MAT 250 ODE Sample Test 1

Multiple choice problems.

1. (15 points.) Assume that the initial value problem $y' = 1 - y^2; y(0) =$

0 is being solved for t in the interval $[0, 3]$ using Euler's method with $h = 1$. That is, one takes $t_0 = 0, t_1 = 1; t_2 = 2, t_3 = 3$ and finds the approximate values $y_0,\ y_1,\ y_2,\ y_3$ of y at $t_0,\ t_1,\ t_2,\ t_3$. What will be the value of y_3?
A. 0; B. 1; C. -1; D. $\frac{2}{3}$; E. 2.
2. (15 points) Let $y(t)$ denote the solution of the initial value problem $y' - y = t;\ y(0) = 0, t > 0$. Then $y(1)$ is equal to:
A. e; B. $e - 2$; C. $\frac{2}{e}$; D. 0; E. 1.
3. (15 points) Let $y(t)$ be the solution of the initial value problem $y' = \frac{3x^2-1}{3y^2+1}$;
$y(1) = 1$. Then $y(-1)$ is equal to
A. -1; B. 2; C. $2^{\frac{1}{3}} - 1$; D. 1; E. 0.
4. (15 points) $y_1(x) = \exp(x)$ is a solution of the differential equation $(x-1)y'' - xy' + y = 0,\ x < 1$. Use this information to find $y(1)$, where $y(t)$ is the solution of the initial value problem $(x - 1)y'' - xy' + y = 0,\ y(0) = 0,\ y'(0) = 1, x < 0$. The value of $y(1)$ is equal to
A. -1; B. e; C. $\frac{1}{e}$; D. 1; E. $1 - e$.

Open ended problems.

5. (15 points) Using a direction field sketch the graph of the solution of the initial value problem $y' = t - \sin y;\ y(0) = 0$. How does $y(t)$ behave as t becomes large?
6. Find the general solutions of the following differential equations:
(a) (7 points) $y'' + 3y' + 2y = 0$;
(b) (8 points) $5y'' + 13y' + 9y = 0$;
(c) (10 points) $y'' - 6y' + 9y = 0$.