

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

*I accept full responsibility under the Haverford Honor System for my conduct on this exam.*

**Math 113 Exam #2**

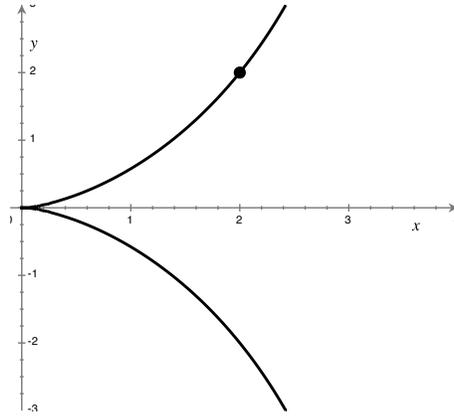
November 5, 2010

**Instructions:** You are welcome to use one sheet of notes, but no other references or tools are allowed (no textbooks, no calculators, etc.). This is a 55 minute exam; you may start working at 10:35 AM and must stop at 11:30 AM. To receive full credit for a correct answer you must demonstrate how you arrived at that answer. To receive partial credit for an incorrect answer your work must be clearly explained. Please hand in your exam with the honor pledge signed.

1. The equation

$$(4 - x)y^2 = x^3,$$

determines a curve called a *cissoid*, pictured below. What is the equation of the tangent line to the cissoid at the point  $(2, 2)$ ?



2. Consider the function

$$f(x) = \sqrt[5]{\sin x}.$$

At which values of  $x$  does the graph of  $f$  have a vertical tangent line?

3. Estimate  $\tan(0.05)$  using an appropriate linearization.

4. Suppose  $g(x) = x^{x^2}$ . What is  $g'(x)$ ?

5. Hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) spontaneously decomposes into water and oxygen gas at a rate proportional to the quantity of hydrogen peroxide. Suppose you start with 100L of hydrogen peroxide in a tank, and after 1 week there are 60L of hydrogen peroxide in the tank. How many liters of hydrogen peroxide will there be in the tank after 2 weeks?

6. A spherical balloon is inflated by an electric pump. To prevent strain on the material, you want to inflate the balloon in such a way that the surface area is increasing at a constant rate of 20 square feet per minute. At what rate (in cubic feet per minute) should air be pumped into the balloon when the radius of the balloon is 2 feet?