March 3

How are parametric functions different from "regular" functions?

$x(t)$, $y(t)$

March 3

Students will verbally explain how to find the first and second derivatives of parametric functions

(using the words:
terms, x(t), x'(t), y(t), y'(t)...)

Important Dates for Calculus:

Wednesday March 12 - 12:00 - 2:00 (room 115)

Thursday March 27 - MOCK AP EXAM

Wednesday April 9 - 6:00 (Gateway HS)
Calculus Bowl

Saturday April 26 - SATURDAY SESSION
8:15 - 12:45 (TJ)

Wednesday May 7th - AP TEST

What does it mean?	
$\frac{dy}{dx}$	The instantaneous rate y changes with respect to x
$\frac{dy}{dt}$	The instantaneous rate y changes with respect to t
$\frac{dx}{dt}$	The instantaneous rate x changes with respect to t

If you have $\frac{dy}{dt}$ and $\frac{dx}{dt}$, how can you get $\frac{dy}{dx}$?

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$$

(equation 7)

what about $\frac{d^2y}{dx^2}$?

$$\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}}$$

the derivative of the derivative

derivative of x

(equation 11)

$y(t) = t^2 - t$

$x(t) = t^2 + t$

find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$

$$\frac{dy}{dt} = 2t - 1$$

$$\frac{dx}{dt} = 2t + 1$$

$$\frac{dy}{dx} = \frac{2t-1}{2t+1}$$

$$\frac{d}{dt}\left(\frac{dy}{dx}\right) = \frac{2(2t+1) - 2(2t-1)}{(2t+1)^2} = \frac{4t+2-4t+2}{(2t+1)^2} = \frac{4}{(2t+1)^2}$$

$$\frac{d^2y}{dx^2} = \frac{\frac{4}{(2t+1)^2}}{\frac{(2t+1)}{1}} = \frac{4}{(2t+1)^2} \cdot \frac{1}{(2t+1)} = \frac{4}{(2t+1)^3}$$

$x(t) = \ln(5t)$

$y(t) = e^{5t}$

find $\frac{dy}{dx}$

and $\frac{d^2y}{dx^2}$

$$\frac{dy}{dt} = 5e^{5t}$$

$$\frac{dx}{dt} = \frac{1}{5t}(5) = \frac{1}{t}$$

$$\frac{dy}{dx} = \frac{5e^{5t}}{\frac{1}{t}} = 5te^{5t}$$

$$\frac{d}{dt}\left(\frac{dy}{dx}\right) = 5e^{5t} + 25te^{5t}$$

$$\frac{d^2y}{dx^2} = \frac{5e^{5t} + 25te^{5t}}{\frac{1}{t}} = 5te^{5t} + 25t^2e^{5t}$$

$x(t) = t^2 + 2t$

$y(t) = t^2 - 2t + 3$

find the left most point

find the lowest point

minimum x-value

$x'(t) = 2t + 2$

$0 = 2t + 2$

$t = -1$

CP		-1	
sign x'		−	+
behav x		left	right

$x(-1) = (-1)^2 + 2(-1) = -1$

$y(-1) = (-1)^2 - 2(-1) + 3 = 6$

left most point = $(-1, 6)$

minimum y

$y'(t) = 2t - 2$

$0 = 2t - 2$

$t = 1$

CP		1	
sign y'		−	+
behav y		down	up

$x(1) = 3$

$y(1) = 2$

lowest point at $(3, 2)$