

B1: Show no work.

a Write $\frac{20 + 10i}{1 + 3i} = \underline{\hspace{2cm}} + \underline{\hspace{2cm}} \cdot i$, both real.

b Using **real** exp, cos, sin, and i (and algebra), write $e^{[4-7i] \cdot t} = \underline{\hspace{4cm}}$.

The complex number $\sin(5i)$ is **circle**: zero, nz-real, nz-imaginary, not-pure-real-nor-pure-imag.

c In autonomous DE

$$y' = [y - 5][y - 6]^2[y - 7]^3[y - 8]^4,$$

classify each equilibrium pt as Up, Dn, Att, Rep.

5: $\underline{\hspace{2cm}}$, 6: $\underline{\hspace{2cm}}$, 7: $\underline{\hspace{2cm}}$, 8: $\underline{\hspace{2cm}}$.

d,e A *critically-damped* unforced spring has DE

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

So the damping constant $\mathbf{B} = \underline{\hspace{2cm}}$.

The *general soln* to critically-damped (1) is

$$y(t) = P \cdot \underline{\hspace{2cm}} + Q \cdot \underline{\hspace{2cm}},$$

where $P, Q \in \mathbb{C}$. (The 3 blanks need **units!**)

The **specific** soln with $y(0\text{sec}) = 0\text{m}$ and $y'(0\text{sec}) = 2 \frac{\text{m}}{\text{sec}}$ has $P = \underline{\hspace{2cm}}$, $Q = \underline{\hspace{2cm}}$.

f As a zero (root) of polynomial

$$f(x) := [x - 1]^{100} + [x - 5]^{100} - 2^{101},$$

the multiplicity of 3 is $\underline{\hspace{2cm}}$. [Hint: At 3, evaluate the derivatives of f . The answer is in $0, 1, 2, 3, 4, 5, \dots, 100$.]

Essay question and Fill-in-the-blanks. Please write (on your own paper) in *complete grammatical sentences*, a soln to the following problem. Write every 3rd line, please. (Don't Scrunch!)

B2: UFs $x(t)$ and $y(t)$ satisfy differential system

2: $x' + 2x + y' = 0;$

3: $x + y' - 2y = e^{2t}.$

On your essay paper, show all the steps to derive a CCLDE for y ; it is

$\underline{\hspace{4cm}} = \underline{\hspace{4cm}}$.
Compute a soln $y(t) = \underline{\hspace{4cm}}$, showing all the steps in your essay. (Do not bother to solve for $x(t)$.) **Fill-in the above 3 blanks.**

Bonus: Two different solns to IVP $y' = 4 \cdot y^{3/4}$ with $y(5) = 0$ are: $y_1(t) := \underline{\hspace{2cm}}$ and $y_2(t) := \underline{\hspace{2cm}}$.

End of B-class

B1: $\underline{\hspace{1cm}} \underline{\hspace{1cm}} \underline{\hspace{1cm}}$ 180pts

B2: $\underline{\hspace{1cm}} \underline{\hspace{1cm}}$ 55pts

Bonus: $\underline{\hspace{1cm}} \underline{\hspace{1cm}}$ 20pts

Total: $\underline{\hspace{1cm}} \underline{\hspace{1cm}} \underline{\hspace{1cm}}$ 235pts

Print name $\underline{\hspace{4cm}}$

Ord: $\underline{\hspace{2cm}}$

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

Signature: $\underline{\hspace{4cm}}$