Project #1

Math 321-A

Due Tuesday, March 18, 2008

Curvature is a way of measuring how fast a curve bends at a given point. One common intuitive use is in driving a car: you should decelerate going into a curve, and accelerate coming out of a curve.

Going into and coming out of a curve is a measure of curvature: curvature is increasing as you go into a curve, and it is decreasing as you come out of the curve. The moment when you should take your foot off the brake and start to accelerate is at the maximum of the curve's curvature. Conversely, at the minimum of a curve's curvature is where you should ease up on the accelerator and start to brake. (This assumes that there is no other traffic, etc.)

Curvature is defined on page 868 of our text; there are formulas there and on page 869. You are to use *Mathematica* to define curvature as a function of t; plot the graph of curvature against t; identify the local maxima and minima of curvature from the graph, and use *Mathematica* to solve for the corresponding values of t; and finally use your curve to find what point(s) (x, y) correspond to those values of t.

Your project should be submitted as a `Mathematica` notebook electronically. It should include the following, all appropriately formatted:

- Title and name at the top.
- Section titles for each stage of your computation.
- A parametric plot of your curve.
- A summary of where (in terms of x- and y-coordinates you should brake and where you should accelerate. (Don't forget to include the endpoints as appropriate as extrema.)

It is possible that you will see warnings about accuracy as you search for the extrema. You should be able to use your graph as a guide to assure yourself if your solutions are correct.

These are the parametric curves that I would like you to use:

- Elizabeth Bowers

  ```
  r[t_] := {t - 3*Sin[t], 4 - 3*Cos[t]}
  ```

  where $-2\pi \leq t \leq 2\pi$.

- Chris England

  ```
  r[t_] := {Cos[t]/(1 + Sin[t]^2), 1 + Sin[t]Cos[t]/(1 + Sin[t]^2)}
  ```

  where $0 \leq t \leq \pi$.

- Dave Filonuk

  ```
  r[t_] := {Tan[t], Cos[t]^2}
  ```

where $-\pi/4 \leq t \leq \pi/4$.

- Drew Gardner

  ```
  r[t_] := {t/(1 + t^3), t^2/(1 + t^3)}
  ```

  where $0.1 \leq t \leq 4$

- Spencer Hayles

  ```
  r[t_] := {Cos[t], 2 + Sin[2t]}
  ```

  where $0 \leq t \leq 2\pi$.

- Greg Mader

  ```
  r[t_] := {2*Cos[t] - Cos[3t], 4 + 2*Sin[t] - Sin[3t]}
  ```

  where $0 \leq t \leq 2\pi$.

- Ryan Miller

  ```
  r[t_] := {4*Cos[t] + 3*Cos[2t], 10 + 4*Sin[t] - 3*Sin[2t]}
  ```

  where $0 \leq t \leq 2\pi$.

- Robb Porter

  ```
  r[t_] := {Cos[t], 2 + Sin[Sin[t]]}
  ```

  where $0 \leq t \leq 2\pi$.

- Danie Roy

  ```
  r[t_] := {(1 + 2*Cos[t])Cos[t], 3 + (1 + 2*Cos[t])Sin[t]}
  ```

  where $0 \leq t \leq 2\pi$.

- Jaime Speiser

  ```
  r[t_] := {t^3 - t, t^4 - t^2 + 1}
  ```

  where $-1 \leq t \leq 1$.

- Tess Stamper

  ```
  r[t_] := {Sin[t], Tan[t] + 2}
  ```

  where $-\pi/4 \leq t \leq \pi/4$.

- Andrew Sutherland

  ```
  r[t_] := {t^2 - t + 2, t^3 - 3t + 4}
  ```

  where $-2 \leq t \leq 3$.

- Jade Thierer

  ```
  r[t_] := {(1 + Cos[t]^3)Cos[t], (1 + Cos[t]^3)Sin[t]}
  ```

  where $0 \leq t \leq 2\pi$.