Differential Eqns
MAP2302

S-Class

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Welcome. 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!)**

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 $[\sin x]$.

Recall $[\![x \downarrow K]\!] := x\cdot[x-1]\cdot[x-2]\cdots[x-[K-1]]$, is read as *"N falling-factorial K"*.

S1: Show no work.

a Prof. King wears bifocals, and cannot read small handwriting. Circle one: **True!** **Yes!** ***Who??***

b $[\mathbf{D}-3\mathbf{I}]^6\left(x^9\cdot \mathrm{e}^{3x}\right)=$ ⌞. . . . . .⌟.

c *A* soln to $[f''-3f'](x)=14-6x$ is **polynomial** $f(x)=$ ⌞. . . . . .⌟. Using parameters α and β, then, the *general* solution to $[h''-3h'](x)=14-6x$ is

$h_{\alpha,\beta}(x)=$ ⌞. . . . . .⌟.

And the h with $h(0)=0$ and $h'(0)=0$ is $h(x)=$ ⌞. . . . . .⌟.

d Fnc $y_\beta(t) :=$ ⌞ . . . . . ⌟ is the general soln to $\frac{dy}{dt} = 8t^3 \cdot [y-5]$. [FOLDE or SoV]

The *particular* $y()$ with $y(0) = 8$ is $y(t) :=$ ⌞ . . . . . ⌟. And this function has $y(1) =$ ⌞ . . . . . ⌟.

e Degree-N polynomial $y = y(t)$ satisfies

†: $\quad 4y^2 - t^9 y' = 15t^9 + 4t^2 .$

Thus $N =$ ⌞ . . . . ⌟. [*Hint:* Don't compute y; just the polynomial's degree.]

S2: Show no work.

f DiffOperators $\mathbf{P}, \mathbf{Q}, \mathbf{R}, \mathbf{S}$ are defined as

$$\mathbf{P}(f) := f(3) \cdot f', \qquad \mathbf{Q}(f) := \cos(3) \cdot f^{(3)},$$
$$\mathbf{R}(f) := [\cos(3) \cdot f] + f'', \qquad \mathbf{S}(f) := \cos(3) + [3f'].$$

Then . . . $\mathbf{P}$ *is linear:* T F. $\mathbf{Q}$ *is linear:* T F.
$\mathbf{R}$ *is linear:* T F. $\mathbf{S}$ *is linear:* T F.

g Write $\cos(-2\boldsymbol{i})$, which is real, ITOf exp() and add/sub/mul/div: $\cos(-2\boldsymbol{i})=$ ⌞. . . . . ⌟.

And $\cos(-2\boldsymbol{i})$ lies in circle the correct interval

$(-\infty, \frac{-1}{5}]$ $(\frac{-1}{5}, \frac{1}{5}]$ $(\frac{1}{5}, 2]$ $(2, 5]$ $(5, 15]$ $(15, 45]$ $(45, \infty)$

End of S-Class

S1: ___ ___ ___ 120pts

S2: ___ ___ 40pts

Total: ___ ___ ___ 160pts