MT 135-56/8 **Derivatives with *Derive*^{TM} *6* , Part I** **Fall, 2004**

The purpose of these exercises is to compute the derivatives of functions of the form $f(x) = x^n$, where *n* is an integer.

Directions:
Use *Derive*^{TM} *6* for the following exercises. Use standard mathematical notation to record the results ***on a separate sheet of notebook paper.*** Do not turn in a print-out of your Derive session.

For each function in the exercises below, do the following:

(a) Author the expression $\frac{f(x+h)-f(x)}{h}$ for the specific function $f(x)$.

(b) Simplify the expression $\frac{f(x+h)-f(x)}{h}$. (Notice that this simplification is valid only if $h \neq 0$.)

(c) Compute $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$, which is $f'(x)$.

Copying Results from Derive onto Your Homework Paper:
What you record on your homework paper should look something like this. That is, you should record more than just the end result from Derive.

$$f(x) = x^2$$
$$\frac{f(x+h)-f(x)}{h} = \frac{(x+h)^2 - x^2}{h} = 2x + h$$
$$f'(x) = \lim_{h\to 0}(2x+h) = 2x$$

You need to author $\frac{(x+h)^2 - x^2}{h}$. Then have Derive simplify to get $2x + h$.

Exercises

1. $f(x) = x^3$ 2. $f(x) = x^4$ 3. $f(x) = x^5$ 4. $f(x) = x^6$

Complete the following sentence: Based on my results in Exercises 1-4, I believe that if *n* is a positive integer and $f(x) = x^n$, then $f'(x) =$ _____ .

Does your formula work when $n = 2$? (See the example above.) Does your formula work when $n = 1$? Use Derive to find out!

For the functions below, use your formula to find $f'(x)$. Then follow steps (a)-(c) above to have Derive compute $f'(x)$.

5. $f(x) = x^{-1}$ 6. $f(x) = x^{-2}$ 7. $f(x) = x^{-3}$

Does your formula for $f'(x)$ seem to work when *n* is a negative integer?