The First Derivative and Slope

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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 $f'(x) < 0$.

There are several different ways to write the derivative of a function in Mathematica. In this project we use the notation **f´** to denote the derivative of the function **f**. We could also write the derivative of **f** as **D[f[x],x]** or **Derivative[1][f]**. Each of these ways has its own context; details are discussed in Mathematica's Help.

Task

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

`In[1]:=` **(* Your name, today´s date *)**	
`In[2]:=` **(* The First Derivative and Slope *)**	
`In[3]:=` **f[x_] := Sin[x]**	Let $f(x) = \sin x$.
`In[4]:=` **f´[x]**	Find f'.
`In[5]:=` **Plot[{f[x], f´[x]}, {x,-2Pi,2Pi}]**	Graph f and f'.
`In[6]:=` **f[x_] := Cos[x]-Sin[1.5x]**	Let $f(x) = \cos x - \sin 1.5x$.
`In[7]:=` **f´[x]**	Find f'.
`In[8]:=` **Plot[{f[x], f´[x]}, {x,-2Pi,2Pi}]**	Graph f and f'.
`In[9]:=` **f[x_] := Sin[2x]+2Cos[x]**	Let $f(x) = \sin 2x + 2\cos x$.
`In[10]:=` **f´[x]**	Find f'.
`In[11]:=` **Plot[{f[x], f´[x]}, {x,-2Pi,2Pi}]**	Graph f and f'.

At this time make a hard-copy of your typed input and Mathematica'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 Mathematica's responses (both text and hand-labeled graphics).