HW-1
Math 537 Ordinary Differential Equations
Due 11:59 PM Sep 11, 2020

Student Name: _____ **ID** _____

Solve the following problems, discuss results, and perform linear stability analysis near equilibrium points.

1: [20+5 points]

$$\frac{dx}{dt} = f(x),$$

here (i) $f(x) = x$; (ii) $f(x) = x^2$; and (iii) $f(x) = x^3$.

(a) Perform (linear) stability analysis. [20 points]

(b) Find and analyze the corresponding solutions. [5 bonus points]

2: [20 points]

$$\frac{dx}{dt} = x^2 - 2x.$$

3: [30 points]

$$\frac{dx}{dt} = -(\alpha x + x^3)$$

for $x \geq 0$ and $x(t = 0) = x_o$.
[Hint: set $r = x^2$, solve for r and discuss the results when $\alpha < 0$, $\alpha = 0$ or $0 < \alpha$.]

4: [30 points] Analyze the following ODE with $\beta > 0$:

$$\frac{dx}{dt} = \beta x(1-x) - h$$

for all values of the parameter $h > 0$.