Jeopardy Questions

MATH 2110

October 12, 2011

- Acceleration and Arclength

  1. Find the arclength parameterization of the curve

  $$\mathbf{r}(t) =< \cos(\ln t), \sin(\ln t) >$$

  2. Find the normal to the curve

  $$\mathbf{r}(t) =< \sin(t^3), t^3, \cos(t^3) >$$

  3. Find the linear acceleration of the curve

  $$\mathbf{r}(t) =< e^{2t}, 2e^t, t >$$

  4. Find the curvature of the curve

  $$\mathbf{r}(t) =< \sin(t), \cos(t), \ln|sec(t)| >$$

- Domains and Limits

  1. Find

  $$\lim_{(x,y)\to(6,3)} xy\cos(x-2y)$$

  2. Find

  $$\lim_{(x,y)\to(-2,2)} \frac{xy^2+2y^2-4x-8}{xy+2y-2x-4}$$

  3. Find and sketch the domain of the function

  $$f(x,y) = \sqrt{y} + \sqrt{x^2-1}$$

  and determine if the domain is open, closed or neither; bounded or unbounded; and connected or not connected.

4. Determine if the following limit exists. If it does, calculate the limit. If it does not exist, show two paths along which the limit has different values.

$$\lim_{(x,y)\to(0,0)} \frac{(x+y)^2}{x^2+y^2}$$

- Partial Derivatives and PDEs

1. Find f_{xy} for

$$f(x,y) = x^2 y e^y$$

2. Find f_{xxy} for

$$f(x,y) = e^{xy^2}$$

3. Find the solution of

$$u_x + y u_y = 0$$

- Linearization and Hessian

1. Find the gradient of

$$f(x,y) = 2e^x + ye^x - y^2$$

2. Find the linearization of

$$f(x,y) = x + e^{xy}$$

at (1,0).

3. Find the quadratic approximation of

$$f(x,y) = \frac{1}{1-xy}$$

at the point (0,0).

- Chain Rule

1. Find $\partial_u z$ where $z = x^2 + y^3$, $x = u^2 + uv$ and $y = u^3 v$.
2. Find y' given that y is implicitly defined as a function of x by

$$x \sin(xy) = y^2$$

using techniques from Calc III.