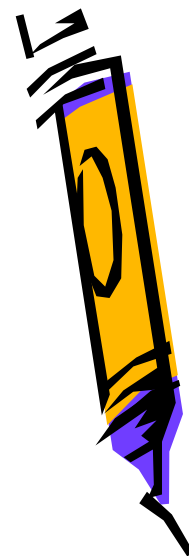
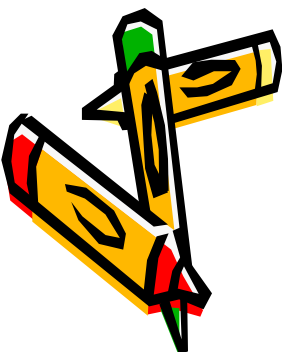


Math 204, Exam 1

September 30, 2008



There are five problems. Each problem is worth twenty points. The total exam is worth hundred points. You may use a calculator, something to write and something to erase, but nothing else. Show all work. Full credit will be given only if work is shown which fully justifies your answer. Turn off your cell phone if you have one. Do not turn this page until told to do so. This is a fifty-minute exam.



#	1	2	3	4	5	Σ
P						
Σ	20	20	20	20	20	100

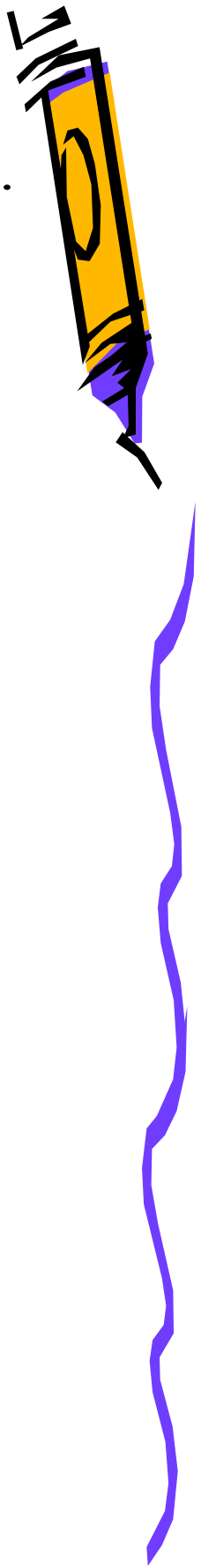
Problem 1, part (a)

Verify that $y(x) = -1/(x+c)$ is a family of solutions of the differential equation $y' = y^2$.



Problem 1, part (b)

Find a solution from this family satisfying $y(0)=1$.



Problem 2, part (a)

Find the critical points and phase portraits of the ODE $y' = y^2(4 - y^2)$. By hand, sketch typical solution curves in the regions in the xy -plane determined by the graphs of the equilibrium solutions.



Problem 2, part (b)

Classify each critical point as asymptotically stable, unstable, or semi-stable.



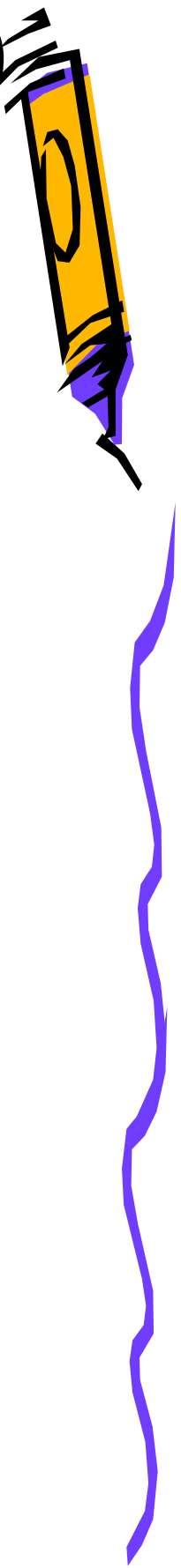
Problem 3, part (a)

A tank contains 200 liters of fluid in which 30 grams of salt is dissolved. Brine containing 1 gram of salt per liter is then pumped into the tank at a rate of 4 liters per minute; the well-mixed solution is pumped out at the same rate. Find an IVP for the number $A(t)$ of grams of salt in the tank at time t .



Problem 3, part (b)

Solve the IVP to find $A(t)$.



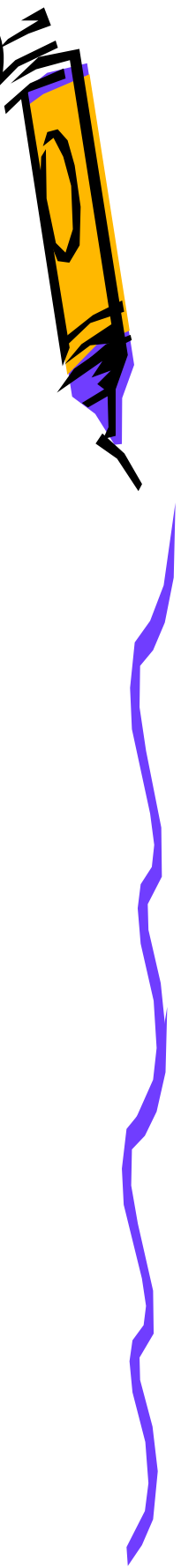
Problem 4, part (a)

A tank is leaking water through a circular hole in its bottom. The height h of water in the tank is described by $h' = -(\sqrt{h})/576$. Solve for h if the initial height of the water is 10 feet.



Problem 4, part (b)

How long will it take to empty the water?



Problem 5

Find the general solution of $3y''+2y'+y=0$.

