Group TMath 126

Exam 2 has no time limit but the work must be turned into my office (GWP 430) before I arrive at school Tuesday Aug 12th.

This is a group exam were you may work in groups as large as two people and turn in ONE copy per group. Groups may collaborate with each other but for each problem that you collaborate on you must identify that you did so. Collaboration should be mutual, if I see that one group cited another group but not vice versa I will take off points from the group that failed to cite the collaboration. Note the word "collaboration", you should not be copying/lecturing to one another which is why collaborators should be mutual!

This is an open book, open note, calculator and internet allowed exam emphasizing material from weeks 4-7. The point values of each question are reported in brackets before each question. You are NOT allowed to use any person outside of this class to help with your exam (that includes clarifying the problem).

All members of the group are required to sign and turn in the below honesty statement with the exam stating that every member followed the above rules.

Keep in mind since this exam has no time limit, is open book, open note, and open internet it will look *very* different from your home work. In order to make sure that you understand the concept I will have to ask questions different than your homework so that you can't simply look up and copy answers without understanding!!

Honesty Statement

My signature on the line below constitutes a pledge that the work on Exam 2 is my own unless otherwise indicated. I certify that I did not receive either direct or virtual help from a tutor, friend, or instructor not in this class.

Name(s): ————————————————————————————

1. [6] TRUE/FALSE: Identify a statement as True in each of the following cases if the statement is *always* true and provide a brief justification. Otherwise, identify it as false and provide a counterexample.

   (a) For any vectors $\vec{v}$ and $\vec{w}$ in $\mathbb{R}^3$, $||\vec{v} + \vec{w}|| = ||\vec{v}|| + ||\vec{w}||$.

   (b) If the points P, Q, R and the vector $\vec{b}$ are as shown, and $||\overrightarrow{PQ}|| = ||\overrightarrow{QR}||$, then $\mathrm{proj}_{\overrightarrow{PR}} 2\vec{b} = \overrightarrow{PR}$.
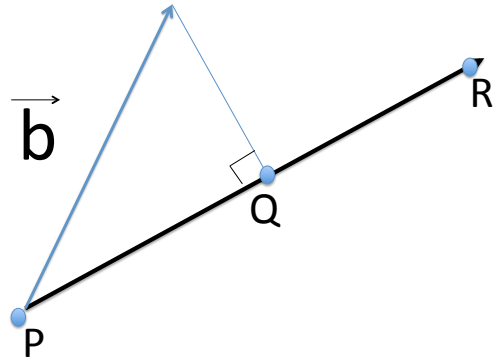
Show your work for the following problems. The correct answer with no supporting work will receive NO credit.

2. [4] You are given the following data of a function $g(x,y)$. Your boss wants you to approximate $g(.8, 1.4)$ and wants to be convinced you're doing something sophisticated. Find a linear approximation for your boss and explain your choices (there are many that you will make!).

x	y	$g(x,y)$
0.55	1.2	27
0.65	1.0	31
0.65	1.1	29
0.75	1.2	50

3. An ant infected by the myrmeconema neutroncum parasite wants to climb as high as possible to make it more likely to be eaten by birds. The algorithm is pretty simple: go in the direction of the steepest assent. The ant is at $(1, 2, \cos(2))$ and climbing on the surface described by $h(x, y) = \cos(xy)$.

   (a) [5] If the ant travels in the direction of $\langle -1, 3 \rangle$, what is the approximate change in elevation experienced by the ant? Be sure to provide work so I can see where your numbers come from.

   (b) [3] Which direction does the ant want to travel?

4. Consider the sphere S centered at $(1, 2, 3)$ with radius 4.

   (a) [2] Write an algebraic equation for the sphere S.

   (b) [6] Find the shortest distance between the sphere S and the plane passing through
   the points $(0, 2, -2)$, $(-1, -1, -2)$ and $(4, 4, -1)$. Explain your reasoning.

5. [8] Role play that you are a mathematician in the 18th century. Another mathematician has contacted you bragging/challenging you to solve the following problem: Identifying all the critical points for

$$f(x, y) = x^4 + 2x - 6xy + 2y + y^4$$

and classify each as a minimum, maximum or neither. Write back with your solution.

Note: your audience is another mathematician of a similar level as you, the numbers are not nice, and the graphing calculator is not going to be available for a few more centuries...