DOT PRODUCT

Find the dot product $\vec{u} \bullet \vec{v}$

1. $\vec{u} = 2\hat{i} + 3\hat{j} - 2\hat{k}$
   $\vec{v} = -4\hat{i} + 4\hat{j} + 3\hat{k}$

2. $\vec{u} = 4\hat{i} + 2\hat{j} + \hat{k}$
   $\vec{v} = -\hat{i} + 4\hat{j} - 2\hat{k}$

3. $\vec{u} = 2\hat{i} + 3\hat{j}$
   $\vec{v} = -4\hat{i} + 4\hat{j}$

4. $\vec{u} = 5\hat{i} + \hat{j}$
   $\vec{v} = 3\hat{i} + 2\hat{j}$

5. $\vec{u} = \hat{i}$
   $\vec{v} = \hat{j}$

6. If $\vec{v} = a\,\hat{i} + b\,\hat{j} + c\,\hat{k}$, prove that $\|\vec{v}\|^2 = \vec{v} \bullet \vec{v}$. Give a coherent argument!

7. If you are given three vectors, $\vec{u}$, $\vec{v}$, and $\vec{w}$, and if $\vec{u} \bullet \vec{v} = \vec{u} \bullet \vec{w}$, does it necessarily follow that $\vec{v} = \vec{w}$? Prove or give a counterexample.

8. Suppose $\vec{v} = < a,b,c >$ and $\vec{w} = < d,e,f >$, and suppose that for any vector $\vec{u}$ we have $\vec{u} \bullet \vec{v} = \vec{u} \bullet \vec{w}$. Does it necessarily follow that $\vec{v} = \vec{w}$? Prove or give a counterexample.