

Name: _____ / 25

There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. **Show all work for full credit.** You should not be using a calculator on this (or any) quiz.

1. **[9 points]** Sand is poured onto a surface at a rate of $15 \text{ cm}^3/\text{sec}$, forming a conical pile whose base radius is exactly two times its height.

a. Since you know that the base radius is twice the height, write an equation relating r and h . Given that equation, what is the relationship between $\frac{dr}{dt}$ and $\frac{dh}{dt}$?

b. How fast is the height of the pile changing when the pile is 3 cm high? Use the formula $V = \frac{1}{3}\pi r^2 h$ for computing the volume of the cone.

Write a complete sentence to answer the question. Units should be included in your answer.

2. [8 points] Consider the function $f(x) = \sqrt{4-x}$.

a. Find the linearization (linear approximation) $L(x)$ of the function $f(x)$ at $a = 0$.

b. What is x if $f(x) = \sqrt{3.9}$? Give your answer as a fraction. _____

c. Use linearization or differentials to **estimate** $\sqrt{3.9}$. Clearly show your work.

3. [8 points] Let $f(x) = (4-x^2)^2$.

a. Find all critical points for $f(x)$. Show your work.

b. Determine the absolute maximum and absolute minimum of $f(x)$ on the interval $[0,3]$ or state that none exist. You must show your work to receive full credit. See the answer-blank below.

maximum value of $f(x)$ for x in $[0,3]$: _____

x -value(s) where the maximum value of $f(x)$ occurs: _____

minimum value of $f(x)$ for x in $[0,3]$: _____

x -value(s) where the minimum value of $f(x)$ occurs: _____