2.20 $\bar{G} = \hat{k} \times \vec{x}$ a)

$= -y\hat{i} + x\hat{j} = r\hat{\phi}$

b) find $\oint \bar{G} \cdot d\bar{l} = \oint (\bar{\nabla} \times \bar{G}) \cdot d\bar{A}$

$$\bar{\nabla} \times \bar{G} = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ -y & x & 0 \end{vmatrix} = -\hat{j} + 2\hat{k}$$

$d\bar{A} = dA\,\hat{k} \rightarrow \oint (\bar{\nabla} \times \bar{G}) \cdot d\bar{A} = 2\int dA = 2\pi r^2$

if $r = 1$, $= 2\pi$

2.21 $\bar{F}(\vec{x}) = f(r)\,\vec{x}$, $r = |\vec{x}|$

a) $\bar{\nabla} \times \bar{F} = f \underbrace{\bar{\nabla} \times \vec{x}}_{= \emptyset} + \bar{\nabla} f \times \bar{x}$

$\bar{\nabla} f = \frac{\partial f}{\partial r} \hat{r}$, $\bar{\nabla} f \times \bar{x} = \frac{\partial f}{\partial r} \underbrace{\hat{r} \times \vec{r}}_{\emptyset} = \emptyset$

b) $\bar{\nabla} \cdot \bar{F} = \emptyset$ also.

$\bar{\nabla} \cdot \bar{F} = \bar{\nabla} f \cdot \bar{x} + f(\bar{\nabla} \cdot \vec{x}) = \hat{r} \frac{df}{dr} \cdot \bar{x} + 3f = r\frac{df}{dr} + 3f$

or $df/dr = -3f/r$

$f = k r^{-3}$