

Variations in the Graph of a Function

Michael Penna, Indiana University – Purdue University, Indianapolis

Objective

To illustrate the variations in the graph of a function that result from variations in the way the function is specified.

Narrative

In this project, we investigate the variations in the graph of a function f that result from varying the definition of f .

Tasks

1. Type the command lines below into Mathematica in the order in which they are listed. They produce a graph of $f(x) = x^3 - x$.

```
In[1] := (* Your name, today's date *)
```

```
In[2] := (* Variations in the Graph of a Function *)
```

```
In[3] := f[x_] := x^3-x
```

Let $f(x) = x^3 - x$.

```
In[4] := Plot[f[x], {x,-4,4}]
```

Graph f over the interval $[-4, 4]$.

2. Continue by typing the following lines into Mathematica.

```
In[5] := Plot[{f[x], f[x+2], f[x-2], f[x]+2, f[x]-2}, {x,-4,4}]
```

```
In[6] := Plot[{f[x], f[2x], f[x/2], 2f[x], f[x]/2}, {x,-4,4}]
```

```
In[7] := Plot[{f[x], f[-2x], f[-x/2], -2f[x], -f[x]/2}, {x,-4,4}]
```

Note: You might want to add color to your graphics (see Task 3 below).

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

3. If your hard-copy is in color, label by hand each of the curves in each of the plots you produced in Task 2; for example, label the graph of f in each plot by " $y = f(x)$ ". If your hard-copy is not in color, highlight each of the curves in each of the plots you produced in Task 2 by hand in a different color pen or pencil, and label each curve; for example, label the graph of f in each plot by " $y = f(x)$ ". (Even if your hard-copy will not be in color, you might find it useful to draw these plots in color to help you identify which is which by referring to the color output on your computer monitor when labeling.)

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