

This exam contains ten multiple-choice problems worth two points each, five true-false problems worth one point each, and four computational problems worth 25 points altogether, for an exam total of 50 points.

Part I. Multiple Choice. (2 points each)

For each of the following, mark your answer card with the letter corresponding to the only correct answer.

1. Consider the following differential equation:  $y' - 3y = e^{2t}$ . The general solution of this differential equation is  $y = -e^{2t} + Ce^{3t}$ . (You do not have to verify this.) If the initial condition is  $y(0) = 4$ , find the value of  $C$ .

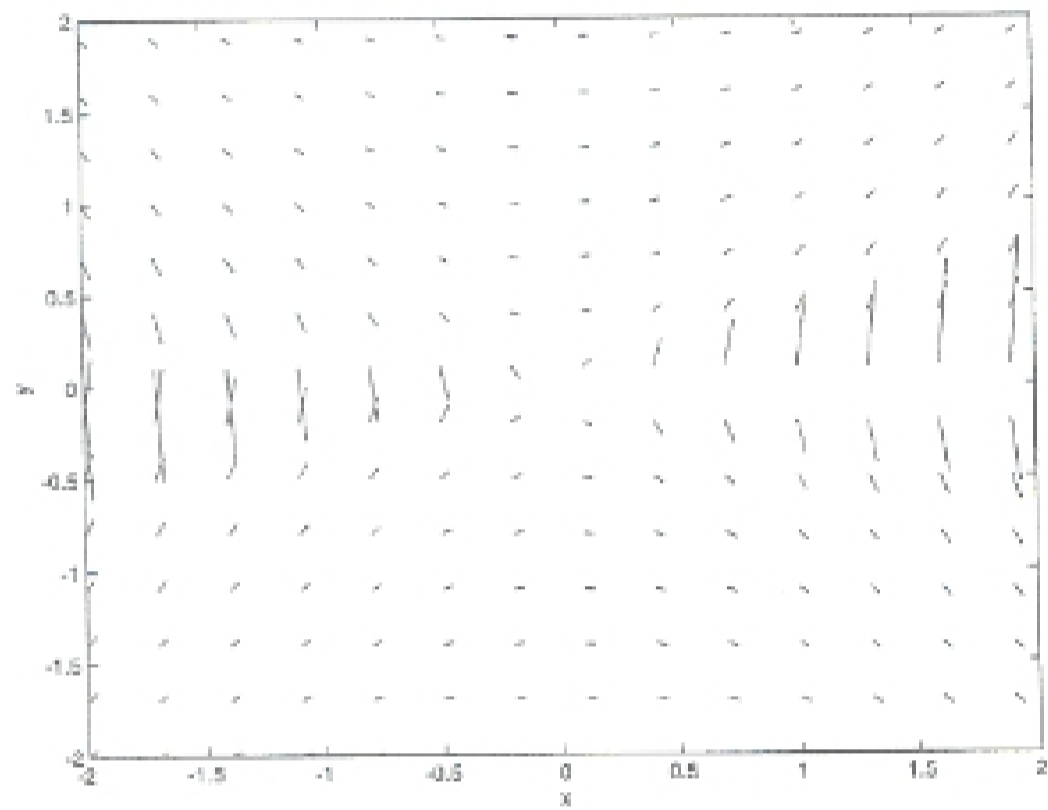
- (A)  $-4$
- (B)  $-1$
- (C)  $0$
- (D)  $1$
- (E)  $3$
- (F)  $4$
- (G)  $5$
- (H)  $e$
- (I)  $e^2$
- (J)  $e^4$

2. Classify the differential equation  $ty' - 2y^2 = 5$ .

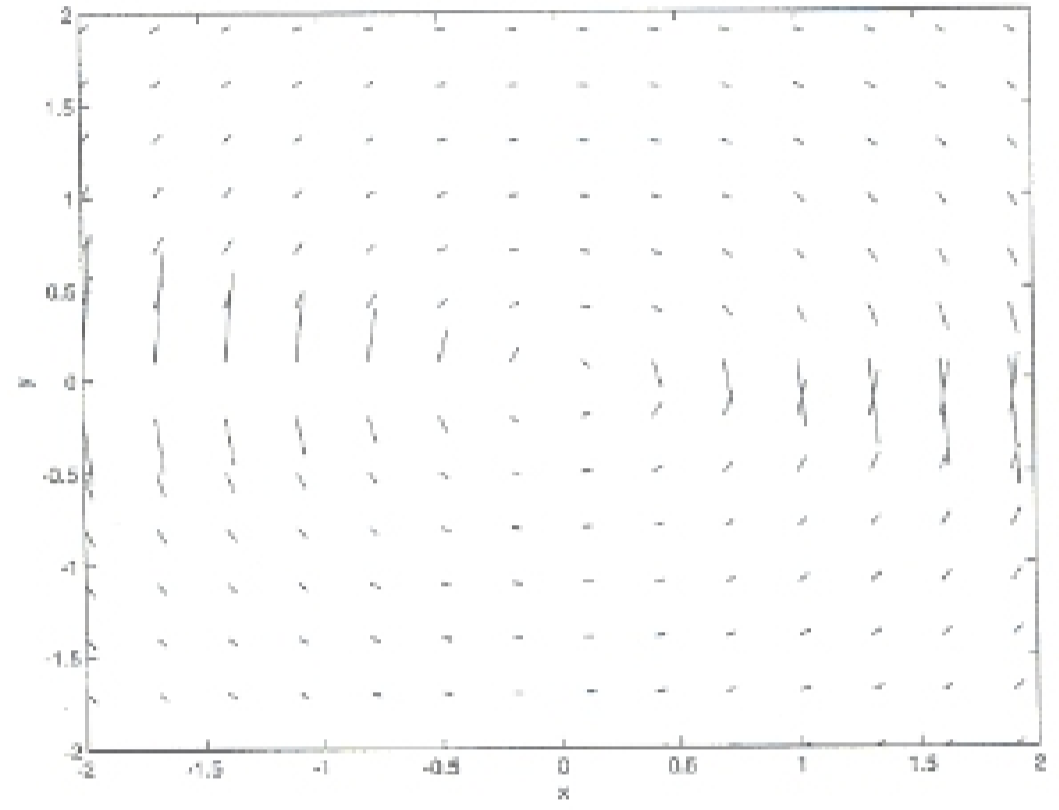
- (A) ordinary, linear, order 1
- (B) ordinary, linear, order 2
- (C) ordinary, nonlinear, order 1
- (D) ordinary, nonlinear, order 2
- (E) partial, linear, order 1
- (F) partial, linear, order 2
- (G) partial, nonlinear, order 1
- (H) partial, nonlinear, order 2

3. Which of the following is the direction field for the differential equation  $y' = t^2 + y^2$ ?

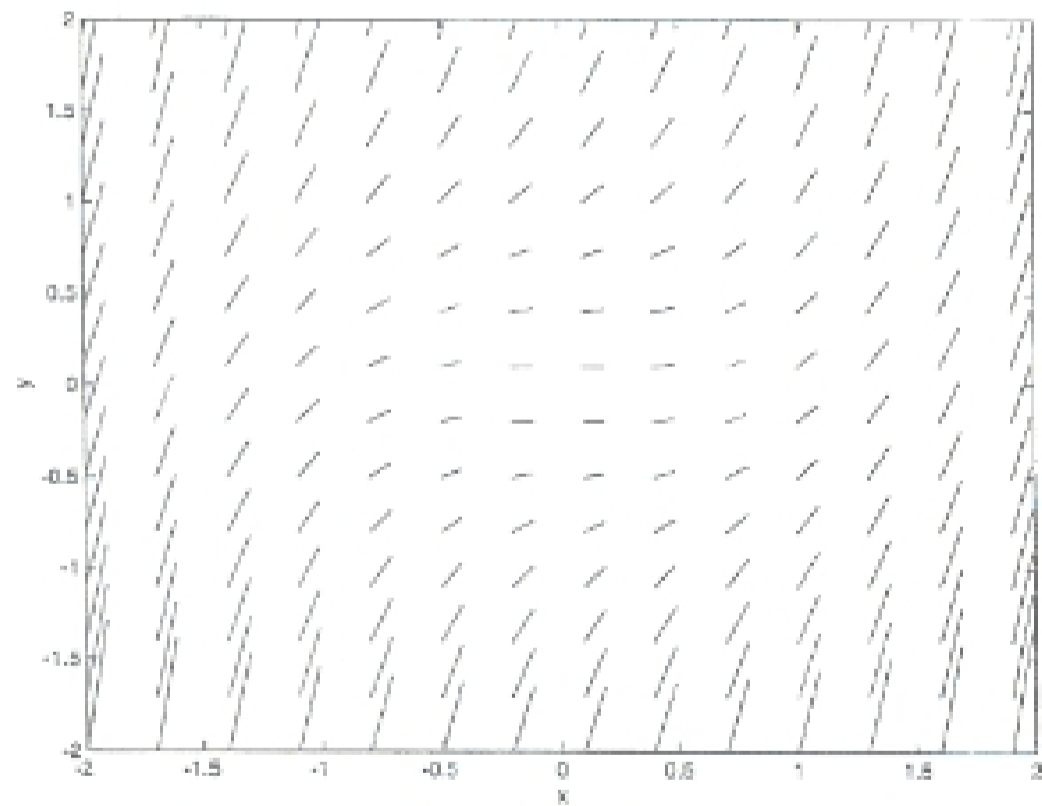
(A)



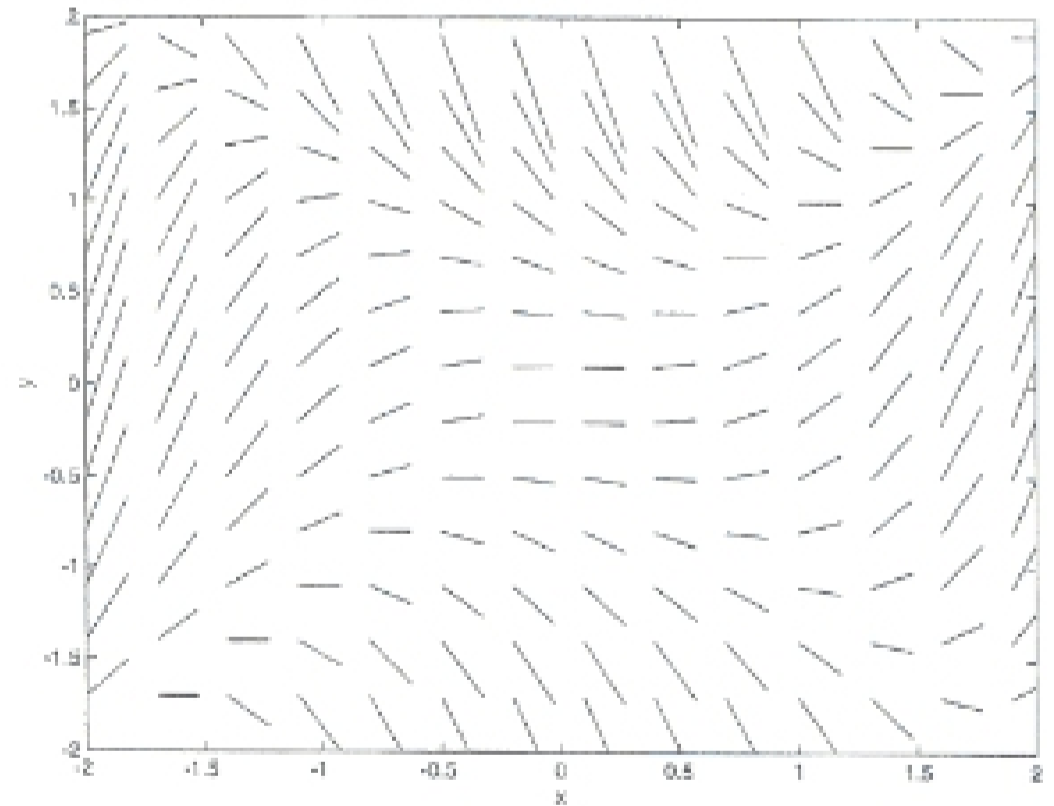
(B)



(C)



(D)



4. How many solutions does the differential equation  $y' = 3y$  have?

- (A) 0
- (B) 1
- (C) 2
- (D) 3
- (E) 10
- (F) 11
- (G) 20
- (H) 60
- (I) 10,000
- (J) infinitely-many

5. What is the equilibrium solution for the differential equation  $y' = 4 - \frac{y}{5}$ ?

- (A)  $y = -5$
- (B)  $y = -4$
- (C)  $y = -\frac{1}{5}$
- (D)  $y = \frac{1}{20}$
- (E)  $y = \frac{4}{5}$
- (F)  $y = \frac{5}{4}$
- (G)  $y = 4$
- (H)  $y = 20$
- (I)  $y = e^{-t/5}$
- (J) There is no equilibrium solution.

6. Only one of the following differential equations is both linear and separable. Which one is it?

- (A)  $y' - 4ty = e^t$
- (B)  $\frac{1}{t}y' = t + y$
- (C)  $ty' = \frac{1}{y}$
- (D)  $y' = \sin(t - 3y)$
- (E)  $t^2y' = 2y$