Differential Eqns MAP2302 **S-Class** Prof. JLF King Mond., 25Sep2017

Welcome. Write **DNE** in a blank if the described object does not exist or if the indicated operation cannot be performed. **Write expressions unambiguously e.g, "$1/a+b$" should be bracketed either $[1/a]+b$ or $1/[a+b]$. (Be careful with negative signs!)**

Do ***not*** approx.: If your result is "$\sin(\sqrt{\pi})$" then write that rather than $.9797\cdots$.

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 $[\sin x]$.

S1: Show no work.

a Prof. King wears bifocals, and cannot read small handwriting. Circle one: **True!** **Yes!** ***Who??***

b Fnc $y_\alpha(t) :=$ ....

is the gen. soln to $\frac{dy}{dt} = 4y^2 t$.

[*Hint:* SoV.] The fnc satisfying init.-cond. $y_\alpha(1) = 1/5$ has $\alpha =$ ....

c Function $h()$ satisfies $2h'' + h' - 6h = 0$, and initial conditions $h(0) = 5$ and $h'(0) = -3$. So

$$h(t) = \alpha e^{At} + \beta e^{Bt}, \text{ for numbers}$$

$\alpha=$ ...., $A=$ ...., $\beta=$ ...., $B=$ ....

d DE $[\mathcal{N}(x,y) \cdot \frac{dy}{dx}] + \mathcal{M}(x,y) = 0$ is *exact*, where

$$\mathcal{N}(x,y) := [x^2 - 7] \quad \text{and} \quad \mathcal{M}(x,y) := 2xy + 3e^{3x}.$$

Its soln $y = y(x)$ satisfies $\mathbf{F}(x, y(x)) = \text{Const}$, where $\mathbf{F}(x,y) =$ ....

e DE $[xe^y \cdot \frac{dy}{dx}] + [8x^4 + 4e^y] = 0$ is not, alas, *exact*. Happily, multiplying both sides by (non-constant) fnc

$W(x) =$ ....

gives a *new* DE which *is* exact. **Did you *Check?***

f Degree-N polynomial $y = y(t)$ satisfies

$$\dagger: \quad 4y^2 - t^9 y' = 15t^9 + 4t^2.$$

Thus $N =$ .... [*Hint:* Don't compute y; just the polynomial's degree.]

OYOP: *In grammatical English **sentences**, write your essay on every **third** line* (usually), *so that I can easily write between the lines.*

S2: Showing all the steps in the FOLDE algorithm, compute the general solution $y = y(x)$ to

$$*: \quad \frac{dy}{dx} - \frac{y}{x} = 3x^3 + x \cdot \sin(2x). \quad \left[\begin{array}{l}\textit{Only consider}\\ x > 0.\end{array}\right]$$

Also write it here, as

$y_\alpha(x) =$ ....

End of S-Class

S1:	___ ___ ___	110pts
S2:	___ ___	75pts
Total:	___ ___ ___	185pts