Mathematical Physics — PHZ 3113

Gradient, (January 23, 2013)

Group #

Participating students (print):

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1. Calculate

$$\frac{\partial}{\partial x_i} x_j \,. \tag{1}$$

2. Calculate

$$\frac{\partial}{\partial x_i} \sum_{j=1}^{n} x_j^2 \,. \tag{2}$$

3. Calculate

$$\frac{\partial}{\partial x_i} \sqrt{\sum_{j=1}^{n} x_j^2} \,. \tag{3}$$

4. Calculate

$$\nabla r \,. \tag{4}$$

5. Calculate

$$\nabla f(r)\,. \tag{5}$$

6. Example: Calculate the electric field $\vec{E}$ from a given central potential:

$$\vec{E} = -\nabla\,\Phi(r)\,, \quad \Phi(r) = \frac{q}{4\pi\,\epsilon_0\,r}\,. \tag{6}$$

7. Calculate

$$\nabla\ (\vec{n}\cdot\vec{r}) \tag{7}$$

where $\vec{n}$ is a constant vector. Describe the solutions $\vec{r}$ for $\vec{n}\cdot\vec{r} = 0$ in words.