CMSC427 Fall 2020

Hw 2 – Parametric Curves

Due by 11:59 pm on Sept. 22nd
Submit pdf to Elms

For parametric equations we'll use interchangeably a few notations.
In coordinate notation we can have $x(t)$ or $f_x(t)$ or even $x = f(t)$
In vector notation $p(t)$

1. Just to work with it, given points P0 = (90,120) and P1 = (150,180), give the vector equation for a parametric line through both points (starts at P0, ends at P1). Also give the midpoint of the segment, and the perp vector to the line's vector (which gives the normal).

2. Given the following two parametric curves, validate that they satisfy the associated implicit equations by substitution and reduction to identity. Assume for both the range of t is (-inf,inf).

Parabola.	Implicit equation	$x^2 - 4ay = 0$
	Parametric equations	$x(t) = 2at$ $y(t) = at^2$
Hyperbola	Implicit equation	$\left(\frac{x}{a}\right)^2 - \left(\frac{y}{b}\right)^2 = 1$
	Parametric equations	$x(t) = a\sec t$ $y(t) = b\tan t$

3. For the parabola in question (2), would any monotonically increasing function of t (t^2, sqrt(t), etc) be valid in the parametric equations? E.g., would the parametric equations below also be valid? (And, yes, in the equation for y(t) that's square root squared.)

Parametric equations

$$x(t) = 2a\sqrt{t}$$
$$y(t) = a\sqrt{t}^2$$

What would happen if you used non-increasing functions of t, like cos or sin?

4. Sketch the 2D implicit curve for the function $f : R^2 \rightarrow R$ where: $f(x, y) = |x| + |y| - 1$
Label the 2D coordinates as appropriate.

Does this function satisfy the inside/outside convention for implicit curves? Why? (The inside/outside convention is that the implicit function is negative inside the curve, positive outside, and zero right on the curve.)