**Summer 2014**
**Summer Review Day 3**

# Curvature

**1. Consider a path in vector form $r(t) = \langle x(t), y(t), z(t)\rangle$:**

**(a) Write the equation for unit tangent vector $T(t)$**

**(b) Write the equation for curvature $\kappa(s)$**

**(c) Write the equation for curvature that uses cross product**

**2. Compute $\kappa(t)$of the following:**

**(a)** $r(t) = \langle 1, e^t, t\rangle$

**(b)** $r(t) = \langle 4\cos(t), t, 4\sin(t)\rangle$

**(c)** $y = t^4$**, at** $t = 2$

**3. Normal Vectors**

**(a) In terms of $T(t)$, write the formula for unit normal vector.**

**(b) Find the normal vectors to $r(t) = \langle t, \cos(t)\rangle$ at $t = \frac{\pi}{4}$ and $t = \frac{3\pi}{4}$.**

# Limits of multivariable functions

**1. Compute the following limits (they all exist):**

$$\lim_{(x,y)\to(1,2)} (x^2 + y)$$

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

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

**2. Compute the following partial derivatives**

**(a)** $\frac{\delta}{\delta x}\frac{xy}{y^2+1}$

**(b)** $\frac{\delta}{\delta x}\frac{y^2}{y^2+1}$

**(c)** $\frac{\delta}{\delta x}\frac{\delta}{\delta y}\frac{x}{y}$

**(d)** $\frac{\delta}{\delta x}x^x$

**3. Linearization**

**(a) Write the linear function for the linearization, $L(x, y)$, of $f(x, y)$ at $(a, b)$**

**(b) Let $f(x, y) = x^2y^3$. Find the linearization of $f$ at $(a, b) = (2, 1)$**

**(c) Use (b) to estimate $f(2.1, 1.1)$.**

**4. Write the equation of the tangent plane to $z = f(x, y)$ at $(a, b)$.**

**5. Find the equation of the tangent plane at the given point.**

**(a)** $z = x^2y + xy^3$, $(2, 1, 6)$

**(b)** $f(x, y) = e^x \ln(y)$, $(0, 1)$