

The Graph of a Function and the Graph of its Derivative

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Objective

To investigate the connection between the graph of a function and the graph of its derivative.

Narrative

Recall that for each x in the domain of the derivative f' of 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 $f'(x) < 0$.

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 Graph of a Function and the Graph of its Derivative *) | |
| In[3] := f[x_] := x^2*Sin[x] | Let $f(x) = x^2 \sin x$. |
| In[4] := f'[x] | Compute $f'(x)$. |
| In[5] := Plot[{f[x], f'[x]}, {x,-4,4}] | Plot the graphs of f and f' . |
| In[6] := f[x_] := (x^4-4x^2)/12 | Let $f(x) = (x^4 - 4x^2)/12$. |
| In[7] := Plot[f[x], {x,-2.5,2.5}] | Plot the graph of f . |
| In[8] := f[x_] := x^2 (x+5)^3/200 | Let $f(x) = x^2(x + 5)^3/200$. |
| In[9] := Plot[f[x], {x,-5,1}] | Plot the graph of f . |
| In[10] := f[x_] := 0.5 x^2 Sin[x]-0.5 Cos[x] | Let $f(x) = 0.5x^2 \sin x - 0.5 \cos x$. |
| In[11] := Plot[f[x], {x,-Pi,Pi}] | Plot the graph of f . |

At this point, make a hard-copy of your typed input and Mathematica's responses. Then:

2. On the last three graphics you created in Task 1, draw by hand the graph of the corresponding derivative $f'(x)$. (The first graphic you created in Task 1 may act as a guide.) You may assume that the units are the same along both axes in each graphic.
3. On each of the four graphics you created in this project, label the graph of f and the graph of f' .

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