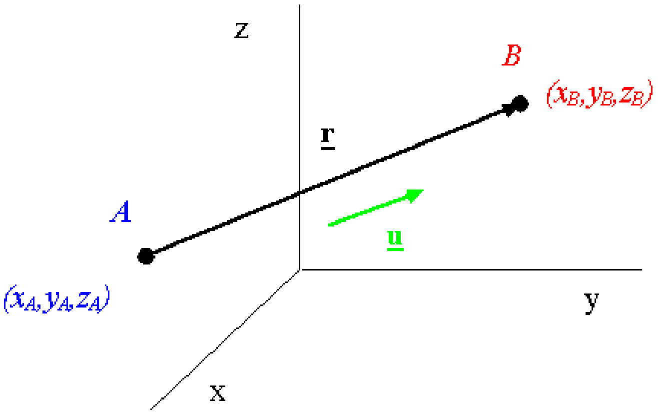
Solution:

$$\cos^2 a + \cos^2 b + \cos^2 g = \frac{F_x{}^2}{F_x^2 + F_y^2 + F_z^2} + \frac{F_y{}^2}{F_x^2 + F_y^2 + F_z^2} + \frac{F_z{}^2}{F_x^2 + F_y^2 + F_z^2} = \frac{F_x^2 + F_y^2 + F_z^2}{F_x^2 + F_y^2 + F_z^2} = 1$$

Coordinates of points in space: The triplet (*x*,*y*,*z*) describes the coordinates of a point.

The vector connecting two points: The vector connecting point A to point B is given by

$$\boldsymbol{r} = (x_B - x_A)\boldsymbol{i} + (y_B - y_A)\boldsymbol{j} + (z_B - z_A)\boldsymbol{k}$$



A unit vector along the line A-B: A unit vector along the line A-B is obtained from

$$\boldsymbol{u} = \frac{\boldsymbol{r}}{r} = \frac{(x_B - x_A)\boldsymbol{i} + (y_B - y_A)\boldsymbol{j} + (z_B - z_A)\boldsymbol{k}}{\sqrt{(x_B - x_A)^2 + (y_B - y_A)^2 + (z_B - z_A)^2}}$$