Math 450H Fall 2009

Problem Set 1

Solve Problems 1-3 using the method of undetermined coefficients.

Problem 1 $y''(t) + y(t) = \sin t + t\cos t$

Problem 2 $y''(t) - y'(t) - 6y(t) = 3 + t^2e^t + t\sin t$

Problem 3 *Let* $k, m > 0$.

1. $mx''(t) + kx(t) = F\cos(\omega t), \quad \omega \neq \sqrt{\frac{k}{m}}$

2. $mx''(t) + kx(t) = F\cos(\omega t), \quad \omega = \sqrt{\frac{k}{m}}$

Solve Problems 4-6 using variation of parameters.

Problem 4 $y''(t) + y(t) = \tan t$

Problem 5 $y''(t) + 6y'(t) + 13y(t) = e^{-3t}\cos(2t)$

Problem 6 *Suppose* $\omega \neq 0$. *Consider the IVP:*

$$y''(t) + \omega^2 y(t) = f(t), \qquad y(0) = y'(0) = 0.$$

Use variation of parameters to solve if*

$$f(t) = \begin{cases} 1, & 0 \leq t \leq 1 \\ 0, & t > 1 \end{cases}.$$

**Use the representation* $y_p(t) = \int_0^t F(t,s) f(s)\, ds$, *where* $F(t,s)$ *is defined as in class lecture.*

Problem 7 *Where possible and as needed, work Problems 1-5 using a different method (VOP or MOUC).*