MATH 341
WRITTEN HOMEWORK 8

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Required textbook problems (hand these in):

1. §4.3: 11, 16, 26, 28, 33, 34.
2. §4.4: 6, 9, 10, 11, 12, 13, 14, 27, 28, 31.
3. §4.5: 4, 12, 21, 22, 23, 24.

4. Some practice with matrices for linear transformations...
   (a) Consider the linear transformation $F: \mathbb{P}_2 \to \mathbb{P}_2$ given by $F(p(t)) = p'(t)$. Let $A$ be the basis $\{1, x, x^2\}$ for $\mathbb{P}_3$ and let $B$ be the basis $\{1, x, x^2\}$ for $\mathbb{P}_2$. Find the matrix for $F$ with respect to $A$ and $B$.
   (b) Now let $C$ 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 $C$ and $B$.
   (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 $A$ and $A$.

5. Consider the subspace $V = \{ae^t + be^{-t} \mid a, b \in \mathbb{R}\}$ 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 $B$ be the basis $\{e^t, e^{-t}\}$ for $V$. Compute the matrix for $F$ with respect to the bases $B$ and $B$.
   (c) Let $C$ 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 $C$ and $C$.
   (It doesn’t matter for this problem, but the elements of $C$ 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.

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