Lecture Questions I: 110.302 Differential Equations

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Richard Brown (Mathematics Department) Lecture Questions I: 110.302 Differential Equa

Determine the truth of the following two statements:

- (1) Every separable ODE can be written as an exact ODE.
- (2) Every linear ODE can be written as a separable ODE.
- A. Both are true.
- B. (1) is true and (2) is false.
- C. (1) is false and (2) is true.
- D. Both are false.

Let $\dot{x} = x^2 - 2x + c$ be an autonomous, first-order ODE with parameter $c \in \mathbb{R}$. For parameter value c = -15, the phase line for the ODE has the following characteristics:

- A. A sink at x = -3 and a source at x = 5.
- B. A source at x = -3 and a sink at x = 5.
- C. A sink at x = -5 and a source at x = 3.
- D. A source at x = -5 and a sink at x = 3.
- E. Not enough information to tell.

The ODE

$$\left(\sin t + \sqrt{2-t}\right)y + e^{t\ln(t+1)}\left(t^2 - 10^{-2000}\right)y' = t^4$$

is linear. By the Existence and Uniqueness Theorem for first-order linear ODEs, we know the following:

- A. Solutions are not guaranteed to exist at all at the point $(0,2) \in \mathbb{R}^2$.
- B. Solutions are guaranteed to exist but may not be unique at (0, 2).
- C. A solution exists and is unique passing through (0, 2).
- D. There is not enough information to determine whether solutions exist and/or are unique at (0, 2).
- E. I have no idea.