1. Evaluate the following surface integrals of scalar fields.

   a. $\iint\limits_S \left(z + 2x + \frac{4y}{3}\right) dS$, where the surface S is the part of the $6x+4y+3z = 12$ plane which lies in the first octant.

   b. $\iint\limits_S x dS$, where S is the part of the sphere of radius 3 and center at the origin which lies int the first octant.

2. Evaluate $\iint\limits_S f(x,y)dS$, where the scalar field $f(x,y) = x\sqrt{y^2+1}$ and S is the surface cut from the paraboloid $y^2 + 4z = 16$ by the planes $x = 0$, $x = 1$ and $z = 0$.

3. Find $\iint\limits_S (x\mathbf{i} + y\mathbf{j} + z\mathbf{k})\, d\mathbf{S}$, where S is that part of the paraboloid $z = x^2 + y^2$ that lies above the circle $x^2 + y^2 = 4x$, oriented so that the normal points outward.

4. Find $\iint\limits_S (x\mathbf{i} + y\mathbf{j})\, d\mathbf{S}$, where S is that part of the sphere $\mathbf{r}(u,v) = 4\{\cos u \cos v, \cos u \sin v, \sin u\}$ for which $v \leq u \leq \frac{\pi}{2}, 0 \leq v \leq \frac{\pi}{2}$ and oriented so that the normal points outward.

5. Evaluate the surface integral $\iint\limits_S \mathbf{F}(x,y,z)d\mathbf{S}$, oriented so that the normal points upward, where

   a. $\mathbf{F}(x,y,z) = (x - 2z)\,\mathbf{i} + (2x + y)\,\mathbf{j} + (x - y + z)\,\mathbf{k}$ and the surface S is the upper half of the sphere of radius 2 and center ath the origin.

   b. $\mathbf{F}(x,y,z) = xy\mathbf{i} + (x + z)\,\mathbf{j} - 2y^2\mathbf{k}$ and S is the surface cut from $z = \frac{y}{x}$ by the planes $y = -x$, $y = x$, $x = 1$ and $x = 2$.

   c. $\mathbf{F}(x,y,z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ and S is that part of the surface $\mathbf{r}(u,v) = \{(3 + \cos u)\cos v, (3 + \cos u)\sin v, \sin u\}$ that lies above the xy-plane.

   d. $\mathbf{F}(x,y,z) = yz\mathbf{i} - xz\mathbf{j} + z\mathbf{k}$ and S is that part of the surface $\mathbf{r} = \{u\cos v, u\sin v, 2v\}$ for which $0 \leq u \leq 1, 0 \leq v \leq 2\pi$.

   e. $\mathbf{F}(x,y,z) = -xy\mathbf{i} + xy\mathbf{j} + z\mathbf{k}$ and S is that part of the surface $z = x^2 - y^2$ that lies about the square $\{(x,y)\,; -2 \leq x \leq 2, -3 \leq y \leq 3\}$.

6. Find the flux of $\mathbf{F}(x,y,z) = x\mathbf{i} + z\mathbf{j}$ out of the tetrahedron bounded by the coordinate planes and tha plane $2x + 3y + 4z = 12$.

7. Find the flux of $\mathbf{F}(x, y, z) = 2x\mathbf{i} + 4y\mathbf{j} + 3\mathbf{k}$ outward through the surface cut from the bottom of the paraboloid $z = x^2 + y^2$ by the plane $z = 2$.