

1. Suppose $\vec{\nabla} \cdot \vec{F} = xyz^2$.
 - (a) Find $\vec{\nabla} \cdot \vec{F}$ at the point $(1, 2, 1)$.
Note: You are given $\vec{\nabla} \cdot \vec{F}$, not \vec{F} !
 - (b) Using your answer to part (a), but no other information about the vector field \vec{F} , estimate the flux out of a small box of side 0.2 centered at the point $(1, 2, 1)$ and with edges parallel to the axes.
 - (c) Without computing the vector field \vec{F} , calculate the exact flux out of the box.
2. A smooth vector field \vec{G} satisfies

$$(\vec{\nabla} \times \vec{G}) \Big|_{(0,0,0)} = 2\hat{x} - 3\hat{y} + 5\hat{z}$$

Estimate the circulation $\oint \vec{G} \cdot d\vec{r}$ around a circle of radius 0.01 centered at the origin in each of the following planes:

- (a) xy -plane, oriented counterclockwise when viewed from the positive z -axis.
- (b) yz -plane, oriented counterclockwise when viewed from the positive x -axis.
- (c) xz -plane, oriented counterclockwise when viewed from the positive y -axis.