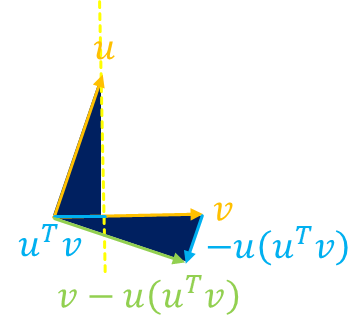
**1.5.1**. Ifandare orthogonal unit vectors, show thatis orthogonal to. What are the lengths of those vectors?

**Sol**.

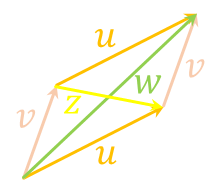
**1.5.2**. Draw unit vectorsandthat are not orthogonal. Show thatis orthogonal to(and addto your picture).

**Sol**.



**1.5.3**. Draw any two vectorsandout from the origin. Complete two more sides to make a parallelogram with diagonalsand. Show thatis equal to.

**Sol**.



**1.5.4**. Key property of every orthogonal matrix:for every vector. More than this, show thatfor every vectorand. So lengths and angles are not changed by. Computations withnever overflow!

**Sol**.

**1.5.5**. Ifis orthogonal, how do you know thatis invertible andis also orthogonal? Ifand, show thatis also an orthogonal matrix.

**Sol**. is invertible.

is orthogonal.

**1.5.6**. A permutation matrix has the same columns as the identity matrix (in some order). Explain why this permutation matrix and every permutation matrix is orthogonal:has orthonormal columns so\_\_\_ and\_\_\_.

When a matrix is symmetric or orthogonal, it will have orthogonal eigenvectors. This is the most important source of orthogonal vectors in applied mathematics.

**Sol**.

**1.5.7**. Four eigenvectors of that matrixare,,, and. Multiplytimes each vector to find,,,. The eigenvectors are the columns of the 4 by 4 Fourier matrix. Show thathas orthonormal columns:

**Sol**.

**1.5.8**. Haar wavelets are orthogonal vectors (columns of) using only,, and. If, . Findandand the eight Haar wavelets for.

**Sol**.