# MA205 - Integral Calculus
# Lesson 44: Analytic Solutions I - Separation of Variables

Solve the following differential equations *by hand* using separation of variables. When you are finished, check each solution using Mathematica's `DSolve` command.

1. $\dfrac{dR}{ds} = (Rs)^2$

   $R(1) = 3$

2. $\dfrac{dy}{dt} = 2 - y$

   $y(0) = 1$

3. $\dfrac{dx}{dt} = \dfrac{e^{2t}}{4x^3}$

4. $\dfrac{dy}{dt} = y^{-1}t + y^{-1}\cos(t)$

   $y(0) = -1$

5. At the time it starts up, a small company has a total of $\$150,000$ in its accounts. Each year, money is drawn out of the company accounts at a constant rate of $\$10,000$ per year, due to fixed costs. At the same time, as the company grows, their incoming dollars total 8 percent of their current holdings.

   (a) Write down a differential equation that models the above situation. Remember to name your variables!

   (b) Find an expression for the amount of money in the company's accounts after $t$ years.

   (c) Do you think the company is profitable in the long run?