

Practice for test

1. Solve for x : $3^{x-3} = 9^{2x-5}$
2. Solve for x : $\log(x+2) - \log 5 = \log(x+2) - \log x$
3. Solve for a : $\log_4 3a + \log_4 5 = 2$
4. Solve for x : $x^2 - 4x = \log_2 32$
5. Solve for c : $2^{2c} - 5(2^c) = 14$

The next two problems (6 & 7) use Newton's Law of Cooling. (D_o is the initial temperature difference between an object and its surroundings, and if its surroundings have a temperature T_s , then the temperature of the object at time t is modeled by the function $T(t) = T_s + D_o e^{-kt}$ where k is a positive constant that depends on the type of object)

6. **Cooling Soup:** A hot bowl of soup is served at a dinner party. It starts to cool according to Newton's Law of cooling so that its temperature at time t is given by $T(t) = 65 + 145e^{-0.05t}$ where t is measured in minutes and T is measured in °F.
 - (a) What is the initial temperature of the soup?
 - (b) What is the temperature after 10 minutes?
 - (c) After how long will the temperature be 100°F?

7. **Time of Death:** Newton's Law of Cooling is used in homicide investigations to determine the time of death. The normal body temperature is 98°F. Immediately following death, the body begins to cool. It has been determined experimentally that the constant in Newton's Law of Cooling is approximately $k = 0.1947$, assuming time is measured in hours. Suppose that the temperature of the surroundings is 60°F.

- (a) Find a function $T(t)$ that models the temperature t hours after death.
- (b) If the temperature of the body is now 72°F, how long ago was the time of death?

8. **Options:** Frances is just about to have his thirtieth birthday when he discovers he will inherit \$100,000. Being a cautious young man, he wants to put it all in savings so he can retire on it when he is sixty-five. Unfortunately, Frances never took Math Analysis. He's afraid his investment advisor is lying to him when he tells him that there isn't that much difference between the three options (shown below), but option C is the best deal because it is compounded monthly. Frances figures the higher the interest rate, the better the deal. With clear algebra, show Frances which option he should take.

Option A. . . . 7% annual interest rate, compounded annually.

Option B. . . . 6.9% annual interest rate, compounded quarterly.

Option C. . . . 6.8% annual interest rate, compounded monthly.

9. Graph a) $y = 2 + \log_3(x - 5)$ b) $y = (.78)^{x-4} - 3$ c) $y = \left(\frac{8}{3}\right)^x + 5$

10. Simplify: a) $\log_a \frac{m^2}{n\sqrt{5}}$ b) $\log_2 8^3 \cdot \frac{4^2}{64^{\frac{1}{2}}}$ c) $3ae^{\ln x^5}$

11. **Wealth Distribution:** Vilfredo Pareto (1848-1923) observed that most of the wealth of a country is owned by a few members of the population. **Pareto's Principle** is $\log P = \log c - k \log W$ where W is the wealth level (how much money a person has) and P is the number of people in the population having that much money.

- (a) Solve the equation for P .
- (b) Assume $k = 2.1$, $c = 8000$, and W is measured in millions of dollars. Use part (a) to find the number of people who have \$2 million or more. How many people have \$10 million or more?