

# Math 220 Practice Exam II

## Chapter 2

**Problem 1.** From the definition of the derivative, calculate  $\frac{d}{dt}(t^3 - 4t^2 + 7)$ , and  $\frac{d}{dx} \frac{1}{\sqrt{2x+1}}$ .

**Problem 2.** Show that for any real numbers  $u$  and  $v$ ,  $|\cos u - \cos v| \leq |u - v|$ .

**Problem 3.** Find the derivative of each function.

a)  $f(x) = \frac{4x^2 - x + 3}{\sqrt{x}}$ .

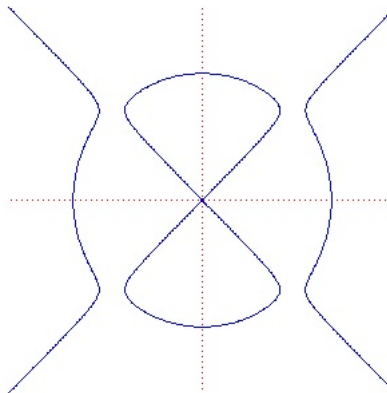
b)  $g(w) = \ln(e^{2w^3} + \sin w)$ .

c)  $h(r) = \frac{\csc(r^2)}{r \tan^{-1} r}$ .

**Problem 4.** The Devil's Curve is a curve defined by the equation

$$y^4 - x^4 + ay^2 + bx^2 = 0,$$

Devil's Curve



where  $a$  and  $b$  are constants. Find the slope of the tangent line to the curve at any point  $(x, y)$  on the curve.

**Problem 5.**  $f(x) = \frac{1}{(4\pi kt)^{1/2}} e^{kx^2/4t}$  is an important function in analysis of the one-dimensional free Schrödinger equation. Find the first two derivatives of  $f(x)$ . (Here  $k$  is a constant.)

**Problem 6.** Find  $f^{(5)}(x)$  for  $f(x) = 6x^7 - 12x^3 + \cos x$ .

**Problem 7.** a)  $\frac{d}{dt}(t^3 + 2^t) \frac{t^2 - 1}{t^2 + 7}$ .

b)  $\frac{d}{du} \sqrt{u^5 \sec u + \ln u}$ .

**Problem 8.** Given  $f(x)$  has an inverse  $g(x)$ , find  $g'(2)$  if  $f(x) = \sqrt{x^3 + 2x + 4}$ .

**Problem 9.** Find  $h'(x)$  if  $h(x) = \sqrt[3]{3^x + \sqrt{4x + \cos x}}$ .

**Problem 10.** Calculate  $\frac{d}{dx}(x^{4-x^2})$ .