

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

$$(\vec{\nabla} \times \vec{G}) \Big|_{(0,0,0)} = 2\hat{i} - 3\hat{j} + 5\hat{k}$$

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.