

Roller Coasters: Theory, Design, and Properties

Short Term 2005

Intermediate Math Homework: Parametric Equations and Curvature

1. This example will consider the circle.
 - a) What is the usual parameterization of a circle of radius r in standard position (centered on the origin)?
 - b) Find the unit tangent vector.
 - c) Find the unit normal vector.
 - d) Calculate the curvature.
 - e) What is the radius of curvature? (This should be obvious, but calculate it anyway)

2. This question will study the special case where the curve can be written as a function in the form $y = f(x)$. The answers to parts $a - e$ should be general (that is, the expression $f(x)$ should appear).
 - a) What a parameterization of this curve?
 - b) Find the unit tangent vector.
 - c) Find the unit normal vector.
 - d) Calculate the curvature.
 - e) What is the radius of curvature?
 - f) Using your answer from part (e), find an expression for the radius of curvature for a parabola. ($f(x) = ax^2$)