

## Relationship between a Function and its Derivative

### Goals:

- Given the graph of a function, to be able to visualize the graph of its derivative.

### The Lab:

2. Let  $f(x) = x^2(x^2 - 1)(x + 2) = x^5 + 2x^4 - x^3 - 2x^2$ .

- a. Find the derivative of  $f$ . Plot the graphs of both  $f$  and  $f'$  in the same viewing rectangle over the interval  $[-2.5, 1.5]$ .

Answer the following questions by inspection of this graph:

- b. Over what intervals does the graph of  $f$  appear to be rising as you move from left to right?
- c. Over what intervals does the graph of  $f'$  appear to be above the x-axis?
- d. Over what intervals does the graph of  $f'$  appear to be falling as you move from left to right?
- e. Over what intervals does the graph of  $f'$  appear to be below the x-axis?
- f. What are the x-coordinates of all of the high points and low points of the graph of  $f$ ?
- g. For what values of  $x$  does the graph of  $f'$  appear to meet the x-axis?
- g. For what values of  $x$  does the graph of  $f$  appear to meet the x-axis?

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

- a. Find the derivative of  $f$ . Plot the graphs of both  $f$  and  $f'$  in the same viewing rectangle over the interval  $[-3, 3]$ .
- b. Answer the same set of questions as in parts b-g above.