Linear Algebra (Math 220)
Assignment due Tuesday, April 1, 2008

1 Preparation

Expect a quiz.

Relevant Reading:

- Lay §§ 4.7, 6.1, 6.2

- Hefferon §§ 3.V – 3.VI

2 Exercises

1. Let $\mathcal{P}_d$ denote the vector space of polynomials of degree d or less. If f is an element of $\mathcal{P}_d$, let I_f be the polynomial given by the formula

$$I_f(x) \;=\; \int_0^x f \quad .$$

   (a) Explain briefly why I_f is linear.

   (b) What is the kernel of I_f ?

   (c) In what set does the function I_f takes its values (regarding $\mathcal{P}_d$ as its domain).

   (d) What is the image of I_f ?

2. What is the length of the line segment from the point $(2, -1, 1)$ to the point $(4, -4, 7)$?

3. What is the angle at the point $(0, 1, -1)$ in the triangle whose vertices are that point, the point $(-1, 3, 1)$, and the point $(3, 7, -3)$?

4. Let M be the 2×3 matrix

$$M \;=\; \begin{pmatrix} 3 & 0 & -1 \\ 3 & -2 & 0 \end{pmatrix} ,$$

   and let f be the linear function from $\mathbf{R}^3$ to $\mathbf{R}^2$ that is defined by $f(x) = Mx$. Find a basis of the kernel of f consisting of vectors of length 1.

5. Find a basis consisting of mutually perpendicular vectors for the plane in $\mathbf{R}^3$ defined by the linear equation

$$2x - y + 2z \;=\; 0 \quad .$$