By providing my signature below I acknowledge that this is my work, and I did not get any help from anyone else:

Name (sign): _____ Name (print): _____

Student Number: _____

Instructor's Name: _____ Meeting Time: _____

Problem Number	Points Possible	Points Made
1	60	
2	20	
3	5	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
11	10	
12	10	
13	10	
Total:	185	

- If you need extra space use the last page.
- Please show your work. **An unjustified answer may receive little or no credit.**
- Your test must be **neat**. We will take off points for sloppiness.
- If it is determined that you copied the work of another student you will receive no points for this test.
- The total number of points that is assigned for each problem is given. This is the *total* number of points for a problem and *not* the number of points for each subproblem.
- Please turn off your mobile phone.
- If you use your calculator to do any operation, write down the steps you take *verbatim*.

1. Determine the derivatives of each of the following functions:

   (a) [10 pts] $f(x) = 4x + 8x^{0.2}$

   (b) [10 pts] $g(x) = \dfrac{x}{1+x}$

   (c) [10 pts] $h(x) = (x^2+1)^2 \cdot \sin(2x)$

(d) [10 pts] $u(x) = \dfrac{1}{\sqrt[3]{x}} + e^{-x^2+1}$

(e) [10 pts] $u(x) = \cos(\ln(2 + (x^2 - 1)^3))$

(f) [10 pts] $v(x) = \dfrac{\tan(x^5 + 1)}{x + 1}$

2. Determine the anti-derivative represented by each of the following integrals.

(a) [10 pts] $\int x^3 - \sqrt{x}\, dx$

(b) [10 pts] $\int e^{2x}\, dx$

3. [5 pts] Evaluate the derivative

$$\frac{d}{dx}\int_0^x t \cdot \sec(5t)\ dt.$$

4. [10 pts] Determine the maximum and the minimum values of the function

$$f(x) = xe^{x-x^2}$$

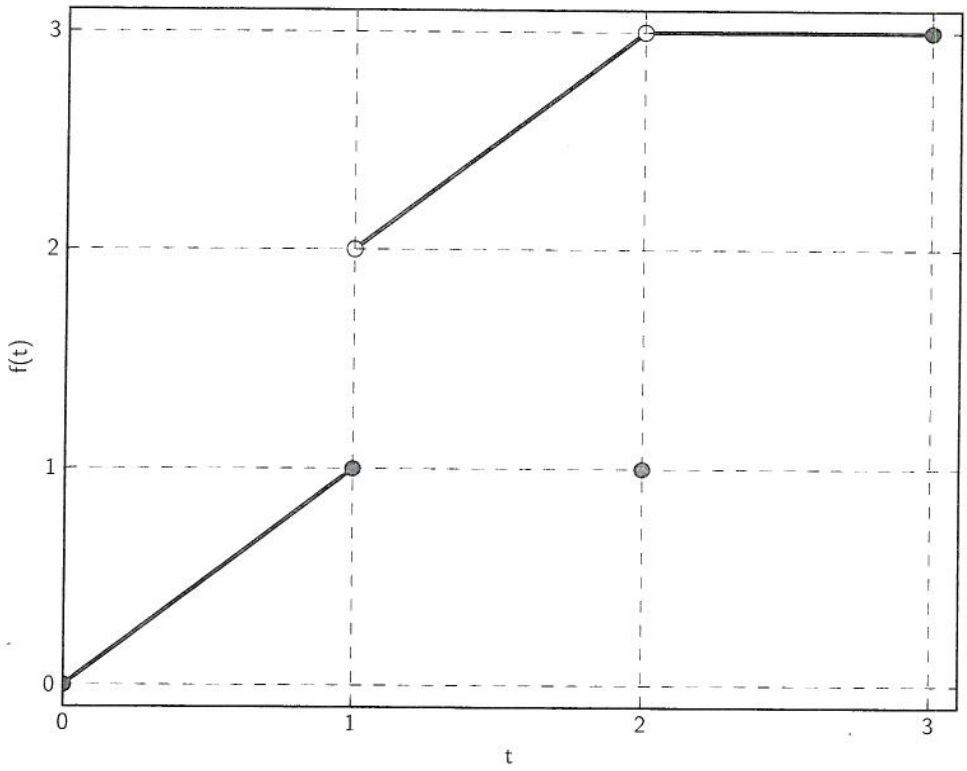
where $0 \leq x \leq 3$.

5. [10 pts] Find the equation of the tangent line to

$$x^2 - y^2 = y,$$

at the point $(x, y) = (-\sqrt{2}, 1)$.

6. A function, $f(t)$, is shown in the plot below. Determine the value of each of the following quantities. Briefly state the reason for your result in one or two **complete** sentences.



(a) [3 pts] $\lim_{t\to 1} f(t) =$

(b) [2 pts] $f(1) =$

(c) [3 pts] $\lim_{t\to 2} f(t) =$

(d) [2 pts] $f(2) =$

7. [10 pts] Approximate the integral

$$\int_0^2 \cos(\pi x)\, dx$$

using a Riemann sum with three intervals. The intervals should be equal length and use a left hand sum. (You do not have to evaluate your result and can leave it as a sum, but it must be in a form that can be directly entered into a calculator.)

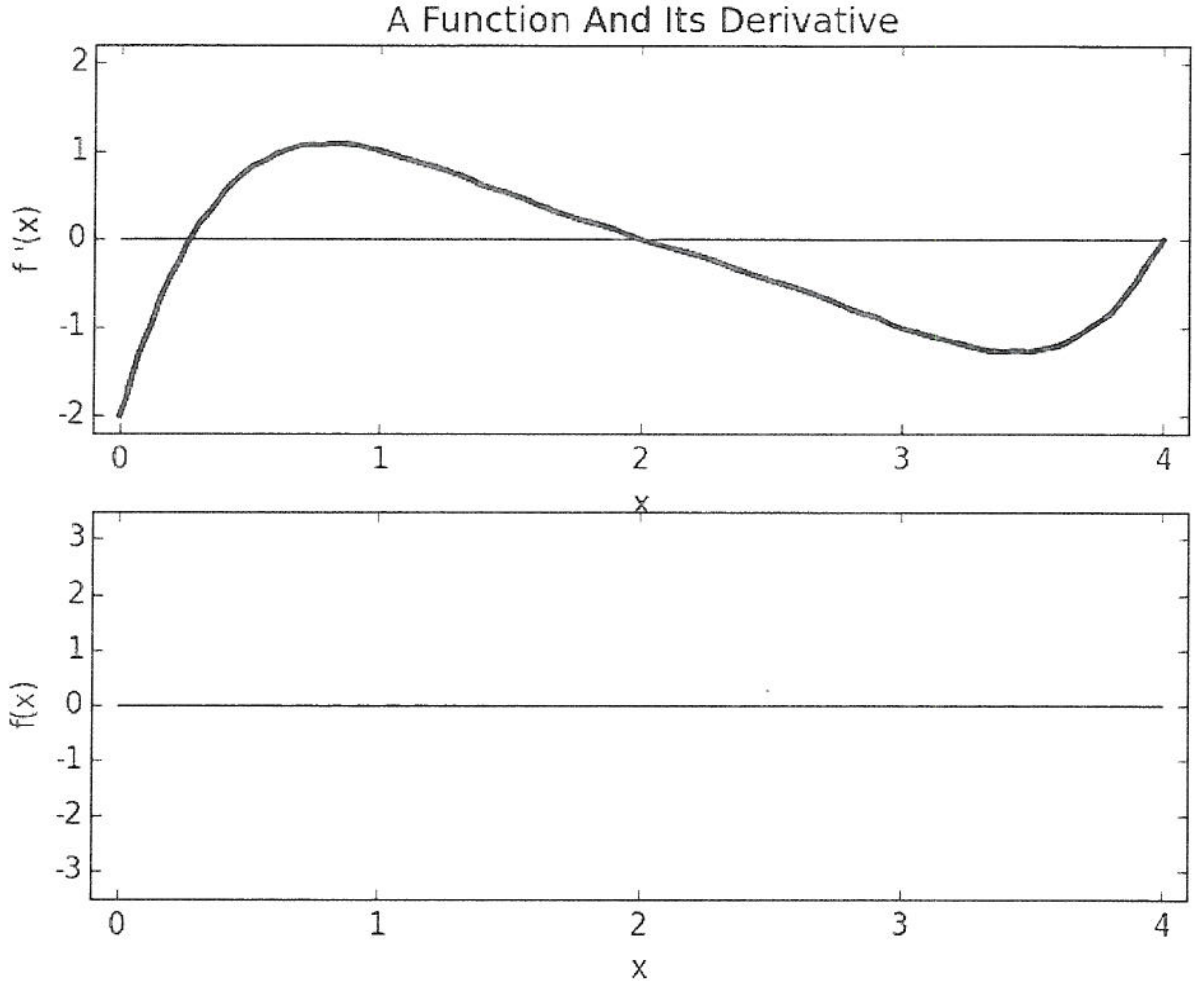
8. [10 pts] Use the definition of the derivative to show that

$$\frac{d}{dx}\left(3x^2 - \frac{1}{x}\right) = 6x + \frac{1}{x^2}.$$

(hint: the quotient can be broken into two parts, one for each function.)

9. [10 pts] A sketch of the derivative of a function, $f'(x)$, is shown in the plot below. Make a sketch of the original function, $f(x)$, given that $f(0) = 0$.

   (Please double check the labels on the plots.)



10. [10 pts] A road has two lanes going north and south, and the lanes are separated by a distance of 0.1 miles. One car, traveling North, is traveling at a constant 80 miles per hour. Another car, traveling South is traveling at constant 70 miles per hour. What is the rate of change of the straight line distance between the two cars when they are approaching one another and the straight line distance between the cars is one mile? What is the rate of change of the straight line distance at the moment when they pass each other?

11. [10 pts] Sketch a plot of the function

$$f(x) = \frac{2x}{x^2 - 4}.$$

Label your axes and indicate the values of all x-intercepts, y-intercepts, and asymptotes including for $x \to -\infty$ as well as $x \to \infty$.

12. A car starts from rest at a stop light. At the end of 10 seconds its position is 100 meters beyond the light. Three statements are given below. For each statement indicate if it must be true, must be false, or if it is not possible to determine indicate that you cannot tell from the given information. For each statement provide a complete, one sentence explanation for your reasoning.

    (a) [3 pts] **True/False/Cannot Tell** Its final speed is 10 meters per second

    (b) [4 pts] **True/False/Cannot Tell** At some point in time its speed was 10 meters per second.

    (c) [3 pts] **True/False/Cannot Tell** It did not move faster than 10 meters per second at any time.

13. [10 pts] A cistern for storing water will be constructed. Its shape is a right circular cylinder with radius R and height H. It must be able to hold 1000 m^3 of water. The cost of the materials is related to the surface area. It is \$8 per square meter for the sides and is \$10 per square meter for the bottom. (The top of the cistern is open) What dimensions for the cistern will minimize the cost of the materials?

Extra space for work. If you want us to consider the work on this page you must write your name and section number at the top of this page.