Differential Eqns MAP2302 **U-Class** Prof. JLF King Wed., 15Nov2017

Welcome. **Use "$f(x)$ notation" when writing fncs; in particular, for trig and log fncs. E.g, write "$\sin(x)$" rather than the horrible $\sin x$ or $[\sin x]$.**

U1: Show no work.

a A *minimum* requirement for an LOR (letter-of-recommendation) from Prof. King is <u>two</u> courses. Circle: **Yes** **True** **Darn tootin'!**

b With $f(x) := \mathsf{e}^{7x}$ and $g(x) := \mathsf{e}^{5x}$, then $[f \circledast g](t) =$ ⌞.....⌟

c This Wronskian is $\mathcal{W}\big(\mathsf{e}^{3t}, \cos(2t)\big) =$ ⌞.....⌟

d Suppose $y(0) = 2$, $y'(0) = 3$, $y''(0) = 5$. Then $\mathcal{L}\big(y^{(3)} + 2y'\big)(s)$ equals $\big[[p(s)\cdot\widehat{y}(s)] + q(s)\big]$ for **polynomials**

$p(s) =$ ⌞.....⌟

and $q(s) =$ ⌞.....⌟.

e Let $h()$ be this square-wave: $h(t) := 5$ if (floor) $\lfloor t \rfloor$ is a multiple of 3, and $h(t) := 0$ otherwise. Then $\widehat{h}(s) =$ ⌞.....⌟.

f $\mathcal{L}\big(t^{26}\mathsf{e}^{3t}\big)(s) =$ ⌞.....⌟.

Determine the inverse-transform, please.

$\mathcal{L}^{-1}\Big(\dfrac{3s+5}{s^2+2s+5}\Big)(t) =$ ⌞.....⌟

g Op $\mathsf{L}(y) := 3t^2y'' + 7ty' - 4y$ is equidim'nal. The gen.soln to $\mathsf{L}(y)=0$ is $y(t) = \alpha\cdot$ ⌞.....⌟ $+ \beta\cdot$ ⌞.....⌟.

U2: Show no work.

A *critically-damped* unforced spring has DE

$*$: $\mathbf{M}y'' + \mathbf{B}y' + \mathbf{K}y = 0\,\frac{\mathsf{kg}\cdot\mathsf{m}}{\mathsf{sec}^2}$, *where* $\mathbf{M} := 3\mathsf{kg}$, *and the Hooke's constant is* $\mathbf{K} := 75\frac{\mathsf{kg}}{\mathsf{sec}^2}$.

The damping constant $\mathbf{B} =$ ⌞.....⌟

The *general soln* to critically-damped $(*)$ is

$y(t) = \Big[\alpha\cdot$ ⌞.....⌟ $+ \beta\cdot$ ⌞.....⌟$\Big]\mathsf{m}$.

Here, $\alpha,\beta \in \mathbb{C}$. (*The 3 blanks will have units & numbers in various places.* Maybe exp(?) is more convenient than $\mathsf{e}^?$ notation.) The **specific** soln with $y(0\mathsf{sec}) = 0\mathsf{m}$ and $y'(0\mathsf{sec}) = 2\,\frac{\mathsf{m}}{\mathsf{sec}}$ has $\alpha =$ ⌞.....⌟, $\beta =$ ⌞.....⌟.

End of U-Class

U1:	___ ___ ___	170pts
U2:	___ ___	55pts
Total:	___ ___ ___	225pts