

Differential Eqns
MAP2302

B-Practice

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Hello. This is longer than the actual exam; also, it only has one essay question. 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...

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 $[\sin x]$.

B1: Show no work.

a Fnc $y_\alpha(t) :=$ _____

is the gen. soln to $\frac{dy}{dt} = [\frac{-1}{6} y^4 \cdot 3^t]$.

[Hint: SoV.] The fnc satisfying init.-cond. $y_\alpha(0) = 1$ has $\alpha =$

[This has a bit more computation than I would put on the actual exam. Easier is if 3^t is replaced by e^t .]

b Function $h()$ satisfies $2h'' + h' - h = 0$, and initial conditions $h(0) = 7$ and $h'(0) = 2$. So

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

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

c $[D - 7I]^2(x^5 \cdot e^{7x}) =$ _____.

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 $[2xy \cdot \frac{dy}{dx}] + [2 + 3x]y^2 = 0$ 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 With $f(t) := \int_{7t}^{\exp(5t)} \cos(x^2) dx$, then $f'(t)$ equals

B1: _____ 110pts

B2: _____ 85pts

B3: _____ 85pts

.....
[Hint: Chain rule and Fund. Thm of Calculus.]

g For $x > 0$, let $B(x) := \sin(7x)^x$. Hence its derivative is $B'(x) = B(x) \cdot M(x)$, where $M(x)$ equals

Total: _____ 280pts

Please PRINT your *name* and *ordinal*. Ta:

Ord: _____

h Blanks $\in \mathbb{R}$. So $\frac{1}{2+3i} =$ _____ $+ i \cdot$ _____.

Thus $\frac{5-i}{2+3i} =$ _____ $+ i \cdot$ _____.

By the way, $|5-3i| =$ _____.

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

B2: Showing all the steps in the FOLDE algorithm, compute the general solution $y = y(x)$ to

*:
$$x^4 \frac{dy}{dx} + x^3 y = 8x^7 + x^6$$

Also write it here, as

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

B3: Showing all the steps in the FOLDE algorithm, compute the general solution $y = y(x)$ to

*:
$$\frac{dy}{dx} - \frac{y}{x} = x \cdot \sin(x)$$

Also write it here, as

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

End of B-Practice

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

Signature: _____