

SAMPLE LAB WRITE UP

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1. EXERCISE

Consider the initial value problem,

$$(1) \quad y' = \frac{ty(4-y)}{1+t}, \quad y(0) = y_0, \text{ with } y_0 > 0$$

- (1) How does the solution behave as $t \rightarrow \infty$?
- (2) If $y_0 = 2$, find the exact solution using Maple.
- (3) (Using the previous answer) Find T when the solution first reaches $y = 3.99$.

1.1. **Solution.** To answer the first question, we plot the direction field in Maple, yielding the graph in Figure 1. From this, we estimate that, if the initial value of y , $y(0) > 0$, then the solution will tend to the line $y = 4$ as $t \rightarrow \infty$.

For the second problem, the solution to Equation 1 was given as:

$$y(t) = \frac{4e^{4t}}{e^{4t} + 1 + 4t + 6t^2 + 4t^3 + t^4}$$

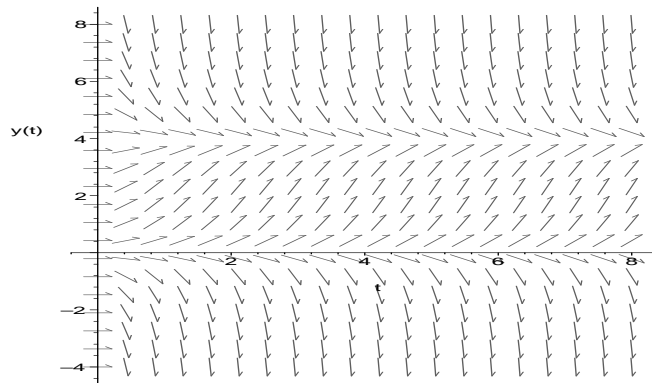


FIGURE 1. This is the direction field for the initial value problem defined in Equation 1. From this picture, we see that if $y(0) > 0$, then $y(t) \rightarrow 4$ as $t \rightarrow \infty$

To find the value of T for which $y(T) = 3.99$, we used `fsolve` from Maple. To get the correct value, we plotted f to get an estimate of the desired value of T , and found it to be between 2 and 5. The commands used were as follows:

```
diffeqn:=diff(y(t),t)=(t*y(t)*(4-y(t)))/(1+t);
F:=dsolve({diffeqn,y(0)=2});
f:=rhs(F);
fsolve(f=3.99,t=2..5);
```

We obtained a value of approximately 2.84367, which agrees with the graph.

NOTES ON THE WRITE UP

- (1) Put descriptive captions on the figures.
- (2) Use equation numbers, and reference them using `\ref` - Do not type equation numbers in manually!
- (3) Include the questions that you are answering, not just the answers. In the answer, include enough detail so that you can replicate what you did.
- (4) If the question just asks for Maple output, you might include the Maple command you used. Notice in the sample write up, I needed to include more lines than just `fsolve(f=3.99, t=2..5)`.
- (5) Notice that the solution was simplified somewhat to be more readable. This footnote is only for the sample, I would not have put it in the lab write up.
- (6) Use complete sentences and correct spelling!
- (7) Although the graph was a little distorted, it showed what I wanted it to show. Feel free to change the scaling if you need to.
- (8) A sample LaTeX document showing a figure with multiple plots is also given only to give you a sample- it's not part of this particular write up.

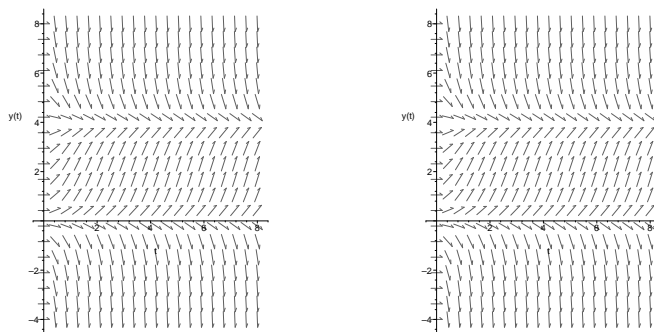


FIGURE 2. This is a sample figure with two graphs