MATH 341
WRITTEN HOMEWORK 8
DUE MARCH 11, 2020.

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(Updated: fixed some typos.)
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 $F\colon \mathbb{P}_3 \to \mathbb{P}_2$ given by $F(p(t)) = p'(t)$. Let $\mathcal{A}$ be the basis $\{1, t, t^2, t^3\}$ for $\mathbb{P}_3$ and let $\mathcal{B}$ be the basis $\{1, t, t^2\}$ 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 $\{1 + t + t^2 + t^3, t + t^2 + t^3, t^2 + t^3, t^3\}$ for $\mathbb{P}_3$. Find the matrix for F with respect to $\mathcal{C}$ and $\mathcal{B}$.
   (c) Now, define $G\colon \mathbb{P}_3 \to \mathbb{P}_3$ 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 $V = \{ae^t + be^{-t} \mid a, b \in \mathbb{R}\}$ 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 $F\colon V \to V$ 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.

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