PROBLEMS

(1) Find \(\|2\mathbf{e} - 3\mathbf{f}\|\), assuming that \(\mathbf{e}\) and \(\mathbf{f}\) are unit vectors such that \(\|\mathbf{e} + \mathbf{f}\| = \sqrt{3/2}\).

(2) Find the projection of \(\mathbf{u}\) along \(\mathbf{v}\).
   (a) \(\mathbf{u} = 5\mathbf{i} + 7\mathbf{j} - 4\mathbf{k}, \mathbf{v} = \mathbf{k}\).
   (b) \(\mathbf{u} = \langle a, a, b \rangle, \mathbf{v} = \mathbf{i} - \mathbf{j}\).

(3) Find the equation of the plane that contains the lines \(\mathbf{r}_1(t) = \langle t, 2t, 3t \rangle\) and \(\mathbf{r}_2(t) = \langle 3t, t, 8t \rangle\).

(4) Sketch the set described in cylindrical coordinates.
   (a) \(r = 4\).
   (b) \(\theta = \frac{\pi}{3}\).
   (c) \(z^2 + r^2 \leq 4\).

(5) Find an arc length parametrization of \(\mathbf{r}(t) = \langle e^t \sin t, e^t \cos t, e^t \rangle\).

(6) Evaluate the limit or determine that it does not exist.
   (a) \(\lim_{(x,y) \to (0,0)} \frac{xy}{\sqrt{x^2+y^2}}\).
   (b) \(\lim_{(x,y) \to (0,0)} \frac{|x|}{x+y}\).
   (c) \(\lim_{(x,y) \to (0,2)} (1 + x)^{y/x}\).
   (d) \(\lim_{(x,y) \to (0,0)} \frac{x^2 - y^2}{\sqrt{x^2+y^2}}\).

(7) Suppose that the plane tangent to \(z = f(x, y)\) at \((-2, 3, 4)\) has equation \(4x + 2y + z = 2\). Estimate \(f(-2.1, 3.1)\).

(8) A fighter plane, which can shoot a laser beam straight ahead, travels along the path
   \(\mathbf{r}(t) = \langle t - t^3, 12 - t^2, 3 - t \rangle\).
   Show that the pilot cannot hit any target on the \(x\)-axis.