TMATH 124: Quiz 6

You may use any work of yours that you made from last week. This includes, practice book problems and worked out WebAssign problems. This does not include photocopies of notes from the book or tutorials shown on WebAssign. Graphing calculators are also not allowed. In short, you are only allowed to use work that you created.

Show all your work (numerically, algebraically, or geometrically) for each and simplify. No credit is given without supporting work.

1. [4] Use the graph of the Cost function below to estimate the value of c that satisfies the conclusion of the Mean Value Theorem for the interval [5, 25].

2. [4] Find the limit of each of the following:

\[
\lim_{x \to \infty} x \sin \left( \frac{5\pi}{x} \right) = \lim_{x \to \infty} \frac{\sin \left( \frac{5\pi}{x} \right)}{\frac{1}{x}} = 0
\]

\[
\lim_{x \to 5} \frac{x^3 + x - 30}{x - 5} = \lim_{x \to 5} \frac{(x+6)(x-5)}{x-5} = 5 \cdot 6 = 30
\]

\[
\lim_{x \to 0} \frac{\cos \left( \frac{5\pi}{x} \right) - \frac{5\pi}{x}}{\frac{1}{x}} = \lim_{x \to 0} \frac{-\sin \left( \frac{5\pi}{x} \right)}{\frac{1}{x}} = 0
\]

\[
\lim_{x \to \infty} \frac{5\pi \cos \left( \frac{5\pi}{x} \right)}{1} = 5\pi
\]
3. Assume the relationship between price \( p \) and quantity demanded \( q \) is linear. Market research shows that 10,000 items are sold when the price is $5, and 12,900 items are sold when the price is $4.50.

(a) [2] Find the revenue function that results from selling \( q \) items for \( p \) as only a function of \( q \).

Looking for \( p = mg + b \) \( \circ \)  

\[ p = \frac{5-4.5}{10000-12900} \cdot 12900 = \frac{1}{5800} \]

Thus \( p = \frac{1}{5800}q + \frac{195}{29} \)

(b) [3] Use calculus to find the price and quantity that will maximize revenue.

Revenue = \( P \cdot q \) \( \circ \)  

\[ Revenue = \left( \frac{-1}{5800} q + \frac{195}{29} \right) q \]

\[ Revenue' = \frac{-1}{2900} q + \frac{195}{29} \]

To find the critical points \( \circ \)

\[ 0 = Revenue' \]

\[ 0 = \frac{-1}{2900} q + \frac{195}{29} \]

\[ q = 19500 \]

Revenue = \( 19500 \) \( \circ \)

Revenue \( (19500) \)

\[ Max \] \( \circ \)

when \( q = 19500 \) and

\[ p = \frac{-1}{5800} (19500) + \frac{195}{29} \]

\[ \approx 3.36 \]