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Math 20D C01

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Exercise 2.1

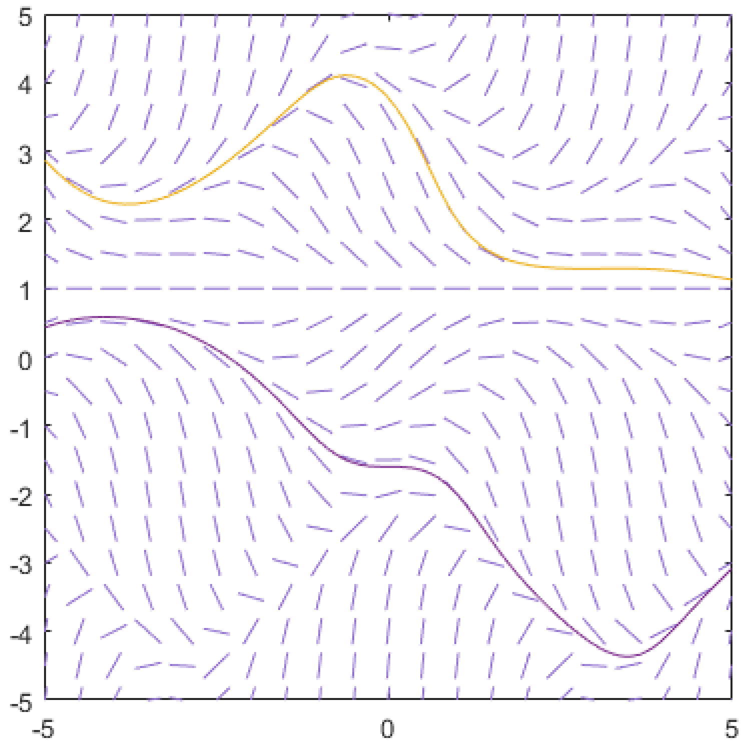
```
>> dsolve('Dy=y/2', 'y(0)=1', 'x')
ans =

exp(x/2)
```

I found that by sketching the solutions to part a and b, the function y = e^x closely matches a solution set to the data. After using dsolve to find the exact solution at the point y(0) = 1, we get the equation y = e^(x/2) which almost mirrors our previous prediction.

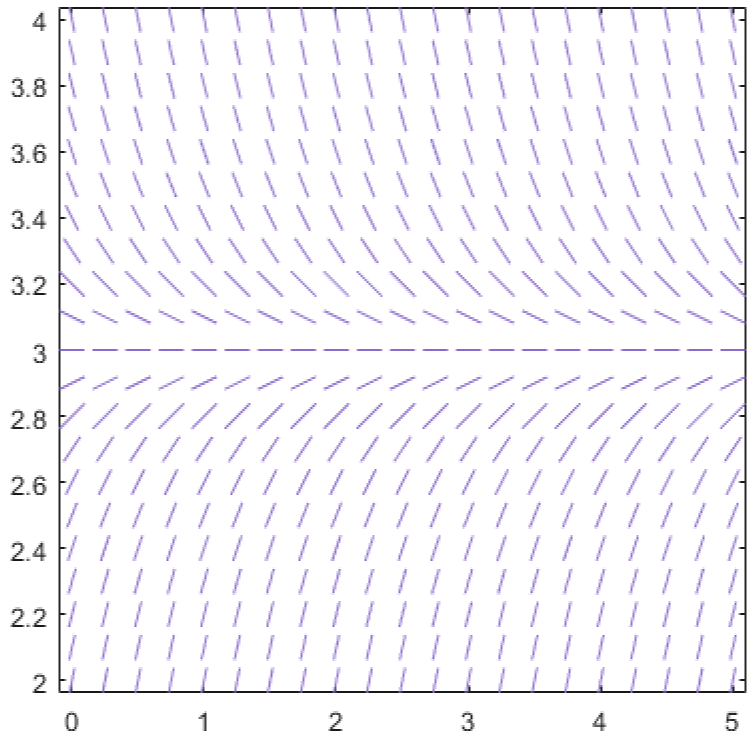
Exercise 2.2

```
f = @(x, y) (cos(x)+sin(y))*(1-y);
slopefield(f, [-5,5], [-5,5], 20)
hold on
axis([-5,5,-5,5])
drawode(f, [-5,5], 1, 2)
drawode(f, [-5,5], 1, -2)
hold off
```



Considering how complicated some ODEs are, we use slope fields to help us immediately visualize a variety of solutions to an ODE. By picking out an initial x and y value on the graph, we can follow the sloped lines to visualize the solution set for those points.

Exercise 2.3



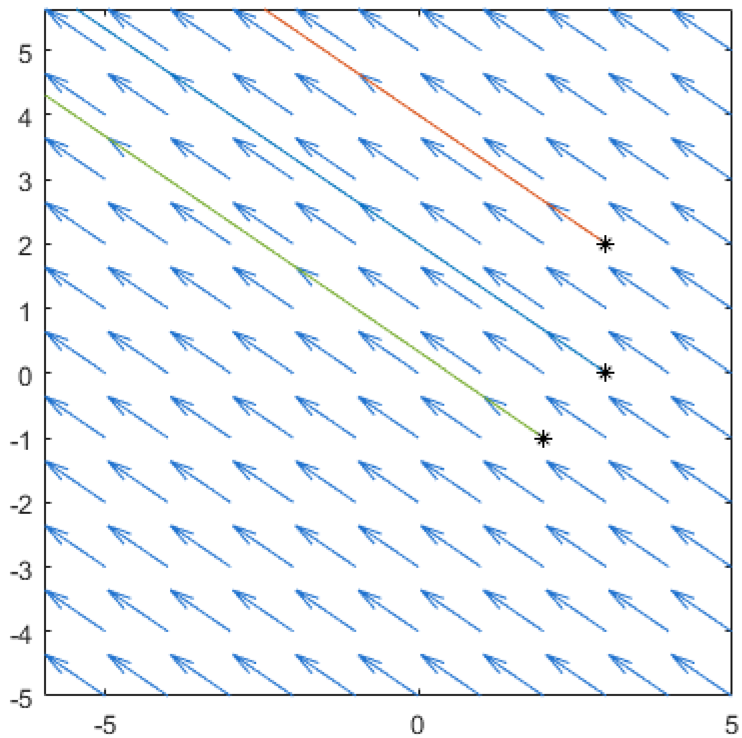
I believe that A is equivalent to the resting temperature of an object in a certain environment. This is because the object will either heat up or cool down (as demonstrated by the graph) until it reaches the A value. Once it reaches this value, the object's temperature will stay consistent, resulting in a differential change in temperature equivalent to zero.

Exercise 2.4

1. The Differential Equation: Dy/dt = 0.4*(41-y), y(0) = -6
2. The value of A should be 41, as this is the temperature that the chicken will stabilize at in the fridge.
3. According to the plot, it would take a t value of approximately 7.9 to defrost the chicken to 39 degrees by putting it in the fridge. Because t is measured in hours, it will take nearly 8 hours to fully defrost the chicken.
4. By defrosting the chicken on the kitchen counter, our t value will be greatly reduced. By looking at the graph, we can see that our t value dropped from 7.9 to approximately 2.3. Because of this, we can conclude that we would save around 5.6 hours by defrosting the chicken on the kitchen counter.

Exercise 2.5

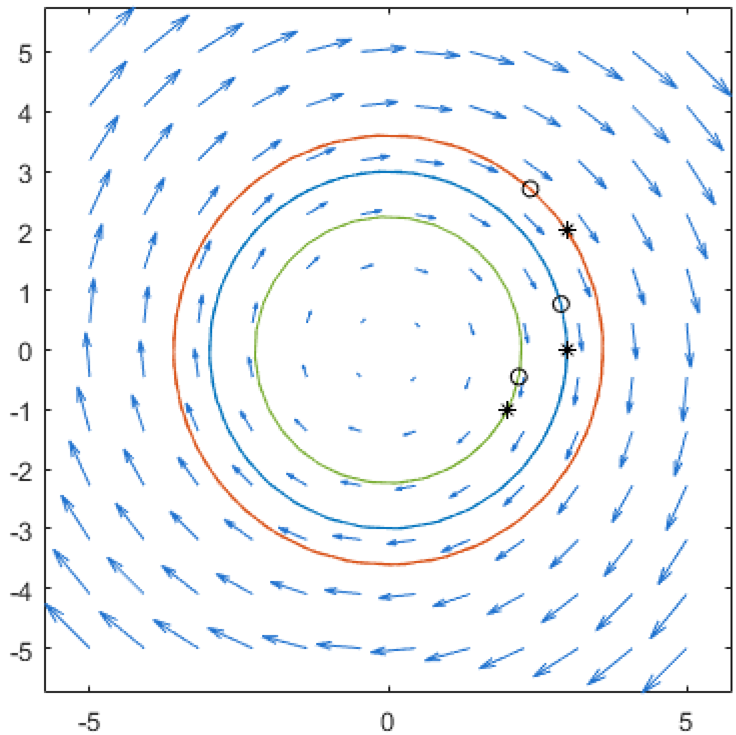
```
g = @(t,Y) [-3; 2];
tmax = 50;
phaseplane(g, [-5,5], [-5,5], 11)
hold on
drawphase(g, tmax, 3, 2)
drawphase(g, tmax, 2, -1)
drawphase(g, tmax, 3, 0)
hold off
```



The slope of the lines in the phase plane changed direction based off of the points I selected. For example, (2,2) yielded a first quadrant slope while (-3, 2) yielded a 2nd quadrant directional slope.

Exercise 2.6

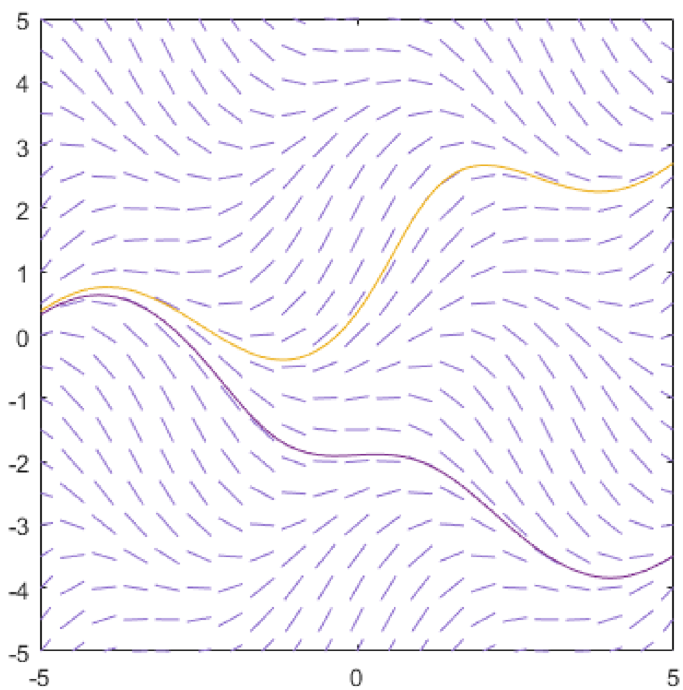
```
g = @(t,Y) [Y(2); -Y(1)];
tmax = 50;
phaseplane(g, [-5,5], [-5,5], 12)
hold on
drawphase(g, tmax, 3, 2)
drawphase(g, tmax, 2, -1)
drawphase(g, tmax, 3, 0)
hold off
```


5
4
3
2
1
0
-1
-2
-3
-4
-5
-5
0
5

Exercise 2.7

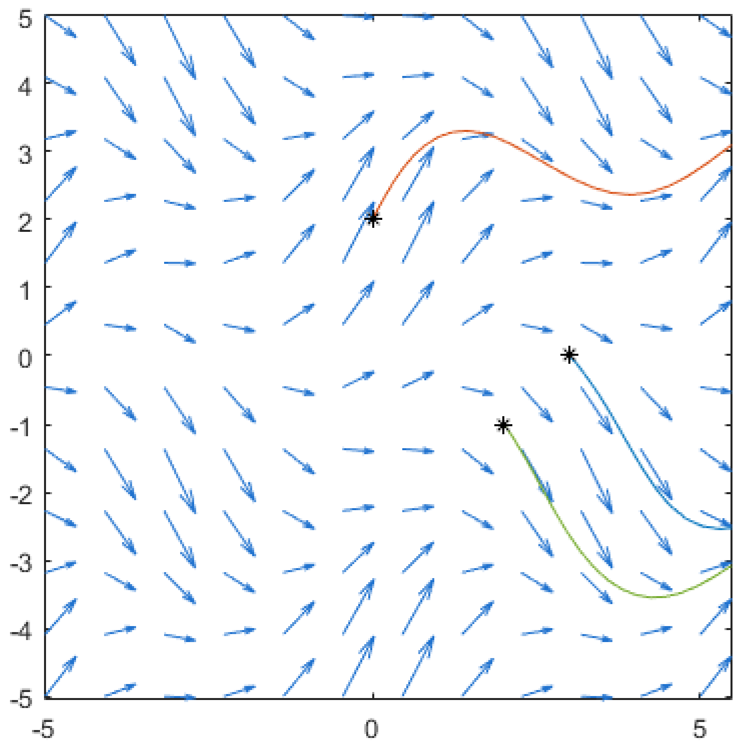
Direction field:

```
f = @(x, y) cos(x) + sin(y);
slopefield(f, [-5,5], [-5,5], 20)
hold on
axis([-5,5,-5,5])
drawode(f, [-5,5], 1, 2)
drawode(f, [-5,5], 1, -2)
hold off
```



Phase Portrait:

```
g = @(t,Y) [1; cos(Y(1)) + sin(Y(2))];
tmax = 50;
phaseplane(g, [-5,5], [-5,5], 12)
hold on
drawphase(g, tmax, 0, 2)
drawphase(g, tmax, 2, -1)
drawphase(g, tmax, 3, 0)
hold off
```

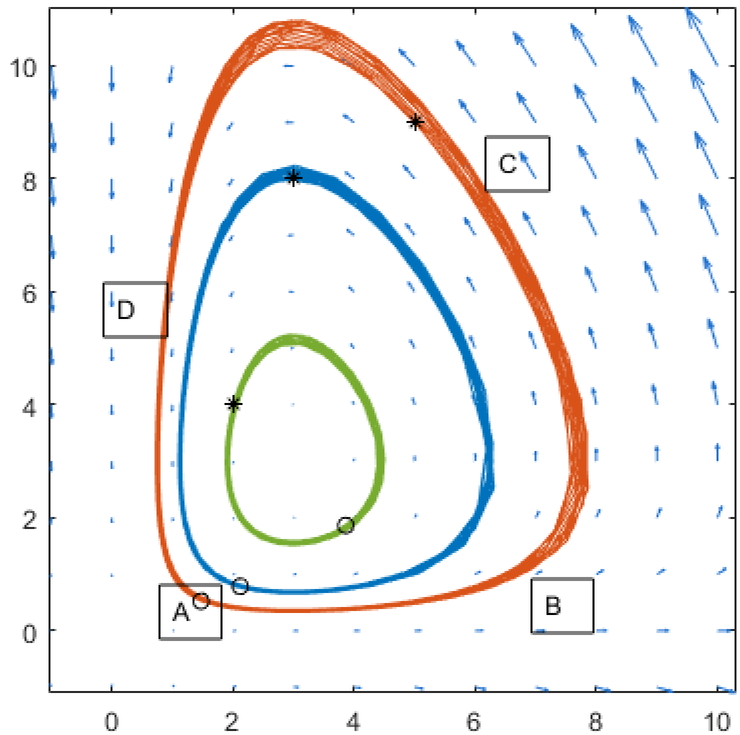


In looking at the two figures, it is evident that they share similar solutions to their ODEs. This is because the solution curves in both figures match up.

Exercise 2.8

a = 3, b = 1, c = 2, d = 3

```
g = @(t,Y) [Y(1)*(a-b*Y(2)); c*Y(2)*(Y(1)-d)];
tmax = 25;
phaseplane(g, [-1,10], [-1,10], 12)
hold on
drawphase(g, tmax, 0, 1)
drawphase(g, tmax, 2, 4)
drawphase(g, tmax, 3, 8)
hold off
```



10
8
6
4
2
0
0
2
4
6
8
10
A
B
C
D