MATH 246 Groupwork 1.5

Name: _____

1. Consider the following autonomous differential equation:

$$y' = y(y-1)(y-5)^2$$

(a) Draw a phase-line portrait for this DE.

(b) Sketch a reasonable family of solutions.

(c) Classify each constant solution as stable, unstable or semistable.

(d) Suppose y(t) were a population in thousands at time t in years. Furthermore suppose at some instant in time y = 5 and then due to some biological consideration the population fluctuated slightly. Explain what would happen.

2. The differential equation

$$y' = \frac{t}{y(y-3)}$$

has solutions given by

$$y^3 - \frac{9}{2}y^2 - 3C - \frac{3}{2}t^2 = 0$$

for various C. If we select a collection of C values and plot the resulting equations we get:



On this graph trace the solutions to the IVP associated with the following initial conditions and label which is which:

- (a) y(0) = 1
- (b) y(0) = 4
- (c) y(-4) = -2
- (d) y(-4) = 2

3. The following graph shows the direction field associated to the differential equation

$$y' = \frac{t}{y^2(y-3)}$$

On this graph trace the solutions to the IVP associated with the following initial conditions and label which is which:

- (a) y(-3) = 1. Identify the (approximate) relative maximum and label with its coordinates.
- (b) y(-4) = 4
- (c) y(0) = -4