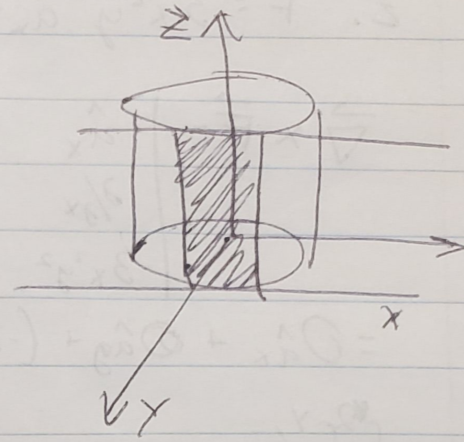
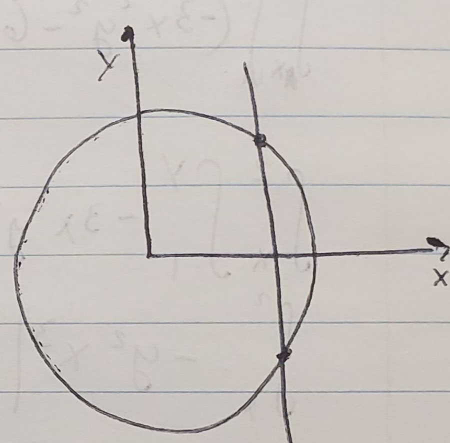
1. $\vec{F} = 2y^2\hat{a}_x + 4x^3\hat{a}_y + 4y\hat{a}_z$



$$\vec{\nabla}\times\vec{F} = \begin{vmatrix} \hat{a}_x & \hat{a}_y & \hat{a}_z \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 2y^2 & 4x^3 & 4y \end{vmatrix}$$

$$= 4\hat{a}_x + 0\hat{a}_y + (12x^2 - 4y)\hat{a}_z$$

$$\iint (\vec{\nabla}\times\vec{F}) \cdot d\vec{S}$$



$$= \int_{-1}^{3}\int_{-2}^{2} 4 \, dy\, dz + \int_{-2}^{2}\int_{\sqrt{5}}^{\sqrt{5}} (12x^2 - 4y)\, dx\, dy$$

$\int_{-1}^{3} 4y\Big|_{-2}^{2} dz$ $\quad$ $\int_{-2}^{2}\left(4x^3\Big|_{\sqrt{5}}^{\sqrt{5}} - 2y^2\Big|_{\sqrt{5}}^{\sqrt{5}}\right) dy$

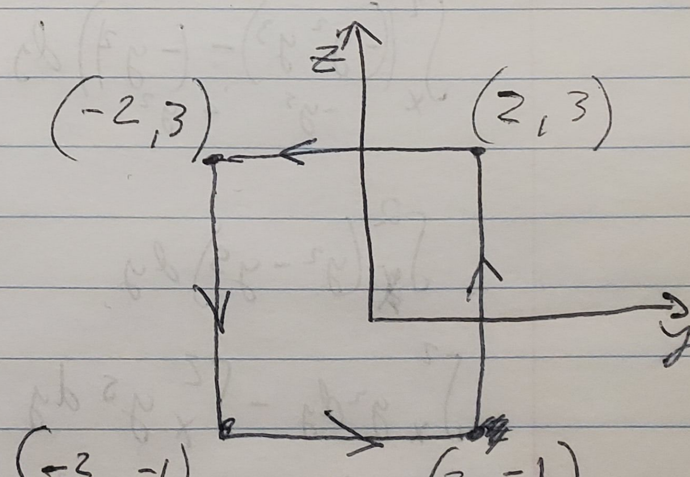
$8-(-8)$

$\int_{-1}^{3} 16\, dz$ $\quad$ $\int_{-2}^{2} 0\, dy$

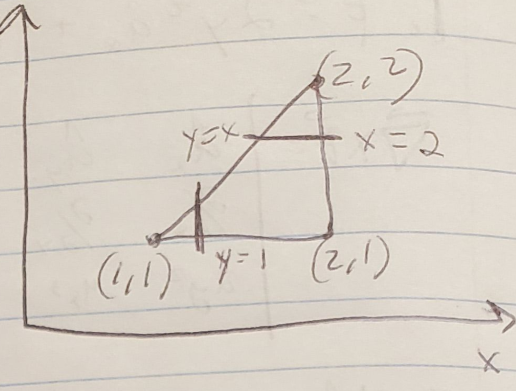
$16z\Big|_{-1}^{3}$ $\quad$ $\downarrow$

$48-(-16)$

$\boxed{64}$ $\quad$ 0



2. $\vec{F} = 3x^2y^2\,\hat{a}_x - x^3y^2\,\hat{a}_y$



$$\vec{\nabla} \times \vec{F} = \begin{vmatrix} \hat{a}_x & \hat{a}_y & \hat{a}_z \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ 3x^2y^2 & -x^3y^2 & 0 \end{vmatrix}$$

$$= 0\,\hat{a}_x + 0\,\hat{a}_y + \left(-3x^2y^2 - \cancel{\ }x^2y\right)\hat{a}_z$$

$$\int_x^2\int_1^y \left(-3x^2y^2 - 6x^2y\right)dx\,dy$$

$$\int_x^2\int_1^y -3x^2y^2\,dx\,dy$$

$$\int_x^2 -y^2x^3\Big|_1^y\,dy$$

$$\int_x^2\left(\left(-y^2y^3\right) - \left(-y^2\right)\right)dy$$

$$-y^5 \quad + y^2$$

$$\int_x^2\left(y^2 - y^5\right)dy$$

$$\int_x^2 y^2\,dy - \int_x^2 y^5\,dy$$

$$\frac{y^3}{3}\Big|_x^2 - \frac{y^6}{6}\Big|_x^2$$

$$\left(\frac{8}{3} - \frac{x^3}{3}\right) - \left(\frac{64}{6} - \frac{x^6}{6}\right)$$

$$-$$

$$- \int_x^2\int_1^y 6x^2y\,dx\,dy$$

$$\int_x^2 2yx^3\Big|_1^y\,dy$$

$$\int_x^2 2y^4 - 2y\,dy$$

$$\int_x^2 2y^4\,dy - \int 2y\,dy$$

$$\frac{2}{5}y^5\Big|_x^2 - y^2\Big|_x^2$$

$$\left(\frac{64}{5} - \frac{2x^5}{5}\right) - \left(4 - x^2\right)$$