

Homework 9, due Friday 3/24

1. p. 273, problems 1, 3, 6
2. p. 281, problems 1, 2, 8
3. p. 293, problems 1, 3, 7
4. Let $f(x, y, z)$ be any function, show that $\text{curl}(\text{grad}(f)) = 0$.
5. Let $\mathbf{F}(x, y, z) = (2x^2, y+x, 0)$. Use the previous problem to show that there exists no function $f(x, y, z)$ such that $\mathbf{F}(x, y, z) = \text{grad}f(x, y, z)$.
6. Let $\mathbf{F}(x, y, z) = (F_1(x, y, z), F_2(x, y, z), F_3(x, y, z))$ be any vector field. Show that $\text{div}(\text{curl}(\mathbf{F})) = 0$.
7. Let $\mathbf{F}(x, y, z) = (x, 0, 0)$.
 - (a) Sketch this vector field.
 - (b) Now sketch a box around the origin and study the ‘flow’ of \mathbf{F} through the box. Do you think it has divergence or not?
 - (c) Now compute $\text{div}(\mathbf{F}(x, y, z))$.
8. Let $\mathbf{F}(x, y, z) = \frac{1}{10}(1, z, -y)$.
 - (a) Sketch this vector field.
 - (b) Do you think the vector field ‘curls’?
 - (c) Now compute $\text{curl}(\mathbf{F}(x, y, z))$.
9. p. 392, problem 20