MAT 122 Homework 7 Name____________________

Due Wednesday, April 11th 3.3 – 3.4

I'd like you to do a nice workup for these problems on unruled (unlined paper). I'll provide the copier paper, if you need it. The important thing, here, is to submit nice, organized work.

1. **3.3** Consider the two points $P(-2,7)$ and $Q(5, -17)$. Find the component form of the vector $\bar{v} = \overrightarrow{PQ}$. Sketch the vector $\bar{v}$.
2. **3.3** Find a unit vector in the direction of $\bar{u} = \langle 3,7 \rangle$.
3. **3.3** Find a vector of length 13 in the direction of $\bar{u} = \langle 3,7 \rangle$.
4. **3.3** If $\bar{u} = \langle 3,7 \rangle$ and $\bar{v} = \langle -2,5 \rangle$, find $3\bar{u} - 2\bar{v}$.
5. **3.3** Find the component form of the vector of magnitude 3 with direction angle $83^0$. Round to 3 decimal places, if necessary.
6. **3.3** Find the angle between 2 force vectors if the magnitude of one is 3,000 pounds, the magnitude of the other is 1,000 pounds and the resultant force is 3750 pounds. This is a nice puzzle.
7. **3.3** #102 in the text. Keep in mind "bearing" is measured clockwise from due North. A commercial jet is flying on a bearing of $332^o$. Its airspeed is 580 miles per hour. The wind is blowing from the southwest with a speed of 60 miles per hour.
   a. Draw a figure that gives a visual representation of the situation.
   b. Write the velocity of the wind as a vector in component form (Leave it in terms of sines and cosines.)
   c. Write the velocity of the plane as a vector in component form (Leave it in terms of sines and cosines.)
   d. What is the speed of the jet with respect to the ground?
   e. What is the true direction of the jet?
8. **3.4** Find the dot product of $\bar{u} = \langle 3,7 \rangle$ and $\bar{v} = \langle -2,5 \rangle$.
9. **3.4** Find the magnitude of $\bar{u} = \langle 3,7 \rangle$.
10. **3.4** Find the angle between the vectors.
    a. $\bar{u} = \langle 3,7 \rangle$ and $\bar{v} = \langle -2,5 \rangle$
    b. $\bar{u} = 3\mathbf{i} + 7\mathbf{j}$ and $\bar{v} = -2\mathbf{i} + 5\mathbf{j}$
11. **3.4** Determine whether the two vectors are orthogonal.
    a. $\bar{u} = \langle 3,7 \rangle$ and $\bar{v} = \langle -2,5 \rangle$.
    b. $\bar{u} = \langle 2,3 \rangle$ and $\bar{v} = \langle -12,8 \rangle$
12. **3.4** Find the projection of $\bar{u} = \langle 2,3 \rangle$ onto $\bar{v} = \langle -12,8 \rangle$. That is to say, find $\text{proj}_{\bar{v}}\bar{u}$.
13. **3.4** Now write the vector $\bar{u} = \langle 2,3 \rangle$ as the sum of a vector parallel to $\bar{v} = \langle -12,8 \rangle$ and a vector orthogonal to $\bar{v}$. Some texts call the orthogonal piece the "orthogonal complement," and write it this way: $\text{orthog}_{\bar{v}}\bar{u}$, so that $\bar{u} = \langle 2,3 \rangle = \text{proj}_{\bar{v}}\bar{u} + \text{orthog}_{\bar{v}}\bar{u}$.