**Math 280: 10.2 Calculus with Parametric Equations**

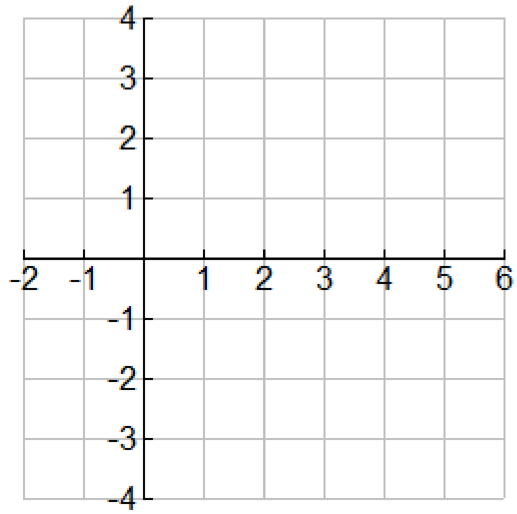
## TANGENT LINES

1. a. Graph the curve defined by the parametric equations:

$$x = t^2 \qquad -2 \le t \le 2$$
$$y = t^3 - 3t$$

Plot points. Indicate with arrows the direction the curve is traced as $t$ increases.

| $t$ | $x$ | $y$ |
|---|---|---|
| -2 | | |
| -1.5 | | |
| -1 | | |
| -0.5 | | |
| 0 | | |
| 0.5 | | |
| 1 | | |
| 1.5 | | |
| 2 | | |




b. Find the curve's point of intersection. How many tangent lines does the curve have at that point?

c. Find the tangent line equations at the point of intersection.

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

$$x = t^2 \qquad\qquad -2 \le t \le 2$$
$$y = t^3 - 3t$$

d. Find the points on the curve where the tangent is horizontal or vertical.

e. Determine where the curve is concave up or concave down.

$$\boxed{\frac{d^2y}{dx^2} = \frac{\frac{d}{dt}(dy/dx)}{dx/dt}}$$

**ARCLENGTH**

$$\boxed{L = \int_{\alpha}^{\beta} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\ dt}$$

2. Prove that the circumference of a circle with radius 2 is $4\pi$ using parametric equations.

3. Set up an integral that represents the length of the curve . $\begin{array}{ll} x = t^2 - t & \quad -1 \le t \le 2 \\ y = t^2 & \end{array}$

Then use your calculator to find the length correct to four decimal places