Homework 12

Due April 27th in class or by 3:20 pm in MATH 602.

1. Find the flux of the vector field

$$((x+1)\sin^2 z, (y+2)\cos^2 z, \pi(z+3)),$$

   through the following surfaces:

   (a) the sphere $x^2 + y^2 + z^2 = 1$ oriented outward,

   (b) the cube with faces $x = 1$, $x = 2$, $y = 3$, $y = 4$, $z = 5$, $z = 6$ oriented inward,

   (c) the part of the paraboloid $x^2 + y^2 + z = 1$ given by $z \geq 0$, oriented downward.

2. For which of the following vector fields F is there a vector field G such that the curl of G is F? If there is such a G, give an example of one.

   (a) $F = (x, y, 2z)$,

   (b) $F = (x, y, -2z)$,

   (c) $F = (y^2, z^2, x^2)$.

   We went over the procedure for this in class, and you can also see it here:

   `https://www.math.unl.edu/~mbrittenham2/classwk/208s04/inclass/`
   `divergence-frees_are_curls.pdf`

   and on pages 20 and 21 here:

   `http://www.owlnet.rice.edu/~fjones/chap14.pdf`

   The key point is that you can set one component (e.g. G_3) to be zero.