Staple!

Ord: ___ ___

Differential Eqns MAP2302 **T-Class** Prof. JLF King Wed.27Feb2019

***Welcome.*** Write **DNE** if the object does not exist or the operation cannot be performed. NB: **DNE** $\neq \{\} \neq 0$. **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** $[\sin x]$**.**

**T1:** Show no work.

___ a The Logistic model is credited to Circle: **Argand Abel Cauchy Eigen Euler Gauss Heaviside Hypatia Lagrange Laplace Lindelöf Logos Malthus Maclaurin Picard Taylor Verhulst Weierstrass Zeno**

___ b Complex number $[x + \mathbf{i}y]^2 = -32\mathbf{i}$, for *real numbers* $x>y$, where $x=$ ⌊.....⌋ and $y=$ ⌊.....⌋.

___ c ITOf $\sqrt{\cdot}, \exp(), \log()$, add/sub/mul/div, write, in simplest form: $\operatorname{acosh}(\frac{5}{3})=$ ⌊.....⌋ and $\operatorname{asinh}(\frac{5}{3})=$ ⌊.....⌋.

___ d U.F. $y=y(x)$ satisfies $y(\pi) = 1$ and

$$\big[2y + x\cos(xy)\big]y' + y\cos(xy) = 2\,.$$

It satisfies $\mathbf{F}\big(x, y(x)\big)=\beta$ for *number* $\beta =$ ⌊.....⌋ and *function* $\mathbf{F}(x, y) :=$ ⌊.....⌋.

___ e A hanging cable has vertex-tension $\mathsf{T} = 200\,\mathsf{lb}$ and cable-density $2\mathsf{lb/ft}$. ITOf exp, log add/sub/mul/div, [write in simplest form] the length of cable lying above $[0\mathsf{ft}, 800\mathsf{ft}]$ is ⌊.....⌋ ft. [Vertex=0ft]

___ f A *critically-damped* unforced spring has DE

$$*: \quad \mathbf{M}y'' + \mathbf{B}y' + \mathbf{K}y = 0\,\tfrac{\mathsf{kg\cdot m}}{\mathsf{sec}^2}\,, \text{ where}$$
$$\mathbf{M} := 3\mathsf{kg}\,, \text{ and the Hooke's constant is } \mathbf{K} := 75\tfrac{\mathsf{kg}}{\mathsf{sec}^2}.$$

The damping constant **B**= ⌊.....⌋.

The *general soln* to critically-damped $(*)$ is

$$y(t)=\Big[\alpha\cdot \text{⌊.....⌋} + \beta\cdot \text{⌊.....⌋}\Big]\,\mathsf{m}.$$

Here, $\alpha,\beta \in \mathbb{R}$, *dimensionless.* [*The above blanks have numbers & units in various places; the bracketed quantity is dimensionless.* Is exp(?) is more convenient than $\mathsf{e}^?$ notation?] The **specific** soln with $y(0\mathsf{sec}) = 0\mathsf{m}$ and $y'(0\mathsf{sec}) = 2\frac{\mathsf{m}}{\mathsf{sec}}$ has

$\alpha=$ ⌊.....⌋, $\beta=$ ⌊.....⌋.

OYOP: *In grammatical English* ***sentences****, write your essay on every* $2^{\text{nd}}$ *line* (usually)*, so I can easily write between the lines.*

**T2:** Fnc $h=h(x)$ describes the height of a hanging cable, where $x::\mathsf{ft}$ and $h(x)::\mathsf{ft}$, and the cable's vertex is at $(0\mathsf{ft}, 0\mathsf{ft})$. Using $\mathsf{T}::\mathsf{lb}$ for the *vertex-tension*, and $\mathsf{S}::\frac{\mathsf{lb}}{\mathsf{ft}}$ for the *cable-density*, write an essay in text and LARGE, LABELED pictures, carefully deriving our DE for $h()$. [Do not solve the DE.]

End of T-Class

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|---|---|---|
| **T1:** | ___ ___ ___ | 175pts |
| **T2:** | ___ ___ | 65pts |
| **Total:** | ___ ___ ___ | 240pts |

*Please PRINT your name and ordinal. Ta:*

Ord: ⌊.....⌋

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

Signature: ⌊.....⌋