Practice

§3.5: 1, 5, 8, 13
§3.6: 2, 7, 9, 10, 18, 20a, 21a, 23a
§3.7: 7, 13, 15, 17

Hand In

30) Using the method of indeterminate coefficients, find general solutions to the following differential equations:
   a) \( y'' + y = xe^{-x} + \cos x \)
   b) \( y'' + y = (10x^5 - x^3 + 23x^2 - x - 17)e^x \sin(x) \)

31) An electric circuit consisting of a resistor \( R \), a capacitor \( C \) and a coil \( L \) is driven by a temporary changing voltage source \( v_s \).
   By Kirchhoff’s Law, we have \( V_L + V_R + V_C = v_s(t) \), where \( V_L \), \( V_R \), \( V_C \) respectively are the voltage changes measured over coil, resistor and capacitor, respectively. We also have a current \( I \) in the circuit that is equal at every place.
   By Ohm’s law, we have that \( V_R = I \cdot R \), and Lenz’ law gives that \( V_L = L \cdot I' \). Finally, the capacitor determines the current by the law \( I = C \cdot V'_C \).

   a) Write down a differential equation for the voltage \( v(t) = V_C(t) \) measured at the capacitor.
   b) Assume the driving voltage fulfills \( v_s(t) = \cos(\omega t) \). Determine a general solution for the differential equation in a).

32) Using the method of variation of parameters, determine a solution to the initial value problem:
   \[
   \frac{d^2 y}{dt^2} + 4y = 4 \tan(2x), \quad y(0) = 10, \quad y'(0) = -2
   \]