Instructions:

• Your exam contains 4 problems.
• Your exam should contain 5 pages; please make sure you have a complete exam.
• Box in your final answer when appropriate.
• Unless stated otherwise, you MUST show work for credit. No credit for answers only. If in doubt, ask for clarification.
• Your work needs to be neat and legible.
• You are allowed one 8.5 \times 11 sheet of notes (both sides). Graphing calculators are NOT allowed; scientific calculators are allowed.
• Round off your final answers to 2 decimal places, unless you are asked for exact answers.

Problem #1 (15 pts) ________________________
Problem #2 (13 pts) ________________________
Problem #3 (13 pts) ________________________
Problem #4 (9 pts) ________________________

TOTAL (50 pts) ________________________
1. Knotweed is an invasive plant. In the year 2000 there were 100 knotweeds in Greenforest. In 2002 the number of knotweeds in Greenforest had grown to 150, and there were 200 knotweed plants in Greenforest in 2005. Assume that the number of knotweed plants in Greenforest can be modeled by a linear to linear function.

(a) Let $f(t)$ be the function defined on $0 \leq t < \infty$, giving the number of knotweeds in Greenforest $t$ years after 2000. Find a formula for $f(t)$.

(b) In the long run how many knotweeds will there be in Greenforest, according to this model?

(c) Find a formula for $f^{-1}(w)$, the inverse of $f(t)$.

(d) Calculate $f^{-1}(250)$ and explain in words what is the meaning of this value.
2. Below you are given the graph of \( f(x) \). The domain of \( f(x) \) is \( 0 \leq x \leq 4 \) and the range is \( -1 \leq y \leq 3.8 \)

\[
\text{y=f(x)}
\]

a) What is the value of \( f(f(2)) \) ?

b) What is the value of \( f^{-1}(2) \) ?

c) Which of the following is the graph of \( 2f(x+3)-1 \)? Circle the correct graph.

d) Find the domain of \( \frac{f^{-1}(2x+1)}{x-1} \)
3. Town A population triples every 100 years. City B population doubles every 90 years. In
the year 2000 the two cities have the same population of 10000. When will city A have
twice as many inhabitants as city B?
4. The cost \( c(x) \) of making \( x \) items is \( c(x) = 2x^2 - 200x + 15000 \). How many items do you need to make in order to minimize the cost?

Suppose that the revenue \( r(x) \) produced by selling \( x \) of the above items is also modeled by a quadratic function. The revenue produced by selling 0 items is of course 0, and the revenue is at a maximum of $30,000 when 100 items are sold. How many items \( x \) should be made and sold in order to maximize the profit \( p(x) = r(x) - c(x) \) (revenue - cost)?