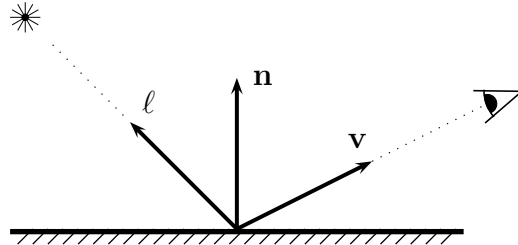


CSE 167 - Intro to Computer Graphics - Fall 2003
ANSWERS Quiz #2 — November 6

1. Describe the Phong lighting model by doing the following. We are restricting attention to a single wavelength (color) of light.

Label the three vectors shown in the figure with the names we used for them in class (and in the textbook).



- a. ANSWERS: ℓ , \mathbf{n} and \mathbf{v} .

- b. The Phong lighting model uses five different scalar values to describe material properties (at a single wavelength). List these five values: give their names (mathematical symbols) along with short descriptions of their meanings (two to four words is enough).

i: ANSWER: ρ_a - Ambient reflectivity coefficient.

ii: ANSWER: ρ_d - Diffuse reflectivity coefficient.

iii: ANSWER: ρ_s - Specular reflectivity coefficient.

iv: ANSWER: f - Specular exponent (or “shininess”).

v: ANSWER: I_e - Emissive light intensity.

- c. Give the equation for the Phong lighting calculation for a single wavelength of light, and a single light source (do not use the halfway vector for this part). Give also the formula for the reflection vector \mathbf{r} .

ANSWER:

$$I = \rho_a I_a^{in} + \rho_d I_d^{in} (\ell \cdot \mathbf{n}) + \rho_s I_s^{in} (\mathbf{r} \cdot \mathbf{v})^f + I_e.$$

$$\mathbf{r} = 2(\ell \cdot \mathbf{n})\mathbf{n} - \ell.$$

- d. Describe how the equation in c. is modified when using the halfway vector. Give the formula for the halfway vector.

ANSWER: Replace “ $(\mathbf{r} \cdot \mathbf{v})$ ” with “ $(\mathbf{h} \cdot \mathbf{n})$ ”.

$$\mathbf{h} = \frac{\ell + \mathbf{v}}{\|\ell + \mathbf{v}\|}.$$