Required textbook problems (hand these in):

1. §4.1: 1, 2, 5, 6, 7, 8, 12, 25, 26, 27, 28, 29, 30.
2. §4.2: 7, 8, 9, 10, 16, 22, 31.
3. Recall that $P_3$ is the vector space of polynomials $p(t)$ of degree $\leq 3$.
   Consider the map $F: P_3 \to P_3$ defined $F(p(t)) = p'(t) + p''(t)$.
   (a) Compute $F(t^3 + 2t + 3)$.
   (b) Verify that $F$ is a linear transformation.
   (c) Is $F$ one-to-one (injective)? Justify your answer.
   (d) Is $F$ onto (surjective)? Justify your answer.
   (e) Describe the kernel (null space) of $F$.
   (f) Describe the image (what the book calls the “range”) of $F$.
   (g) Find one solution $p(t)$ to the equation $F(p(t)) = 2t^2 + 3t + 4$.
   (h) Find all solutions $p(t)$ to the equation $F(p(t)) = 2t^2 + 3t + 4$.
4. Consider the map $G: P_2 \to P_3$ defined $G(p(t)) = \int_0^t p(x)dx$.
   (a) Compute $F(t^2 + t + 5)$.
   (b) Verify that $F$ is a linear transformation.
   (c) Is $F$ one-to-one (injective)? Justify your answer.
   (d) Is $F$ onto (surjective)? Justify your answer.
   (e) Describe the kernel (null space) of $F$.
   (f) Describe the image (what the book calls the “range”) of $F$.
   (g) Find one solution $p(t)$ to the equation $F(p(t)) = 2t^2 + 3t$.
   (h) Find all solutions $p(t)$ to the equation $F(p(t)) = 2t^2 + 3t$.
5. Consider the map $H: P_3 \to P_3$ defined by $H(p(t)) = p'(t)p''(t)$.
   • Compute $H(t^3 + 2t + 3)$.
   • Is $H$ a linear transformation? Justify (prove) your answer.
6. Consider the map $K: P_3 \to P_3$ defined by $K(p(t)) = t^3p(0) + 2p'(t)$.
   • Compute $K(t^3 + 2t + 3)$.
   • Verify that $K$ is a linear transformation.
   • Is $K$ one-to-one (injective)? Justify your answer.
   • Is $K$ onto (surjective)? Justify your answer.
   • Compute $(F \circ K)(t^3 + 2t + 3) = F(K(t^3 + 2t + 3))$.
   • Compute $(K \circ F)(t^3 + 2t + 3) = K(F(t^3 + 2t + 3))$. 
Suggested practice (don’t hand these in):

- Please read and make sure you can do the practice problems in section 4.1, 4.2.
- Please read and use for review problems 4.1.23, 4.1.24, 4.2.25, 4.2.26.
- Some more nice practice with the definitions: 4.1.19, 4.1.31, 4.1.32, 4.1.33, 4.1.34
- If you had trouble or got help with any of the assigned problems, solve another, similar problem (or two).

*Bonus points*. As usual, bonus points for learning Sage.

1. Follow the post “Random matrices for practice”. Print out your worksheet and turn it in.

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