

In the following exercises, assume the following values.

**Geometric properties**

Light position:  $S = (10, 10, 10)$

Viewpoint:  $E = (0, 5, 10)$

Surface point:  $P = (5, 5, 5)$

Surface normal:  $\mathbf{n} = (\frac{2}{3}, \frac{2}{3}, \frac{1}{3})$

**Light properties**

Scene ambient:  $s_a = (0.1, 0.1, 0.1)$

Light ambient:  $L_a = (0.3, 0.3, 0.3)$

Light diffuse:  $L_d = (0.5, 0.5, 0.5)$

Light specular:  $L_s = (1.0, 1.0, 1.0)$

**Material properties**

Material ambient:  $m_a = (1.0, 0.5, 0.0)$

Material diffuse:  $m_d = (1.0, 0.5, 0.0)$

Material specular:  $m_s = (1.0, 1.0, 1.0)$

Shininess:  $shiny = 64$

1. Calculate the scene ambient light (RGB) reflected from the point  $P$ .
2. Calculate the total ambient light reflected from  $P$ .
3. Assuming a positional light source, calculate the diffuse light reflected from  $P$ .
4. Find the reflection vector.
5. Assuming a local viewer, calculate the specular light reflected from  $P$ .
6. Calculate the shade (total light reflected) of the point  $P$ .
7. Assume that the light source is directional. Calculate the diffuse light reflected from  $P$ . How much does it differ from the value calculated earlier?
8. Assume a infinite viewer. Calculate the specular light reflected from  $P$ . How much does it differ from the value calculated earlier?