Homework Questions?

§16.1

§16.2

§16.3

§16.4

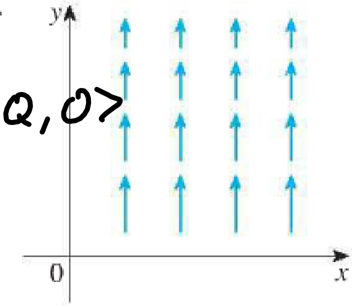
§16.5 $\bar{F} = \langle P, Q, 0 \rangle$

9–11 The vector field **F** is shown in the xy-plane and looks the same in all other horizontal planes. (In other words, **F** is independent of z and its z-component is 0.)

(a) Is div **F** positive, negative, or zero? Explain.

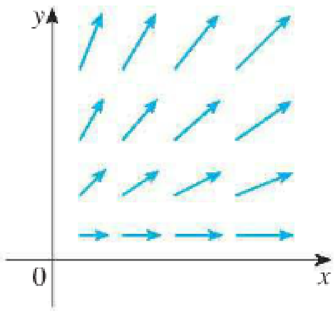
(b) Determine whether curl **F** $=$ **0**. If not, in which direction does curl **F** point?

9.



$\bar{F} = \langle 0, Q, 0 \rangle$

10.



(a) $\nabla \cdot \bar{F} = P_x + Q_y + R_z = P_x + Q_y$

$= Q_y < 0$

(b) curl $\bar{F} = \nabla \times \bar{F}$:

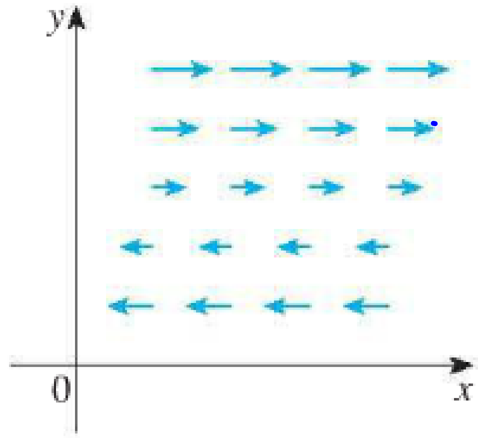
$$\begin{array}{c} \left\langle \frac{\partial}{\partial x} \quad \frac{\partial}{\partial y} \quad \frac{\partial}{\partial z} \right\rangle \\ \times \left\langle 0 \quad Q \quad 0 \right\rangle \\ \hline \end{array}$$

$\langle -Q_z,$

$= \langle 0, -0, Q_x \rangle$

$= \langle 0, 0, 0 \rangle = \bar{0}$

11.



$P_x > 0$

$Q = 0$

$R = 0$

$P_y > 0$

(a) $\text{div}\,\bar{F} = \nabla \cdot \bar{F} = P_x + Q_y + R_z$

$= P_x = 0$

(b) $\text{curl}\,\bar{F} = \nabla \times \bar{F}$

$$\begin{array}{rl} & \langle \frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \cancel{\frac{\partial}{\partial z}} \rangle \\ \times & \langle P, 0, \cancel{0} \rangle \\ \hline & \langle 0, -P_z, -P_y \rangle \\ = & \langle 0, 0, -P_y \rangle \end{array}$$

what direction does curl $\bar{F}$ point?

Points down.

#12 f is func. $f(x,y,z) = f$
$\bar{F}$ is vector field $\bar{F} = \langle P, Q, R \rangle$

(a) $\text{curl } f = \nabla \times f \quad \nexists$

(b) $\text{grad } f = \nabla f = \langle f_x, f_y, f_z \rangle$ is vec.

(c) $\text{div } \bar{F} = \nabla \cdot \bar{F}$ is scalar.

(d) $\text{curl}(\text{grad } f) = \nabla \times (\nabla f) =$ vector

(e) $\text{grad } \bar{F} = \nabla \bar{F}\,? \quad \nexists$ Double-check

(f) $\text{grad}(\text{div } \bar{F}) = \nabla(\nabla \cdot \bar{F})$

$= \nabla(P_x + Q_y + R_z) =$

$= \langle P_{xx} + Q_{yx} + R_{zx}, P_{xy} + Q_{yy} + R_{zy}, P_{xz} + Q_{yz} + R_{zz} \rangle$

$= \left\langle \frac{\partial^2 P}{\partial x^2} + \frac{\partial^2 Q}{\partial x \partial y} + \frac{\partial^2 R}{\partial x \partial z}, \text{etc.} \right\rangle$ vector