

MTH 370, Fall 2009
Homework 6

Instructions: Do these calculations by hand (you may use a computer or calculator for simple arithmetic and function evaluations) and show your work.

1. Solve the following first-order ODEs using either separation of variables or integrating factors. Then determine the limit of the solution as $t \rightarrow \infty$.

(a) $\frac{dx}{dt} = rx(1-x)$ ($r > 0$)

(b) $\frac{dx}{dt} = -rx \ln(x)$ ($r > 0$)

(c) $\frac{dx}{dt} = rx - e^{-t}$ ($r > 0$)

2. Find the equilibria of the following first-order ODEs and determine their stability. Then draw a phase-line diagram illustrating your findings.

(a) $\frac{dx}{dt} = -rx(x-\alpha)(x-1)$ ($r > 0, \alpha \in (0,1)$)

(b) $\frac{dx}{dt} = -rx(\ln(x)-1)$ ($r > 0$)