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?

1.5	1 4			-	-	1	1	12	1.5	10	10	10	39	82	8	4	1	. ⁵							
1	A 7	1	1	-	~	1	K	i.	1	1	1	t	1	1	1			1-	-	1	1	t I	1	1	1
	1	1	1	-	5	1	X	,	13	1	1	10	1	1	1				1	~	1	t	1	1	1
0.5	Ţ	1	1	-	1	1	N		0.5	1	t	10	1	1	1		¢	5	-	4	~	t.	1		-7.
0	Ĵ	1	t	39	4	1	Ň	5	0 -	1	1	t	1	1	1			0	_	-	-	80		->	
-0.5	7	1	1	-	1	į	1.)	-0.5	1	1	t	1	1	1		-0	.5 -	-	-	-	ŧ.	1	1	-> '
	-1	1	1	+	1	1	1	Y		1	1	1	1	1				-	-	~	1	í.	1	1	
-1	1	1	~		1	1	1	V,	-1	4	1	1	1	1	1			-1-	/	1	4	Į.	1	1	~
-1.5	-1	1	-0.5		0.5		k.	4.5	-1.5	1	- 1	-0.5	1	0.5	1	1.5	-1	-1.5	-1		-0.5	0	0.5		1.5

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