1. Evaluate \( \|u + v\|, \|3u - 5v + w\| \), for \( u = (2, -2, 3), v = (1, -3, 4) \), and \( w = (3, 6, -4) \). (Solution: \( \sqrt{83}, \sqrt{466} \))

2. Evaluate \( \|3u - 5v + w\|, \|3u\| - 5\|v\| + \|w\| \) for \( u = (-2, -1, 4, 5), v = (3, 1, -5, 7) \), and \( w = (-6, 2, 1) \). (Solution: \( \sqrt{2570}, 4\sqrt{46} - 5\sqrt{84} \)).

3. For the \( u, v \) in problem 2 find \( u \cdot v \) (solution: 8, -14, 46)

4. Find the Euclidean distance between \( u \), \( v \) where \( u = (0, -2, -1, 1) \) and \( v = (1, -2, 1, 1) \). (Solution: \( \sqrt{59} \))

5. For \( v = (1, 2, -4, 0) \) and \( w = (-3, 5, 1, 1) \) solve the following equation for \( x \):
\[
5x - \|v\|v = \|w\|(w - 5x).
\]
(Solution: \( x = (\frac{18 + \sqrt{21}}{35}, \frac{30 + 2\sqrt{21}}{35}, \frac{6 - 4\sqrt{21}}{35}, \frac{6}{35}) \))

6. Verify that the Cauchy Schwartz inequality holds for \( u = (0, 2, 2, 1), v = (1, 1, 1, 1) \).

7. Find two unit vectors that are orthogonal to the nonzero vector \( u = (a, b) \).
(solution: \( \left( \frac{-b}{\sqrt{a^2 + b^2}}, \frac{a}{\sqrt{a^2 + b^2}} \right) \), \( \left( \frac{b}{\sqrt{a^2 + b^2}}, \frac{-a}{\sqrt{a^2 + b^2}} \right) \))

8. Show that the vectors \( v_1 = (\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}), v_2 = (\frac{1}{2}, \frac{-5}{6}, \frac{1}{6}, \frac{1}{6}), v_3 = (\frac{1}{2}, \frac{1}{6}, \frac{1}{6}, \frac{-5}{6}), v_4 = (\frac{1}{2}, \frac{1}{6}, \frac{-5}{6}, \frac{1}{6}) \), form an orthonormal set.

9. For which values of \( k \), if any, are the vectors \( u = (k, 1, 3) \) and \( v = (1, 7, k) \) are orthogonal. (Solution: \( k = \frac{-2}{7} \))

10. Prove the identity \( u \cdot v = \frac{1}{4}\|u + v\|^2 - \frac{1}{4}\|u - v\|^2 \) for vectors in \( \mathbb{R}^n \) by expressing the two sides in terms of dot products.