

**Math 0120
Examination #1
Sample**

Name (Print) _____ **S.S.#** _____

Signature _____ **Score** _____.

TA (Circle one)

Instructions:

1. Clearly print your name and social security number and sign your name in the space above.
2. There are 9 problems, each worth the specified number of points, for a total of 100 points. There is also an extra-credit problem worth up to 8 points.
3. Please work each problem in the space provided. Extra space is available on the back of each exam sheet. Clearly identify the problem for which the space is required when using the backs of sheets.
4. Show all calculations and display answers clearly. Unjustified answers will receive no credit.
5. Write neatly and legibly. Cross out any work that you do not wish to be considered for grading.
6. **Calculators may not be used. All derivatives are to be found by learned methods of calculus.**

1. (8 pts.) $f(x) = \frac{\sqrt{x^2-1}}{x-1}$ and $g(x) = x + 1$.

(a) Find the domain of f .

(b) Find the composition $f(g(x))$.

2. (12 pts.) Use the definition of derivative to find the derivative of $f(x) = x^3$.

3. (6 pts.) A language student can memorize $p(t)$ phrases in t hours of class. What are the units of $p'(t)$? Interpret $p'(4) = 6$.

4. (24 pts.) Find the derivatives of the following functions (you need not simplify):

(a) $f(x) = -\frac{8}{x} + \pi x^{-4} - 4x^3 + 100e$

(b) $f(x) = (3x^5 - 18x)^4(5x^{-3} - 10x)$

(c) $f(x) = \frac{x^2 - 1}{20x + x^3}$

(d) $f(x) = \left(\frac{x^2 + 1}{1 - x^3} \right)^4$

5. (12 pts.) When a certain ball is thrown into the air, its vertical distance above the ground at t seconds is given by $s(t) = -16t^2 + 128t = -16t(t - 8)$ feet .

(a) Find the velocity of the ball.

(b) Find the acceleration of the ball at $t = 8$.

(c) Find the maximum height of the ball.

(d) Find the impact velocity of the ball.

6. (10 pts.) If total costs are given by $C(x) = 10x + 12$ and total revenues are given by $R(x) = 18x - x^2$, both in thousands of dollars, where x is the number of units, find the break-even points.

You may earn up to 8 points extra credit by finding the maximum profit.

7. (8 pts.) $f(x) = x + \sqrt{x}$.

(a) Find the instantaneous rate of change of f at $x = 4$.

(b) Find an equation of the tangent line at $x = 1$.

8. (12 pts.) A company manufactures cordless telephones and finds that its cost function (the total cost of manufacturing x telephones) is $C(X) = 400\sqrt{x} + 500$ dollars, where x is the number of telephones produced. Find the marginal cost, the average cost, the marginal average cost, and estimate the cost of producing the 65-th telephone.

9. (8 pts.) Give examples of:

(a) A function f which is defined at $x = 3$, but discontinuous at $x = 3$.

(b) A function g which is continuous at $x = 1$, but has a vertical tangent line at $x = 1$.