DEPARTMENT OF MATHEMATICS & STATISTICS
MATH 1503

Paper Assignment 3

Instructions: Complete each of the following tasks.

Homework problems to be handed in can be found in part **C** below.

A. Read the text, sections 1.2, 1.3 and 1.4. It will also be helpful to read chapter 12 in the Stewart calculus text. (Copies are on reserve in the libraries.)

B. Try some of the following problems from the text for practice (not to be handed in). It will be a few days or more before we cover all these topics.

Page 37 – True/False questions

Page 38 – 1, 3, 5, 7(a,b), 8, 11(a), 13(a), 15, 24, 25

Page 59 – True/False questions

Page 60 – 2, 3, 4(a), 6, 13(a), 14(a), 18(a), 19, 21, 22, 23(a),24, 25(a), 28(a)

Page 71 – True/False questions

Page 72 – 1, 2(a), 3(a), 4(a), 6(a), 7(a), 9(a)

C. Hand in the following problems, as instructed in class.

1. In this question let $\mathbf{a} = \begin{bmatrix} 3 \\ 0 \\ 2 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$.
   (a) Find $\mathbf{c} = 2\mathbf{a} - 3\mathbf{b}$.
   (b) Find $\|\mathbf{c}\|$.
   (c) Compute $2\|\mathbf{a}\| - 3\|\mathbf{b}\|$. Does this scalar equal $\|\mathbf{c}\|$?
   (d) Find the approximate angle in degrees between vectors $\mathbf{a}$ and $\mathbf{b}$.
2. Find the distance between points $P(2, 0, -1, 3)$ and $Q(1, 1, 1, 1)$ in $\mathbb{R}^4$.

more questions →

3. The *direction angles* of a non-zero vector $\mathbf{v}$ in $\mathbb{R}^3$ are the three angles it makes with the unit vectors $\mathbf{i}, \mathbf{j}, \mathbf{k}$. Find the direction angles α, β, γ for $\mathbf{v} = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$.

   Remark: it is true, but you don't have to prove,
   that $\cos^2(\alpha) + \cos^2(\beta) + \cos^2(\gamma) = 1$.

4. **Background** The solution to the equation $x = 5$ depends on context! On the line $\mathbb{R}^1$, the solution is clearly one single point; but in the plane $\mathbb{R}^2$, the solution is a 'vertical' line. In this question the context is ordinary space $\mathbb{R}^3$.

   (a) The equation $y = 2$ describes a plane. Sketch it. Give a unit normal vector. (Hint: put the equation in the form $ax + by + cz = k$.)
   Which, if any, of the coordinate lines are parallel to this plane?

   (b) Give a normal vector for the plane $y = x + 3$.

   (c) Suppose a plane has normal vector $\mathbf{n} = [n_1, n_2, n_3]$, written as a row to save space.
   In one sentence, give a simple rule which tells which of the coordinate axes, if any, are parallel to the plane.

5. Find the following cross products. (Again to save space we write row vectors.)

   (a) $\mathbf{j} \times \mathbf{k}$ ($= [0, 1, 0] \times [0, 0, 1]$).

   (b) $\mathbf{k} \times \mathbf{j}$

   (c) $\mathbf{j} \times 3\mathbf{k}$

   (d) $[3, -1, 2] \times [1, 1, -1]$