APMA 3140, Spring 2022 **Classwork 1: Characteristic Equations**

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1. [4 pts] Find five solutions to the equation. Then write the general solution.

$$y''(x) - 8y'(x) + 16y(x) = 0$$

$r^2 - 8r + 16 = 0$

$(r-4)^2 = 0$

$r = 4, r = 4$

$y_1 = e^{4x}$ $y_2 = xe^{4x}$

$y_3 = 3e^{4x}$ $y_4 = -xe^{4x}$

$y_5 = 10e^{4x} + 3xe^{4x}$

$y = c_1 e^{4x} + c_2 xe^{4x}$

2. [3 pts] Find the general solution to the equation

$$\phi''(x) + 9\phi(x) = 0.$$

$r^2 + 9 = 0$

$r^2 = -9$

$r = \sqrt{-9} = 3i$

$y = \cos(3x)$

$y = \sin(3x)$

$y = c_1 \cos(3x) + c_2 \sin(3x)$

3. [3 pts] Find the general solution to the equation

$$y''(t) + 7y'(t) = 0.$$

$r^2 + 7r = 0$

$r(r+7) = 0$

$r = 0$ $r = -7$

$y = e^{0x} = 1$

$y = e^{-7x}$

$y = c_1 + c_2 e^{-7t}$