Same instructions as Mission 1. Thanks!

Problem 181 Find the surface area of $z = xy$ for $x^2 + y^2 \leq 1$.

Problem 182 Find the surface area of the plane $y + 2z = 2$ bounded by the cylinder $x^2 + y^2 = 1$.

Problem 183 Find the surface area of the cone frustrum $z = \frac{1}{3}\sqrt{x^2 + y^2}$ with $1 \leq z \leq 4/3$

Problem 184 Find the surface area of torus with radii $A, R > 0$ and $R \geq A$ parametrized by

$$\vec{X}(\alpha, \beta) = \Big\langle \big[R + A\cos(\alpha)\big]\cos(\beta), \big[R + A\cos(\alpha)\big]\sin(\beta), A\sin(\alpha) \Big\rangle$$

for $0 \leq \alpha \leq 2\pi$ and $0 \leq \beta \leq 2\pi$.

Problem 185 Find an explicit double integral which gives the surface area of the graph $x = g(y, z)$ for $(y, z) \in D$.

Problem 186 Integrate $H(x, y, z) = xyz$ over the surface of the solid $[0, a] \times [0, b] \times [0, c]$ where $a, b, c > 0$.

Problem 187 Integrate $G(x, y, z) = x^2$ over the surface of the unit-sphere.

Problem 188 Consider a thin-shell of constant density δ. Let the shell be cut from the cone $x^2 + y^2 - z^2 = 0$ by the planes $z = 1$ and $z = 2$. Find **(a.)** the center of mass and **(b.)** the moment of inertia with respect to the z-axis.

Problem 189 Find the flux of $\vec{F}(x, y, z) = \langle z^2, x, -3z \rangle$ through the parabolic cylinder $z = 4 - y^2$ bounded by the planes $x = 0$, $x = 1$ and $z = 0$. Assume the orientation of the surface is outward, away from the x-axis.

Problem 190 Find the flux of $\vec{F}(x, y, z) = z\,\widehat{z}$ through the portion the sphere of radius R in the first octant. Give the sphere an orientation which points away from the origin. In other words, assume the sphere is outwardly oriented.

Problem 191 Find the flux of $\vec{F}(x, y, z) = \langle -x, -y, z^2 \rangle$ through the conical frustrum $z = \sqrt{x^2 + y^2}$ between the planes $z = 1$ and $z = 2$ with outward orientation.

Problem 192 Let S be the outward oriented paraboloid $z = 6 - x^2 - y^2$ for $x, z \geq 0$. Calculate the flux of $\vec{F} = (x^2 + y^2)\,\widehat{z}$

Problem 193 Find the flux of $\vec{F}(x, y, z) = \langle 2xy, 2yz, 2xz \rangle$ upward through the subset of the plane $x + y + z = 2c$ where $(x, y) \in [0, c] \times [0, c]$.

Problem 194 Suppose $\vec{C}$ is a constant vector. Let $\vec{F}(x, y, z) = \vec{C}$ find the flux of $\vec{F}$ through a surface S on plane with nonzero vectors $\vec{A}, \vec{B}$. In particular, the surface S is parametrized by $\vec{r}(u, v) = \vec{r}_o + u\vec{A} + v\vec{B}$ for $(u, v) \in \Omega$.

Problem 195 Let $\vec{F}(x, y, z) = \langle a, b, c \rangle$ for some constants a, b, c. Calculate the flux of $\vec{F}$ through the upper-half of the outward oriented sphere $\rho = R$.

Problem 196 Once more consider the constant vector field $\vec{F}(x,y,z) = \langle a,b,c \rangle$. Calculate the flux of $\vec{F}$ through the downward oriented disk $z = 0$ for $\phi = \pi/2$.

Problem 197 Let $\vec{F} = \langle x^2, y^2, z^2 \rangle$. Calculate the flux of $\vec{F}$ through $z = 4 - x^2 - y^2$ for $z \geq 0$.

Problem 198 Let $\vec{F} = \langle x^2, y^2, z^2 \rangle$. Calculate the flux of $\vec{F}$ through the downward oriented disk $x^2 + y^2 \leq 4$ with $\phi = \pi/2$.

Problem 199 Let $\phi = \pi/4$ define a closed surface S with $0 \leq \rho \leq 2$. Find the flux of

$$\vec{F}(\rho,\phi,\theta) = \phi^2 \widehat{\rho} + \rho \widehat{\phi} + \widehat{\theta}$$

through the outward oriented S.

Problem 200 Consider the closed cylinder $x^2 + y^2 = R^2$ for $0 \leq z \leq L$. Find the flux of

$$\vec{F}(r,\theta,z) = \theta\, \widehat{z} + z\widehat{\theta} + r^2 \widehat{r}$$

out of the cylinder.