



Staple!

Differential Eqns  
MAP2302

## B-Practice

Prof. JLF King  
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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  $.9797\ldots$

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  $\frac{dy}{dt} = \left[ \frac{-1}{6} y^4 \cdot 3^t \right]$ .

[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  $\boxed{h(0) = 7}$  and  $\boxed{h'(0) = 2}$ . So

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

$$\alpha = \text{_____}, A = \text{_____}, \beta = \text{_____}, B = \text{_____}.$$

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

**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

$$\mathbf{F}(x, y) = \text{_____}.$$

**e** DE  $[2xy \cdot \frac{dy}{dx}] + [2 + 3x]y^2 = 0$  is not, alas, *exact*. Happily, multiplying both sides by (non-constant) fnc

$$W(x) = \text{.....}$$

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.]

**Total:** \_\_\_\_\_ 280pts

**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

Please PRINT your name and ordinal. Ta:

Ord:

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

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

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: