16.1

1.) $P = (1,2)$ $\quad Q = (-1,-1)$

$$v = \langle x^2, x \rangle$$

$F(1,2) = \langle 1,1 \rangle$

$F(-1,-1) = \langle 1,-1 \rangle$

sketched on maple ✓

3) $P = (0,1,1)$, $\quad Q = (2,1,0)$

$$F = \langle xy, z^2, x \rangle$$

$F(0,1,1) = \langle 0,1,0 \rangle$

$Q(2,1,0) = \langle 2,0,2 \rangle$

Sketched on maple

5) $F = \langle 1, 0 \rangle$ for $-3 \le x \le 3$

$-3 \le y \le 3$

Sketched on maple

7) $F = xi$ for $-3 \le x \le 3$

$-3 \le y \le 3$

Sketched on maple

9) $F = \langle 0, x \rangle$ for $-3 \le x \le 3$

$F(x, y) = \langle 0, x \rangle$ $-3 \le y \le 3$

Sketched on maple

11) $F = \left\langle \frac{x}{x^2+y^2}, \frac{y}{x^2+y^2} \right\rangle$

for $-3 \le x \le 3$

$-3 \le y \le 3$

Sketched on maple

23) $F = \langle xy, yz, y^2 - x^2 \rangle$

1. *curl* **F** equals

$$\nabla \times \mathbf{F} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ P & Q & R \end{vmatrix} .$$

Set it up for the specific P, Q, R.

$$div\, \mathbf{F} = \frac{\partial P}{\partial x} + \frac{\partial Q}{\partial y} + \frac{\partial R}{\partial z} .$$

$$\text{curl} = \nabla \times F$$

$$= \begin{vmatrix} i & j & k \\ \frac{d}{dx} & \frac{d}{dy} & \frac{d}{dz} \\ xy & yz & y^2 - x^3 \end{vmatrix}$$

Using maple

$$\text{curl} = \langle y, 3x^2, -x \rangle$$

$$\text{div } F = \frac{d}{dx}(xy) + \frac{d}{dy}(yz) + \frac{d}{dz}(y^2 - x^3)$$

Maple → $\text{div } F = y + z$

25) $F = \langle x - 2zx^2, z - xy, z^2x^2 \rangle$

curl F = Using formula &
maple

$= \langle -1, 2x^2 - 2xz^2, -y \rangle$

$\text{div}(F) = 1 - 4xz - x + 2x^2z$

27) $F = \langle z - y^2, x + z^3, y + x^2 \rangle$

$\text{curl}(F) = \langle 1 - 3z^2, 1 - 2x, 1 + 2y \rangle$

$\text{div}(F) = 0$

17) Ans. Plot(C)