

## Calculus I (Math 231) Exam 2

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Justify answers and show all work for full credit. No calculators allowed.

NAME: \_\_\_\_\_

**Problem 1.** *Compute the derivative of the following functions. Show all work!*

(a)  $f(x) = (x^2 + 3x)^9 \sqrt{x^3 - 5}$

(b)  $f(x) = e^{\sin(x^2-1)}$

(c)  $f(x) = e^{-6x} \cos(2x)$

(d)  $f(x) = \frac{x^4}{10x^2 - 8}$

(e)  $f(x) = \ln(x^{\frac{3}{2}} + 5)$

**Problem 2.** Let  $f(x) = x^2 + 3x$ . Use the definition of the derivative to find  $f'(1)$ .

**Problem 3.** Compute using the definition of the derivative:  $\lim_{h \rightarrow 0} \frac{\sqrt[3]{-8+h} + 2}{h}$

**Problem 4.** A ball is thrown upward from 64 feet above the ground, with an initial velocity of 48 ft/sec.

(a) Find the velocity of the ball when it hits the ground.

(b) Find the maximum height of the ball.

**Problem 5.** Suppose  $x$  and  $y$  satisfy  $x + x^2y + \cos y = 2$

(a) Find  $\frac{dy}{dx}$  as a function of  $x$  and  $y$ .

(b) Find an equation of the tangent line to this graph at the point  $(1, 0)$ .

**Problem 6.** A paper cup has the shape of a cone with height 5 cm, and radius at the top 4 cm. Water leaks out of the cup at 3 ml/min. At what rate is the height of the water dropping when the cup still has 2 cm of water in it?

Draw a picture and indicate all quantities that you know and the ones you must find.

[Hint: Choose the correct formula:  $V = 4\pi r^2 h$ ,  $V = \frac{1}{3}\pi r^2 h$ ,  $V = \frac{4}{3}\pi r^2 h$ ]