

## 212 Lab #10 Key

My comments are in blue.

1.

```
>> syms x y x1 x2 t lambda L a b
>> [x1,x2]=dsolve('Dx1=x1+2*x2','Dx2=3*x1+2*x2','x1(0)=a','x2(0)=b','t')
```

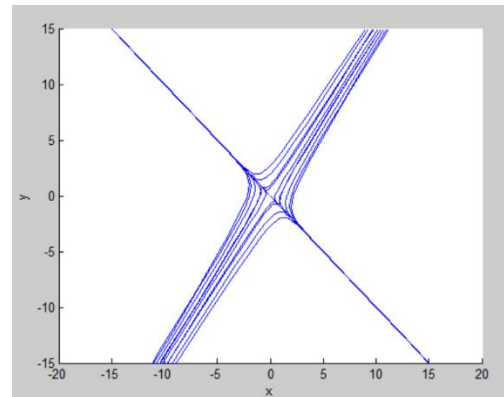
x1 =

$$(\exp(-t)*((9*a)/5 - (6*b)/5 + 2*\exp(5*t)*((3*a)/5 + (3*b)/5)))/3$$

x2 =

$$\exp(-t)*((2*b)/5 - (3*a)/5 + \exp(5*t)*((3*a)/5 + (3*b)/5))$$

```
>> xf=@(t,a,b)eval(vectorize(x1));
>> yf=@(t,a,b)eval(vectorize(x2));
>> figure; hold on
>> t=-3:0.1:3;
>> for a=-2:2
for b=-2:2
plot(xf(t,a,b),yf(t,a,b))
end
end
>> hold off
>> axis([-20 20 -15 15])
>> xlabel 'x'
>> ylabel 'y'
>>
```



2.

```
>> [x1,x2]=dsolve('Dx1=4*x1+7*x2','Dx2=-2*x1-5*x2','x1(0)=a','x2(0)=b','t')
```

x1 =

$$-(\exp(-3*t)*((4*a)/5 + (14*b)/5 - 7*\exp(5*t)*((2*a)/5 + (2*b)/5)))/2$$

x2 =

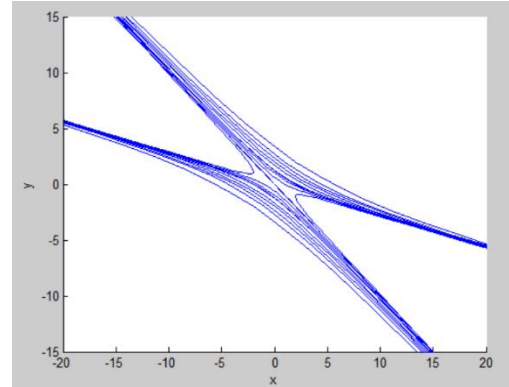
$$\exp(-3*t)*((2*a)/5 + (7*b)/5 - \exp(5*t)*((2*a)/5 + (2*b)/5))$$

```
>> xf=@(t,a,b)eval(vectorize(x1));
>> yf=@(t,a,b)eval(vectorize(x2));
>> figure; hold on
>> t=-3:0.1:3;
>> for a=-2:2
for b=-2:2
```

```

plot(xf(t,a,b),yf(t,a,b))
end
end
>> hold off
>> axis([-20 20 -15 15])
>> xlabel 'x'
>> ylabel 'y'
>>

```



3.

```

>> [x1,x2]=dsolve('Dx1=2*x1','Dx2=-x1-5*x2','x1(0)=6','x2(0)=1','t')

```

x1 =

$6 \cdot \exp(2 \cdot t)$

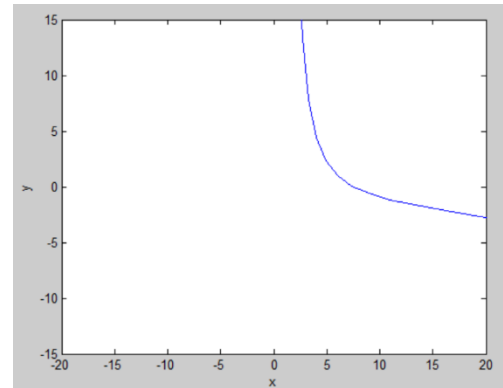
x2 =

$-\exp(-5 \cdot t) \cdot ((6 \cdot \exp(7 \cdot t))/7 - 13/7)$

```

>> xf=@(t)eval(vectorize(x1));
>> yf=@(t)eval(vectorize(x2));
>> t=-3:0.1:3;
>> plot(xf(t),yf(t))
>> axis([-20 20 -15 15])
>> xlabel 'x'
>> ylabel 'y'
>>

```



4.

```

>> syms A B C
>> [A,B,C]=dsolve('DA=30-15*A/500','DB=15/500*A-15*B/1000','DC=15*B/1000-15*C/2000','A(0)=0','B(0)=0','C(0)=0','t')

```

A =

$(3 \cdot \exp(-3 \cdot t)/100) \cdot ((4000 \cdot \exp((3 \cdot t)/100))/3 - 4000/3)/4$

B =

$(\exp(-3 \cdot t)/100) \cdot (\exp((3 \cdot t)/200) \cdot (8000 \cdot \exp((3 \cdot t)/200) - 8000) - 4000 \cdot \exp((3 \cdot t)/100) + 4000)/2$

C =

$\exp(-3t/100) * ((4000 * \exp(3t/100))/3 - \exp(3t/200) * (8000 * \exp(3t/200) - 8000) + \exp(9t/400) * ((32000 * \exp(3t/400))/3 - 32000/3) - 4000/3)$

>>

5.

>> [A,B,C]=dsolve('DA=30-15\*A/500+15\*C/2000','DB=15/500\*A-15\*B/1000','DC=15\*B/1000-15\*C/2000','A(0)=0','B(0)=0','C(0)=0','t')

A =

$(30t)/7 - (4000 * \cos((3 * 7^{1/2} * t)/800))/(7 * \exp(t)^{(21/800)}) + (20000 * 7^{1/2} * \sin((3 * 7^{1/2} * t)/800))/(49 * \exp(t)^{(21/800)}) + 4000/7$

B =

$(60t)/7 - (4000 * \cos((3 * 7^{1/2} * t)/800))/(7 * \exp(t)^{(21/800)}) - (44000 * 7^{1/2} * \sin((3 * 7^{1/2} * t)/800))/(49 * \exp(t)^{(21/800)}) + 4000/7$

C =

$(120t)/7 + (8000 * \cos((3 * 7^{1/2} * t)/800))/(7 * \exp(t)^{(21/800)}) + (24000 * 7^{1/2} * \sin((3 * 7^{1/2} * t)/800))/(49 * \exp(t)^{(21/800)}) - 8000/7$

>>

6.

>> syms x1 x2 x3 x4 t

>> [x1,x2,x3,x4]=dsolve('Dx1=x3','Dx2=x4','Dx3=-x1+4/5\*x2','Dx4=2/5\*x1-3/5\*x2','x1(0)=a','x2(0)=b','x3(0)=0','x4(0)=0','t')

x1 =

$(a * \cos((5^{1/2} * t)/5))/3 + (2 * a * \cos((35^{1/2} * t)/5))/3 + (2 * b * \cos((5^{1/2} * t)/5))/3 - (2 * b * \cos((35^{1/2} * t)/5))/3$

x2 =

$(a * \cos((5^{1/2} * t)/5))/3 - (a * \cos((35^{1/2} * t)/5))/3 + (2 * b * \cos((5^{1/2} * t)/5))/3 + (b * \cos((35^{1/2} * t)/5))/3$

x3 =

$(2 * 35^{1/2} * b * \sin((35^{1/2} * t)/5))/15 - (2 * 35^{1/2} * a * \sin((35^{1/2} * t)/5))/15 - (2 * 5^{1/2} * b * \sin((5^{1/2} * t)/5))/15 - (5^{1/2} * a * \sin((5^{1/2} * t)/5))/15$

x4 =

$$(35^{1/2} * a * \sin((35^{1/2} * t) / 5)) / 15 - (5^{1/2} * a * \sin((5^{1/2} * t) / 5)) / 15 - \\ (2 * 5^{1/2} * b * \sin((5^{1/2} * t) / 5)) / 15 - (35^{1/2} * b * \sin((35^{1/2} * t) / 5)) / 15$$

```
>> xf=@(t,a,b)eval(vectorize(x1));  
>> yf=@(t,a,b)eval(vectorize(x2));  
>> figure; hold on  
>> t=-6:0.1:6;  
>> for a=-2:2  
for b=-2:2  
plot(xf(t,a,b),yf(t,a,b))  
end  
end  
>> hold off  
>> axis([-5 5 -5 5])  
>> xlabel 'x'  
>> ylabel 'y'  
  
>>
```

