Name:______________________________________________________________

Write all of your responses on the exam paper. Remember that there is no sharing of calculation devices on this exam. If an exact value is requested, give your answer in exact form. Otherwise, give an approximation to the value correct to at least 8 decimal places.

1. (20 points) Consider the function

\[ f(x) = \left( \cos(x) - x^2 \right)^{7/x^2} \]

(a) Find the exact value of

\[ \lim_{x \to 0} f(x) \]

(b) Find \( f'(x) \)

(c) Find the tangent line to \( f(x) \) at \( x = -\frac{1}{3} \).

(d) This function has two points of inflection on the interval \([-1, 1]\), find them.
2. (20 points) Consider the function

\[ f(x) = \sin(x) \cos(x^2 + x) \]

on the interval \([0, \pi]\)

(a) Draw a graph of the function on the specified interval and label all of the local maximums, local minimums and inflection points.

(b) What are the critical values?

(c) Find the intervals where the function is increasing and decreasing.

(d) Find all of the relative extrema.

(e) Find the intervals where the function is concave up and concave down.

(f) Find the inflection points.

(g) Say that this function represents the position of a particle and \(x\) represents time, measured in seconds. Where is the acceleration a maximum within the first two seconds of the particle’s motion?