09.29.2014, Question 1: We are testing the function $f(x)=C_0e^{2x}+C_1e^{-2x}$ as a possible solution to a DE. After we substitute the function and its derivative into the DE we get $2C_0e^{2x}-2C_1e^{-2x} = -2(C_0e^{2x}+C_1e^{-2x})+3e^{2x}$. What value of C_0 will allow this function to work as a solution?

(a) $C_0 = \frac{3}{4}$ (c) $C_0 = 3$ (e) Any value of C_0 will work.

(b) $C_0 = \frac{3}{2}$ (d) $C_0 = 2$ (f) No value of C_0 will work.

Look at the coefficients of the exp(2x):

2 C_0 = -2C_0 + 3 --> 4C_0 = 3 --> C_0 = 3/4.

Just for fun, look at coefficients of exp(-2x):

-2C_1 = 2C_1 --> 4C_1 = 0 --> C_1 = 0.

This is called the method of undetermined coefficients and is a very powerful solution technique

09.29.2014, Question 2: When we have ***y'=7y+2x*** we should conjecture $y=C_0e^{7x}+C_1x+C_2$. Why include the C_2?

(a) Because the $7y$ becomes a constant 7 when we take the derivative and we need a term to cancel this out.

(b) Because when we take the derivative of C_1x we get a constant C_1 and we need a term to cancel this out.

(c) Because this will allow us to match different initial conditions.

(d) This does not affect the equation because it goes away when we take the derivative.

B *y*'=7*y* is the homogeneous DE which has exp(7x) as it's solution. The non-homogeneous function is 2*x* so our guess is C_1*x*+C_2*.* Plug this in to *y*'=7*y*+2*x:*

(C_1x+C_2)'=7(C_1x+C_2)+2x

C_1=7C_2 & ***0=7C_1x+2x*** -> C_1=-2/7, C_2=-2/49

As you can see the C_1x gets balanced by C-_2.

09.29.2014, Question 3: We have the equation ***y'=2y+sin(3t).*** What should our conjecture for ***y(t)*** be?

(a) $y = C_0 e^{2t} + \sin 3t$

(b) $y = C_0 e^{2t} + \sin 3t + \cos 3t$

(c) $y = C_0 e^{2t} + C_1 \sin 3t$

(d) $y = C_0 e^{2t} + C_1 \sin 3t + C_2 \cos 3t$

(e) $y = C_0 e^{2t} + C_1 e^{-2t} + C_2 \sin 3t + C_3 \cos 3t$

(f) None of the above

D Since the non-homogeneous term is *sin(3t)* the conjecture for ***y_p*** should look like *C_1 cos(3t)+C_2 sin(3t)* while ***y_h*** is *C_0 exp(2t).*

09.29.2014, Question 4: Which of the following is **NOT** a solution to ***y'(t)=5y+3t***?

(a) $y = 8e^{5t}$

(b) $y = -\frac{3}{5}t - \frac{3}{25}$

(c) $y = 8e^{5t} - \frac{3}{5}t - \frac{3}{25}$

(d) All are solutions.

(e) More than one of (a) - (c) are not solutions.

A

Clearly (a) is a solution to the homogeneous DE *y'=5y* **since** *A* exp(5t) **is** *y_h.* **However** *y_p* **is (b) since** *(-3/5 t-3/25)'=-3/5=LHS.*

RHS=5(-3/5 t-3/25)+3t = -3t -3/5+3t=-3/5=LHS.

(c) is also a solution since it is *y_h+y_p.*

Since (a) is NOT a solution to the non-homogeneous problem *y'=5y+3t* **the answer is (a).**