Critical Numbers and Inflection Points

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Objective

To illustrate how Maple 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 Maple can be used to assist in performing these tasks.

Task

1. Type the command lines in the left-hand column below into Maple in the order in which they are listed. These commands are aimed at finding where $f(x) = x^2(4-x)^{2/3}/4$ 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.

`> # Your name, today´s date`	
`> # Critical Numbers and Inflection Points`	
`> restart;`	Clear Maple's memory.
`> Digits := 5;`	
`> f := x -> 0.25*x^2*surd(4-x,3)^2;`	Let $f(x) = x^2(4-x)^{2/3}/4$.
`> evalf(solve(f(x)=0,x));`	Find where $f(x) = 0$.
`> f1 := D(f);`	Let `f1` denote the first derivative f' of f.
`> f1expr := simplify(f1(x));`	Simplify the first derivative $f'(x)$.
`> evalf(solve(numer(f1expr)=0,x));`	Find where the numerator of $f'(x) = 0$.
`> evalf(solve(denom(f1expr)=0,x));`	Find where the denominator of $f'(x) = 0$.
`> f2 := D(f1);`	Let `f2` denote the second derivative f'' of f.
`> f2expr := simplify(f2(x));`	Simplify the second derivative $f''(x)$.
`> evalf(solve(numer(f2expr)=0,x));`	Find where the numerator of $f''(x) = 0$.
`> evalf(solve(denom(f2expr)=0,x));`	Find where the denominator of $f''(x) = 0$.
`> plot(f(x),x=-4..6);`	Plot the graph of f. (OK, but let's try again ...)
`> plot(f(x),x=-4..6,y=-4..6,numpoints=1000,scaling=constrained);`	
	A better graph of f.

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

2. On the second graphic you made, plot and label both the critical numbers and the inflection points of f by hand: label the critical numbers "critical number", and the inflection points "inflection point".

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