1. Solve for t, and simplify whenever possible.
   (a) $3e^{-4t} = 5$
   (b) $2 = e^3 \cdot e^{2t}$
   (c) $t^2 = e^6$
   (d) $(\frac{4}{3})^{-t} = 7$
   (e) $e^{\frac{1}{3}\ln t} = 27$
   (f) $e^{-\frac{1}{3}\ln t} = 27$
2. Compute the following integrals:
   (a) $\displaystyle\int \frac{1}{2t}\,dt$
   (b) $\displaystyle\int \frac{1}{3-4t}\,dt$
3. Find the general solution of the following differential equations.
   (a) $y' = ty$
   (b) $ty' = -2y$
   (c) $y' = e^{t-y}$
4. Suppose that $1200 is invested at a rate of 5%, compounded continuously.
   (a) Assuming no additional withdrawals or deposits, how much will be in the account after 10 years?
   (b) How long will it take the balance to reach $5000?
5. Tritium is an isotope of hydrogen that is sometimes used as a biochemical tracer. Suppose that 100 mg of tritium decays to 80 mg in 4 hours. Determine its half-life.
6. Suppose a cold beer at 40°F is placed into a warm room at 70°F. Suppose 10 minutes later, the temperature of the beer if 48°F. Use Newton's law of cooling to find the temperature 25 minutes after the beer was placed into the room.
7. A murder victim is discovered at midnight at the temperature of the body is recorded at 31°C. One hour later, the temperature of the body is 29°C. Assume that the surrounding air temperature remains constant at 21°C. Use Newton's law of cooling (the differential equation $T' = k(A - T)$) to calculate the victim's time of death (when his body temperature was 37°C).
8. A parachutist of mass 60 kg free-falls from an airplane at an altitude of 5000 meters. He is subjected to an air resistance force proportional to his speed. Assume that the constant of proportionality is $r = 10$ kg/sec.

(a) Find and solve the differential equation govering the velocity of the parachuter at time t seconds after the start of his free-fall.

(b) Assuming he does not deploy his parachute, find his limiting velocity and how much time will elapse before he hits the ground (you may need to use a computer for this last part, a visual approximation from the appropriate graph is fine).

9. In our model of air resistance, the resistance force has depended only on the velocity. However, for an object that drops a considerable distance, such as the parachutist in the previous exercise, there is a dependence on the altitude as well. It is reasonable to assume that the resistance force is proportional to air pressure, as well as to the velocity. Furthermore, to a first-order approximation, the air pressure varies exponentially with the altitude (i.e., it is proportional to e^{-ax}, where a is a constant and x is the altitude). Propose and justify (*but do not solve!*) a differential equation model for the velocity of a falling object subject to such a resistance force.