Same instructions as in Mission 1. See Mission 1 for details.

Problem 106 Your PRINTED NAME below indicates you have:

(a.) I have read §7.6 − 7.10 of Cook: _____.

(b.) I have attempted 10 problems either from Stewart(see below) or the end of chapter problems in my notes:_____.

§ 16.4 #'s 1, 3, 5, 7, 9, 11, 13, 17, 19, 21*, 22, 23, 29

§ 16.6 #'s 1, 3, 5, 13, 15, 19, 21, 23, 25, 29, 33, 35, 39, 41, 45, 49

§ 16.7 #'s 5, 7, 9, 11, 13, 19, 21, 23, 25, 27, 29, 31, 39, 45, 49

§ 16.8 #'s 1, 3, 5, 7, 9, 13, 15, 17

§ 16.9 #'s 1, 3, 5, 7, 9, 11, 13, 17

Problem 107 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 108 Let S be the outward oriented unit-sphere. Calculate $\displaystyle\iint_S \langle x^3, y^3, z^3\rangle \bullet d\vec{S}$.

Problem 109 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 intertia with respect to the z-axis.

Problem 110 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 111 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 112 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 113 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 114 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.

Problem 115 Let $\vec{F}(x, y, z) = \langle y^2 + z^2, x^2 + z^2, x^2 + y^2 \rangle$. Find the work done by $\vec{F}$ around the CCW (as viewed from above) triangle formed from the intersection of the plane $x + y + z = 1$ and the coordinate planes. (use Stoke's Theorem)

Problem 116 Let $\vec{F} = \langle 2x, 2y, 2z \rangle$ and suppose S is a simply connected surface with boundary ∂S a simple closed curve. Give two arguments (one by Stokes', the other by Gauss' theorem) that $\int_{\partial S} \vec{F} \bullet d\vec{r} = 0$.

Problem 117 Suppose S is the union of the cylinder $x^2 + y^2 = 1$ for $0 \leq z \leq 1$ and the disk $x^2 + y^2 \leq 1$ at $z = 1$. Suppose $\vec{F}$ is a vector field such that

$$\nabla \times \vec{F} = \left\langle \sinh(z)(x^2 + y^2), ze^{xy + \cos(x+y)}, (xz + y)\tan^{-1}(z) \right\rangle.$$

Calculate the flux of $\nabla \times \vec{F}$ though S.

Problem 118 Let E be the cube $[-1, 1]^3$. Calculate the flux through ∂E of the vector field

$$\vec{F}(x, y, z) = \langle y - x, z - y, y - x \rangle$$

(please use the divergence theorem!)

Problem 119 Calculate the flux of $\vec{F}(x, y, z) = \langle 1, 2, z^2 \rangle$ out of the paraboloid $z = 4 - x^2 - y^2$ bounded below by the xy-plane.

Problem 120 Let a spherical shell S of radius R and total mass M have constant mass density $\sigma = \frac{dm}{dS}$. Find the moment of intertia for this shell with respect to the z-axis. In particular, calculate

$$\iint_S \sigma r^2 dS.$$