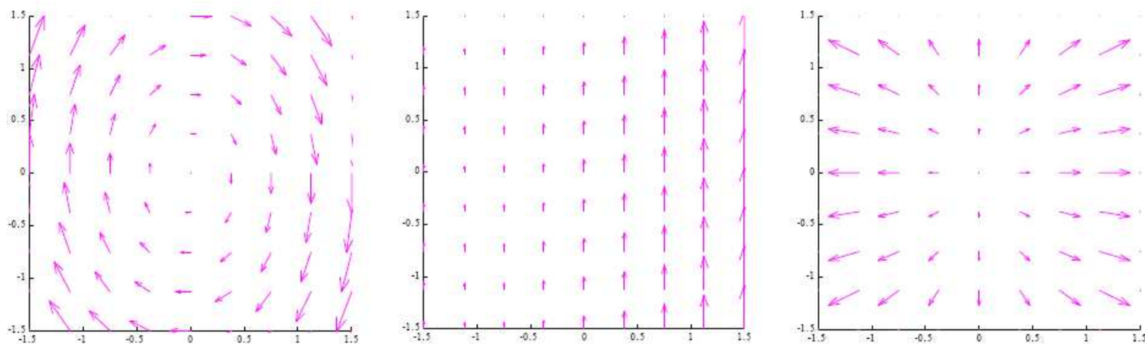
Classroom Voting Questions: Multivariable Calculus

20.3 The Curl of a Vector Field

1. The pictures below show top views of three vector fields, all of which have no z component. Which one has the curl pointing in the positive $\hat{k}$ direction at the origin?



   (a) the one on the left
   (b) the one in the middle
   (c) the one on the right
   (d) none of them

2. Let $\vec{F}(x, y, z)$ be a vector field and let $f(x, y, z)$ be a scalar function. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, which of the following is not defined?

   (a) $\nabla \times f$
   (b) $\nabla \times \vec{F} + \nabla f$
   (c) $\nabla \times (\vec{r} \times \nabla f)$
   (d) $f + \nabla \cdot \vec{F}$
   (e) More than one of the above

3. Which one of the following vector fields has a curl which points purely in the $\hat{j}$?

   (a) $y\hat{i} - x\hat{j} + z\hat{k}$
   (b) $y\hat{i} + z\hat{j} + x\hat{k}$
   (c) $-z\hat{i} + y\hat{j} + x\hat{k}$

(d) $x\hat{\imath} + z\hat{\jmath} - y\hat{k}$

4. True or False? If all the flow lines of a vector field $\vec{F}$ are straight lines, then $\nabla \times \vec{F} = 0$.

   (a) True, and I am very confident
   (b) True, but I am not very confident
   (c) False, but I am not very confident
   (d) False, and I am very confident

5. True or False? If all the flow lines of a vector field $\vec{F}$ lie in planes parallel to the xy-plane, then the curl of $\vec{F}$ is a multiple of $\hat{k}$ at every point.

   (a) True, and I am very confident
   (b) True, but I am not very confident
   (c) False, but I am not very confident
   (d) False, and I am very confident