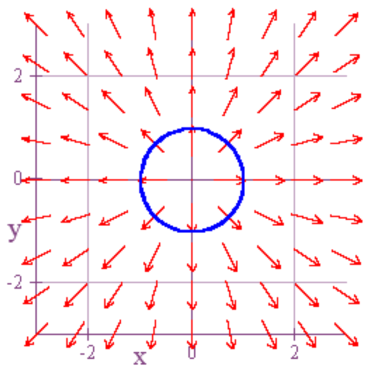
THE DIVERGENCE THEOREM - ANSWERS

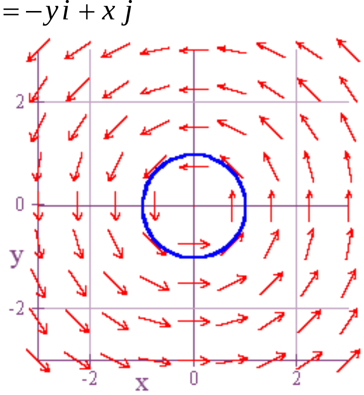
Use the Divergence Theorem (Gauss' Theorem), $Flux = \int_C \vec{F} \bullet N\, ds = \iint_R \nabla \bullet \vec{F}\, dA$, to measure the flux across the boundary of the unit circle (oriented counterclockwise) caused by each of the following vector fields.

1. $\vec{F} = x\hat{i} + y\hat{j}$



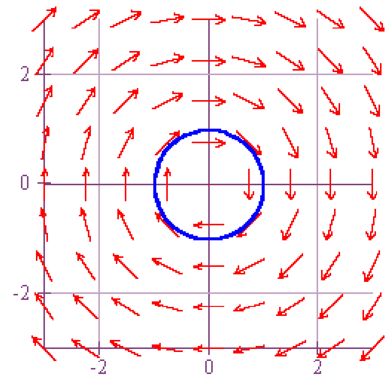
$$\iint_R \nabla \bullet \vec{F}\, dA = \iint_R 2\, dA = 2\pi$$

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



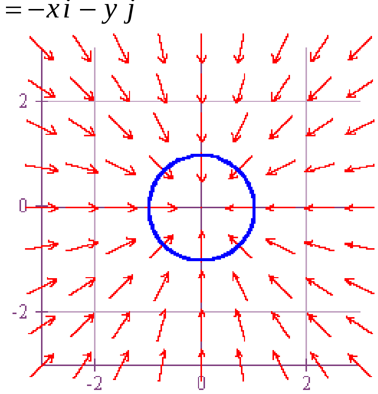
$$\iint_R \nabla \bullet \vec{F}\, dA = \iint_R 0\, dA = 0$$

3. $\vec{F} = y\hat{i} - x\hat{j}$



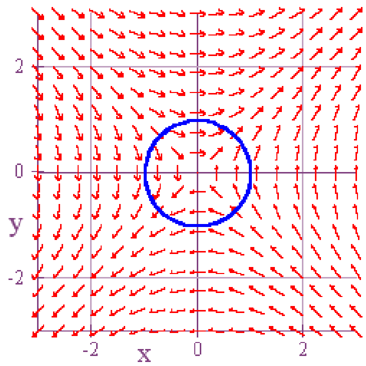
$$\iint_R \nabla \bullet \vec{F}\, dA = \iint_R 0\, dA = 0$$

4. $\vec{F} = -x\hat{i} - y\hat{j}$



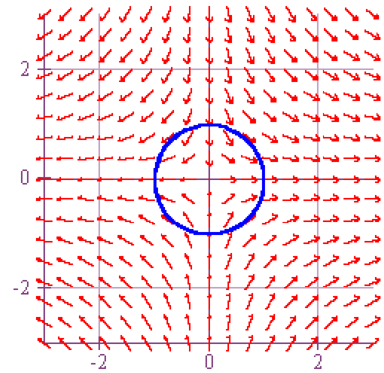
$$\iint_R \nabla \bullet \vec{F}\, dA = \iint_R -2\, dA = -2\pi$$

5. $\vec{F} = y\,\hat{i} + x\,\hat{j}$



$$\iint_R \nabla \bullet \vec{F}\, dA = \iint_R 0\, dA = 0$$

6. $\vec{F} = 4x\,\hat{i} - 3y\,\hat{j}$



$$\iint_R \nabla \bullet \vec{F}\, dA = \iint_R (4-3)\, dA = \pi$$