**PreCalculus Parametric Equations 6.3**

Notes – Unit 9, Day 1

**Parametric:**

~A third way to graph (rectangular & polar are the other two)

~Allows you to graph a relationship in terms of separate functions for x & y

x=f(t) & y =h(t) are our parametric equations

\* A “Parameter” is a variable.

**You need 3 things:**

* Function for x in terms of t
* Function for y in terms of t
* Bounds for t
* t is the parameter so you need to say the t min and t max
* we use t usually because you can determine the horizontal & vertical position with respect to time, but you may use other variables

Examples:

1. x=4 y=3 🡪 point (4,3)
2. Graph x=t y =t -∞ < t < ∞ What is it?
3. Now change the interval to 0≤t<1 What is it?
4. Graph x=5t y=5t -∞ < t < ∞ What is it?
5. Now what would you have to change the interval to in order to make the same line segment as before?
6. Can you create another equation for y=x?
7. **Eliminate the parameter** for the following (change to rectangular form)

y=t+2 x=3t2-5 -∞ < t < ∞

1. **Parameterize** the line that goes through (5,8) (-2,7)

Easiest if you look from t=0 to t=1… (basically saying you are going from point A to point B in 1 second)

**CIRCLES** (these aren’t functions, but now can be graphed)

Thinking of the Ferris wheel, we can come up with a parameterization for a circle

 x=cos t y=sin t 0 ≤ t < 2π

1. Now, make a circle with radius 5
2. Make Part a. go around 2x
3. Make Part a. go clockwise
4. Make Part a. start at (0,5)
5. Make the center of Part a. be (4,-2)

You try …

Ex) Parameterize a circle with r=11 and center (0,3)

**ELLIPSES**

Same idea as circle with $cos^{2}t+sin^{2}t=1$… just one side is longer.

Ex) How can we represent an ellipse with center (0,0) with vertex (0,4) and b=3 starting at (4,0) and

 rotating counterclockwise?

 What happens if you increase the interval 0 ≤ t < 4π ?

 How would you go the opposite way around the ellipse?

Ex) Parameterize an ellipse with a center of (-3,5) with a horizontal major axis of 12 and

 a vertical minor axis of 8 a=6 b=4

 $\frac{(x+3)^{2}}{36}+\frac{(y-5)^{2}}{16}=1$

You try…

Ex) Parameterize an ellipse vertically oriented with a=16, e=$\frac{5}{8}$, & center (0,0)

Ex) Show that $x=2\cos(t)$ $y=8\sin(t)$ 0 ≤ t < 2π is the same as $\frac{x^{2}}{4}+\frac{y^{2}}{64}=1$

Ex) Parameterize the ellipse above with a new center at (5,-3)

**HYPERBOLAS**

If circles & ellipses are based off of $\frac{x^{2}}{\#}+\frac{y^{2}}{\#}=1$ relating to $cos^{2}t+sin^{2}t=1$…

Then we need to think of a basis for hyperbola form $\frac{x^{2}}{\#}-\frac{y^{2}}{\#}=$1

How about $sec^{2}t-tan^{2}t=1$ or $csc^{2}t-cot^{2}t=1$?

Ex)Parameterize a hyperbola with center (0,0), vertex (±3,0), and asymptote slope ±$\frac{4}{3}$

Ex) Parameterize the hyperbola with center (3,-7), vertex (5,-7), and focus (8,-7)