Calculus Quiz 2: Prof. Kaplan

January 30, 2025

Student name: _____. Do what you can in 15 minutes.

Question 1: Figure 1 shows a function $Af(a(x - x_0)) + B$ that uses input scaling and output scaling on a pattern-book function.
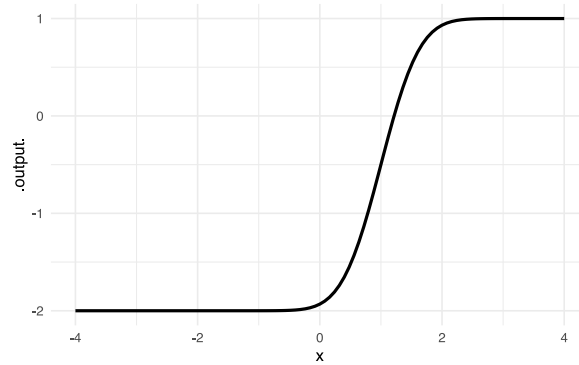

Figure 1: $Af(a(x - x_0)) + B$

  i. Which pattern-book function is involved?

 ii. Give numerical values for each of the four parameters.

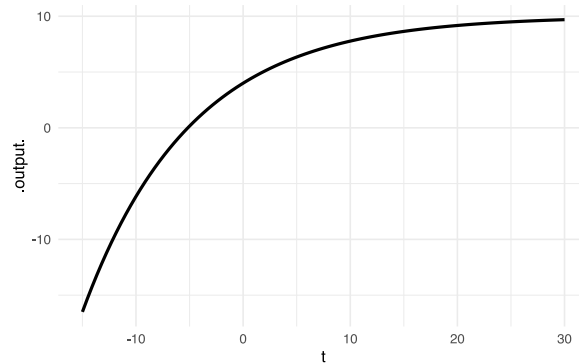**Question 2**: Figure 2 shows an exponential function with input and output scaling.

Figure 2: For Question 2.

   i. Is this exponential decay or exponential growth?

  ii. What is the baseline parameter B?

 iii. Find either the half-life or the doubling-time depending on your answer to (i).

Question 3: Draw a graph of $g(t) \equiv 3\sin\left(\frac{2\pi}{4}t\right) - 5$ over a domain of your choice but which clearly shows the period. Place reasonably accurate labelled tick marks along the two axes.

Question 4: Figure 3 shows a handful of data points and a candidate function not them.

i. Draw in the residual for each data point, quantify it, and calculate the "sum of squared residuals." (You can round off reasonably in quantifying the residuals.)

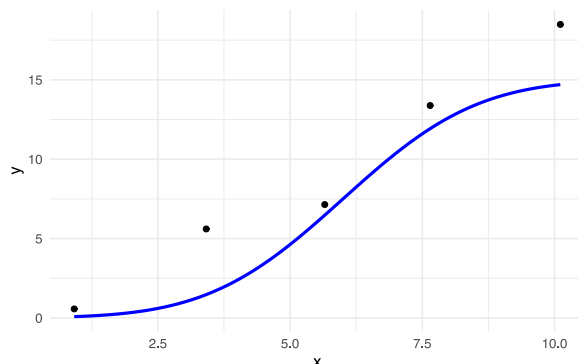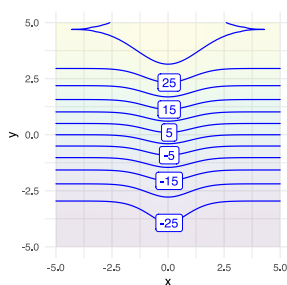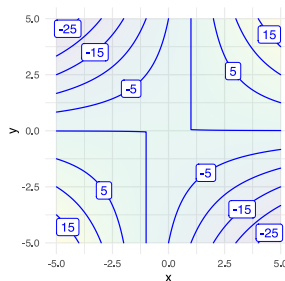ii. Draw in a better fitting function of the same shape.
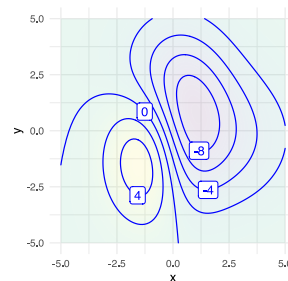

Figure 3: Data and a fitted function

Question 5:

(a) $f(x, y)$

(b) $g(x, y)$

(c) $h(x, 7)$

Figure 4: Plots for Question 5

Above are contour plots for three unrelated functions: $f(x, y)$, $g(x, y)$, and $h(x, y)$. One of the three involves a linear combination of two functions $u_1(x)$ and $u_2(y)$. Another is defined piecewise. The third is a nonlinear combination (e.g. function multiplication).

a. We haven't talked about the features of a function of two variables that would let you answer this question precisely, but which contour plot corresponds to which kind of function?

  i. $f(x, y)$: linear-comb or piecewise or nonlinear-comb

  ii. $g(x, y)$: linear-comb or piecewise or nonlinear-comb

  iii. $h(x, y)$: linear-comb or piecewise or nonlinear-comb

b. Briefly explain what feature(s) in the contour plots informed your answer to (a).