Name:_____

Section (circle one): 1 2 3 4 5 6
Team (circle one):   a b c d e f

SM122 – Test #4– Fall 2010

Closed book. Calculators/one note sheet allowed. Properly label all graphs. Box/circle your final answer. <u>YOU MUST SHOW ALL WORK FOR FULL CREDIT.</u>

1. (20 points) Given the following points: P (2, 1, 2),   Q (0, 3, 1), R (1, 4, 0), complete the table below (do not use calculator):

$\overrightarrow{PQ}$	$\langle -2,\ 2,\ -1\rangle$	$|\overrightarrow{PQ}|$		$\overrightarrow{PQ}\cdot\overrightarrow{PR}$	
$\overrightarrow{QP}$		$|\overrightarrow{PR}|$		$\overrightarrow{PQ}\cdot\overrightarrow{RQ}$	-1
$\overrightarrow{PR}$		$|\overrightarrow{RQ}|$	—	$\overrightarrow{RQ}\cdot\overrightarrow{PR}$	
$\overrightarrow{RP}$		$2\,\overrightarrow{PQ}$		$\overrightarrow{PQ}\times\overrightarrow{PR}$	
$\overrightarrow{QR}$		$\overrightarrow{QP}+\overrightarrow{QR}$		$\overrightarrow{PQ}\times\overrightarrow{RQ}$	
$\overrightarrow{RQ}$	<-1,-1,1>	$3\,\overrightarrow{QR}+4\,\overrightarrow{RP}$		$\overrightarrow{RQ}\times\overrightarrow{PQ}$	

Fill in answers carefully! Highlighted data in this table can be used in problems 2-7.

No marks on this table	
GW (10 pts)	
1 (20 pts)	
2 (10 pts)	
3 (10 pts)	
4 (5 pts)	
5 (5 pts)	
6 (10 pts)	
7 (10 pts)	
8 (10 pts)	
9 (10 pts)	
10 (5 pts EC)	
cumm.	

2. (10 points) Find the angle between the vectors $\vec{PQ}$ and $\vec{PR}$?

3. (10 points) Find the area of triangle PQR using cross products.

4. (5 points) Calculate $\vec{PQ} \cdot \left(\vec{PQ} \times \vec{PR} \right)$ and $\vec{PR} \cdot \left(\vec{PQ} \times \vec{PR} \right)$. Explain your results.

5. (5 points) Is triangle PQR a right triangle? Why?

6. (10 points) Find:
    a. The vector equation of line connecting points P and Q.

    b. The equation of a plane containing points P, Q and R.

7. (10 points) Find the following:
    a. The scalar projection of $\overrightarrow{PQ}$ onto $\overrightarrow{PR}$ $\left(comp_{\overrightarrow{PR}} \overrightarrow{PQ}\right)$.

    b. The vector projection of $\overrightarrow{PQ}$ onto $\overrightarrow{PR}$ $\left(proj_{\overrightarrow{PR}} \overrightarrow{PQ}\right)$

8. (10 points) Somewhere on the Severn River: A YP sets up a tow line to rescue a floundering sailboat. The towline forms a 15 degree angle with the water line. A total of 50 lbs of force is required to tow the sail boat. How much work is done in towing the vessel 500 feet?

9. (10 points) Somewhere in the South Pacific: Your ship is traveling on a course 055 at a speed of 10 knots. You are tracking a contact whose relative course is 160 at a speed of 3 knots. Use vector addition to find the true course/speed of the contact.

Recall that course is measured in degrees clockwise off of the North-South axis. In mathematics the angle   is measured in degrees counter-clockwise off of the x-axis. (i.e. cse+ =90)

N

Ship's cse/spd
= 055/10kts

W   E

Relative cse/spd =
160/3kts

S