

## Vector Analysis

Spring 2014

Ex Tempore 5

Mon 24.3.

1. Calculate the curl  $\nabla \times \vec{F}$  of the following vectors:

a.  $\vec{F} = xy\hat{i} + yz\hat{j} + zx\hat{k}$

b.  $\vec{F} = (\sin y)\hat{i} + (\sin z)\hat{j} + (\sin x)\hat{k}$

2. Define  $\vec{F} = 2x\hat{i} + y\hat{j} - 3z\hat{k}$ .

a. Show that  $\nabla \cdot \vec{F} = 0$ .

b. Find a vector  $\vec{G}$  such that  $\vec{F} = \nabla \times \vec{G}$ .

3. Define  $\vec{F} = x^2\hat{i} + y^2\hat{j} + z^2\hat{k}$ . Calculate  $\nabla \cdot (\nabla \times \vec{F})$ .

4. Show that the gravitational force

$$\vec{F} = \frac{-Gm_1m_2}{|\vec{r}|^3} \vec{r}$$

is curlless.