

HOMEWORK 0

Due date: January 24, 2018, 11:55PM.

Bibliography: Course lecture notes Lessons 1-3. Textbook chapter 2

Homework 0 is a test of submission procedures, and not included in course grade. Exercises from the textbook are solved using the various software packages available in the SciComp@UNC environment. You are invited to follow along, perhaps change a few parameters to see what happens.

Problem 1. (2.1.4, p.16)

Mathematica

```
In[2]:= SetDirectory["/home/student/courses/MATH564/homework"];
sol1 = DSolve[{y'[t] == 3 y[t], y[0]==2},y[t],t] [[1,1]]
```

$y(t) \rightarrow 2e^{3t}$

```
In[3]:= sol2 = DSolve[{y'[t] == 2 y[t], y[0]==3},y[t],t] [[1,1]]
```

$y(t) \rightarrow 3e^{2t}$

```
In[4]:= sol3 = DSolve[{y'[t] == 2 y[t], y[0]==-3},y[t],t] [[1,1]]
```

$y(t) \rightarrow -3e^{2t}$

```
In[5]:= sol4 = DSolve[{y'[t] == -2 y[t], y[0]==3},y[t],t] [[1,1]]
```

$y(t) \rightarrow 3e^{-2t}$

```
In[6]:= plots=Plot[{y[t] /. sol1, y[t] /. sol2, y[t] /. sol3, y[t] /. sol4},{t,0,1}];
Export["hw00ex01.png",plots];
```

Null

```
In[7]:=
```

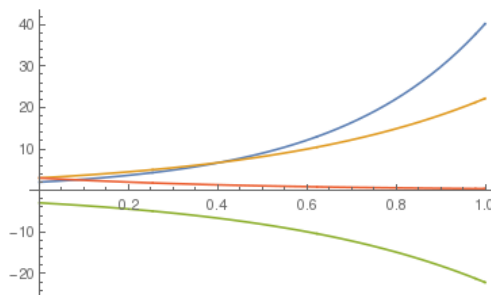


Figure 1. Solutions to ODEs in Ex 2.1.4, p.16

Problem 2. (2.2.1, p.25)

```
octave> h=62:73
```

h =

```
62 63 64 65 66 67 68 69 70 71 72 73
```

```
octave> w=[128 131 135 139 142 146 150 154 158 162 167 172]
```

w =

128 131 135 139 142 146 150 154 158 162 167 172

octave>

Form linear model $\tilde{w} = a_1 \mathbf{1} + a_2 \mathbf{h} = (\mathbf{1} \ \mathbf{h}) \mathbf{a} = \mathbf{X} \mathbf{a}$

octave> m=length(h)

m = 12

octave> X=[ones(m,1) h']; [Q,R]=qr(X,'0'); a=R\ (Q'*w')

a =

-118.5012

3.9580

octave> size(Q)

ans =

12 2

octave> size(R)

ans =

2 2

octave> [w; (X*a)']

ans =

Columns 1 through 8:

128.00	131.00	135.00	139.00	142.00	146.00	150.00	154.00
126.90	130.86	134.81	138.77	142.73	146.69	150.65	154.60

Columns 9 through 12:

158.00	162.00	167.00	172.00
158.56	162.52	166.48	170.44

octave>

In[7] := h=Table[i, {i, 62, 73}]

{62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73}

In[8] := w={128, 131, 135, 139, 142, 146, 150, 154, 158, 162, 167, 172}

{128, 131, 135, 139, 142, 146, 150, 154, 158, 162, 167, 172}

In[9] := Fit[Transpose[{h,w}], {1,x}, x]

3.95804x - 118.501

In[10] :=

Note that the statement in the textbok $w = 4.04h + 124.14$, is not true.

Problem 3. (2.4.1, p.45)

```
In[10]:= sol1 = DSolve[{y''[t]+6 y[t]==0, y[0]==1, y'[0]==0},y[t],t] [[1,1]]
```

$y(t) \rightarrow \cos(\sqrt{6}t)$

```
In[11]:= sol2 = DSolve[{y''[t]-6 y[t]==0, y[0]==1, y'[0]==0},y[t],t] [[1,1]]
```

$y(t) \rightarrow \frac{1}{2}e^{-\sqrt{6}t}(e^{2\sqrt{6}t} + 1)$

```
In[12]:= sol3 = DSolve[{y''[t]+2y'[t]+6 y[t]==0, y[0]==1, y'[0]==0},y[t],t] [[1,1]]
```

$y(t) \rightarrow \frac{1}{5}e^{-t}(\sqrt{5}\sin(\sqrt{5}t) + 5\cos(\sqrt{5}t))$

```
In[13]:= sol4 = DSolve[{y''[t]-2y'[t]+6 y[t]==0, y[0]==1, y'[0]==0},y[t],t] [[1,1]]
```

$y(t) \rightarrow \frac{1}{5}e^t(5\cos(\sqrt{5}t) - \sqrt{5}\sin(\sqrt{5}t))$

```
In[14]:= plots=Plot[{y[t] /. sol1, y[t] /. sol2, y[t] /. sol3, y[t] /. sol4},{t,0,1}];  
Export["hw00ex03.png",plots];
```

Null

```
In[15]:=
```

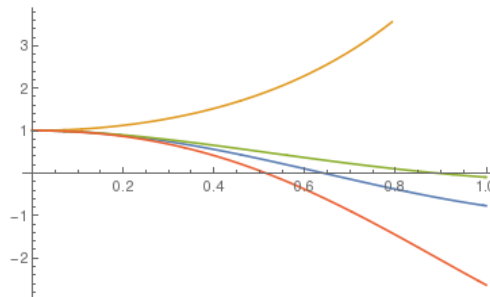


Figure 2.

Problem 4. (2.6.1.a, p.56)

```
octave> A=[0 0 -2; 1 2 1; 1 0 3]
```

A =

0	0	-2
1	2	1
1	0	3

```
octave> [X,L]=eig(A)
```

X =

0.00000	-0.81650	0.70711
1.00000	0.40825	0.00000
0.00000	0.40825	-0.70711

L =

Diagonal Matrix

2	0	0
0	1	0
0	0	2

```
octave> inv(X)
ans =
    1.00000    1.00000    1.00000
   -2.44949    0.00000   -2.44949
   -1.41421    0.00000   -2.82843
```

```
octave> X*L*inv(X)
ans =
    0    0   -2
    1    2    1
    1    0    3
```

```
octave>
```

Problem 5. (2.7.2, p.67)

```
octave> n=[2 1 2 7 10 14 7 5 2 1]; h=66:75; m=sum(n)
```

```
m = 51
```

```
octave> sum(n.*h)/m
```

```
ans = 70.667
```

```
octave> d=zeros(1,m);
```

```
octave> n1=1;
```

```
    for i=1:length(n)
        d(n1:n1+n(i)-1)=h(i);
        n1=n1+n(i);
    end
```

```
octave> [mean(d) median(d) var(d) std(d)]
```

```
ans =
```

```
    70.6667    71.0000    3.5467    1.8833
```

Problem 6. (2.8.3, p. 79)

```
octave> die=fix(6*rand(1,300)+1);
```

```
octave> count3s=1./(die-3);
```

```
octave> count3s=isinf(count3s);
```

```
octave> number3s=sum(count3s)
```

```
number3s = 47
```

```
octave>
```