

## Homework #2

**Problem 3 - 3.5.1:**

$$S(x, y, z) = (x^2 + y^2 + z^2)^{-3/2} = r^{-3} \quad (1)$$

a)

$$\nabla S = -3xr^{-5}\hat{\mathbf{x}} - 3yr^{-5}\hat{\mathbf{y}} - 3zr^{-5}\hat{\mathbf{z}}. \quad (2)$$

Then,

$$\nabla S|_{(1,2,3)} = -0.004\hat{\mathbf{x}} - 0.0081\hat{\mathbf{y}} - 0.01227\hat{\mathbf{z}}. \quad (3)$$

b)

$$|\nabla S|_{(1,2,3)}| = \nabla S|_{(1,2,3)} \cdot \nabla S|_{(1,2,3)} = 0.015306. \quad (4)$$

c) We know that

$$\cos\alpha_i = \frac{\nabla S \cdot \hat{\mathbf{x}}_i}{|\nabla S|}, \quad (5)$$

then  $\cos\alpha = -1/\sqrt{14}$ ,  $\cos\beta = -2/\sqrt{14}$ , and  $\cos\gamma = -3/\sqrt{14}$ .