

Instructions: Give concise answers, but clearly indicate your reasoning.

- I.** Suppose that the function $-8 \cos(x) - 3 \sin(x)$ is rewritten in phase-angle form $C \cos(\omega t - \alpha)$ (do not try to carry this out, just suppose that someone did). Give the phase angle α as an expression that involves a value of the inverse tangent function (that is, as an expression containing a number of the form $\tan^{-1}(\text{something})$, not a decimal number. You do not need to evaluate it on a calculator.)
- (3)
- II.** Write trial solutions for using the method of undetermined coefficients to find a particular solution of the following DE's, but *do not* carry out the calculations or proceed further with obtaining a particular solution.
- (7)
- (a) $y'' + 4y = e^{2x}$
- (b) $y'' - 4y = e^{2x}$
- (c) $y^{(4)} + 6y'' + 9y = \cos(3x)$
- III.** A certain mass-spring system is modeled by the second-order equation $x'' + cx' + 12x = 0$, where c is the damping constant. Find the value of c that gives critical damping (that is, the value of c for which the system neither overdamped nor underdamped).
- (2)
- IV.** Define what it means to say that a collection of functions $\{y_1, y_2, \dots, y_n\}$ is *linearly independent*.
- (3)