Name: _____

1. Class notes for this week: This week we have covered Sections 2.5, 2.6, and 2.7. Next week we will cover Section 2.8, which will take two lectures, and do a bit of exam review.

2. A reminder that all exam information is at `math.msu.edu/Classes/mth_132` under the "Uniform Exams" tab. Go to "Content" to find the formula sheet and previous exams, and to "Exam 1 Locations and Info" for exam logistics.

3. (a) (1 point) Suppose a particle moves along a line with position $s(t) = t^4 - 2t^3 + t^2$. Find the velocity and acceleration. At what points are velocity and acceleration zero?

   (b) (2 points) Draw the position, velocity, and acceleration graphs corresponding to the particle's motion.

(a) $v(t) = s'(t) = 4t^3 - 6t^2 + 2t$

$0 = 4t^3 - 6t^2 + 2t$

$= t(2t-1)(2t-2)$

$t = 0 \quad t = \frac{1}{2} \quad t = 1$

$a(t) = v'(t) = s''(t) = 12t^2 - 12t + 2$

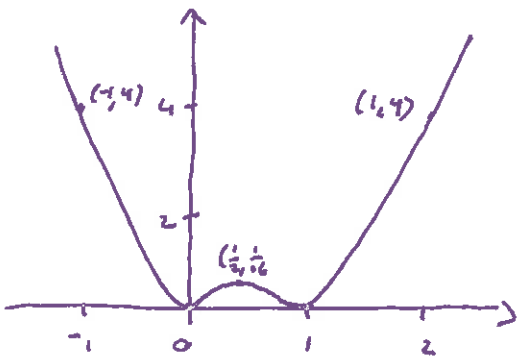
$0 = 12t^2 - 12t + 2$

$t = \frac{12 \pm \sqrt{144 - 4(2)(12)}}{24}$

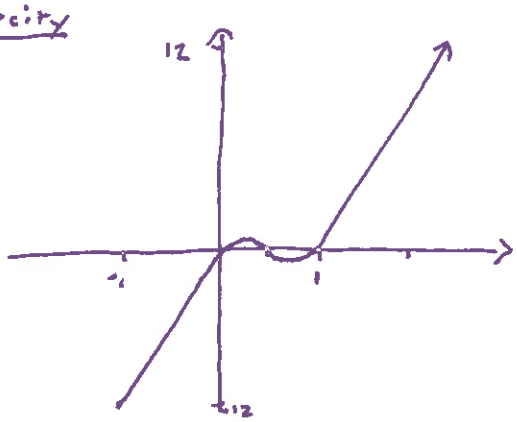
$= \frac{1}{2} \pm \frac{\sqrt{48}}{24}$

$= \frac{1}{2} \pm \frac{\sqrt{3}}{6}$

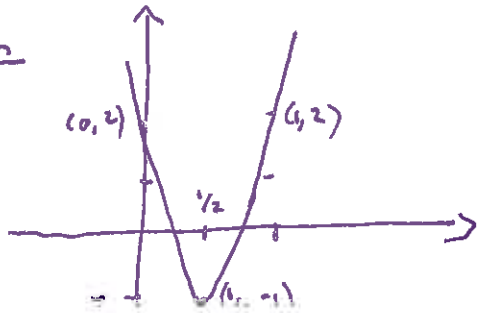
(b) Position



Velocity

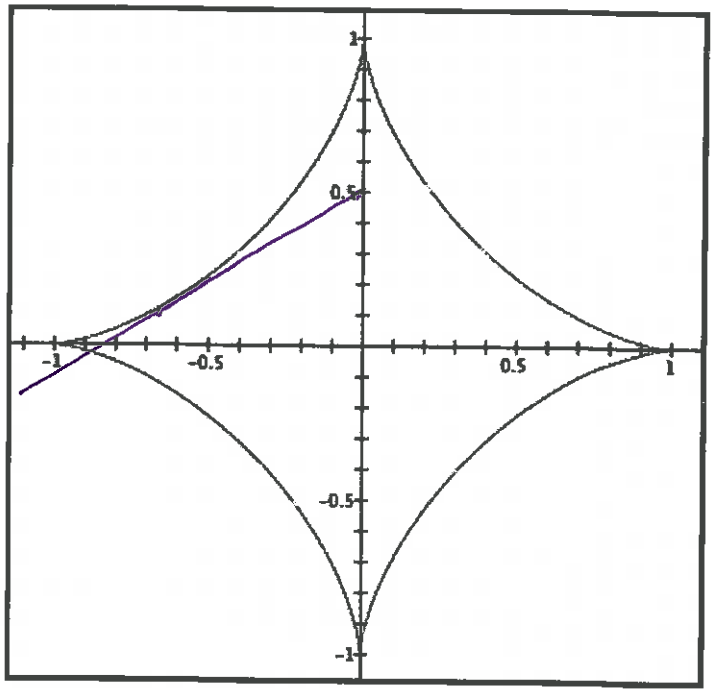


Acceleration



Question 4 is on the back

4. The curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 1$ is called an astroid. There is a picture below.



Find the tangent line to this curve at $\left(-\frac{3\sqrt{3}}{8}, \frac{1}{8}\right)$.

$$x^{2/3} + y^{2/3} = 1$$

$$\frac{2}{3}x^{-1/3} + \frac{2}{3}y^{-1/3}\cdot\frac{dy}{dx} = 0$$

$$\frac{2}{3}y^{-1/3}\cdot\frac{dy}{dx} = \frac{-2}{3}x^{-1/3}$$

$$\frac{dy}{dx} = \frac{-x^{-1/3}}{y^{-1/3}} = \frac{-y^{1/3}}{x^{1/3}}$$

$$\text{At } \left(\frac{-3\sqrt{3}}{8}, \frac{1}{8}\right),\ \frac{dy}{dx} = \frac{-\left(\frac{2\sqrt{3}}{8}\right)^{-1/3}}{\left(\frac{1}{8}\right)^{-1/3}} = \frac{\pm 1}{\sqrt{3}}$$

$$y - \frac{1}{8} = \frac{\pm 1}{\sqrt{3}}\left(x + \frac{\pm 3\sqrt{3}}{8}\right)$$

$$\boxed{y = \frac{x}{\sqrt{3}} + \frac{1}{2}}$$