DEPARTMENT OF MATHEMATICS & STATISTICS
MATH 1503

Paper Assignment 4

Instructions: Complete each of the following tasks.

A. Read the text, sections 1.3, 1.4 and 1.5.

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 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)

Page 80 – True/False questions

Page 81 – 1(a), 4

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 $\text{proj}_{\mathbf{b}}\mathbf{a}$ (the projection of $\mathbf{a}$ onto the vector $\mathbf{b}$).

   (b) Find $\text{proj}_{\mathbf{k}}\mathbf{a}$.
   (Look carefully: $\mathbf{k}$ is the third standard basis vector in $\mathbb{R}^3$.)

2. Suppose $P = (-1, 1)$ and $Q = (1, 2)$ in $\mathbb{R}^2$.

   (a) Find parametric equations for the line through points $P = (-1, 1)$ and $Q = (1, 2)$ in $\mathbb{R}^2$.
   Advice. The proper style in your answer is to align terms something like this (which is not the answer, of course):

$$\begin{cases} x &= -3t + 100 \\ y &= 6t - 7 \end{cases}, \quad t \in \mathbb{R}.$$

more questions→

Question continues from first page:

(b) Give the midpoint of the segment PQ.

(c) Find <u>two</u> points on the line that are twice as far from P as from Q.

3. With the aid of the cross product, determine an equation for the plane through $(1, 1, 2)$, $(3, 2, 1)$ and $(2, 1, 0)$.

4. This question concerns the hyperplane

$$2x - y + z - 3w = 6$$

in $\mathbb{R}^4$, along with the point $P(1, 1, -2, 1)$.

(a) Give the normal vector $\mathbf{n}$ for the hyperplane.

(b) Find the x-intercept C for the hyperplane.
Hint: C is a point in $\mathbb{R}^4$. As in $\mathbb{R}^2$ or $\mathbb{R}^3$, you get it by setting the 'remaining' variables equal 0.

(c) Find the projection of the vector $\vec{CP}$ onto $\mathbf{n}$.

(d) Find the distance from P to the hyperplane.
Hint: a picture will tell you that this is simply the length of the projection just found.