PreCalculus **Parameterization, Part 2**

Notes, Day 2

**Parameterizations of a line:**

**Ex:** x = 4t – 3 and y = 2t + 1 Eliminate the parameter.

**Ex2:** Find the parameterization of the line segment with endpoints (2, 4) and (5, 9).

You can choose to make t=0 for the first point and t = 1 for the last point. Plot Δx and Δt. Figure out the slope by doing Δx/Δt. Use point/slope form of a line. Do this again for the y coordinates.

**Ex 3:** Wayne and Garth are in a Foot Race. Wayne can sprint at a rate of 20 ft/sec. Garth can sprint at a rate of 18 ft/sec. Wayne gives Garth a 4ft head start. The parametric equations to model the race are:

X1 = 18t y1 = 3 (this number doesn’t matter, we can pretend that this is the lane #)

X2 = 20t – 4 y2 = 5

1. Find a viewing window to simulate a 100 yard dash. Mode – simul. T = 0, Tstep = .05…
2. Who is ahead after 3 seconds and by how much (can use trace to do this)

**Parabolas:**

The trigonometric functions can also be used with parabolas if we think of the initial velocity in terms of the vertical and horizontal components of the velocity vector.

V0 v0 sin θ: vertical component

V0 cos θ: horizontal component

Recall: **Distance = rate x time**

As a result, Horizontal motion can be defined as: x = (V0 cos θ)t

The Vertical motion is found the same way the Algebra II parabolas that describe height over time:

**y = -16t2 + (v0 sin θ) t + h (h = initial height at t = 0, height is in feet)**

**Ex:** Kevin hits a baseball at 3 feet above the ground with an initial speed of 150 ft/sec at an angle of 20° with the horizontal. If the outfield wall is 20 feet high and 400 feet away from Kevin, will he hit a homerun?

- First, graph the path of the ball… x = 150 cos( 20°)t y = -16t2 + 150 sin (20°) t + 3

- How long will the ball be in the air? Set t max to this time.

-To graph the wall: x =400 (keeps the x-coordinate = 400) y = 20(t/3) since t max = 3… this will keep ymax = 20.

What angle will be necessary to hit the ball over the wall?

**Ex2:** Les is riding on a Ferris Wheel with a radius of 30 feet. The bottom of the wheel is 10 feet off the ground. The wheel is turning counterclockwise at a rate of 1 revolution every 10 seconds. Les is sitting at 0°. Find the parametric equations to model Les’s ride. Find his position 22 seconds into the ride.

X = 30cosθ y = 30 sinθ + 10

We need to re-write θ in terms of t. The wheel is turning at a rate of 2𝜋 radians every 10 seconds. θ = 𝜋/5t.

So, x = 30cos (𝜋/5t) y = 30 sin (𝜋/5t) + 10

Plug in 22 for t in each one to get the horizontal and vertical components.

Pre Calculus Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Homework – Parametrics Day 2

1. Find the parametric equations for an ellipse with a center (3, -2), V(3, -7) and b = 2.

2. The complete graph of x = 4cos t and y = 4 sin t is a circle. Find the interval of t values that will restrict the circle to the portion of the circle described:

a) The portion in the first quadrant: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) The portion above the x-axis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) The portion to the left of the y-axis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Find the parameterization of the line segment that has the endpoints (-2, 4) and (0, 10).

4. The center-field fence in a ballpark is 10 feet high and 400 feet from home plate. The baseball is hit 3 feet above the ground. It leaves the bat at an angle with the horizontal at a speed of 120 miles per hour.

a) Write a set of parametric equations for the path of the baseball. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) Suppose the baseball is hit at an angle of 23. Is the hit a home run? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) If not, find the minimum angle required for the hit to be a homerun. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What window gives you the best picture of the problem situation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Refer back to the notes and the problem about Kevin’s baseball.

a) How long does it take the ball to hit the wall? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) How far up the wall did the ball hit? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) Would it be likely that an outfielder would have caught the ball? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Two opposing players in “Capture the Flag” are 100 ft apart. On a signal, they run to capture a flag that is on the ground midway between them. The faster runner hesitates for 0.1 sec. The following parametric equations model the race to the flag:



Who captures the flag and by how many feet? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_

7. Ron is on a Ferris wheel of radius 40 ft that turns counterclockwise at the rate of one revolution every 15 sec. The lowest point of the Ferris wheel is 10 feet above the ground. Ron is one of the last people to get on the ride. When the ride actually begins he is in a chair whose arm is parallel to the ground.

a) Write a set of parametric equations for Ron’s position as a function of time. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) What is Ron’s exact position 40 seconds after the ride begins? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Bryan hits a baseball when it is 4 feet above the ground with an initial velocity of 120 ft/sec. The ball leaves the bat at a 40 angle with the horizontal and heads toward a 30 ft fence 350 from home plate.

a) Write a set of parametric equations that model the path of the ball. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) Write a set of parametric equations to create the fence. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) Graph both sets of equations in simultaneous mode. Does the ball clear the fence? \_\_\_\_ By how much? \_\_\_\_\_\_\_\_\_\_