Ellipses:

A. Definitions

An ellipse is an egg-shape figure in which the sum of the distances from any point on the edge to the two foci is equal for all points.

Foci are two points in the interior of the ellipse (both equidistant from the c enter and which are along the major axis) which are used to draw the ellipse.

The major axis is the longer of the two axis' of symmetry of the ellipse.

The minor axis is the shorter of the two axis' of symmetry of the ellipse.

B. Basic Memorizations

1. An ellipse is represented by the equation:

$$\frac{(x-x_0)^2}{a^2}+\frac{(y-y_0)^2}{b^2}=1$$

2. The center of the ellipse is (x_0,y_0).

3. The major axis is defined by 2a or 2b depending on whether a or b is larger.

4. The minor axis is defined by 2a or 2b depending on whether a or b is smaller.

5. The area of the ellipse is defined by $(\text{major axis})(\text{minor axis})/4 \times \pi$

C. Examples

Ex [1] The major axis of the ellipse $4x^2 + 9y^2 = 36$ is _____.

a. The first thing you should do is to think of this equation as being

$$\frac{x^2}{9}+\frac{y^2}{4}=1.$$

b. In this case, a=3 and b=2. (Just take the square root of the denominators to find this.) Since a>b, the major axis is defined by 2a or 2(3) = 6.

c. The answer is 6.

Ex [2] The area of the ellipse $4x^2 + 16y^2 = 64$ is _____.

a. Think of this as being $\frac{x^2}{16}+\frac{y^2}{4}=1$

b. In this case, a=4 and b=2. But be careful. The major axis is actually 8 and the minor axis is actually 4. So the area is $(8)(4)/4 \times \pi = 8\pi$

c. The answer is 8π

Note: Any time you have a problem, like Ex[2], that follows the form: $ax^2 + by^2 = ab$, the area is always going to be equal to $\sqrt{ab}\cdot\pi$. So in Ex[2] we know the area is $\sqrt{64}\cdot\pi = 8\pi$