Due: Wednesday, 10/17/17 at the *beginning* of class.

In general, answers to homework problems should include any computations necessary to get the final answer and an explanation of your work. Some problems may be entirely computational, with very little writing, whereas others are proofs or explanations with little computation. If you're in doubt about what's required for a particular problem, ask me. As a rule of thumb, common sense prevails. This is a 5000 level course, not college algebra, so I don't need to see your work in excruciating detail. If you need to solve a system of equations as part of a problem, just tell me what the solution is; don't include a page of work showing every step of the Gauss-Jordan reduction of an augmented matrix.

When you write explanations, you should write in complete sentences with (reasonably) correct grammar. Granted, this is not a writing intensive course, but it is a 5000-level mathematics course, and at this level you're expected to be able to explain your work in a coherent, organized and logical manner.

Starred exercises in the textbook have answers in the back, ranging from quick hints to full solutions. If I assign any of those, explaining your reasoning becomes even more important; you should enhance, and not just transcribe, the solution in the back. In other cases it might be a good idea to do those problems and check your answers before working on the assigned problems, as a way to check your understanding.

In this course, vectors and points are always two-dimensional unless otherwise specified.

Chapter 4: Problem 4.15

Chapter 6: Problem 6.17(i,ii,iv). In (ii), $W = (x, y)$, so the line is $(0, 1) \cdot (x, y) = -1$, or $y = -1$. You don't need to write out full matrix formulas, although it could be useful for (iv). In (ii), for example, you can reflect across a horizontal line using the geometric properties of a reflection.

A: Using the method from class, find a matrix formula for the rotation by $\pi/3$ centered at the point $(7, -2)$. You can leave your answer in the form $\mathcal{R}(X) = R(X - C) + C$, but you should fill in all the entries of your matrix with numbers.

B: The book calls the rotation by π centered at C a *Central Inversion* centered at C, denoted $\mathcal{C}_C(X)$.
(1) Using the method from class, find a matrix formula for $\mathcal{C}_C(X)$ and then prove $\mathcal{C}_C(X) = 2C - X$.
(2) Find all fixed points of $\mathcal{C}_C$, i.e. all points X such that $\mathcal{C}_C(X) = X$.

C: Using the method from class, find a matrix formula for the reflection in the mirror

$$\ell : (3, 4) \cdot X = 8.$$

You can leave your answer in the form $\mathcal{M}_\ell = F(X - P) + P$, but you should fill in all the entries of your matrix with numbers.

D: Let $\mathcal{M}_\ell$ be the same reflection as in the previous problem, and let $U = (-4, 3)$. For this one problem, it's worth multiplying things out to write your matrix formulas in the form $MX + P$.
(1) Use your work from the previous problem to find a matrix formula for $\mathcal{M}_\ell \circ \mathcal{T}_U$.
(2) Use your work from the previous problem to find a matrix formula for $\mathcal{T}_U \circ \mathcal{M}_\ell$.
Hint: your answers should be the same – we'll see why on Monday, 10/15!

E: Find an isometry that maps $\angle(1, 1)(3, 2)(2, 2)$ to $\angle(3, -1)(3, 2)(4, 0)$.