Miniproject 4: Linear Approximation and Calculus

Overview: In this miniproject you will put the idea of the *local linearization* of a function to build linear approximations to complex functions and then make *interpolations* and *extrapolations* using them.

Prerequisites: Sections 1.8 in *Active Calculus*, which focuses on this topic. **Completion of Miniprojects 1 and 2 is recommended before doing this miniproject**.

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1. A potato is placed in an oven, and the potato's temperature F (in degrees Fahrenheit) at various points in time is taken and recorded in the following table. The time t is measured in minutes.

t	0	15	30	45	60	75	90
F	70	180.5	251	296	324.5	342.8	354.5

   (a) Use a central difference to estimate $F'(75)$. Use this estimate as needed in subsequent questions in this problem.

   (b) Find the local linearization $y = L(t)$ to the function $y = F(t)$ at the point where $a = 75$.

   (c) Determine an estimate for $F(72)$ by employing the local linearization. Terminology: This estimate is called an *interpolation* because we are estimating a value that lies within a data set, between two known data points.

   (d) Do you think your estimate in (c) is too large, too small, or exactly right? Why?

   (e) Use your local linearization to estimate $F(100)$. Terminology: This estimate is called an *extrapolation* because we are estimating a value that lies outside the range of values of a data set.

   (f) Do you think your estimate in (c) is too large, too small, or exactly right? Why?

   (g) Plot both F and L and comment on how or when the line $L(x)$ is a good approximation of $F(X)$.

Submission instructions: The writeup that you prepare is to be saved as a PDF file and submitted using Canvas. (You may use any program you want to write the writeup but the submission *must* be a PDF, or your work will be marked at Novice level and returned without comment. You may important screenshots to show the Desmos output for any steps. Just remember to be neat with your work.)