

### Homework 3 Problem 1

1. Recall the following formulae:

$$(a) \cos x = \frac{e^{ix} + e^{-ix}}{2i}$$

$$(b) \sin x = \frac{e^{ix} - e^{-ix}}{2i}$$

$$(c) \cosh x = \frac{e^x + e^{-x}}{2}$$

$$(d) \sinh x = \frac{e^x - e^{-x}}{2}$$

(i) Using these formulae show explicitly that the general solution of the ODE

$$X'' + k^2 X = 0$$

may be written as  $X(x) = A \cos x + B \sin x$ .

(ii) Using the formulae above show explicitly that the general solution of the ODE

$$X'' - k^2 X = 0$$

may be written as  $X(x) = A \cosh x + B \sinh x$ .

NOTE: I would like to see you solve each equation using the characteristic equation for each ODE. This will yield sums of exponentials with either real or imaginary powers. I then want you to find the appropriate combinations of the formulae (a)-(d) to rewrite the solution as stated in each problem.