

# MATH 13, FALL '16

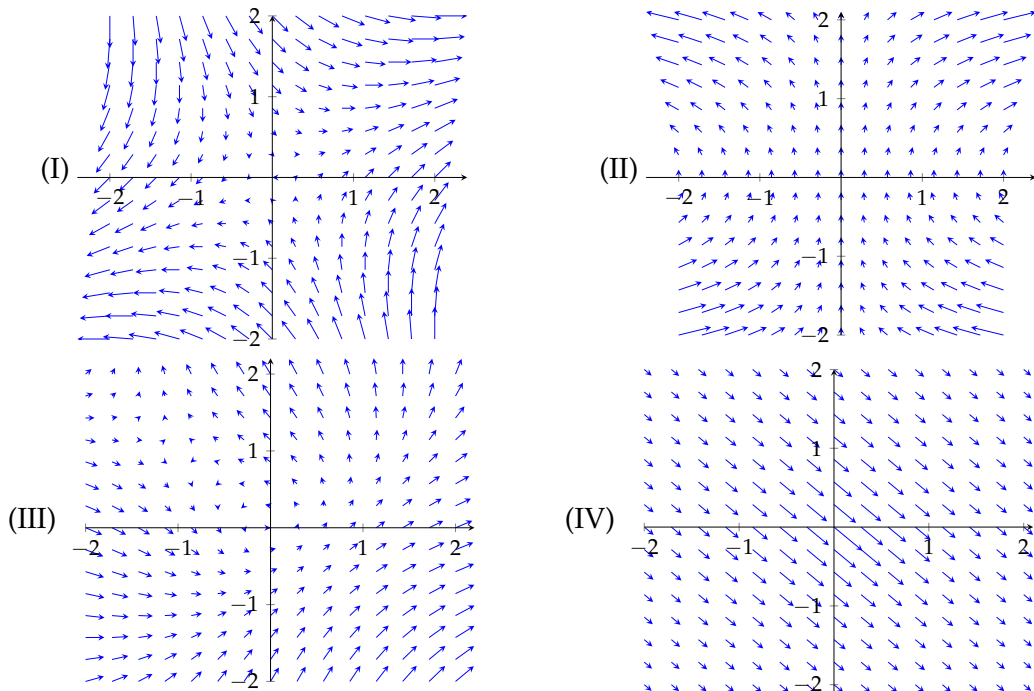
## HOMEWORK 5

Due Wednesday, Oct 19

Write your answers neatly and clearly. Use complete sentences, and label any diagrams. List problems in numerical order and staple all pages together. Start each problem on a new page. Please show your work; no credit is given for solutions without work or justification.

Remember that you may discuss the problems with classmates, but all work should be your own. List the names of anybody with whom you discussed the problems at the top of the page.

1. a) Match the vector field with with the plots. **You must justify your answers.**



(1)  $\langle x^2 - y, x + y^2 \rangle$

(2)  $\langle xy, 1 \rangle$

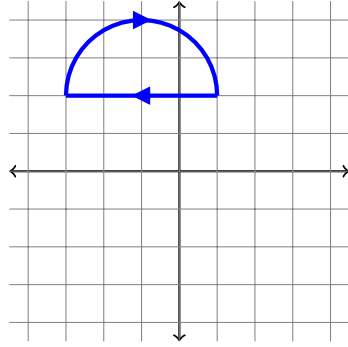
(3)  $\langle x + y, x - y \rangle$

(4)  $\left\langle \frac{1}{\sqrt{x^2 + y^2 + 1}}, -\frac{1}{\sqrt{x^2 + y^2 + 1}} \right\rangle$

- b) Find the curl and divergence of the vector field  $\langle x^2 - y, x + y^2, 2x \rangle$ .

2. Let  $\mathbf{F} = \langle 2y, -3x \rangle$ , and let  $\mathcal{C}$  be the curve below. The curved component is half of a circle.

Find  $\int_{\mathcal{C}} \mathbf{F} \cdot d\mathbf{r}$ . *Hint:*  $\int \sin^2(t) dt = \frac{t}{2} - \frac{\sin(2t)}{4} + C$  and  $\int \cos^2(t) dt = \frac{t}{2} + \frac{\sin(2t)}{4} + C$ .



3. a) Find a potential function for  $\mathbf{F}$  or prove that  $\mathbf{F}$  is not conservative.

$$\mathbf{F} = \left\langle y \ln(z) + ye^{xy}, x \ln(z) + xe^{xy}, \frac{xy}{z} + 2z \right\rangle$$

b) Find a potential function for  $\mathbf{F}$  or prove that  $\mathbf{F}$  is not conservative.

$$\mathbf{F} = \left\langle x^2 \sin(y), \frac{x^3 \cos(y)}{3} + 2yz, y \right\rangle$$

4. Compute  $\int_{\mathcal{C}} (2x + 9z) ds$  where  $\mathcal{C}$  is the curve  $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$  for  $0 \leq t \leq 1$ .