100 points   NAME:_____
Show all work neatly.   EXACT answers unless specified.

(1) Given the vectors **u** = 2 **i** + 2 **j** and **v** = -4**i** + 3**j** , find the following:

     a) ‖ **u** ‖   _____

     b) **u** + **v**   _____

     c) **u** • **v**   _____

     d) The angle between **u** and **v**   _____

     e) The direction angle of **v** (exact)   _____

     f) Find a value for b such that < b,2> is orthogonal to **v** _____

     g) Find a value for c such that < 8,c> is parallel to **v** _____

     h) If **PQ** is a representative of **v** where P=(3,-1), find the coordinates of point Q._____

(2) Two forces act on an object as shown. Find the magnitude and the direction of the resultant.
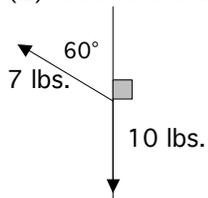
   60°   (exact and approx.)   (10 pts)
7 lbs.

     10 lbs.

(3) An airplane is traveling at a constant airspeed of 450 mph in the direction N45°W. If wind is blowing directly northward at a rate of 50 mph, what is the actual speed and direction of the airplane?
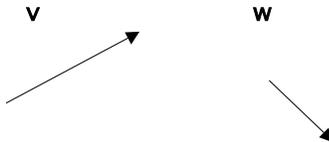
(4) On the axes below, plot (and label) the polar points A(2, 150°),   B(3, -π/6) , C(-2, π/2) (3pts)
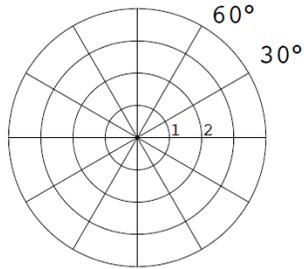
(5) Given the vectors **w** and **v** below, find **w** + **v**   and   -2**v** .

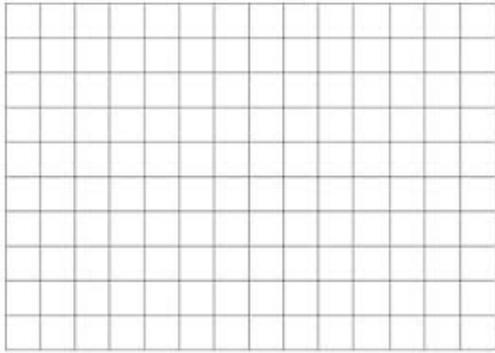(6) Given the point (5, 7π/4) in polar coordinates, find the rectangular representation.

(7) Given the point $\left(-1, \sqrt{3}\right)$ in rectangular coordinates, find two different polar representations; one with r > 0, the other with r < 0.

(8) Convert to rectangular coordinates: r secθ=4

(9)   Graph the polar curve: r = 2+2cosθ.
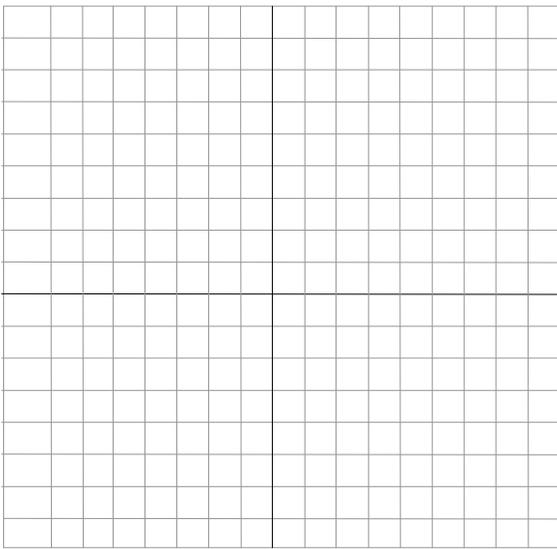
(10) Graph the polar curve: r = -4sin3θ.

(11) Carefully sketch the graph of $9x^2 + 4y^2 - 72x + 8y + 112 = 0$, and find the following desired
      information. Label at least 2 points on your graph and show scale. (11 points)

   VERTICES: _____   FOCI: _____   COVERTICES: _____

(12)   Carefully sketch the graph of $2x^2 + 8y + 4x - 14 = 0$, and find the following desired information.
       Label at least 2 points on your graph and show scale.   (11 points)

   VERTEX: _____   FOCUS: _____