Math 0120
Examination #1
SAMPLE

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

Signature _____   **Scor**e _____ .

TA (Circle one)

Instructions:

1. Clearly print your name and PeopleSoft number and sign your name in the space above.

2. There are 7 problems, each worth the specified number of points, for a total of 100 points. There is also an extra-credit problem worth up to 5 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. **No calculators, headphones, cell phones, tables, books, notes, or computers may be used. All derivatives are to be found by learned methods of calculus.**

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1. (30 pts.) Find the indicated derivatives of the following functions (<u>you need not simplify, but you must label all derivatives and use correct notation</u>):

(a) $f(x) = \dfrac{4}{x} + 7x^{-3} - 8x^2 + 200\pi..$ Find $\dfrac{d^2}{dx^2} f(x)$. Use Leibniz notation throughout.

(b) Find $\dfrac{d}{dx}\left(\dfrac{x^2+1}{1-x^3}\right)$ by the quotient rule.

(c) $y = (3x^5 - 18x)^8$. Find $\dfrac{dy}{dx}$.

You may earn 5 points extra credit by finding $\dfrac{d^2f}{dx^2}\Big|_{x=16}$ for $f(x) = 16\sqrt[4]{x^3}$.

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

(a) Find the domain of f and express it in interval notation.

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

3. (a) (5 pts) Find $\lim_{x \to -3} \dfrac{x^3 + 27}{x + 3}$

(b) (5 pts.) Write the definition of the derivative of $f(x)$.

(c) (7 pts.) Use the definition to find the derivative of $f(x) = \dfrac{2}{x}$.

4. (8 pts.) Give examples (no graphs) of:

(a) A function f that is defined at x = 2, but discontinuous at x = 2 because $\lim_{x \to 2} f(x) \neq f(2)$.

(b) A function g that is continuous at x = -1, but not differentiable at x = -1 because of a sharp corner at x = -1

5. (a) At time t = 0, a diver jumps from a diving board that is 32 feet high. The height of the diver above the water at t seconds is given by

$h(t) = -16t^2 + 16t + 32 = -16(t^2 - t - 2) = -16(t + 1)(t - 2)$ feet, $0 \leq t \leq 2$.

(i) (4 pts.) Find the diver's maximum height.

(ii) (5 pts.) What is the diver's impact velocity?

(b) (6 pts.) After t hours, a passenger train is $s(t) = 24t^2 - 2t^3$ miles from its starting point, $0 \leq t \leq 12$. What is its average velocity between t = 1 hour and t = 2 hours?

6. (8 pts.) $f(x) = \sqrt[3]{x}$.

   (a) Find the instantaneous rate of change of f at x = 1.

   (b) Find the equation of the tangent line at x=1 in point-slope form.

7. (14 pts.) The revenue function for a certain commodity is given by $R(x) = 3x \sqrt{x^2 + 11}$ thousand dollars, where x is the number of units sold. Find the marginal revenue, the average revenue and the marginal average revenue. Estimate the revenue generated by the 6-th unit.