Section 10.6

Definition: A **parabola** is the set of points in a plane that are equidistant from a fixed point F (called the focus) and a fixed line (called the directrix).

Definition: A **hyperbola** is the set of all points in a plane the difference of whose distances from two fixed points F_1 and F_2 (the foci) is a constant.

Definition: An **ellipse** is the set of all points in a plane the sum of whose distances from two fixed points F_1 and F_2 is a constant.

Theorem: Let F be a fixed point and l a fixed line in a plane. The set of all points P in the plane, such that the ratio $d(P,F)/d(P,Q)$ is a positive constant e with $d(P,Q)$ the distance from P to l, is a conic section. The conic is a parabola if $e = 1$, an ellipse if $0 < e < 1$, and a hyperbola if $e > 1$.

Theorem: A polar equation that has one of the four forms

$$r = \frac{de}{1 \pm e\cos\theta},\ r = \frac{de}{1 \pm e\sin\theta}$$

is a conic section. The conic is a parabola if $e = 1$, an ellipse if $0 < e < 1$, or a hyperbola if $e > 1$.

Exercise 1. Describe and sketch the graph of the polar equation $r = \frac{10}{3+2\cos\theta}$.

Exercise 2. Describe and sketch the graph of the polar equation $r = \frac{10}{2+3\sin\theta}$.

Class Exercise 1. (i) Find the eccentricity, (ii) identify the conic, (iii) give an equation of the directrix, and (iv) sketch the conic.

(a) $r = \frac{12}{3-10\cos\theta}$.
(b) $r = \frac{3}{2+2\cos\theta}$.
(c) $r = \frac{8}{4+5\sin\theta}$.
(d) $r = \frac{10}{5-6\sin\theta}$.

Exercise 3. Sketch the graph of the polar equation $r = \frac{15}{4-4\cos\theta}$.

Exercise 4. Find an equation in x and y that has the same graph as the polar equation $r = \frac{15}{4-4\sin\theta}$.

Homework: 1-15 ODD, 27-33 ODD