

The First Derivative and Slope

Michael Penna, Indiana University – Purdue University, Indianapolis

Objective

To discuss and emphasize what the derivative of a function tells you about slope.

Narrative

Recall that for each x in the domain of the derivative f' of a function f , $f'(x)$ is the slope of the tangent line to the graph of f at x , and that f is increasing at x if and only if $f'(x) > 0$, and f is decreasing at x if and only if $f'(x) < 0$.

In this project we use two Maple commands for computing derivatives:

$D(f)$	the derivative f' of f (Note: $D(f)$ is a function.)
$D(f)(x)$	the expression $f'(x)$

Task

1. Type the command lines in the left-hand column below into Maple in the order in which they are listed. The effect of each command is described in the right-hand column for your reference.

<code>> # Your name, today's date</code>	
<code>> # The First Derivative and Slope</code>	
<code>> restart;</code>	Clear Maple's memory.
<code>> f := x -> sin(x);</code>	Let $f(x) = \sin x$.
<code>> plot({f(x),D(f)(x)},x=-2*Pi..2*Pi);</code>	Plot the graphs of f and f' .
<code>> f := x -> cos(x)-sin(1.5*x);</code>	Let $f(x) = \cos x - \sin 1.5x$.
<code>> plot({f(x),D(f)(x)},x=-2*Pi..2*Pi);</code>	Plot the graphs of f and f' .
<code>> f := x -> sin(2*x)+2*cos(x);</code>	Let $f(x) = \sin 2x + 2 \cos x$.
<code>> plot({f(x),D(f)(x)},x=-2*Pi..2*Pi);</code>	Plot the graphs of f and f' .

At this time make a hard-copy of your typed input and Maple's responses. Then:

2. On each of the three graphics you created in Task 1, label the graphs of f and f' .

3. On each of the three graphics you created in Task 1, highlight that part of the graph of f over which the tangent lines (to the graph of f) have positive slope, and that part of the graph of f' over which f' is positive.

Your lab report will be a hard copy of your typed input and Maple's responses (both text and hand-labeled graphics).

Comments

You can also refer to $D(f)(x)$ in Maple by `diff(f(x),x)`.