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.

\[
\begin{align*}
\mathbf{v}(t) &= s'(t) = 4t^3 - 6t^2 + 2t \\
0 &= 4t^3 - 6t^2 + 2t \\
&= t(2t - 1)(2t + 2) \\
&= 0 \quad t = \frac{1}{2}, t = 1
\end{align*}
\]

\[
\begin{align*}
\mathbf{a}(t) &= v'(t) = a(t) = 12t^2 - 12t + 2 \\
0 &= 12t^2 - 12t + 2 \\
&= \frac{12 \pm \sqrt{144 - 4(2)(2)}}{2} \\
&= \frac{12 \pm \sqrt{144}}{2} \\
&= \frac{12 \pm 12}{2}
\end{align*}
\]

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 $\left(-\frac{3\sqrt{3}}{8}, \frac{1}{8}\right)$.

\[
x^{\frac{2}{3}} + y^{\frac{2}{3}} = 1
\]

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

\[
\frac{2}{3} y^{-\frac{1}{3}} \cdot \frac{dy}{dx} = -\frac{2}{3} x^{-\frac{1}{3}}
\]

\[
\frac{dy}{dx} = \frac{-x^{-\frac{1}{3}}}{y^{-\frac{1}{3}}} = -\frac{y^{\frac{1}{3}}}{x^{\frac{1}{3}}}
\]

At $\left(-\frac{3\sqrt{3}}{8}, \frac{1}{8}\right)$, \[
\frac{dy}{dx} = -\frac{\left(-\frac{3\sqrt{3}}{8}\right)^{-\frac{1}{3}}}{\left(\frac{1}{8}\right)^{-\frac{1}{3}}} = \frac{1}{\sqrt{3}}
\]

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

\[
y = \frac{x}{\sqrt{3}} + \frac{1}{2}
\]