

**D1:** Show no work.

**a** Prof. King believes that writing in complete, coherent sentences is crucial in communicating Mathematics, improves posture, and whitens teeth. Circle one:

True! Yes! **wH'at S a? sEnTEnCE**

**b** For the RLC-circuit on the blackboard, denote the loop-currents at time  $t$  by  $x(t)$  and  $y(t)$  [in amps]. The system of DEs satisfied by  $x()$  and  $y()$  is

Loop 1: = andLoop 2: = .

**c** With  $f(x) := e^{7x}$  and  $g(x) := e^{4x}$ , then

$$[f \circledast g](5) = \text{.....}.$$

**d** Matrices  $A, B, U$  are  $2 \times 2$ , with  $U$  is invertible. Then  $e^{A+B} = e^A \cdot e^B$ : AT AF Nei  
 $Ue^B U^{-1} = e^{UBU^{-1}}$ : AT AF Nei  
If  $e^B$  invertible, then  $B$  is invertible: AT AF Nei

**e** Fncts  $x(t)$  and  $y(t)$  satisfy this system of DEs,

$$\begin{aligned} x' + x - 3y &= 0, \\ y' + 6x - 8y &= 0. \end{aligned}$$

It can be written  $\mathbf{Y}' = \mathbf{M} \cdot \mathbf{Y}$ ,where  $\mathbf{Y} := \begin{bmatrix} x \\ y \end{bmatrix}$  and  $\mathbf{M}$  is matrixCharacteristic poly of  $\mathbf{M}$  is  $\phi_{\mathbf{M}}(z) =$ A soln has  $x(t)$  a linear combination of  $e^{\alpha t}$  and  $e^{\beta t}$  for numbers  $\alpha =$  ..... and  $\beta =$  .....

**f** Matrix  $\mathbf{G} := \begin{bmatrix} 2 & -1 & 3 \\ 4 & -2 & 4 \\ 0 & 0 & 0 \end{bmatrix}$

is nilpotent. Computing,  $\mathbf{G}^2 =$ The  $(1, 3)$ -entry of  $e^{\mathbf{G}t}$  is

We can re-write function

$$f(t) := \cdot \cos\left(\frac{3}{4}\pi + 5t\right) + \sqrt{2} \cdot \cos\left(\frac{3}{2}\pi + 5t\right)$$

as  $f(t) = R \cdot \cos(\theta + 5t)$ , for real numbers

$$R = \text{.....} \geq 0 \text{ and } \theta = \text{.....} \in [0, 2\pi).$$

End of D-Class

**D1:** ..... 165pts**Total:** ..... 165ptsPlease 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: .....