

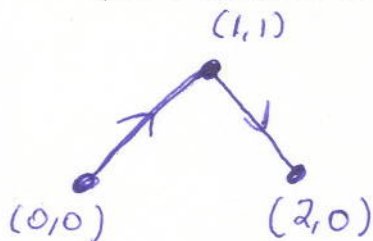
Recitation Time _____ PRINT your name _____

Math 141, Exam 2, Spring 2009

The exam is worth a total of 50 points. There are 11 questions on 5 pages. **SHOW your work. Make your work be coherent and clear.** Write in complete sentences whenever this is possible. **CIRCLE** your answer. **CHECK** your answer whenever possible. **No Calculators.**

I will post the solutions on my website a few hours after the exam is finished.

1. (5 points) Parameterize the curve pictured below. Use t as your parameter with $0 \leq t \leq 2$. The point that corresponds to $t = 0$ is $(0, 0)$. The point that corresponds to $t = 1$ is $(1, 1)$. The point that corresponds to $t = 2$ is $(2, 0)$. (Note: Each part of the curve that **looks** like a line segment **is** a line segment.)



2. (4 points) Express $\sin(x + h)$ in terms of $\sin x$, $\sin h$, $\cos x$, and $\cos h$.

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3. (5 points) Let $f(x) = \sqrt{x}$. Find $\lim_{a \rightarrow b} \frac{f(a) - f(b)}{a - b}$.

4. (5 points) Let $f(x) = \sqrt{3x + 1}$. Use the **DEFINITION OF THE DERIVATIVE** to find $f'(x)$.

5. (4 points) Compute $\lim_{h \rightarrow 0} \frac{\cos h - 1}{h}$.

6. (4 points) Compute $\lim_{x \rightarrow \infty} \left(x + \frac{2}{x}\right)^{3x}$.

7. (4 points) Find the equation of the line tangent to $f(x) = x^{10} + x$ at $x = 1$.

8. (5 points) The height of an object above the ground is given by $y(t) = -16t^2 + 32t + 48$, where y is measured in feet and t is measured in seconds. Find the velocity of the object when it hits the ground. **Be sure to give units.**

9. (4 points) Let $f(x) = \frac{2}{x} + 3x^2 + \sqrt{2x}$. Find $f'(x)$.

10. (5 points) Let $f(x) = \frac{2x^2+4x}{\sqrt{x+2x}}$. Find $f'(x)$.

11. (5 points) Consider the function $f(x) = \begin{cases} x^2 + 2 & \text{if } x \leq 1 \\ 4 - x & \text{if } 1 < x. \end{cases}$

(a) Graph $y = f(x)$.

(b) Is $f(x)$ continuous at $x = 1$? Explain.

(c) Is $f(x)$ differentiable at $x = 1$? Explain.