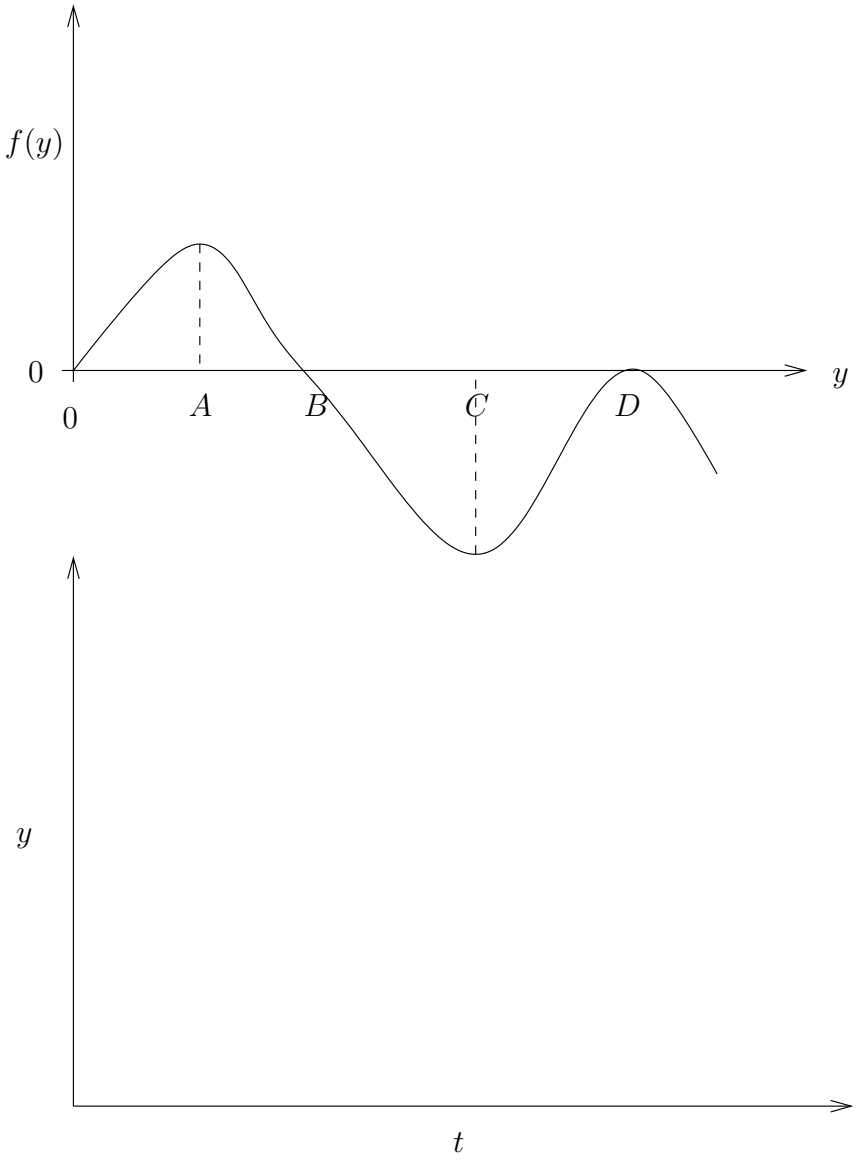
Math 305 Test 1 Spring 1999

Name: _____ ID #: _____

Part I: NO CALCULATORS

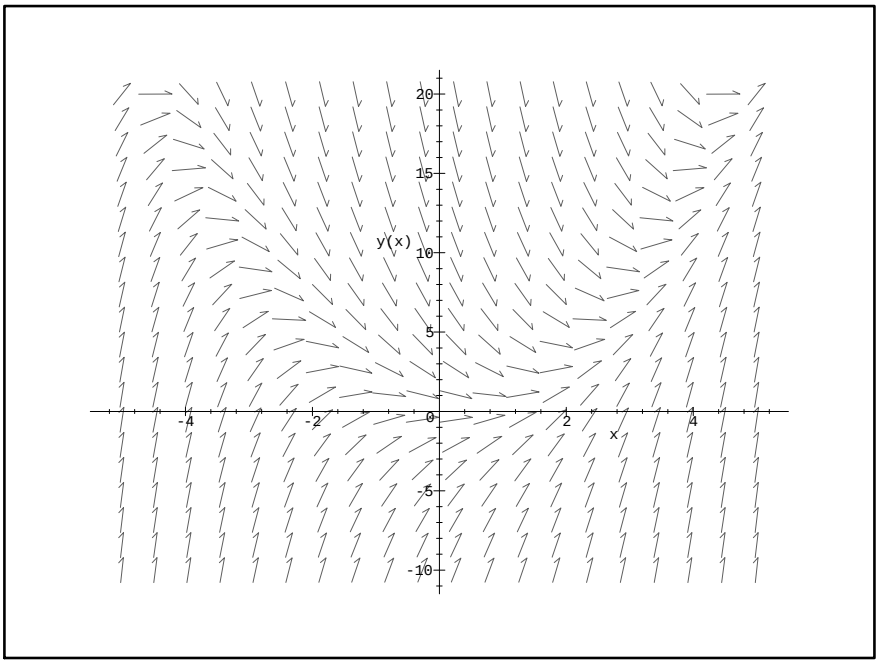
1. [10 points] Suppose $y'(t) = F(y(t))$, where the graph of $F(y)$ is given below. Carefully draw the integral curves for this equation. What are the equilibrium solutions? What are their stability types? Describe the initial concavity of the solution curves. Assume $y(t)$ and t are nonnegative.



2. [10 points] The direction field below is from $y' = Ay^2 + Bx^2 + Cy + Dx + E$, where each of the coefficients is either 1, 0 or -1. Find them.

3. [20 points] Solve the initial value problem $y'' + 2y' - 15y = 0$, $y(0) = 1$, $y'(0) = a$. For which value(s) of a is $\lim_{x\to\infty} y(x) = 0$?

4. [20 points] Consider the equation $3y^2y' + 2y^3 = x$. This equation can be made linear by using the change of variable $v = y^3$. Do this, then solve the equation for $y(x)$. Hint: $\int ue^u\,du = (u-1)e^u + C$.



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Part II: CALCULATORS ALLOWED

5. [20 points] A tank has 100 gal. of fresh water. A flow of 2 gal/min of salt water with saliently 1/2 lbs/gal starts at $t = 0$. The solution in the tank is well mixed and is being drained off at a rate of 1 gal/min. How much salt is in the tank when the volume of water has reached 200 gal.?

6. [20 points] A 32 pound weight is dropped into a tank of fluid 320 feet deep. The weight lands on the tank bottom after 15 seconds. Find the fluid's resistance coefficient k, assuming the resistance is proportional to the speed of the weight. Note: You will not be able to solve for k. Instead set up a function in k whose zero gives the desired value. Graph this function and zoom in on the zero.