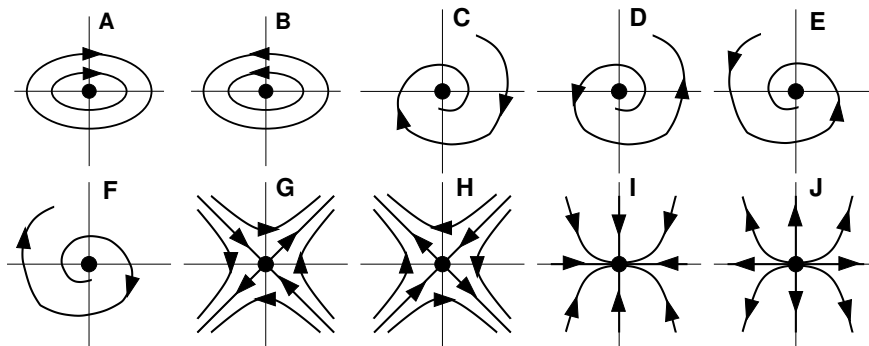


Differential Equations (MAS118) Problem Sheet 10

Problem 28

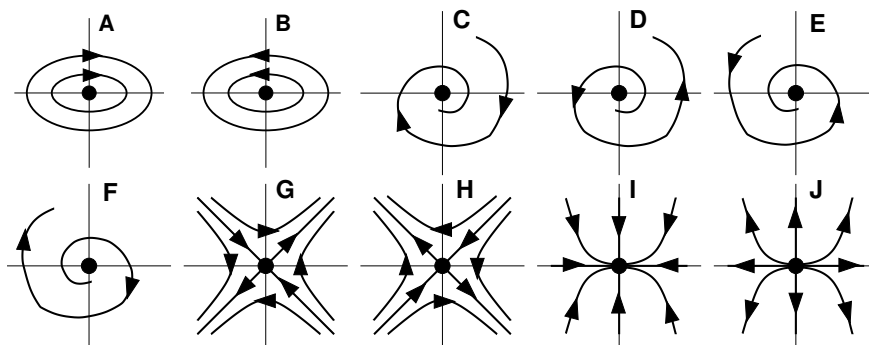
Assign to the following two dimensional differential equations the (qualitatively) correct phase space portrait (as usual the y_1 -axis is the horizontal axis, the y_2 -axis the vertical axis): (4 points each)

- | | | | |
|--------------------------|----------------------|--------------------------|----------------------|
| a) $y_1' = 4y_1 + y_2,$ | $y_2' = 4y_2 + y_1$ | b) $y_1' = y_1 - 4y_2,$ | $y_2' = y_2 + 4y_1$ |
| c) $y_1' = y_1 + 4y_2,$ | $y_2' = y_2 - 4y_1$ | d) $y_1' = -y_1 + 4y_2,$ | $y_2' = -y_2 - 4y_1$ |
| e) $y_1' = -y_1 - 4y_2,$ | $y_2' = -y_2 + 4y_1$ | f) $y_1' = -4y_1 + y_2,$ | $y_2' = -4y_2 + y_1$ |
| g) $y_1' = 4y_2,$ | $y_2' = y_1$ | h) $y_1' = 4y_2,$ | $y_2' = -y_1$ |
| i) $y_1' = -4y_2,$ | $y_2' = y_1$ | j) $y_1' = -4y_2,$ | $y_2' = -y_1$ |



Problem 29

For initial condition $y_1(0) = 0, y_2(0) = 1$ sketch for each of the following phase space portraits the functions $y_1(x)$ and $y_2(x)$ in a diagram (as usual the y_1 -axis is the horizontal axis, the y_2 -axis the vertical axis): (4 points each)



Problem 30

$$y_1(x) = e^x \cos(x), \quad y_2(x) = e^x \sin(x)$$

is a particular solution of a system of two linear differential equations with constant coefficients.

- a) Write down the system of differential equations. (10 points)
- b) Sketch the phase space portrait of the system of differential equations. (10 points)

*To be handed in by Monday 26.03.2007, 13:00
(green box on the 2nd floor of the mathematics building)*

Problem J

Compute the solution of the following initial value problem

$$y_1' = -y_1 + y_2, \quad y_2' = -y_2 \quad y_1(0) = 1, \quad y_2(0) = 1$$

(20 bonus points)