Closing Fri: 3.4(part 1),3.4(part 2)
Closing Mon: 10.2
Closing Wed: 3.5(part 1)
Closing Next Fri: 3.5(part 2)

Some motivation/review:

Given y = f(x), we have learned

1. $\frac{dy}{dx} = f'(x) =$ slope of tangent.
2. Equation for tangent:
   $y = f'(a)(x - a) + f(a)$
3. If y = distance and x = time,
   then is $f'(x) =$ velocity.

Original	***Derivative***
Horiz. Tangent	Zero (f'(x) = 0)
Increasing	Positive
Decreasing	Negative
Vertical Tangent	Undefined

10.2 Parametric Calculus

Parametric equations describe motion in 2D (or 3D) by giving equations for x and y separately in terms of time:

x = x(t), y = y(t)

1. $\frac{dx}{dt} = x'(t) =$ horizontal velocity
2. $\frac{dy}{dt} = y'(t) =$ vertical velocity
3. x = distance, y = distance, t = time
4. $\frac{dy}{dx} = ???$ (we will see this today)

Original	***Derivatives***
Horiz. Tangent	y'(t) = 0
Moving Upward	y'(t) positive
Moving Down	y'(t) negative
Vert. Tangent	x'(t) = 0
Moving Right	x'(t) positive
Moving Left	x'(t) negative

Special parametric equations:

1. An object moving around a circle at a constant speed:

$$(x_c, y_c) = \text{center of circle}$$

$$r = \text{radius}, \theta_0 = \text{initial angle}$$

$$\omega = \text{angular speed}, \frac{\text{rad}}{\text{time}}$$

$$\boldsymbol{x = x_c + r\cos(\theta_0 + \omega t)}$$

$$\boldsymbol{y = y_c + r\sin(\theta_0 + \omega t)}$$

Note also the fundamental facts about circular motion (which are only true in radians):

$$\text{linear speed} = v = \omega r,$$
$$\text{arc length} = s = r\theta$$

2. An object moving on a straight line at a constant speed:

$$(x_0, y_0) = \text{initial location}$$
$$a = \text{horizontal velocity}$$
$$b = \text{vertical velocity}$$
$$\boldsymbol{x = x_0 + at}$$
$$\boldsymbol{y = y_0 + bt}$$

Given an applied problem that involves either of these situations, you should initially plug all your information in and solve for the constants.

Directly from homework:

A 4-centimeter rod is attached at one end A to a point on a wheel of radius 2 cm. The other end B is free to move back and forth along a horizontal bar that goes through the center of the wheel. At time *t=0* the rod is situated as in the diagram at the left below. The wheel rotates counterclockwise at 3.5 rev/sec. Thus, when *t=1/21* sec, the rod is situated as in the diagram at the right below.