Lab 5: Method of Undetermined Coefficients: Answer Template **ENGR-232 Summer 2022**

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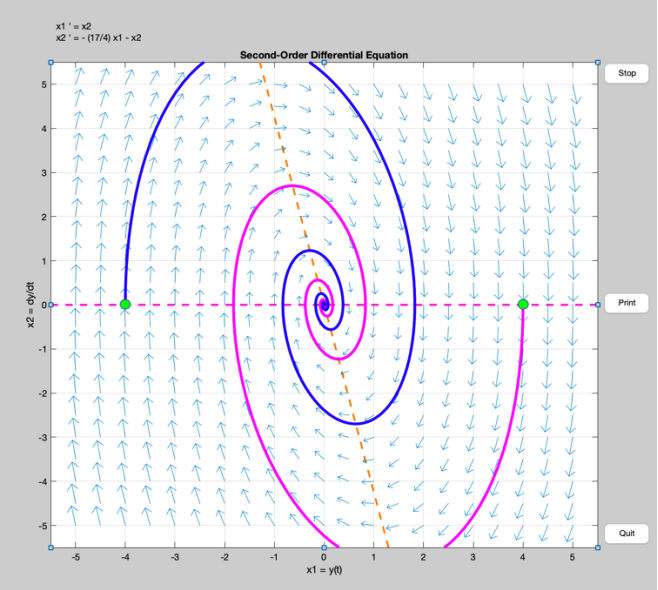
First *Last*

Q1: Paste your completed phase plot here.

Be sure the solution for (4,0) is in **magenta** and that for (−4,0) is in **blue**. Be sure the nullclines are visible.



Q2: Write in the exact solution here, including the code used to find it.

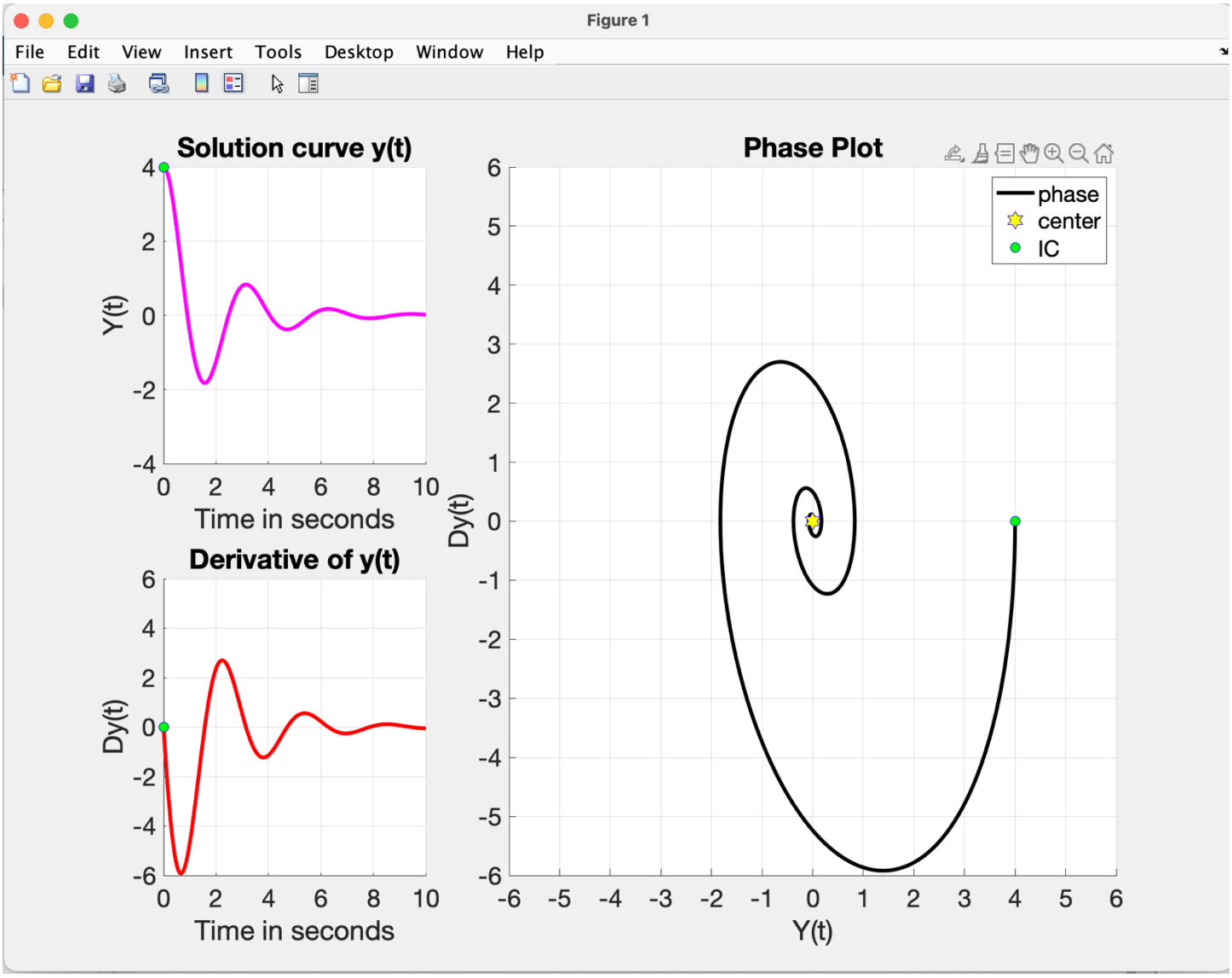
```
%% Q2 - Solve the Homogeneous IVP exactly using dsolve.
% Add your code here.
syms y(t)

Dy = diff(y,t); D2y = diff(y,t, t);

DE = 4*D2y +4*Dy + 17*y == 0;

sol = dsolve(DE, y(0)==4, Dy(0)==0)

% The exact solution is: y(t) = e^(-t/2) · [4 cos(2t) + sin(2t)]
```

Q3: Now evaluate both functions at time $t = 1$. Paste in your values for Y(1) and DY(1) below.

Q3: Answer

```
>> Y(1)
-0.4581
>> DY(1)
-4.6879
```

Q4-5: Paste your completed component and phase plots below for credit.



Questions 6-7: Complete the last column in the table below. The last column already includes the homogeneous solution. Just add the particular solution by typing over the **red** dots.

Forcing function $f(t)$	**Guess for Particular Solution**	**Unique Solution $y(t)$**
a. $f(t) = 17 + 289t$	$At + B$	$y(t) = e^{-\frac{t}{2}} \cdot \left[7\cos 2t - \frac{27}{4}\sin 2t\right] + 17t - 3$
b. $f(t) = 100\, e^{-2t}$	$A\, e^{-2t}$	$y(t) = e^{-\frac{t}{2}} \cdot [4\sin 2t\,] + 4e^{-\frac{t}{2}}$
c. $f(t) = 260\cos 2t$	$A\cos 2t + B\sin 2t$	$y(t) = -e^{-\frac{t}{2}} \cdot [32\sin 2t\,] + 4\cos(2t) + 32\sin(2t)$
d. $f(t) = 16e^{-\frac{t}{2}}\cos 2t + 32\, e^{-\frac{t}{2}}\sin 2t$	**Bump up!** $t\, e^{-t/2}[A\cos 2t + B\sin 2t]$	$y(t) = e^{-\frac{t}{2}} \cdot [4\cos 2t + 2\sin 2t\,] + te^{-\frac{t}{2}}[\boldsymbol{sin(2t) - 2cos(2t)}]$

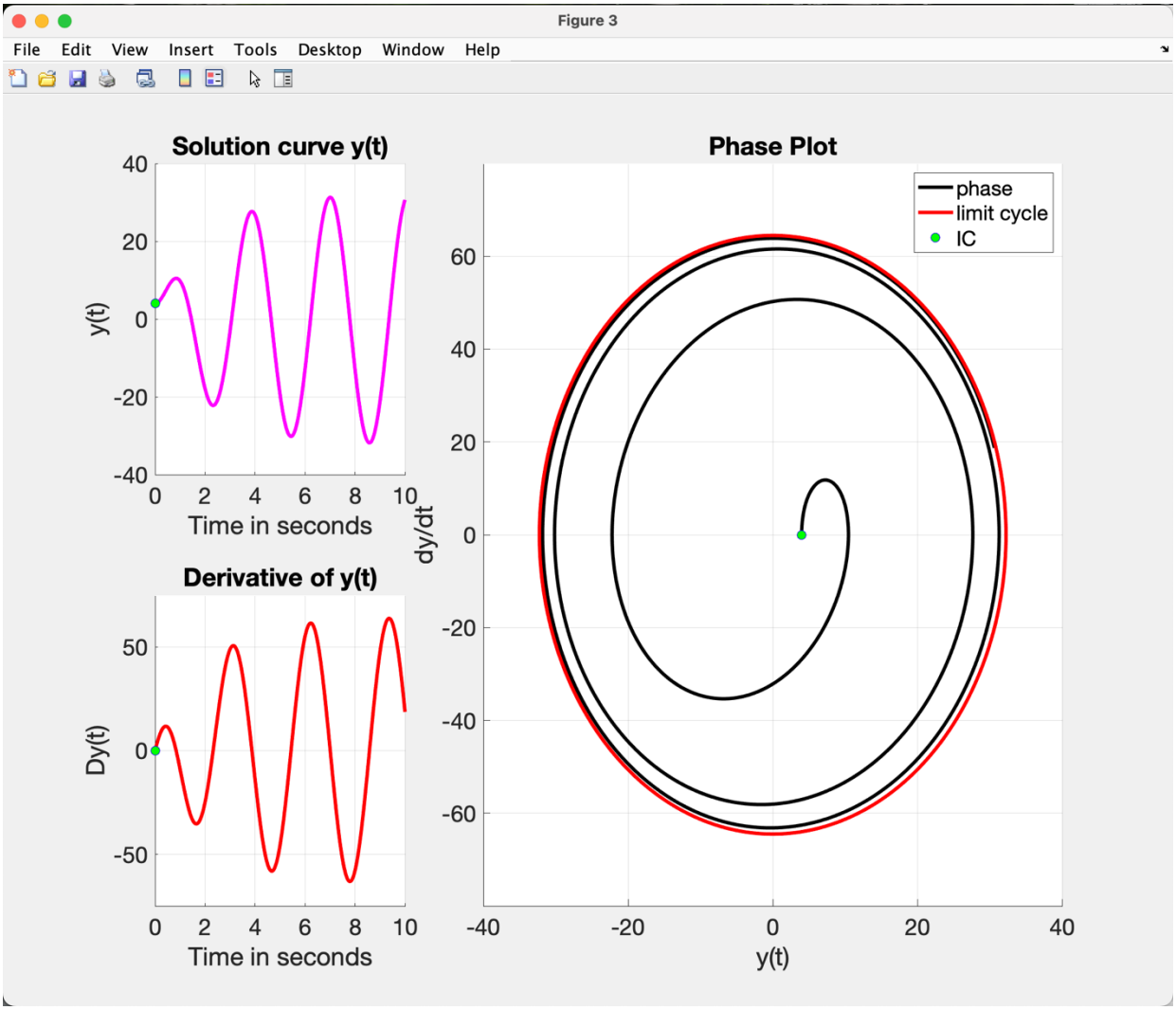
*** Grader will randomly pick two to check for correctness.**

Question 8: Now that you have found the particular solution, record its derivative for one point.

$y_p'(t) = 64\cos(2t) - 8\sin(2t)$

Questions: 9-10: Paste your completed multiplot here.

Be sure to include the **red** limiting ellipse.



Ready to Submit?

Be sure all ten questions are answered. When your lab is complete, be sure to submit three files:

1. Your **completed Answer Template** as a PDF file
2. A copy of your **MATLAB Live Script**
3. A **PDF** copy of your **MATLAB Live Script** (Save-Export to PDF…)

The due date is the day after your lab section by **11:59pm** to receive full credit. You have one more day, to submit the lab (but with a small penalty), and then the window closes for good and your grade will be zero.