11 b.) $F = \langle P, Q, 0 \rangle$ $\quad$ curl $F = \langle 0, 0, \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) \rangle$

$\frac{\partial Q}{\partial x} = 0$ since the y components of the vectors are 0.

$\frac{\partial P}{\partial y}$ is positive since x components of the vectors increase as $y \to \infty$

$\text{curl} F = \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) k = -\frac{\partial P}{\partial y} k = \boxed{\text{Negative } z \text{ direction}}$

(13.) $F(x,y,z) = \langle y^2z^3, 2xyz^3, 3xy^2z^2 \rangle$

$\text{curl} F = \langle \left(\frac{\partial R}{\partial y} - \frac{\partial Q}{\partial z}\right), \left(\frac{\partial P}{\partial z} - \frac{\partial R}{\partial x}\right), \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) \rangle$

$= \langle (6xyz^2 - 6xyz^2), (3y^2z^2 - 3y^2z^2); (2yz^3 - 2yz^3) \rangle = \langle 0, 0, 0 \rangle$

$\therefore$ Conservative

$f_x = y^2z^3$ $\qquad$ $f_y = 2xyz^3$ $\qquad$ $f_z = 3xy^2z^2$

$f(x,y,z) = xy^2z^3 + g(y,z)$ $\quad$ $f(x,y,z) = xy^2z^3 + g(x,z)$ $\quad$ $f(x,y,z) = xy^2z^3 + g(x,y)$

$g(y,z) = g(x,z) = g(x,y) = C$ b/c $g'(y,z) + g'(x,z) + g'(x,y) = 0$

$$\boxed{\begin{array}{l}\text{Conservative vector field.} \\ f(x,y,z) = xy^2z^3 + C\end{array}}$$