Class 1 Partial Solutions

Physics 403: Mathematical Methods

January 25, 2008

1. (a) $\nabla\varphi = 2x\hat{x} + 2y\hat{y} + 2z\hat{z}$,
   (b) $\nabla\gamma = -2x\cos(x^2+y^2)\hat{x} - 2y\cos(x^2+y^2)\hat{y} + \hat{z}$, and
   (c) $\nabla\tau = -2\hat{x} + 3\hat{y} + \hat{z}$.

2. (a) $\vec{\nabla} f = 2xy\hat{x} + x^2\hat{y}$
   (b) $(\vec{F}\cdot\vec{G})\vec{G} = \vec{G} * (2x^3z^2 + y^2 + y^3xz^3$
   (c) $\vec{\nabla}\times\vec{F} = \hat{x}(3y^2zx) + \hat{y}(4xz - y^3z)$
   (d) $\vec{F}\cdot(\vec{\nabla} f) = 4x^2yz^2 + x^2$
   (e) $\vec{F}\times\vec{\nabla} f = \hat{x}(-y^3zx^3) + \hat{y}(2x^2y^4z) + \hat{z}(2x^3z^2 - 2xy)$
   (f) $\vec{\nabla}\cdot\vec{\nabla}\times\vec{F} = 0$

3. (a) $\nabla\cdot\vec{A} = 2$, $\nabla\times\vec{A} = 0$,
   (b) $\nabla\cdot\vec{B} = 0$, $\nabla\times\vec{B} = -2\hat{z}$ and
   (c) $\nabla\cdot\vec{C} = y - 2x^2z + 1$, $\nabla\times\vec{C} = \hat{x}(2x^2y) + \hat{z}(-4xyz - x)$.