

Midterm 1, Math 217  
Sep. 25th, 2006

Name: \_\_\_\_\_ Student ID: \_\_\_\_\_ Score: \_\_\_\_\_

**Part I: Multiple Choices(5pts each)**

(1) Classify the differential equation  $e^t y'' - 5t^2 y = \sin(y)$ .

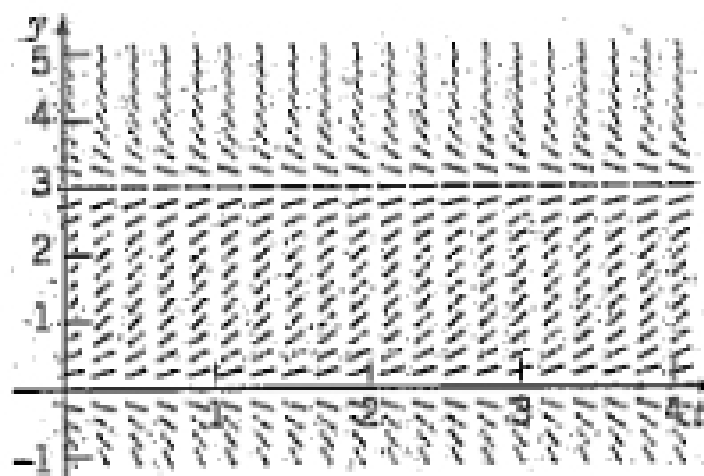
- (A) ordinary, linear, order 1
- (B) ordinary, linear order 2
- (C) ordinary, nonlinear, order 1
- (D) ordinary, nonlinear, order 2
- (E) partial, linear, order 1
- (F) partial, linear, order 2
- (G) partial, nonlinear, order 1
- (H) partial, nonlinear, order 2

2. Suppose that  $M(x, y)$  is the partial derivative of  $F(x, y)$  with respect to  $x$  and that  $N(x, y)$  is the partial derivative of  $F(x, y)$  with respect to  $y$ . Assume that all of these functions have continuous derivatives of all orders. Which of the following statements best describes the equation  $\frac{d}{dx}y(x) = -\frac{M(x,y)}{N(x,y)}$ ? (In the answers,  $C$  is a constant.)

- (A) The equation is separable.
- (B) The equation is homogeneous.
- (C) The equation is linear.
- (D) The solution is give implicitly by  $\int N(x, y)dy = -\int M(x, y)dx + C$ .
- (E) The solution is given explicitly as  $y(x) = F(x, C)$ .
- (F) The solution is given implicitly by  $x = F(C, y(x))$ .
- (F) The solution is given implicitly by  $C = F(x, y(x))$ .
- (G) The solution is given implicitly by  $y(x) = F(x, y(x))$ .
- (H) The solution has no solution.

3. The direction field picture corresponds to which of the following differential equations?

- (A)  $y' = 2y - 3$ ,  
 (B)  $y' = 2 + y$ ,  
 (C)  $y' = y(y + 3)$ ,  
 (D)  $y' = y(y - 3)$ ,  
 (E)  $y' = -2 - y$ ,  
 (F)  $y' = y(3 - y)$ ,  
 (G)  $y' = 2 - y$ ,  
 (H)  $y' = y - 3$ .



4. Find the solution of the initial value problem  $y' - 3y = 0, y(0) = 7$ .

- (A)  $7e^{-3t}$   
 (B)  $7e^{3t}$   
 (C)  $e^{3t} + 7$   
 (D)  $e^{-3t} + 7$   
 (E)  $e^{-\frac{1}{3}t} + 7$   
 (F)  $e^{\frac{1}{3}t} + 7$   
 (G)  $7e^{-\frac{1}{3}t}$   
 (H)  $7e^{\frac{1}{3}t}$

(5) Find  $y(1)$  if  $y(t)$  is a solution of the initial value problem

$$\frac{dy}{dt} + xy^3 = \log(1 + y), \quad y(0) = 0.$$

- (A) 0  
 (B) 1  
 (C) 1.57  
 (D) 3.14  
 (E) 2.73  
 (F) 0 or 3.14  
 (G) 1 or 2.73  
 (H) 2 or 1.57

6. Find the solution of the given initial value problem.

$$y' + \frac{2}{t}y = \frac{\cos(t)}{t^2}, \quad y(\pi) = 0, \quad t > 0$$

(A)  $\frac{\sin(t)}{t}$ ,

(B)  $\frac{\sin(t^2)}{t}$ ,

(C)  $\frac{\sin(t)}{t^2}$ ,

(D)  $\frac{\sin t^2}{t^2}$ ,

(E)  $\frac{\cos(t)}{t}$ ,

(F)  $\frac{\cos(t^2)}{t}$ ,

(G)  $\frac{\cos(t)}{t^2}$ ,

(H)  $\frac{\cos(t^2)}{t^2}$ .

7. Find the limit  $\lim_{t \rightarrow \infty} y(t)$ ? where  $y(t)$  is the solution to the initial value problem

$$2y' + 5y = 2, \quad y(0) = 1.$$

(A) 0

(B) 1

(C) 2

(D) 3

(E) does not exist.

8. What is the general solution to  $\frac{dy}{dx} = 2y(y + 3)$ ?

(A)  $y = Ce^x$ ,

(B)  $y = \frac{2Ce^{3t}}{1 - Ce^{3t}}$

(C)  $y = \frac{2Ce^{3t}}{1 + Ce^{3t}}$

(D)  $y = \frac{2Ce^{3t}}{1 \pm Ce^{3t}}$

(E)  $y = \frac{3Ce^{6t}}{1 - Ce^{6t}}$

(F)  $y = \frac{3Ce^{6t}}{1 + Ce^{6t}}$

(G)  $y = \frac{3Ce^{6t}}{1 \pm Ce^{6t}}$

(H) none of the above