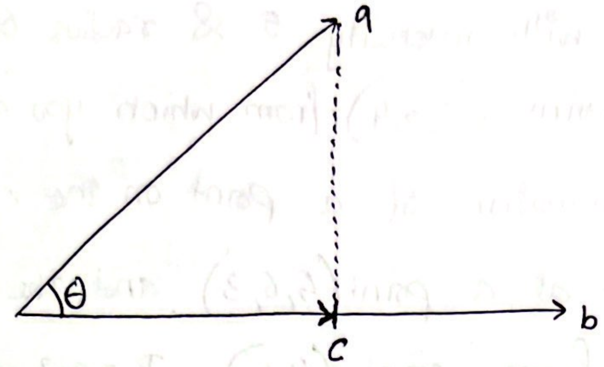


Relation

$|c| = |a| \cos\theta$

$\therefore \cos\theta = \dfrac{|c|}{|a|}$

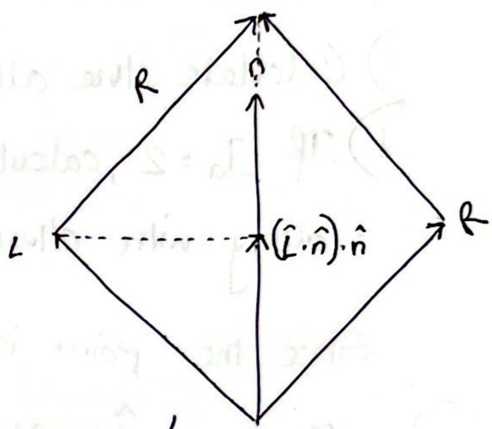
$$\vec{a} \cdot \vec{b} = |a||b| \cos\theta = \cancel{|a|}|b| \cdot \frac{|c|}{\cancel{|a|}}$$

$$\Rightarrow \vec{a} \cdot \vec{b} = |b| \cdot |c|$$

$$\Rightarrow |c| = \vec{a} \cdot \frac{\vec{b}}{|b|}$$

$$\Rightarrow |c| = \vec{a} \cdot \hat{b}$$

and $\Rightarrow \hat{c} = (\hat{a} \cdot \hat{b}) \cdot \hat{b}$



$$\hat{L} + \hat{R} = 2(\hat{L} \cdot \hat{n}) \cdot \hat{n}$$

$$\Rightarrow \hat{R} = 2(\hat{L} \cdot \hat{n}) \cdot \hat{n} - \hat{L}$$

$$f_{att} = \max\left[1 - \left(\frac{d}{r}\right)^2 , 0 \right]$$

where d = distance between source light and point.

r = radius of influence

1) A light source with intensity 5 & radius of influence 50 is located at point (2,3,4) from which you are called to calculate the illumination of a point on the xy plane. The camera is set at a point (5,6,3) and the light is reflected back from point (4,4). $K_a = 0.2$, $K_d = 0.5$, $K_s = 0.4$

a) Calculate $\hat{R}$

b) Calculate Intensity of specular reflection for $n = 10$

c) Calculate the attenuation factor.

d) If $I_a = 2$, calculate the total reflected light intensity along with attenuation factor.

Since the point is on the xy plane,

(a) $\varnothing$ $\hat{n} = 0i + 0j + 1k$

$\varnothing$ $\vec{L} = (2,3,4) - (4,4,0)$
$= -2i + (-1j) + 4k$

$\varnothing$ $\hat{L} = \dfrac{-2i - 1j + 4k}{\sqrt{21}}$

We know,

$\varnothing$ $\hat{R} = 2(\hat{L} \cdot \hat{n})\hat{n} - \hat{L}$

$\hat{L} \cdot \hat{n} = (0i + 0j + 1k) \cdot \left(\dfrac{-2i - 1j + 4k}{\sqrt{21}} \right)$

$= \dfrac{4}{\sqrt{21}} \hat{k}$,

$2(\hat{L} \cdot \hat{n}) = \dfrac{8}{\sqrt{21}} \hat{k} \longrightarrow 2(\hat{L} \cdot \hat{n})\hat{n} = \dfrac{8}{\sqrt{21}} \hat{k}$,

$\hat{R} = 2(\hat{L} \cdot \hat{n})\hat{n} - \hat{L} = \dfrac{8}{\sqrt{21}} \hat{k} - \dfrac{(-2i - 1j + 4k)}{\sqrt{21}}$

$= \dfrac{+2i + 1j + 4k}{\sqrt{21}}$ Ans

(b) $\vec{V} = (5,6,3) - (4,4,0)$

$= (1,2,3)$

$$\hat{V} = \frac{i + 2j + 3k}{\sqrt{14}}$$

$$\hat{R}\cdot\hat{V} = \left(\frac{2i + j + 4k}{\sqrt{21}}\right)\cdot\left(\frac{i + 2j + 3k}{\sqrt{14}}\right)$$

$$= \frac{16}{\sqrt{294}}$$

$$I = I_s K_s (\hat{R}\cdot\hat{V})^n$$

$$= 5 \times 0.4 \times \left(\frac{16}{\sqrt{294}}\right)^{10}$$

$= 1.0011$ units

(c) $f_{att} = 1 - \left(d/r\right)^2$

$$\overset{L}{(2,3,4)} \xleftrightarrow{d} \overset{P}{(4,4,0)}$$

$$d = \sqrt{(2-4)^2 + (3-4)^2 + (4-0)^2}$$

$$= \sqrt{21}$$

$$f_{att} = 1 - \frac{21}{(50)^2}$$

$= 0.9916$ units

(d) $$I = I_a K_a + I_s f_{att}\left(K_d . max(\hat{L}\cdot\hat{n}, 0) + K_s \cdot mas(\hat{V}\cdot\hat{R}, 0)^n\right)$$