All work is to be done in a programming notebook either Mathematica and Jupyter (python3).
Please refer to the blackboard site for commands and examples.
Submissions must be made electronically on blackboard, consider using a GitHub repository to store your code.
You will be graded on the output that I am able to generate from your commands.

1. Let the last digit of your student number be a (if it happens to be a zero use $a = 10$). Consider the function

$$f(x) = \sqrt{ax + 1}.$$

   (a) Define the function $f(x)$ in the programming language. Compute $f(0)$.

   (b) Find the value b for which the domain of the function is $[b, \infty)$. Be sure to explain in words how you found b.

   (c) Plot the function from b to 5.

2. Consider the function built by compositions, where a is as defined above and n is a natural number,

$$f_0(x) = \frac{1}{a - x} \qquad \text{and} \qquad f_{n+1} = f_0 \circ f_n.$$

   (a) Plot f_0, f_1, f_2, f_3 on the same screen and describe the effects of repeated composition.

   (b) Make a prediction for what function $f_n(x)$ might be. Explain in words.

3. The point $P(1, 0)$ lies on the curve $y = \sin\left(\frac{2a\pi}{x}\right)$, for a as defined above.

   (a) If Q is the point $\left(x, \sin\left(\frac{2a\pi}{x}\right)\right)$, find the slope of the secant line PQ for $x = 2$, $x = 1.5$, $x = 1.1$, $x = 1.01$ and $x = 1.001$ You can do each individually or use an automation in the programming language. Do these slopes appear to be approaching a limit, explain in words.

   (b) Use a graph of the curve to explain why the slopes of the secant lines in part 3a are not close to the slopes of the tangent line at P.

   (c) By choosing appropriate secant lines, estimate the slope of the tangent line at P.