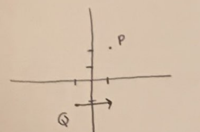
16.1 - #, 1, 3, 5, 7, 9, 11, 17, 23, 25, 27

1.

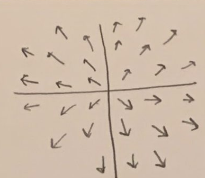


$F = \langle x^2, x \rangle$

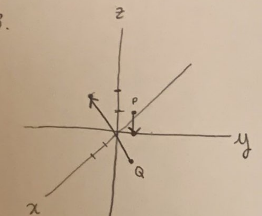
$F = \langle 1^2, 2 \rangle = \langle 1, 2 \rangle$

$F = \langle -1^2, -1 \rangle = \langle 1, -1 \rangle$

11.



3.



$P = (0,1,1)$

$Q = (2,1,0)$

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

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

$F = \langle 2, 0, 2 \rangle$

17. C

23. $f(\text{curl}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{d}{dx} & \frac{d}{dy} & \frac{d}{dz} \\ xy & yz & y^2 - x^3 \end{vmatrix}$

$= \hat{i}\left(\frac{d}{dy}(y^2 - x^3) - \frac{d}{dz}(yz)\right)$

$- \hat{j}\left(\frac{d}{dx}(y^2 - x^3) - \frac{d}{dz}(xy)\right)$

$+ \hat{k}\left(\frac{d}{dx}(yz) - \frac{d}{dy}(xy)\right)$

$= (2y - y)\hat{i} - (-3x^2 - 0)\hat{j} + (0 - x)\hat{k}$

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

$f(\text{div}) = \langle y + z + 0 \rangle = y + z$

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

$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{d}{dx} & \frac{d}{dy} & \frac{d}{dz} \\ z - y^2 & x + z^3 & y + x^2 \end{vmatrix}$

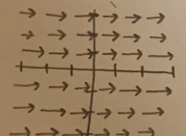
$= (1 - 3z^2)\hat{i} - (2x - 1)\hat{j}$

$+ (1 + 2y)\hat{k}$

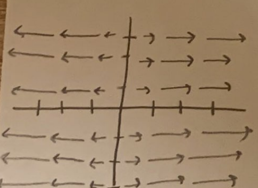
$f(\text{curl}) = \langle 1 - 3z^2, -2x + 1, 1 + 2y \rangle$

$f(\text{div}) = 0 + 0 + 0 = 0$

5. $F = \langle 1, 0 \rangle$



7. $F = x\hat{i}$



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

$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{d}{dx} & \frac{d}{dy} & \frac{d}{dz} \\ x - 2zx^2 & z - xy & z^2x^2 \end{vmatrix}$

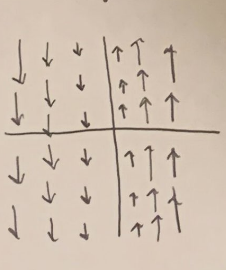
$= (0 - 1)\hat{i} - (2z^2x + 2x^2)\hat{j} + (-y - 0)\hat{k}$

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

$f(\text{div}) = (1 - 4zx) + (-x) + (2zx^2)$

$= 1 - 4zx + 2zx^2 - x$

9. $F(x,y) = \langle 0, x \rangle$



16.6 - #1, 3, 13, 15, 17, 19, 23
16.1 - # 1, 3, 5, 7, 9, 11, 17, 23, 25, 27

1. a) u axis is $y = 1/2x$ v axis is y axis
   b) Parallelogram
   c) Line segment
   d) Triangle

2. a) Domain is one-to-one for $u \geq 0$
   b) yes
   c) Domain one-to-one for $u \leq 0$
   d) Domain one-to-one for $u \leq 1$

13. $G(u,v) = (3u + 4v, u - 2v)$

$\cancel{\begin{vmatrix} \hat{i} & \hat{j} \\ \frac{dx}{du} & \frac{dy}{dv} \\ 3u+4v & u-2v \end{vmatrix} \quad \frac{dx}{du}(u-2v) - \frac{dy}{dv}(3u+4v) = (1) - (4)}$

$$\begin{vmatrix} 3 & 4 \\ 1 & -2 \end{vmatrix} = -6 - (-4) = -10$$

15. $G(r,t) = (r\sin t, r - \cos t)$

$$\begin{vmatrix} \sin t & r\cos t \\ 1 & \sin t \end{vmatrix} = \sin^2 t - r\cos t \quad @ \ (r,t) = (1, \pi)$$

$$= \sin^2(\pi) - \cos(\pi) = 0 - (-1) = +1$$

17. $G(r,\theta) = (r\cos\theta, r\sin\theta)$ $(r,\theta) = (4, \pi/6)$

$$\begin{vmatrix} \cos\theta & -r\sin\theta \\ \sin\theta & r\cos\theta \end{vmatrix} = r\cos^2\theta + r\sin^2\theta = r(\cos^2\theta + \sin^2\theta) = r = 4$$

19. $\langle \check{2}, \check{3} \rangle$ and $\langle \check{4}, \check{1} \rangle$
$R = [0,1] \times [0,1]$
$= G(u,v) = (4u + 2v, u + 3v)$

23. $G(u,v) = (3u + v, u - 2v)$

$$\begin{vmatrix} 3 & 1 \\ 1 & -2 \end{vmatrix} = -6 - 1 = -7$$