1. Suppose the vectors \((\mathbf{A} + \mathbf{B})\) and \((\mathbf{A} - \mathbf{B})\) are orthogonal. What, if anything, can you conclude about \(\mathbf{A}\) and \(\mathbf{B}\)?

2. In three dimensions, consider the vector \(\mathbf{V} = a_1 \mathbf{i} + a_2 \mathbf{j} + a_3 \mathbf{k}\). Determine the projections of \(\mathbf{V}\) onto the \(x\), \(y\), and \(z\) axis. How do you interpret the results?

3. Let \((-1, 5, -2), (-3, 7, 2),\) and \((1, 3, 6)\) be 3 vertices of a cube. Find the coordinates for the center of the cube.

4. Consider the curve associated with \(y = f(x)\) and a point \(P_0\) on that curve with coordinates \((x_0, f(x_0))\). Let \(L\) be the tangent line to the curve at the point \(P_0\).

   (a) At the point \(P_0\), one can build two vectors of equal magnitude that are parallel to \(L\). (Each is simply the negative of the other.) Let \(t = ai + bj\) be one of these two tangent vectors. Determine one possible set of values for \(a\) and \(b\). Your answer should be written in terms of only \(x_0\) and \(f'(x_0)\).

   (b) At the point \(P_0\), there are two directions (again, each is the opposite of the other) that are orthogonal to the direction of \(t\). Let \(n = ci + dj\) be one of these two orthogonal vectors. If the magnitudes of \(t\) and \(n\) are equal, determine one possible set of values for \(c\) and \(d\). Your answer should be written in terms of only \(x_0\) and \(f'(x_0)\).