Most of the following problems are modified versions of homework problems from your text book *Multivariable Calculus* by James Stewart.

13.4a. Prove the law of cosines. (Hint: Follow the same rules as when you proved the Pythagorean theorem.)

13.4d. Find two unit vectors which are orthogonal to both $\langle -3, 1, 5 \rangle$ and $\langle 2, 3, 5 \rangle$. Can you find any others?

13.4e. Problem 43 of §13.4 of Stewart’s *Multivariable Calculus*. Think carefully about how should one define the distance from $P$ to $L$.

13.5a. Problem 73 of §13.5 of Stewart’s *Multivariable Calculus*. One approach to this problem is to find a line perpendicular to both planes and then measure the length of that part of the line that lies between the two planes.

13.5b. Suppose $P$ is the plane described by the equation $ax + by + cz + d = 0$. Given two points $(x_0, y_0, z_0)$ and $(x_1, y_1, z_1)$, how does one go about determining whether or not the two points lie on the same side of the plane. Carefully explain your reasoning.

13.5c. Find the equation of the line consisting of those points which are equidistant from the three points $(1, 1, -3)$, $(2, 4, -1)$, and $(-3, 1, -1)$.

13.7a. A solid lies above the cone $z = \sqrt{7(x^2 + y^2)}$ and inside the sphere $x^2 + y^2 + z^2 = 8z$. Using spherical coordinates, write a description of the solid.

13.7b. Sketch the solid or surface described by the following equations and inequalities.

(a) $0 \leq \varphi \leq \pi/3$, $\rho \leq 5$
(b) $z - r^2 = 0$
(c) $4 - \rho \sin \varphi = 0$
(d) $r^2 \leq z \leq 2 - r^2$
(e) $\rho^2 - 5\rho = -6$
(f) $\pi/4 \leq \theta \leq 3\pi/4$, $z \leq r \leq 5$
(g) $\theta = \pi/3$.


14.1b. Find parametric equations which describe the curve defined by intersecting the cylinder $r = 7$ with the paraboloid of revolution $7z + (x^2 + y^2) = 0$. Sketch the two surfaces and the curve of intersection.