Homework is due at the beginning of class. No late homework will be accepted. You may collaborate on the homework, but your final write-up must be done on your own and should reflect your own understanding of the problem. Please cite any help you get. The following problems refer to problems in the Axler textbook, 3rd edition. (If you own the wrong edition of the text, see the course webpage for how to get an electronic version of the text.)

(All solutions must be supported with a proof, a counterexample, or a detailed computation, as appropriate. Simple Yes/No answers are unacceptable, even if the question is phrased in those terms. Solutions should be written in complete sentences and paragraphs.)

(2) Do problems 1, 3, 4, 8, 9, and 11 from 3.A.
(3) Do problems 1, 4, 5, 6, 9, 10, 26, and 30 from 3.B.
(4) Section 3.B is perhaps the most important section of the book in the first half of the course. It would be a good idea to think about as many exercises from 3.B as you can.
(5) Let \( P_{2,2}(\mathbb{R}) \) denote the vector space of polynomials in two variables \( x, y \) with coefficients in \( \mathbb{R} \) and degree at most 2. For example, 
\[
x^2 + 2xy - 3y + 4
\]
is an element in this space. The vector space operations are the obvious ones.
(a) What is the dimension of \( P_{2,2}(\mathbb{R}) \)? Give a basis for \( P_{2,2}(\mathbb{R}) \).
(b) Let \( p_1, \ldots, p_5 \in \mathbb{R}^2 \) be five points in the plane. Use linear algebra to show that there is a conic (i.e. a curve defined by a nonzero degree 2 equation \( p(x, y) = 0 \)) which passes through all five points. (Hint: construct a useful linear transformation \( T : P_{2,2}(\mathbb{R}) \rightarrow \mathbb{R}^5 \).)