1) Given a vector field P(x, y) **i** + Q(x, y) **j** in R^2, its scalar curl is the **k** – component of the vector curl (P**i** + Q**j** + 0**k**) in R^3 (the **i** and **j** components of that curl are 0). In other words, the scalar curl of the vector field P**i** + Q**j** equals $\partial Q/\partial x - \partial P/\partial y$. Find the scalar curl of **F**(x, y) = sin (xy) **i** + cos (xy) **j**.

2) Find such a function that f(x, y) that $\nabla f = e^{2r} \bullet (\mathbf{r}/k)$ for all **r** not equal to 0 (here **r** = (x, y), r = $||\mathbf{r}||$ = sqrt ($x^2 + y^2$). Hint: the answer is a function depending only on **r**.

3) Let f(x, y, z) = $x^2y^2 + x^2z^2$. Find curl (grad f), or $\nabla \times (\nabla f)$. Writing just the answer is not enough.