2.1 Exercises

Problem 1 **Solve the initial value problem**: $\frac{dx}{dt} = 9 - 4x^2, \qquad x(0) = 0.$

(**Hint**: **you will need to use partial fractions**).

Problem 2 **Consider a prolific breed of rabbits whose birth and death rates**, β **and** δ, **are each proportional to the rabbit population** $P = P(t)$, **with** $\beta > \delta$.

Show that $P(t) = \frac{P_0}{1-kP_0t}$, **with** k **constant**: **Note that as** $t \to \frac{1}{kP_0}$ we have $P(t) \to +\infty$. **This is doomsday**.

Problem 3 Recall the Logistic Equation, $\frac{dP}{dt} = kP(M - P)$.

Suppose that at time $t = 0$, half of a "**logistic**" **population** of $100,000$ persons have heard a certain rumor, and that the number of those who have heard it is then increasing at the rate of $1,000$ persons per day. How long will it take for this rumor to spread to 80% of the population?