

You may use a notesheet, prepared in advance, and no larger than  $8.5 \times 11$  inches in size. You are expected to have a scientific calculator, and you may use it. Please note  $\log(x)$  means the natural logarithm of  $x$  on this test.

This test is multiple-choice. Work carefully. Try to avoid errors and try to avoid being misled by the offered answers.

There are 10 problems for a total of 160 points.

**This is not a real test. It is just a collection of a few sample problems.**

**Problem 1.** (16 points if correct, 0 points if wrong). Find the general solution of the differential equation

$$\frac{d^2y}{dx^2} - 5 \frac{dy}{dx} - 14y = 0$$

- A.)**  $y = c_1 e^{2x} + c_2 x e^{2x}$     **B.)**  $y = c_1 + c_2 e^{7x}$   
**C.)**  $y = c_1 e^{-2x} + c_2 e^{7x}$     **D.)**  $y = c_1 e^{-2x} \cos(7x) + c_2 e^{-2x} \sin(7x)$     **E.)** None of the foregoing.

←Letter corresponding to your answer to problem 1.

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**Problem 2.** (16 points if correct, 0 points if wrong). The differential equation

$$\frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + 17y = x e^{-x} \cos(2x)$$

has characteristic roots  $-1 + 4i$ ,  $-1 - 4i$ . Find the form of a particular solution as specified by the method of undetermined coefficients.

- A.)**  $x(Ax + B)e^{-x} \cos(2x) + x(Cx + D)e^{-x} \sin(2x)$     **B.)**  $(Ax + B)e^{-x} \cos(2x) + (Cx + D)e^{-x} \sin(2x)$   
**C.)**  $Ax e^{-x} \cos(2x)$     **D.)**  $Ax^2 e^{-x} \cos(2x)$     **E.)** None of the foregoing.

←Letter corresponding to your answer to problem 2.

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**Problem 3.** (16 points if correct, 0 points if wrong). Find the general solution of the differential equation

$$y \frac{d^2y}{dx^2} + \left( \frac{dy}{dx} \right)^2 = 0$$

- A.)**  $y = C_1 + C_2 \exp(x)$     **B.)**  $y = C_1 + \exp(C_2 x)$   
**C.)**  $y = C_1 \exp(C_2 x)$     **D.)**  $y = C_1 + C_2 x$     **E.)** None of the foregoing.

←Letter corresponding to your answer to problem 3.

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