MATH 341 SECTION
WRITTEN HOMEWORK 8
DUE DECEMBER 2, 2015.

INSTRUCTOR: ROBERT LIPSHITZ

Required textbook problems (hand these in):
(1) 4.3.11, 4.3.16, 4.3.26, 4.3.28, 4.3.33, 4.3.34.
(2) 4.4.6, 4.4.9, 4.4.10, 4.4.11, 4.4.13, 4.4.14, 4.4.27, 4.4.28, 4.4.31.
(3) 4.5.4, 4.5.12, 4.5.21, 4.5.22, 4.5.23, 4.5.24.
(4) Some practice with matrices for linear transformations...
   (a) Consider the linear transformation \( F: \mathbb{P}_3 \to \mathbb{P}_2 \) given by \( F(p(t)) = p'(t) \). Let \( \mathcal{A} \) be the basis \( \{1, x, x^2, x^3\} \) for \( \mathbb{P}_3 \) and let \( \mathcal{B} \) be the basis \( \{1, x, x^2\} \) for \( \mathbb{P}_2 \). Find the matrix for \( F \) with respect to \( \mathcal{A} \) and \( \mathcal{B} \).
   (b) Now let \( \mathcal{C} \) be the basis \( \{1 + x + x^2 + x^3, x + x^2 + x^3, x^2 + x^3, x^3\} \) for \( \mathbb{P}_3 \). Find the matrix for \( F \) with respect to \( \mathcal{C} \) and \( \mathcal{B} \).
   (c) Now, define \( G: \mathbb{P}_3 \to \mathbb{P}_3 \) to be \( G(p(t)) = p'(t) \). (So, \( G \) is the same as \( F \) except that we view it as mapping to a different space of polynomials.) Find the matrix for \( G \) with respect to \( \mathcal{A} \) and \( \mathcal{A} \).
(5) Consider the subspace \( V = \{ae^t + be^{-t} | a, b \in \mathbb{R}\} \) of the space \( C^\infty(\mathbb{R}) \) of smooth functions. (So, for example, \( 5e^t + 7e^{-t} \) is an element of \( V \), but \( \sin(t) \) is not an element of \( V \.) Let \( F: V \to V \) be the linear map \( F(g(t)) = g'(t) \).
   (a) Compute \( F(5e^t + 7e^{-t}) \).
   (b) Let \( \mathcal{B} \) be the basis \( \{e^t, e^{-t}\} \) for \( V \). Compute the matrix for \( F \) with respect to the bases \( \mathcal{B} \) and \( \mathcal{B} \).
   (c) Let \( \mathcal{C} \) be the basis \( \{(e^t + e^{-t})/2, (e^t - e^{-t})/2\} \) for \( V \). Compute the matrix for \( F \) with respect to the bases \( \mathcal{C} \) and \( \mathcal{C} \).
   (It doesn’t matter for this problem, but the elements of \( \mathcal{C} \) are the hyperbolic cosine and hyperbolic sine functions, and are denoted \( \cosh(t) \) and \( \sinh(t) \).)

Suggested practice (don’t hand these in):
• Please read and make sure you can do the practice problems in section 4.3, 4.4, 4.5.
• Please read and use for review problems 4.3.21, 4.3.22, 4.4.15, 4.4.16, 4.5.19, 4.5.20, 4.5.29, 4.5.30.
• Some more nice practice with the definitions: 4.3.31, 4.3.32, 4.4.20, 4.4.23–26, 4.4.37, 4.5.26.
• If you had trouble or got help with any of the assigned problems, solve another, similar problem (or two).

Bonus points. None this week.

E-mail address: lipshitz@uoregon.edu