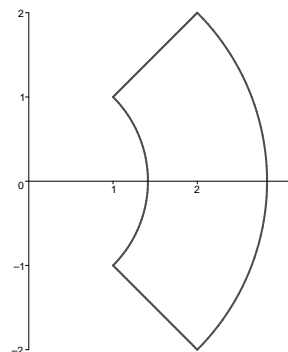


1. For each of the problems below, say whether you expect the given vector field to have positive, negative, or zero circulation *counterclockwise* around the closed curve  $C$  in the figure shown at the right. Two of the segments of  $C$  are circular arcs centered at the origin; the other two are radial line segments. You may find it helpful to sketch the vector field.



- (a)  $\vec{G} = x \hat{i} + y \hat{j}$   
 (b)  $\vec{H} = y \hat{i} - x \hat{j}$

2. Consider the vector field  $\vec{F}$  shown at the right, and the loop  $C$ , which is to be traversed in the *counterclockwise* direction.

- (a) Is  $\oint_C \vec{F} \cdot d\vec{r}$  positive, negative, or zero?  
 (b) From your answer to part (a), can you determine whether or not  $\vec{F} = \vec{\nabla} f$  for some function  $f$ ?  
 (c) Which of the following formulas best fits  $\vec{F}$ ?

$$\vec{F}_1 = \frac{x}{x^2 + y^2} \hat{i} + \frac{y}{x^2 + y^2} \hat{j}$$

$$\vec{F}_2 = -y \hat{i} + x \hat{j}$$

$$\vec{F}_3 = \frac{-y}{(x^2 + y^2)^2} \hat{i} + \frac{x}{(x^2 + y^2)^2} \hat{j}$$

