Peer Questions for Section 9.5

Read this material prior to class on Wed., Nov. 13, attempting to answer the questions below. In your group (minimum of two people per), discuss your responses to the following questions. Rotate (again) the role of "group scribe", a person who should submit your group’s responses, using the web form below, by 5 pm, Wed., Nov. 13.

1. For each conic section indicated below, describe
   (i) what are the requisite objects—the things you must have at the start—needed to construct the conic section, and
   (ii) how the conic section is defined (i.e., built up from the requisite objects).
   (iii) what is assumed about the placement of the requisite objects with regards to the coordinate axes in Figures 2–6 in order to arrive at the corresponding formulas (those for parabolas at the bottom of p. 529, the formula in Box 1 for ellipses, and the formula in Box 2 for hyperbolas).

   (a) parabola
   (b) ellipse
   (c) hyperbola

2. How do circles arise as special cases of ellipses? That is, given the definition for ellipse that you gave in part (b)(ii) above, what special instances give rise to circles?

3. Given number 1 above, it is perhaps surprising that one can associate a directrix to ellipses and hyperbolas. Suppose we take the directrix at \( x = 1 \) and eccentricity \( e = 2 \). Play around with different \( \theta \)-intervals \( \alpha < \theta < \beta \) until you are happy with appearance of the polar equation
   \[ r = \frac{2}{1 - 2 \cos \theta}. \]
   Do the same, obtaining reasonable-looking plots for the hyperbolas
   \[ r = \frac{2}{1 + 2 \cos \theta}, \quad r = \frac{2}{1 - 2 \sin \theta}, \quad \text{and} \quad r = \frac{2}{1 + 2 \sin \theta}. \]
   (I believe you will need a different interval of \( \theta \) values for each in order to get similar-looking plots.) Is it the case that, if you choose two of these together, you get a full hyperbola? What happens if you pair up these two polar functions
   \[ r = \frac{2}{1 + 2 \cos \theta} \quad \text{and} \quad r = -\frac{2}{1 + 2 \sin \theta}? \]

4. Can any single one of the four polar equations given in Box 8 provide the graph of a full ellipse? a full parabola? If so, which one(s)?
5. **True or False.** The polar equations in Box 8 on p. 532 always place one of the foci at the origin.

6. Identify one item (a concept, a step in an example, a statement, etc.) from this reading assignment you found difficult or confusing.

7. (You do not need to submit an answer to this one.) If you are unfamiliar with why parabolas, ellipses and hyperbolas are known as **conic sections**, investigate this (i.e., use this bolded phrase as keywords for an internet search).