1. [11 points] The temperature in degrees Celsius ($^\circ$ C) of a certain cup of hot tea x minutes after it has been poured is given by $T(x) = 20 + 60\left(\frac{1}{2}\right)^{x/30}$.

a. [2 points]

    i. What was the initial temperature of the tea in degrees Celsius?

                                          Answer: _____ $^\circ$ C

    ii. What is $\lim\limits_{x \to \infty} T(x)$?

                                            Answer: _____

b. [3 points] The hot tea sits on a table cooling for an entire hour before you remember to drink it. Find the average rate at which the tea cools during this hour. *Your answer should be a positive number. Include units.*

                    Answer: _____

c. [3 points] If t is the temperature of a liquid in degrees Celsius, then its temperature in degrees Fahrenheit is $f(t) = \frac{9}{5}t + 32$.

    i. [2 points] Find constants m and b such that $f^{-1}(x) = mx + b$.

               Answers: $m =$ _____ $b =$ _____

    ii. [1 point] Write an expression for the temperature of the tea in degrees Fahrenheit x minutes after it has been poured. *Your answer may involve one or both of the letters T or f, but it does not have to; either way, you do <u>not</u> need to simplify.*

                    Answer: _____

d. [3 points] Assuming the tea was poured at 12 noon, circle the **<u>one best</u>** practical interpretation of the fact that $(T^{-1})'(50) \approx -1.5$.

    i.   At 12:50 pm, the tea is cooling at a rate of about 1.5° C per minute.

    ii.   It takes about three minutes for the tea to cool down from 51° C to 49° C.

    iii.   50 minutes after the tea was poured, it takes the tea about 90 seconds to cool down 1° C.

    iv.   It takes about a minute for the tea to cool down from 51.5° C to 50° C.

    v.   The tea had a temperature of 60° C fifteen minutes before its temperature was 50° C.