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MATH 287

<u>**Comparison Project**</u>

Newton's Method

Newton's Method is a way of approximating roots of a real-valued function. In this paper I will compare three sources that introduce and explain Newton's Method, ultimately ranking them from most to least helpful/useful. I will determine this by comparing and contrasting their similarities, examples, and overall presentation of the material.

Source 1

Source 1 is from the Calculus Homepage that is used as an online supplement to math sections that are being taught at University of British Columbia. The audience is entry level college student's, and the content of the material matches such an audience. In their intro to Newton's Method, they present a polynomial who's roots cannot be found with old techniques and state how one might approximate the roots through calculus. This helpful intro as to why Newton's Method is useful is followed by a simple example of applying such a method. No explicit formulas have been given, and yet this simple example has been very helpful. It walked the reader through the same approach of applying Newton's Method as well as provided a graph illustration of how the approximations are being made.

Following the simple example, is the general method. This is where the process of Newton's Method is explicitly written and explained. The source also indicates that a good initial value must be chosen in order for approximate solutions to be accurate. I think this should be further explained as a good initial value is vague and the reader does not know what would happen if their initial guess wasn't good enough. An example of how to guess an initial value is shown in the simple example, but is not generalized for guessing initial values for other problems.

This source continues on with more realistic examples containing graphs

that are all easy to follow along. The biggest issue of this source being that the equation of Newton's Method is not outlined or made easy to find. This is harder for students to refer back to and find the method in the future. Overall Source 1 is a very accurate and useful tool of introducing and teaching intro college students Newton's Method.

Source 2

This second source is from Wolfram MathWorld, given that it is "the webs most extensive mathematics resource", it's intended audience is for those with extensive math backgrounds and comprehension. In introducing Newton's Method, it states it's relation to the first few terms of the Taylor series of a function. Note their are several hyper-links that will go in depth explanation on other subjects, Taylor series being one of those links. The source goes on to compare Newton's Method to being essentially the same as Horner's Method (again hyper-linked).

After a rather intense introduction, advanced equations are presented and manipulated as Newton's Method is produced. The complexity of the formulas make this source a poor way to introduce Newton's Method. This source also states how a good initial choice of the roots position can prevent the method from becoming unstable. No examples as well as no picture or visual representation has been shown up to this point, adding to the overall poor presentation and understanding of the material.

Source 2 continues on to implement Newton's Method into Wolfram Language. Finally graphs are produced and a few different examples of iterations through Newton's Method are analyzed and graphed. Given that this source is intended for an audience with a firm understanding of math, I can see how it would be useful to them. I would strongly discourage this source as being a way of introducing Newton's Method. I also feel the assumptions of intense math background knowledge can be discouraging. Overall, I did not find Source 2 to be useful or helpful to the mass majority of audience who might be inferring on Newton's Method.

Source 3

Source 3 is a video, produced by Patrick on his channel, PatrickJMT (Just Math Tutorials) where he makes free, videos to help assist mathematical learning around the world. He does not explicitly say his intended audience,

but I infer that his videos are comprehensible for people with High School math knowledge as well as those who have watched his former videos as I assume they build on each other. Patrick begins the video with the first few iterations and the general equation for approximating roots using Newton's Method. These equations are accompanied with a function on a graph as Patrick explains the utility of Newton's Method.

He is able to draw in the asymptote lines on the graph created by the first iterations as well as the approximations as they grew closer to the root of the function. The audio explanation as well as visual guidance allows for thorough understanding of the content. He then continues to make a bad initial choice and explains how, both through words and visually why Newton's Method fails if the initial guess isn't good enough. This has been the most clear example and explanation as to why a bad initial guess does not produce accurate approximations using Newton's Method.

It is about two minutes into the video when he starts his example of Newton's Method, where he spends the remaining five minutes of his time. He goes over the example in detail allowing the viewers to understand his process. The only issue with video is that as he continues on he has to erase his board to make room for new content, making it harder to recall all the steps to solving a problem. I think a video is a really good initial approach to introducing the topic of Newton's Method, but it is not easily referred back to for reference.

Ranking of Sources

After analyzing the data presented by each source as well as considering their audiences, I have concluded that Source 1 is the most helpful and useful source to introduce and allow thorough explanation of Newton's Method. Though it was vague at initially stating what was a good initial choice, it was explained in further details further on in the document. Source 3 took second place as it worked very well at introducing the topic with detailed explanation, but failed in the sense of utility and helpfulness to refer back on the subject. I suggest as an introduction to Newton's Method that one could use a video accompanied with a worksheet like Source 1 optimizing the understanding of the audience. Source 2 was the least helpful/useful source of them all, even considering that their audience would have higher levels of math comprehension. Source 3 stated short complex equations with very little explanation. The graphs are only useful if one is using the Wolfram

Language and therefore applies to an even smaller audience who might be inferring on Newton's Method. I think with learning any new theorem or method that searching multiple sources and getting several different views and takes on the subject will ultimately increase one's learning and comprehension overall.

Work Cited

"Newton's Method." UBC Calculus Online Course Notes, www.ugrad.math.ubc.ca/coursedoc/n

"Newton's Method." From Wolfram MathWorld, mathworld.wolfram.com/NewtonsMethod.h

PatrickJMT. "Newton's Method." YouTube, YouTube, 9 Nov. 2008, www.youtube.com/watch?v=1uN8cBGVpfs.