

**Practice Problems**

These problems are not to be handed in, but try them first; do as many of them as you need until they're easy, or make up more along the same lines if you need more practice. The answers to these are at the end of this handout.

- 1 Suppose that  $x$  is a variable quantity that changes from 1 to 3, and suppose that  $u = 3x$ .
  - a. What is  $\Delta x$ ?
  - b. What is  $\Delta(x + 5)$ ?
  - c. What is  $\Delta u$ ?
  - d. What is  $\Delta(u - ux)$ ?
- 2 Suppose that  $x$  is a smoothly variable quantity.
  - a. Find  $d(x + 3)$  in terms of  $dx$ .
  - b. Find  $d(-5x)$  in terms of  $dx$ .
  - c. Differentiate (find the differential of)  $u = 2x - 5$ .
  - d. If  $u = 3x$  and  $v = x + 11$ , differentiate  $u + v$ .

**Due Problems**

These problems are due April 10 Tuesday.

- 1 Suppose that the annual profit from making and selling car seats is given by

$$P = 600x - 50x^2 - 500,$$

where  $P$  is the profit in thousands of dollars and  $x$  is the number of millions of car seats made and sold that year.

- a. If  $x$  changes from 4 to 5, then what is  $\Delta P$ ? (Show at least what numerical calculation you make to decide this.)
  - b. If the firm changes from making 4 million car seats in one year to making 5 million car seats in the next year, then what is the change in its annual profit? (Give an answer consistent with part a, and be sure to include correct units of measurement.)
- 2 Given  $u = x + 1$  and  $v = 2x + 3$ , differentiate (find the differentials of) the following:
    - a.  $5x + 7$
    - b.  $v$
    - c.  $13u - 6v$

## Answers to Practice Problems

Here are the answers to the Practice Problems from the beginning of the assignment.

**1**

a.  $\Delta x = 3 - 1 = 2$ .

b.  $\Delta(x + 5) = (3 + 5) - (1 + 5) = 8 - 6 = 2$ .

c. Either

$$\Delta u = \Delta(3x) = 3(3) - 3(1) = 6;$$

or

$$x = 1 \Rightarrow u = 3(1) = 3,$$

$$x = 3 \Rightarrow u = 3(3) = 9,$$

$$\Delta u = 9 - 3 = 6.$$

d. Either

$$\Delta(u - ux) = \Delta(3x - 3x^2) = [3(3) - 3(3)^2] - [3(1) - 3(1)^2] = -18;$$

or

$$x = 1 \Rightarrow u = 3(1) = 3,$$

$$x = 3 \Rightarrow u = 3(3) = 9,$$

$$\Delta(u - ux) = (9 - 9 \cdot 3) - (3 - 3 \cdot 1) = -18.$$

**2**

a.  $d(x + 3) = dx$ , because 3 is constant.

b.  $d(-5x) = -5 dx$ , because  $-5$  is constant.

c. Either

$$du = d(2x - 5) = 2 dx$$

or

$$u = 2x - 5,$$

$$du = d(2x - 5),$$

$$du = 2 dx.$$

d. Either

$$d(u + v) = d(3x + x + 11) = d(4x + 11) = 4 dx$$

or

$$du = d(3x) = 3 dx,$$

$$dv = d(x + 11) = dx,$$

$$d(u + v) = du + dv = 3 dx + dx = 4 dx.$$