

Note that the exam is printed on both sides of the paper!  
Read the rules on page 2 before beginning.

**Student Conduct Certification**

This certification must be signed or your exam will not be graded.

I certify that I have read and understand the rules of the exam, and further, that the work shown in this examination is my own and that it has been completed in accord with the California State University Northridge student conduct code. I also understand that failure to abide by the student conduct code is subject to discipline as provided in sections 41301 through 41304 of Title 5, California Code of Regulations.

Sign here: \_\_\_\_\_

Problem	Points/Total
1	/10
2	/10
3	/10
4	/10
5	/10
6	/10
7	/10
8	/10
9	/10
10	/10
Total	/100

## Rules

- There are 10 problems. Complete all problems.
- Clearly indicate your answer to each problem (circle or underline). Ambiguous answers will be ignored.
- Show all your work.
- Simplify all your answers.
- All answers should be exact (no calculator approximations).
- You may use a calculator to check your answers.
- You NOT use cell phones, PDAs, computers, or any other personal computing device.
- You may use any of the formulas listed below:

$$\begin{aligned}
 (uv)' &= uv' + vu' & \left(\frac{u}{v}\right)' &= \frac{vu' - uv'}{v^2} \\
 (\sin x)' &= \cos x & (\cos x)' &= -\sin x \\
 x^{1/n} &= \sqrt[n]{x} & 1/x^n &= x^{-n} \\
 x^{m/n} &= \sqrt[n]{x^m} = (\sqrt[n]{x})^m & \sqrt[n]{xy} &= \sqrt[n]{x} \sqrt[n]{y} \\
 \sin(x \pm y) &= \sin x \cos y \pm \cos x \sin y \\
 \cos(x \pm y) &= \cos x \cos y \mp \sin x \sin y \\
 \cos^2 x + \sin^2 x &= 1 \\
 \cos 2x &= \cos^2 x - \sin^2 x \\
 \sin 2x &= 2 \sin x \cos x
 \end{aligned}$$

Object Shape	Object's Volume	Object's Surface Area
Sphere	$\frac{4}{3}\pi r^3$	$4\pi r^2$
Cylinder	$\pi r^2 h$	$2\pi r h + 2\pi r^2$
Cone:	$\frac{1}{3}\pi r^2 h$	$\pi r \sqrt{r^2 + h^2}$
Cube:	$l^3$	$6l^2$

1. Find the linearization of  $f(x) = 8\sqrt{5x + \frac{20}{x}}$  about  $x = 4$  in the form  $y = mx + b$  and simplify.

2. A balloon is rising at a constant speed of 5 feet/second. A boy is cycling along a straight road at a speed of 15 feet/second. When he passes under the balloon it is 45 feet above him. How fast is the distance between the boy and the balloon increasing 3 seconds later (simplify)?

Your Name Here

3. The circumference of a sphere is measured to be 84 centimeters with a possible error of 0.5 centimeters. Estimate the maximum error and percentage error in the calculated surface area.

4. Find all numbers that satisfy the mean value theorem for  $f(x) = x^3 + x - 1$  on  $[0, 2]$ .

5. Identify (a) the critical points and find the (b) absolute maximum and (c) absolute minimum of  $f(x) = \frac{x^2 - 4}{x^2 + 4}$  on  $[-2, 4]$ .

6. Suppose that a ball is given a push so that the distance rolled after  $t$  seconds is  $s(t) = 5t + 3t^2$ . Find (a) the velocity after 2 seconds; and (b) how long does it take for the velocity to reach 35 meters/second?

Your Name Here

7. The volume of a cube is increasing at a rate of  $10 \text{ cm}^3/\text{minute}$ . How fast is the surface area increasing when the length of an edge is  $30 \text{ cm}$ ?

8. Estimate  $\sqrt{170}$  using differentials.

9. Find the intervals where  $f(x) = x^4 - 2x^3 + 3$  is increasing and decreasing.

10. Find the inflection points and identify the intervals of concavity for  $f(x) = x^4 - 2x^3 + 3$ .