

Name:

Instructions:

- Attempt all questions.
- The test is out of 100 marks.
- There are 7 questions; Questions 1–4 are 10 marks each; Questions 5–7 are 20 marks each.
- You have 65 minutes to complete the test.

Advice:

- Budget your time.
- First, do those questions which you know how to do immediately.
- Leave questions which you find difficult until last.
- Ask for clarification if you do not understand a question.
- You must show your work. Label sketches well (points of interest, asymptotes, axes, etc).

Good Luck!

Problem 1. (10 marks) Assuming x , y , and z are positive, use properties of logarithms to write the expression as a single logarithm.

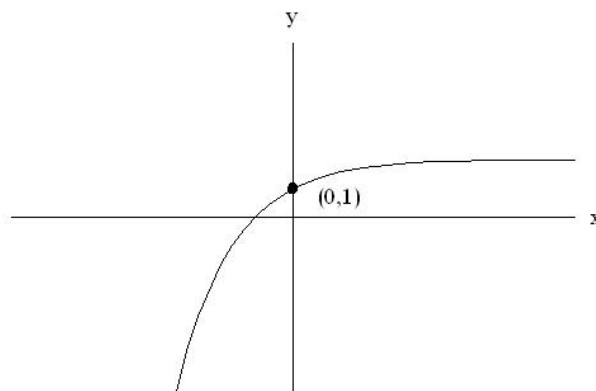
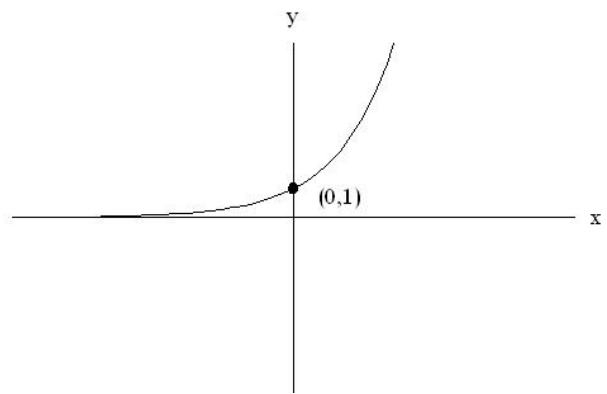
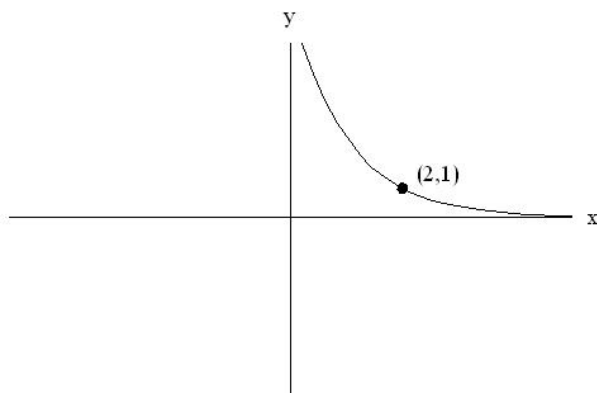
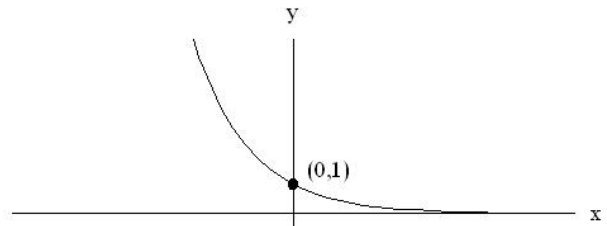
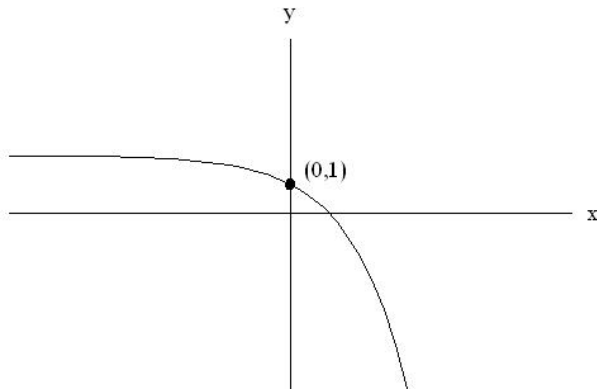
$$3\ln(x^3y) + 2\ln(yz^2) - \ln(xyz)$$

Problem 2. (10 marks) Solve the equation $\frac{44}{1 + 4e^{-x/7}} = 32$ algebraically.

Problem 3. (10 marks) Find the inverse function $f^{-1}(x)$ if $f(x) = -2e^{-x}$.

Problem 4. (10 marks) Match the functions to their graphs. You do not need to show any work for this problem.

- a) $y = e^x$ b) $y = e^{-x}$ c) $y = 2 - e^{-x}$ d) $y = 2 - e^x$ e) $y = e^{2-x}$



Problem 5. (20 marks) Solve the equation $\ln(x + 10) + \ln x = 2$ algebraically. Be sure to eliminate any extraneous solutions.

Problem 6. (20 marks) Suppose a culture of 100 bacteria is put in a petri dish and the culture doubles in size every 2 hours. Find an expression for the number of bacteria present at any time t hours later. At what time will the number of bacteria be 35×10^3 ? Show your work.

Problem 7. (10+10=20 marks) Given $f(x) = \ln(\sqrt{x})$, $g(x) = e^{x/4}$, and $h(x) = x^2$. Find the following functions, and simplify as much as possible. Your final answers should **not** have exponentials and logarithms in them.

a) $(f \circ g \circ h)(x)$

b) $(h \circ g \circ f)(x)$