

This is the second of our "spiraling review" homework sets.

Write your homework *neatly, in pencil*, on  $8\frac{1}{2} \times 11$  blank white printer paper (the back can be used). Always *write the problem*, or at least enough of it so that your work is readable. In particular, you *must* write any function the problem refers to.

Learn to *write in sentences*. Use words, sentences, paragraphs when appropriate. Sentences begin with a word and end with a period. Avoid having apparently random expressions and equations scattered around the page. Justify your conclusions.

**Problem 1.** Let

$$f(x) = \frac{x}{1+x^2}.$$

Find the slope of the line tangent to the graph of  $f$  at the point  $(2, \frac{2}{5})$ .

**Problem 2** (Thomas §4.1 # 59). The function

$$V(x) = x(10 - 2x)(16 - 2x) \quad \text{for} \quad 0 < x < 5$$

models the volume of a box.

(a) Find the extreme values of  $V$ .

(b) Interpret any values found in part (a) in terms of volume of the box.

**Problem 3** (Thomas §4.1 # 66). If an even function  $f(x)$  has a local maximum at  $x = c > 0$ , can anything be said about the value of  $f$  at  $x = -c$ ? Justify your answer.

**Problem 4** (Thomas §4.1 # 67). If an odd function  $g(x)$  has a local maximum at  $x = c > 0$ , can anything be said about the value of  $g$  at  $x = -c$ ? Justify your answer.

**Problem 5** (Thomas §4.1 # 69). Consider a generic cubic function

$$f(x) = ax^3 + bx^2 + cx + d.$$

(a) Show that  $f$  can have 0, 1, or 2 critical points. Give examples and graphs to support your argument.

(b) How many local extreme values can  $f$  have?

**Problem 6.** Compute

$$\int_0^1 x^2 \tan(x^3) dx.$$

**Problem 7** (Thomas §3.6 # 30). Consider the equation

$$x + \sin y = xy.$$

Use implicit differentiation to find  $dy/dx$ .

**Problem 8** (Re: Thomas §3.6 # 30). Consider the equation

$$y + \sin x = xy.$$

- (a) Solve for  $y$  so that  $y$  is a function of  $x$ . Let  $f(x) = y$ .
- (b) Graph your function on a graphing calculator, and sketch the graph.
- (c) What is the domain of  $f$ ?
- (d) Where does the equation  $y + \sin x = xy$  implicitly define  $y$  as a function of  $x$ ?
- (e) Where does the equation  $x + \sin y = xy$  implicitly define  $x$  as a function of  $y$ ?

**Problem 9.** Compute

$$\lim_{h \rightarrow 0} \frac{\sin(a+h) - \sin a}{h},$$

where  $a = \pi/3$ .

**Problem 10.** Let

$$f(x) = x^4 - 32x.$$

Find the range of  $f$ .