

**Exam 3**  
**Chapters 3,4 and 5**

---

Answer the following questions. *You must show your work to receive full credit.* Be sure to make reasonable simplifications. Give exact answers. Indicate your final answer with a box.

1. (8 points) Evaluate the following logarithms without using a calculator. (Show at least one step of work for credit.)

- $\log_3\left(\frac{1}{27}\right)$
- $\log_8(2)$

---

2. (6 points) Use logarithm rules to combine the following into a single logarithm.

$$2 \ln(a + b) + 2 \ln(a - b) - \ln(c).$$

**3.** A patient is administered 180 mg of a therapeutic drug. It is known that 30% of the drug is expelled every hour.

- (a) (2 points) Find an exponential model for the amount of drug remaining in the patient's body after  $t$  hours.
- (b) (3 points) Use the model to predict the amount of the drug that remains in the patient's body after 6 hours.
- (c) (3 points) Use the model to predict how long it will take before there is only 30 mg of the drug remaining in the patient's body.

4. A bacterial infection starts with 1500 bacteria and the bacterial count quadruples every 8 hours.
- (a) (3 points) Find an exponential growth model for the number of bacteria after  $x$  8 hour time periods.
  - (b) (3 points) Find an exponential growth model for the number of bacteria after  $t$  hours.

5. Shalan invests \$5000 dollars into investment option A that earns 6% interest each year, compounded semiannually. He also invests \$3000 dollars into investment option B that earns 9% interest each year, compounded continuously.

- (a) (3 points) Find a model for the amount of money accrued in investment A after  $t$  years.
- (b) (3 points) Find a model for the amount of money accrued in investment B after  $t$  years.
- (c) (2 points) How many years will it take before investment B outgrows investment A?

6. (4 points) Determine if the two functions below are inverses of each other.

$$h(x) = 10 \cdot 4^x \quad \text{and} \quad l(x) = \log_4\left(\frac{x}{10}\right).$$

---

7. (6 points) Let  $f(x) = 2x^2$  and  $g(x) = x - 1$ . Find  $f(g(x))$ .

8. (4 points) Consider the function given by the graph below. Is it invertible? Explain your reasoning.

