Differential Eqns MAP2302 3145 | **A-class** | Prof. JLF King 10Sep2015

Note. 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 $[\sin x]$. Write expressions unambiguously e.g, "$1/a+b$" should be bracketed either $[1/a]+b$ or $1/[a+b]$. (Be careful with **negative** signs!)

Use ***cts*** for "continuous" and ***IVP*** for "initial value problem".

A1: Show no work.

z If $\lim_{x\to 0+} 8/x$ equals ∞, then $\lim_{x\to 0+} 5/x$ is [*Circle*]:

Prof. King's cap *a snowplow*

a Let $\mathcal{L} := [\mathbf{D}+2\mathbf{I}][\mathbf{D}-3\mathbf{I}]^2$. Then a gen.soln y to DE $\mathcal{L}(y)=0$ is

$$y(t) = A\cdot\_\_\_\_\_ + B\cdot\_\_\_\_\_ + C\cdot\_\_\_\_\_,$$

where A, B, C are arbitrary real numbers.

b $\mathcal{L}(t^2) = A_0 + A_1 t + A_2 t^2$ where

$A_0 =$ _____, $A_1 =$ _____, $A_2 =$ _____.

c Give the general solution

$q(t)=$ _____

to DE $q''+q'-6q=0$.

d Function $x(t) :=$ _____

is the general soln to $\dfrac{dx}{dt} = 2x^2 t$. [*Hint:* SoV]

Essay question

Please write (on your own paper) in *complete grammatical sentences* a soln to the following problem. Write every 3rd line, please. (Don't Scrunch!) **Also fill in the blank(s).**

A2: Consider a large tank holding 1200lit (here, lit=liters) of pure water, into which a brine solution (salt) begins to flow at a constant rate of 6 lit/min. The solution inside the tank is kept well stirred and is flowing *out* of the tank also at 6 lit/min.

Suppose that the concentration of salt in the entering-the-tank brine is 3 kg/lit. Use C_0 and $C_1(t)$ to denote the I/P and O/P concentrations of salt, in kg/lit.

Draw a large (use a whole page) *carefully labeled* picture of the tank and quantities and concentrations. Carefully *define* all quantities that YOU introduce in your solution. Carefully *explain* how you obtained your DE for $C_1(t)$, then how you solved it. Give the general solution

$C_1(t) =$ _____

Also: The concentration of salt in the tank will reach 1 kg/lit at time $T=$ _____.

Give a complete *explanation* about how you solved the IVP so as to compute T.

End of A-class

A1:	___ ___ ___	125pts
A2:	___ ___	55pts
Total:	___ ___ ___	180pts

Print name _____ Ord:

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

Signature: _____