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HW #7

EECU 101

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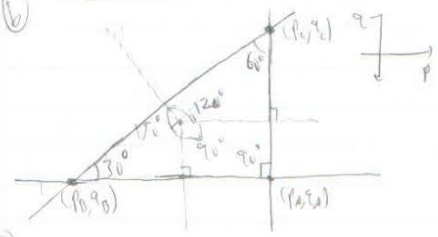
1) (a)

$$R(p,q) = \frac{p_1 + q_2 + 1}{\sqrt{p^2+q^2+1}\sqrt{p_1^2+q_2^2+1}}$$

Since the estimated curve is at the same position as the viewer, $p_1 = q_1 = 0$.

$$\Rightarrow \boxed{R(p,q) = \frac{1}{\sqrt{p^2+q^2+1}}}$$

(b)



(c)

$E(x,y) = R(p,q)$

$E_A(x,y) = 1$, $E_B(x,y) = \frac{1}{\sqrt{5}}$

$E_D(x,y) = R_D(p,q) = \frac{1}{\sqrt{p_0^2+q_0^2+1}} = 1$

$\Rightarrow (p_D, q_D) = (0,0)$

$E_D(x,y) = R_D(p,q) = \frac{1}{\sqrt{p_0^2+q_0^2+1}} = \frac{1}{\sqrt{3}}$

$\Rightarrow q_B = q_A = 0$

$\frac{1}{\sqrt{p_B^2+1}} = \frac{1}{\sqrt{5}} \Rightarrow p_B = -2$

$\Rightarrow (p_B, q_B) = (-2, 0)$

$\tan(30°) = \frac{q_c - q_B}{p_A - p_B} = \frac{q_c}{2}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{q_c}{2} \Rightarrow q_c = \frac{2}{\sqrt{3}}$

$p_c = p_A = 0 \quad \therefore \boxed{(p_c, q_c) = \left(0, \frac{2}{\sqrt{3}}\right)}$

$E_c(x,y) = R_c(p,q) = \frac{1}{\sqrt{0^2 + \frac{4}{3} + 1}} = \boxed{\sqrt{\frac{3}{7}}}$

2) $z(x,y) = z_0 + \sqrt{r^2 - (x^2+y^2)}, \quad (x^2+y^2) \le r^2$

$\hat{N} = \frac{N}{|N|}, \quad p = \frac{-x}{\sqrt{r^2-(x^2+y^2)}}, \quad q = \frac{-y}{\sqrt{r^2-(x^2+y^2)}}$

$= \frac{(-p, -q, 1)}{\sqrt{p^2+q^2+1}}$

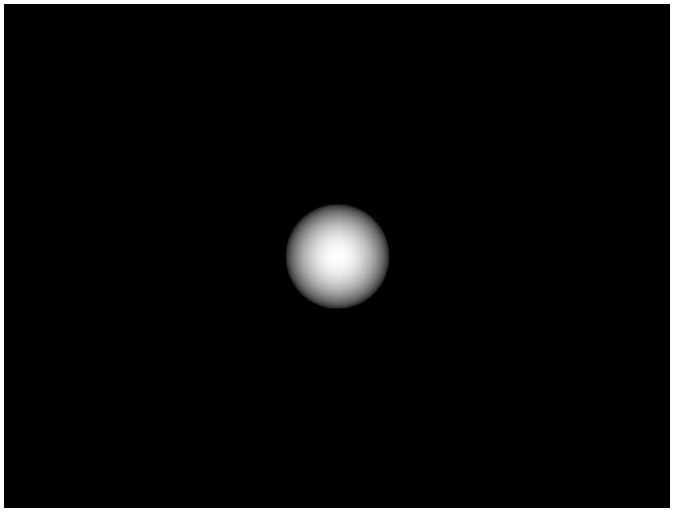
$\Rightarrow |N| = \sqrt{\frac{x^2}{r^2-(x^2+y^2)} + \frac{y^2}{r^2-(x^2+y^2)} + 1} = \frac{\sqrt{x^2+y^2+r^2-(x^2+y^2)}}{\sqrt{r^2-(x^2+y^2)}}$

$= \frac{r}{\sqrt{r^2-(x^2+y^2)}}$

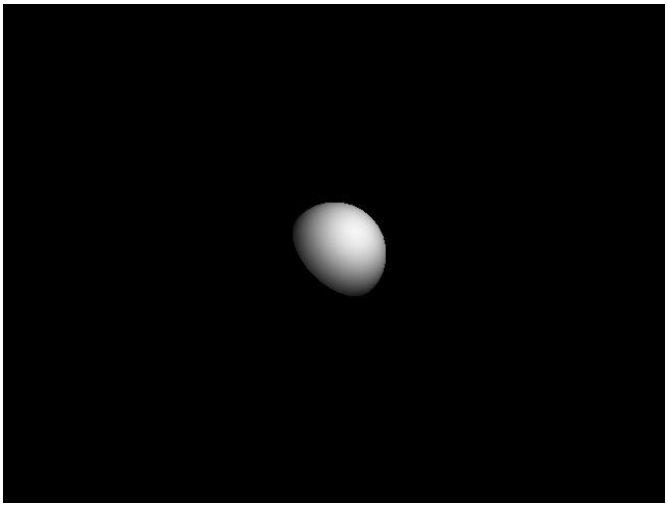
$\hat{N} = \left(\frac{\frac{x}{\sqrt{r^2-(x^2+y^2)}}}{\frac{r}{\sqrt{r^2-(x^2+y^2)}}}, \frac{\frac{y}{\sqrt{r^2-(x^2+y^2)}}}{\frac{r}{\sqrt{r^2-(x^2+y^2)}}}, \frac{\frac{1}{\sqrt{r^2-(x^2+y^2)}}}{\frac{r}{\sqrt{r^2-(x^2+y^2)}}}\right)$

$= \boxed{\left(\frac{x}{r}, \frac{y}{r}, \frac{\sqrt{r^2-(x^2+y^2)}}{r}\right)}$

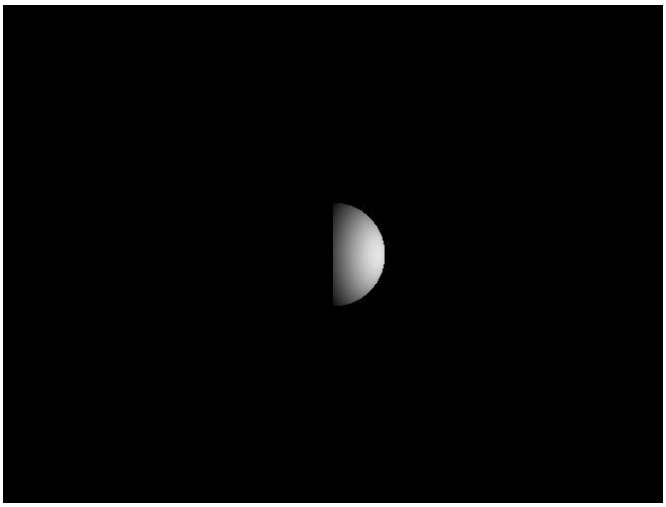
a) **S = [0, 0, 1], r = 50, a = 0.5, m = 1**



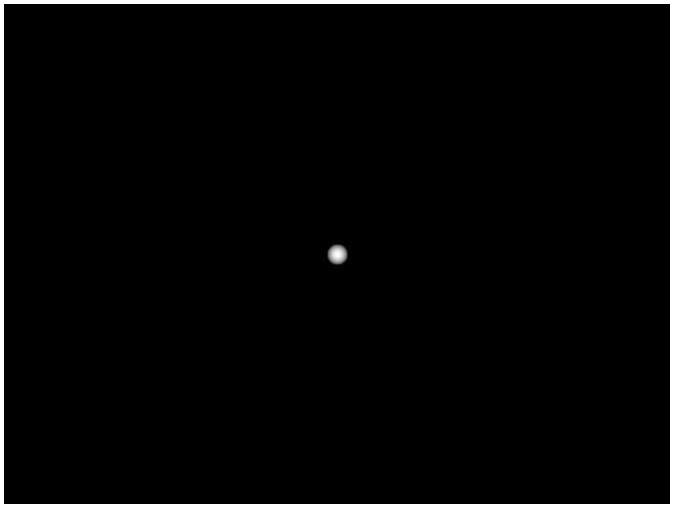
b) **S = [1/sqrt(3), 1/sqrt(3), 1/sqrt(3)], r = 50, a = 0.5, m = 1**



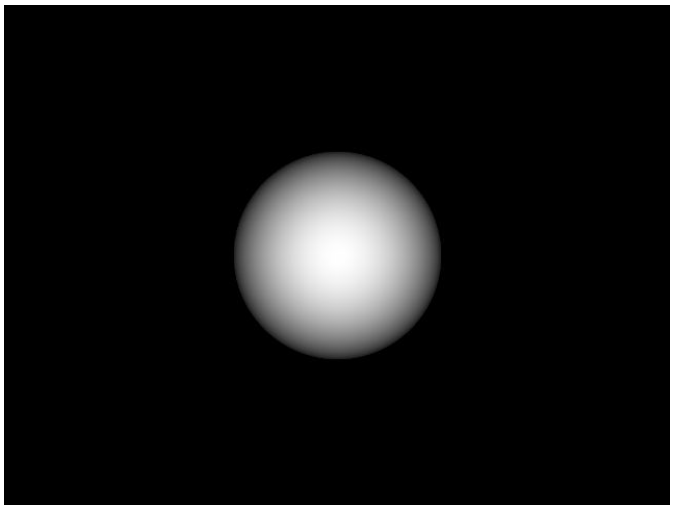
c) **S = [1, 0, 0], r = 50, a = 0.5, m = 1**



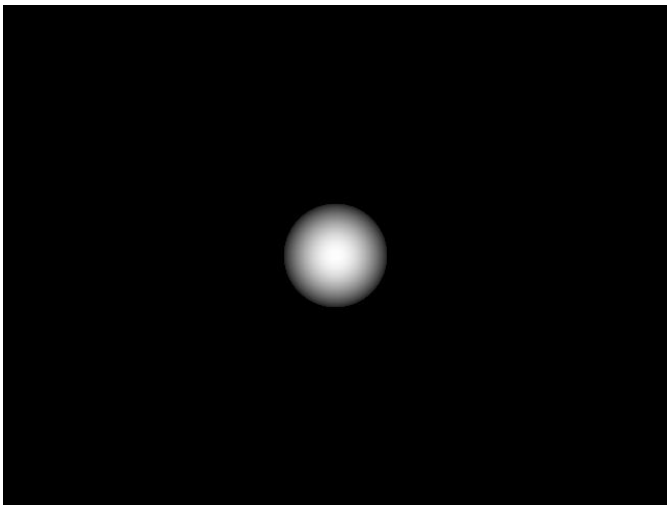
d) S = [0, 0, 1], r = 10, a = 0.5, m = 1



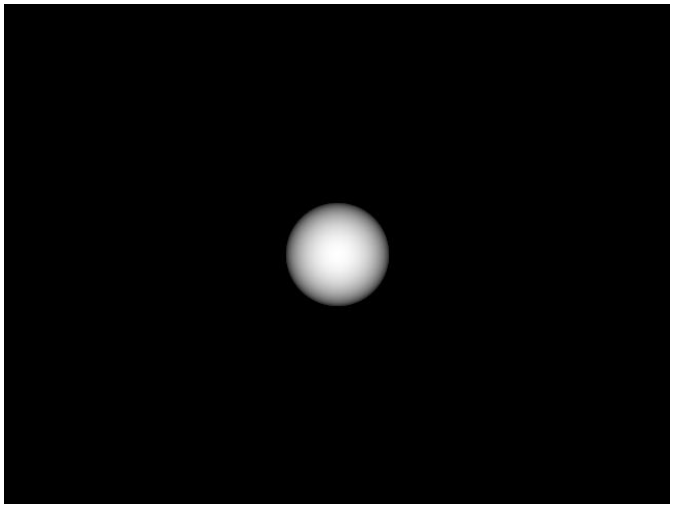
e) S = [0, 0, 1], r = 100, a = 0.5, m = 1



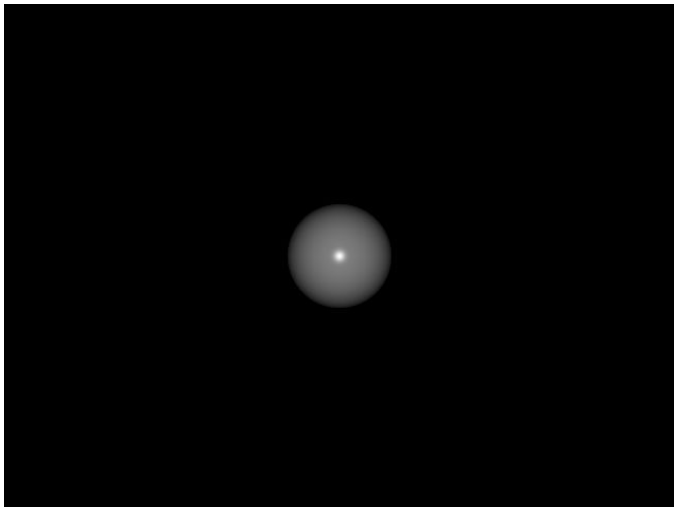
f) S = [0, 0, 1], r = 50, a = 0.1, m = 1



g) S = [0, 0, 1], r = 50, a = 1, m = 1



h) S = [0, 0, 1], r = 50, a = 0.5, m = 0.1



i) S = [0, 0, 1], r = 50, a = 0.5, m = 10000