

The Graph of a 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 $f'(x) < 0$. In this project you will be given the graphs of several derivatives $f'(x)$ and asked to draw the graph of $f(x)$.

In this project we define some piecewise functions **f1** using Mathematica's **If** control structure: the command:

```
If[condition, statement 1, statement 2]
```

instructs Mathematica to perform *statement 1* if *condition* is true, and *statement 2* otherwise. Thus, for example, the value of the function **f1**[x] := **If**[$x < 1$, x , $2x + 3$] is x if $x < 1$, and $2x + 3$ if $x \geq 1$.

Task

1. Type the command lines in the left-hand column below into Mathematica in the order in which they are listed. These commands draw the graphs of several functions.

```
In[1] := (* Your name, today's date *)
In[2] := (* The Graph of a Derivative *)
In[3] := f1[x_] := (IntegerPart[x]+1)/2
In[4] := Plot[f1[x], {x,0,3}, AspectRatio->Automatic]
In[5] := f1[x_] := If[x<1, 0.5, If[x<2, -0.5, 3]]
In[6] := Plot[f1[x], {x,0,3}, AspectRatio->Automatic]
In[7] := f1[x_] := If[x<1, x, If[x<2, x-1, x-2]]
In[8] := Plot[f1[x], {x,0,3}, AspectRatio->Automatic]
In[9] := f1[x_] := If[x<1, x, If[x<3, -x+2, x-4]]
In[10] := Plot[f1[x], {x,0,4}, AspectRatio->Automatic]
```

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

2. On each graphic you created in Task 1, draw the graph of a function f whose derivative f' is **f1** and for which $f(0) = 0$.
3. On each 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).