



Staple!

Ord: _____

Differential Eqns
MAP2302 4689

C-Class

Prof. JLF King
Touch: 6May2016

C1: Show no work.

a A soln to $[f'' - 3f'](x) = 14 - 6x$ is **polynomial** $f(x) = \underline{\dots}$. Using parameters α and β , then, the *general* solution to $[h'' - 3h'](x) = 14 - 6x$ is

$$h_{\alpha, \beta}(x) = \underline{\dots}$$

And the h with $h(0) = 0$ and $h'(0) = 0$ is $h(x) = \underline{\dots}$

b DiffOperators **P, Q, R, S** are defined as

$$\begin{aligned} \mathbf{P}(f) &:= f(3) \cdot f', & \mathbf{Q}(f) &:= \cos(3) \cdot f^{(3)}, \\ \mathbf{R}(f) &:= [\cos(3) \cdot f] + f'', & \mathbf{S}(f) &:= \cos(3) + [3f']. \end{aligned}$$

Then... **P** is linear: $T \ F$. **Q** is linear: $T \ F$.
R is linear: $T \ F$. **S** is linear: $T \ F$.

c Complex number $[x + iy]^2 = -8i$, for *real numbers* $x = \underline{\dots}$ and $y = \underline{\dots}$.

d With **1()** the constant-1 fnc and $F(x) := \sin(5x)$, then, convolution

$$[\mathbf{1} * F](x) = \underline{\dots}$$

C2: OYOP: *In grammatical English sentences, write your essay on every third line (usually), so that I can easily write between the lines. Do not restate the question.*

Brine with $5 \frac{\text{lb}}{\text{gal}}$ salt flows at rate $1 \frac{\text{gal}}{\text{min}}$ into a tank that initially held 100gal of $2 \frac{\text{lb}}{\text{gal}}$ -salt brine. The tank is well-mixed, and brine is flowing *out* at rate $3 \frac{\text{gal}}{\text{min}}$. So the tank will empty in $\underline{\dots}$ minutes.

At time t , let $\sigma(t)$ denote the tank-salinity [in lb/gal] and use $y(t)$ for the total number of pounds of salt in the tank.

Explain how to derive a DE for $y()$. Don't just pull a DE out of the air; explain, using *Text* and *Pictures*, how it comes from the physical situation. Now re-write the DE in linear-DE form. Use FOLDE

to solve the DE. Dividing by the amount of water in the tank at time t , gives this formula for the salinity:

$$\sigma(t) = \left[\dots \right] \frac{\text{lb}}{\text{gal}}.$$

As the tank approaches empty, its salinity approaches $\left[\dots \right] \frac{\text{lb}}{\text{gal}}$. Do Not approximate.

End of C-Class

C1: _____ 100pts

C2: _____ 100pts

Total: _____ 200pts