

Critical Numbers and Inflection Points

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Objective

To illustrate how Mathematica can be used to help you do your curve sketching homework.

Narrative

One of the major difficulties in curve sketching is finding where the derivatives of a function are zero and where they do not exist. In this project we illustrate how Mathematica can be used to assist in performing these tasks.

Task

1. Type the command lines in the left-hand column below into Mathematica in the order in which they are listed. These commands are aimed at finding where $f(x) = x^4 - 3x^2 + 0.75x + 1$ and its first two derivatives are zero and where they do not exist. The effect of each command is described in the right-hand column for your reference. Observe that we use Mathematica's **NSolve** command — rather than the **Solve** command — to generate numerical approximations to intercepts, critical numbers, and potential inflection numbers.

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

In[2] := (* Critical Numbers and Inflection Points *)

In[3] := f[x_] := x^4 - 3x^2 + 0.75x + 1 Let $f(x) = x^4 - 3x^2 + 0.75x + 1$.

In[4] := NSolve[f[x]==0,x] Find where $f(x) = 0$.

In[5] := NSolve[f'[x]==0,x] Find where $f'(x) = 0$.

In[6] := NSolve[f''[x]==0,x] Find where $f''(x) = 0$.

In[7] := Plot[f[x], {x,-2,2}] Plot the graph of f .

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

2. On the graphic you created, plot and label the points along the x -axis at which $f(x) = 0$, at which $f'(x) = 0$, and at which $f''(x) = 0$. Label a point at which $f(x) = 0$ as an intercept, a point at which $f'(x) = 0$ as a critical number, and a point at which $f''(x) = 0$ as a potential inflection number.

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