Differential Eqns MAP2302 | **X-Class** | Prof. JLF King Wedn., 28Oct2015

X1: Show no work.

a A multivariate polynomial, where each monomial has the same degree, is [circle]

monogamous **atrocious** **gregarious**
monic **expialadocious** **homogeneous**
manic **unitary** **Unitarian** **utilitarian**

b DE $h'' - 2h' + 10h = 0$, has fund.-set of solns $\{e^{\alpha t}, e^{\beta t}\}$, for complex numbers α= ______ and β= ______.

Alternatively, we can write our fund.-set as

$$e^{Jt} \cdot \cos(Kt) \quad \text{and} \quad e^{Jt} \cdot \sin(Kt),$$

for *real* numbers J= ______ and K= ______.

c A soln to $[f'' - 3f'](x) = 14 - 6x$ is **polynomial** $f(x)$= ______. Using parameters α and β, then, the *general* solution to $[h'' - 3h'](x) = 14 - 6x$ is

$h_{\alpha,\beta}(x)$= ______.

And the h with $h(0) = 0$ and $h'(0) = 0$ is $h(x)$= ______.

d DE $\left[[2x^2 + y] \cdot \frac{dy}{dx}\right] - 2xy = 0$ is not, alas, *exact*. Happily, multiplying both sides by (non-constant) fnc $V(y)$ = ______

gives a *new* DE which *is* exact.

Solving the exact-DE, every soln $y=y(x)$ satisfies $F\big(x, y(x)\big) = \alpha$ for some constant α, where $F(x,y)$ = ______.

e [Here, $t>0$.]

Acting on $y=y(t)$, DiffOp $E(y) := t^2y'' - ty' + y$ is linear. Fnc $Y(t) := t$ satisfies $E(Y) = 0$. Then Roo gives us a $Z(t)$ = ______

satisfying $E(Z) = 0$ *and* Z is L.I of Y.

Roo also produces a function

$\varphi(t)$ = ______ s.t $E(\varphi) = t^{1/2}$.

X2: Show no work.

A tank initially holds 60gal of $2\frac{\text{lb}}{\text{gal}}$ brine. Pipe-1 feeds the tank, at rate $4\frac{\text{gal}}{\text{min}}$, with brine of time-varying salinity $5^t\,\frac{\text{lb}}{\text{gal}}$. Pipe-2 feeds the tank at $1\frac{\text{gal}}{\text{min}}$, brine of salinity $t^3\,\frac{\text{lb}}{\text{gal}}$. The tank discharges brine at rate $9\frac{\text{gal}}{\text{min}}$. Until the tank empties, the tank holds $W(t)$ = [______]gal; it empties in ______ min.

Finally, $y(t)$, the number of pounds of salt in the tank at time t, satisfies FOLDE $\frac{dy}{dt} + F(t) \cdot y = H(t)$, where $F(t)$= ______

and $H(t)$= ______.

End of X-Class

X1:	___ ___ ___	175pts
X2:	___ ___	60pts
Total:	___ ___ ___	235pts

Please PRINT your name and ordinal. Ta:

______ Ord:

Honor Code: *"I have neither requested nor received help on this exam other than from my professor."*

Signature: ______