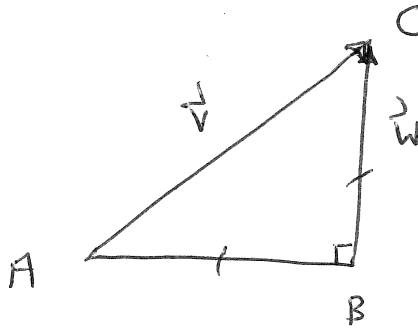


# Math 2415

## Homework on 12.3

1. The triangle  $ABC$  in the figure below is an isosceles triangle for which the length of the hypotenuse is 1. Let  $\mathbf{v} = \overrightarrow{AC}$  and  $\mathbf{w} = \overrightarrow{BC}$ . Calculate  $\mathbf{v} \cdot \mathbf{w}$ , the scalar projection of  $\mathbf{w}$  onto  $\mathbf{v}$ , and the vector projection of  $\mathbf{v}$  onto  $\mathbf{w}$ .



2. Find the scalar and vector projections of  $\mathbf{u} = -\mathbf{i} + \mathbf{j} + \mathbf{k}$  onto  $\mathbf{v} = 2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$ .
3. Calculate the angle between  $\mathbf{u} = \mathbf{i} + \mathbf{j} + \mathbf{k}$  and  $\mathbf{v} = -\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ .
4. Find two unit vectors that each make an angle of  $30^\circ$  with the vector  $(5, 12)$ .
5. The cube in the figure has side length one with one vertex at the origin,  $O$ .
- (a) Let  $Q$  be the vertex opposite  $O$  and let  $R$  be the midpoint of a face of the cube as shown in the figure. Find a formula for the vectors  $\overrightarrow{OQ}$  and  $\overrightarrow{OR}$  in terms of the vectors  $\mathbf{i}$ ,  $\mathbf{j}$ , and  $\mathbf{k}$ .
- (b) Find the angle between the vectors  $\mathbf{i}$  and  $\overrightarrow{OQ}$ .

