

Phys 3010 Mathematical Physics Assignment 15

For the following problems, solve by hand, although you can check your answers using Maple (highly recommended.)

1. Find the full solution to the differential equation

$$\frac{d^3 y}{dx^3} + 2 \frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} - 6y = 255 \sin(8x)$$

given that $y = 5$, $dy/dx=0$, and $d^2y/dx^2=0$ all when $x=0$. (To input the third initial condition you can use either $D^{(2)}(y)(0)$ or $D(D(y))(0)$ to denote the second differential. For more details search for “D” in the help menu.)

2. Find the full solution to the differential equation

$$\frac{d^2 y}{dt^2} - 8 \frac{dy}{dt} + 12y = 6 e^{4t}$$

given that $y = 1$ and $dy/dt=2$ when $x=0$.

3. Find the full solution to the differential equation

$$\frac{d^2 x}{dt^2} + 2 \frac{dx}{dt} + 5x = 5 e^{3t}$$

given that $x = 0$ at $t=0$ and $x = 4$ when $t = \pi/4$.

4. Find the full solution to the differential equation

$$\frac{dx}{dt} + 6x = 3 e^t \sin(4t)$$

given that $x = dx/dt = 0$ at $t=0$.

Hint: first use the identity

$$\sin(\theta) = \frac{e^{i\theta} - e^{-i\theta}}{2i}$$

and then rearrange your answer to yield a real trigonometric representation.