

**Math 141 - Homework 8****Name:** \_\_\_\_\_

1. A point moves along the parabola  $y = 1 - x^2$  so that its horizontal velocity is  $\frac{dx}{dt} = 3$  when  $x = 2$ . Find  $\frac{dy}{dt}$  at that instant.
2. Let  $z^2 = x^2 - y^2$ . Find  $\frac{dz}{dt}$  if  $x = 5$ ,  $y = 3$ ,  $\frac{dx}{dt} = -1$ , and  $\frac{dy}{dt} = 0$ .
3. Two buses are driving along parallel highways that are 5 miles apart, one heading east and the other heading west. Assuming that each bus drives a constant 60 mph, find the rate at which the distance between the buses is changing when they are 13 miles apart, heading toward each other.
4. A 25-ft ladder is leaning against a wall. If we push the ladder toward the wall at a rate of 1 ft/sec, and the bottom of the ladder is initially 20 ft away from the wall, how fast does the ladder move up the wall 5 sec after we start pushing?
5. A pump is filling a spherical balloon with 20 cubic centimeters of helium per second. How fast is the radius of the balloon increasing at the instant when the radius is 5 cm? Hint: The volume of a sphere is  $V = \frac{4}{3}\pi r^3$ .

For each of the following functions, find the linear approximation  $L(x)$  near  $x = a$ .

6.  $f(x) = \frac{1}{x}$  at  $a = 10$ .

7.  $f(x) = x \sin x$  at  $a = \pi$ .

8.  $f(x) = \sqrt{25 - x^2}$  at  $a = 4$ .

9.  $f(x) = x^3$  at  $a = -1$ .

Find the differentials of the following equations.

10.  $y = 2 \cos x + x^2$

11.  $P = \left(1 + \frac{r}{4}\right)^3$

Use a linear or differential approximation to estimate the following without a calculator.

12.  $\sqrt{4.16}$

13.  $\frac{4}{3.9}$