Mth 201
Hour Exam 1

Name: _____ Date: _____

9 Problems. 100 Points. Follow directions carefully. Please do not leave any question blank, and turn off cell phones and other noisemakers to avoid disturbing your classmates.

I have verified that this exam contains 9 problems and 6 printed pages. Initial_____.

Print the name of the people sitting either side of you :- _____

Short Answer (7 points each) - Minimal explanation and calculations necessary though where appropriate, answers should be exact.

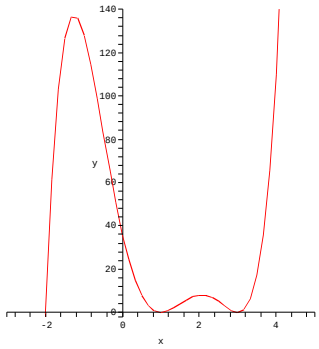
1. A snake bites you at time $t = 0$. The concentration of venom in your bloodstream t minutes after the bite is given by the function $V(t)$. Why should you worry if $V'(t) > 0$?

2. By way of example, show that a function can be continuous but not differentiable.

3. Evaluate

$$\lim_{h \to 0} \frac{(2+h)^2 - 4}{h}.$$

4. How do you know that the following graph is not the complete graph of a polynomial of degree 24?



5. Calculate the derivative of the function

$$f(x) = 3 * 10^{log_{10}(e^{\ln(2x)})}.$$

Hint: This problem is a lot easier than it looks if you know the logarithm and exponential identities!

6. What is the inverse function of $f(x) = x^2$ with the domain restriction $x \leq 0$?

Long Answer (20 points each) - show work and provide explanations, an answer without supporting work will not receive credit.

1. The population of a type of insect is being depleted by the destruction of its habitat. At the current rate of decrease, the half life of the population is 10 years. The present population is estimated to be 122 million.

   (a) Determine a function $P(t) = P_0 e^{kt}$ for the approximate number of insects after t years.

   (b) An insect population is considered to be endangered when there are less than one million specimens. After how many years will this species be considered as endangered?

2. Use the definition of the derivative (difference quotient) to find the derivative function of $f(x) = x^2 - 1$. **Warning**- you need to show **all** work - you cannot apply any rules of differentiation since they have not yet been developed in this class!

3. A ball is thrown downward from the top of a tower that is $132.5m$ high with an initial speed of $2m/s$. Its height in metres above the ground t seconds after it is thrown is given by the equation $h(t) = 132.5 - 2t - 4.9t^2$.

   (a) Complete the second row in the table below which records the height after t seconds.

t	1	2	3	4
h				

   (b) Use the heights you found in part (a) to find the average velocity over each interval and complete the table below

Interval	$[1, 2]$	$[2, 3]$	$[3, 4]$
Average Velocity			

   (c) Use your results to estimate the instantaneous velocity of the stone at $t = 3$. **Warning**- If you just differentiate this function to find the velocity, you will receive NO credit, you must use the heights you have calculated above to estimate the velocity.