

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

Y1: Show no work.

Z If $\lim_{x \rightarrow 0^+} 8/x$ equals ∞ , then $\lim_{x \rightarrow 0^+} 5/x$ is : L
Prof. King's cap a snowplow

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

$$y(t) = A \cdot \text{_____} + B \cdot \text{_____} + C \cdot \text{_____},$$

where A, B, C are arbitrary complex numbers.

b (With operator L as above.) Please find a solution $z(t) = \text{_____}$ to DE $L(z) = e^{3t}$.

c Find a soln $q(t) = \text{_____}$ to DE $q'' + 4q' + 4q = t^5$.

d Directly compute the Wronskian $W[x^3, \sin(x)] = \text{_____}$.

é Use *Bill's Identity* (well... Abel's Identity, actually) to compute the Wronskian, $W = \text{_____}$, of two linearly independent solns to DE

$$x \cdot y'' - [x - 1] \cdot y' + 3y = 0.$$

[Hint: Don't bother computing solns y .]

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.**

Y2: Consider a large tank holding 1200L (here, L=liters) of pure water, into which a brine solution (salt) begins to flow at a constant rate of 6L/min. The solution inside the tank is kept well stirred and is flowing *out* of the tank also at 6L/min.

Suppose that the concentration of salt in the entering-the-tank brine is 3kg/L. Then *the concentration of salt in the tank will reach 1kg/L at time $T = \text{_____}$.*

Draw a large (use a whole page) *carefully labelled* 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, then how you solved it, then how you solved the IVP so as to compute T .

End of Y-class

Y1: _____ 280pts

Y2: _____ 105pts

Total: _____ 385pts

Print name _____ Ord: _____

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

Signature: _____

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