

100 points

NAME: \_\_\_\_\_

Show all work neatly. EXACT answers unless specified.

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(1) Given the vectors  $\mathbf{u} = 2\mathbf{i} + 2\mathbf{j}$  and  $\mathbf{v} = -4\mathbf{i} + 3\mathbf{j}$ , find the following:

a)  $\|\mathbf{u}\|$  \_\_\_\_\_

b)  $3\mathbf{u} + \mathbf{v}$  \_\_\_\_\_

c)  $\mathbf{u} \cdot \mathbf{v}$  \_\_\_\_\_

d) The angle between  $\mathbf{u}$  and  $\mathbf{v}$  \_\_\_\_\_

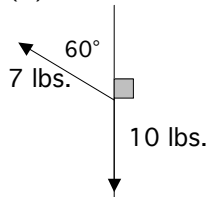
e) The direction angle of  $\mathbf{v}$  (exact) \_\_\_\_\_

f) Find a value for  $b$  such that  $\langle b, 2 \rangle$  is orthogonal to  $\mathbf{v}$  \_\_\_\_\_

g) Find a unit vector in the direction of  $\mathbf{v}$  \_\_\_\_\_

h) If  $\mathbf{PQ}$  is a representative of  $\mathbf{v}$  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.



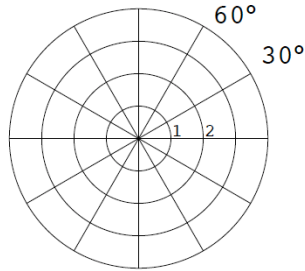
(exact and approx.)

(10 pts)

(3) An airplane is traveling at a constant airspeed of 450 mph in the direction  $N60^\circ W$ . If wind is blowing directly eastward at a rate of 50 mph, what is the actual speed and direction of the airplane?

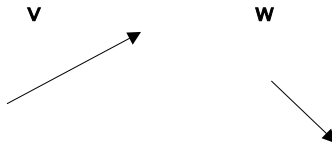
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(4) On the axes below, plot (and label) the polar points  $A(2, 150^\circ)$ ,  $B(3, -\pi/6)$ ,  $C(-2, \pi/2)$  (3pts)



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(5) Given the vectors  $\mathbf{w}$  and  $\mathbf{v}$  below, find  $\mathbf{w} + \mathbf{v}$  and  $-2\mathbf{v}$ .



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

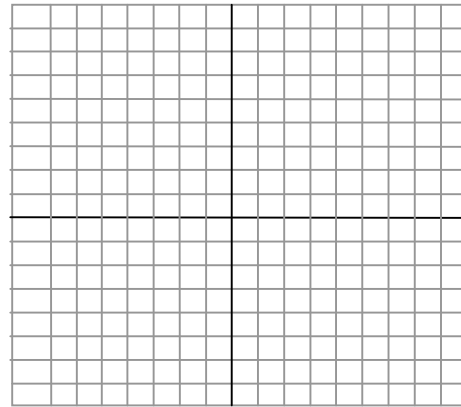
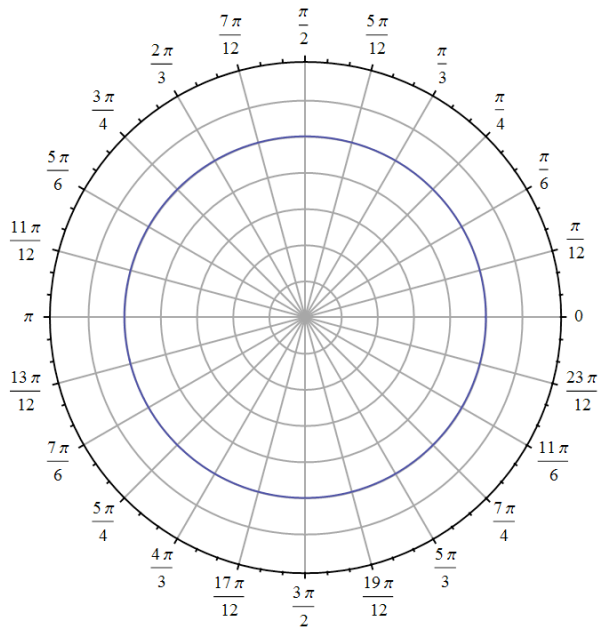
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(7) Given the point  $(-1, \sqrt{3})$  in rectangular coordinates, find two different polar representations; one with  $r > 0$ , the other with  $r < 0$ .

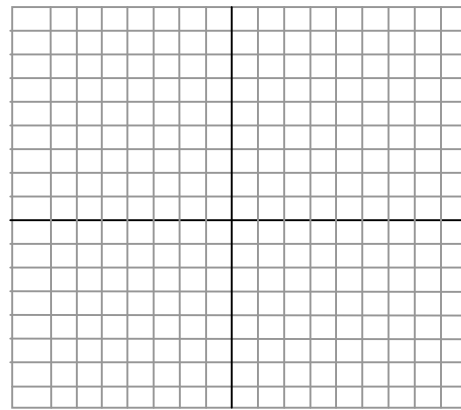
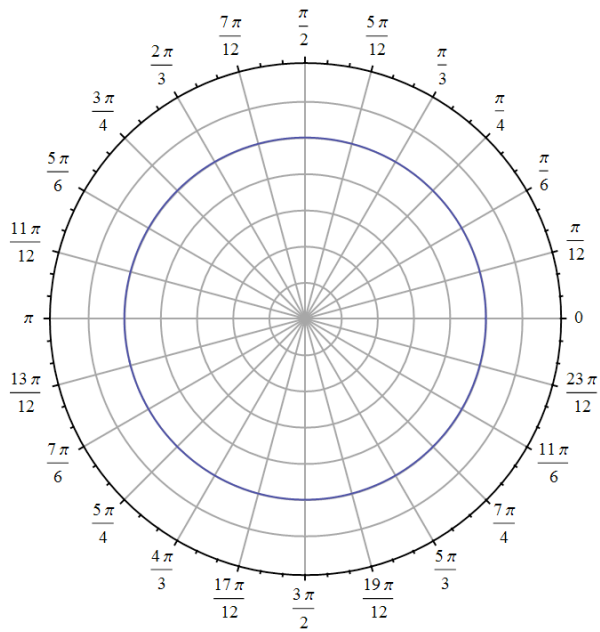
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(8) Convert to rectangular coordinates:  $r = \cos\theta + \sin\theta$

(9) Graph the polar curve:  $r=4\sin 2\theta$ . (You may use either grid)



(10) Graph the polar curve:  $r=1+4\sin\theta$ . (You may use either grid)



- (11) Find all remaining parts of the following triangle(s)  $c = 4$ ,  $B = 60^\circ$ ,  $A = 70^\circ$ , and find the area. Approx. accurately (i.e. used "stored values") to one decimal place.

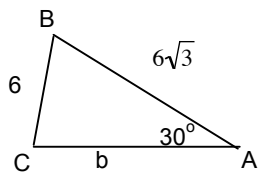
$$a \approx \underline{\hspace{2cm}}$$

$$b \approx \underline{\hspace{2cm}}$$

$$C \approx \underline{\hspace{2cm}}$$

$$\text{Area} \approx \underline{\hspace{2cm}}$$

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- (12) Find all remaining parts of the given triangle(s), exactly.



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- (13) Solve:  $8 - 6\sin^2\theta - 7\cos\theta = 0$

(14)

The Colonel spots a campfire at a bearing of  $N42^\circ E$  from his current position. Sarge, who is positioned 3000 feet due east of the Colonel, reckons the bearing to the fire to be  $N20^\circ W$  from his current position. Determine the distance from the campfire to each man, rounded to the nearest foot.

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(15)

**Time Lost to a Navigation Error** In attempting to fly from city  $P$  to city  $Q$ , an aircraft followed a course that was  $10^\circ$  in error, as indicated in the figure. After flying a distance of 50 miles, the pilot corrected the course by turning at point  $R$  and flying 300 miles farther. If the constant speed of the aircraft was 250 miles per hour, how much time was lost due to the error?

