Exercises

§11.3 Given $\vec{u} = \langle 1, 2, 3 \rangle$ and $\vec{v} = \langle -1, 1, 4 \rangle$, find:
(a) Cosine of the angle between $\vec{u}$ and $\vec{v}$.
(b) $\text{proj}_{\vec{u}} \vec{v}$.

§11.7 A golf ball has an initial position $\langle x_0, y_0 \rangle = \langle 0, 0 \rangle$ when it is hit at an angle of 30° with an initial speed of 150 ft/s. Find the position and velocity vectors $\vec{r}(t)$ and $\vec{v}(t)$, where $t \geq 0$ is time in seconds.
(Assume the x-axis is the ground, the positive y-axis is up, and the only acceleration force on the golf ball is gravity, at 32 ft/s^2.)

§12.1 Give the equation for the plane parallel to vectors $\vec{u} = \langle 3, 1, 1 \rangle$ and $\vec{v} = \langle 0, 1, 1 \rangle$, which passes through the point $P = (2, 3, 1)$.

§12.5 Given $z = \arctan(3x + 2y)$, $x = s^2 t$, $y = \sin t$, find $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$ at $(s, t) = (1, \frac{1}{e})$.

§12.6 Let $f(x,y) = \sin(xy) + \cos y$, $P = (-1, \pi)$, and $\vec{u} = \langle 12, -5 \rangle$.

(a) Find the directional derivative of f at P in the direction of $\vec{u}$.

(b) Find the direction of steepest ascent of f at P.

§12.7 Find the equation of the tangent plane to $F(x,y,z) = yz + xz + xy^{-2} = 9$ at the point $(x,y,z) = (3,1,2)$.

§12.8 Find the critical points of $f(x,y) = xye^{-x-y}$. Then use the D-Test to classify them as local min, local max, or saddle.

§13.5 Set up (don't evaluate) the integral to express the volume of the region bounded by the spheres $\rho = 2\cos\phi$ and $\rho = 1$, as depicted below: