

This is part 1 (of 3) of the weekly homework. It is due August 6 at the beginning of class. More problems to this lecture can be found on pages 922-924 in the book.

SUMMARY.

- $F(x, y) = (P(x, y, z), Q(x, y, z))$ **vector field.**
- $F(x, y, z) = (P(x, y, z), Q(x, y, z), R(x, y, z))$ **vector field in space.**
- $F(x, y, z) = \nabla f(x, y, z)$ **gradient field.**

- 1) (4 points) Sketch the vector field $F(x, y) = (-y/(x^2 + y^2), x/(x^2 + y^2))$.
- 2) (4 points) Calculate the gradient field of $f(x, y) = \sin(x) + \sin(y)$.
- 3) (4 points) Can $(P(x, y), Q(x, y)) = (x, y^2)$ be a gradient field? Hint: Assume it is $P = f_x, Q = f_y$, then calculate f_{xy} in two ways.
- 4) (4 points) Given a vector field $F(x, y) = (x^2y^3, 2x + y)$. At which points is the field strength $|F(x, y)|$ extremal?
- 5) (4 points) For which values of (a, b) is the vector field $F(x, y) = (ax^3y + by^2, x^4 + yx)$ a gradient field?

CHALLENGE PROBLEM:



An electric charge has a field $F = \nabla f$ where $f(x, y, z) = 1/\sqrt{|x^2 + y^2 + z^2|}$. Assume you have three positive electric charges located on an equilateral triangle with side length 1. Try to figure out how the field F would look like in the plane spanned by the charges?

SUPER CHALLENGE PROBLEM:



Get a wind velocity chart from the US of today. Use the web: type "GOES 8 wind" into google.