## MATH 246 Groupwork 1.5

Name: $\qquad$

1. Consider the following autonomous differential equation:

$$
y^{\prime}=y(y-1)(y-5)^{2}
$$

(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

$$
y^{\prime}=\frac{t}{y(y-3)}
$$

has solutions given by

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

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

$$
y^{\prime}=\frac{t}{y^{2}(y-3)}
$$



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) $y(0)=-4$

