Petroleum Seismology, spring 2012 Homework #2

Due Feb 3, 2010, typed and on paper by the start of class

Purpose: Review Vector Algebra

Q. 1 Demonstrate that the following identities are true with a 3-D example. You can do it with without a programming tool or you can use Matlab, Mathematica, or Excel.

 $-a, b, \nabla$ are 3-D vectors

(i)
$$a \times b = -b \times a$$

(ii) $\mathcal{E}_{ijk} \mathcal{E}_{ijl} = 2\delta_{kl}$

(iii)
$$a \times (b \times c) = (a \bullet c)b - (a \bullet b)c$$

(iv)
$$\nabla (a \bullet b) = (a \bullet \nabla)b + (b \bullet \nabla)a + a \times (\nabla \times b) + b \times (\nabla \times a)$$

(one way of showing (iv) is true is to use the following identity:

$$\boldsymbol{\mathcal{E}}_{ijk}\boldsymbol{\mathcal{E}}_{klm} = \boldsymbol{\delta}_{jl}\boldsymbol{\delta}_{km} - \boldsymbol{\delta}_{jm}\boldsymbol{\delta}_{kl}$$

Q. 2. Express the following using (i) indicial notation and (ii) as an undeveloped determinant:

 $a \times b \bullet c$

Q. 3 Calculate the following determinant by hand, or use **Matlab** or **Mathematica or Excel**:

34	6	3	56	
2	89	1359	3457	=?
1	5	1123	444	
2	6345	567	1	