1. Suppose a snowball has radius $r_0$ at time 0. As time goes by, the volume of the snowball is decreasing proportionally to its surface area. Find the radius $r(t)$ of the snowball at time $t > 0$.
   (Hint: A ball of radius $r$ has volume $\frac{4}{3} \pi r^3$ and surface area $4\pi r^2$.)
2. Solve the initial value problem $y' - 3t^2 y = t^2$, $y(0) = 1$.
3. Given are two tanks containing 50 gallons of water each. At time 0, the first tank contains 1 lb of dye thoroughly mixed, and there is no dye in the second tank. Now, water is entering the first tank at a rate of 5 gallons per minute. From the first tank water is flowing into the second tank at a rate of 5 gallons per minute. And water is leaving the second tank, also at a rate of 5 gallons per minute.
   (a) Draw a picture.
   (b) Determine the amount of dye in the first tank at time $t$.
   (c) Determine the amount of dye in the second tank at time $t$.
4. Separate the variables to solve the initial value problem $P' = 2P - 2tP$, $P(0) = 5$.
5. In 1920, R. Pearl used experiments to show that the rate of change in a population of the fruit fly “drosophila” is equal to $\frac{1}{5} P(t) - \frac{1}{1275} P^2(t)$, where $P(t)$ is the quantity of the population after $t$ days. Assume that we have 10 flies at time 0.
   (a) Find $P(t)$ for $t > 0$.
   (b) How many flies are there after 12 days?
   (c) Find the limit of $P(t)$ as $t \to \infty$ and give an interpretation of your result.