MATLAB Session 2

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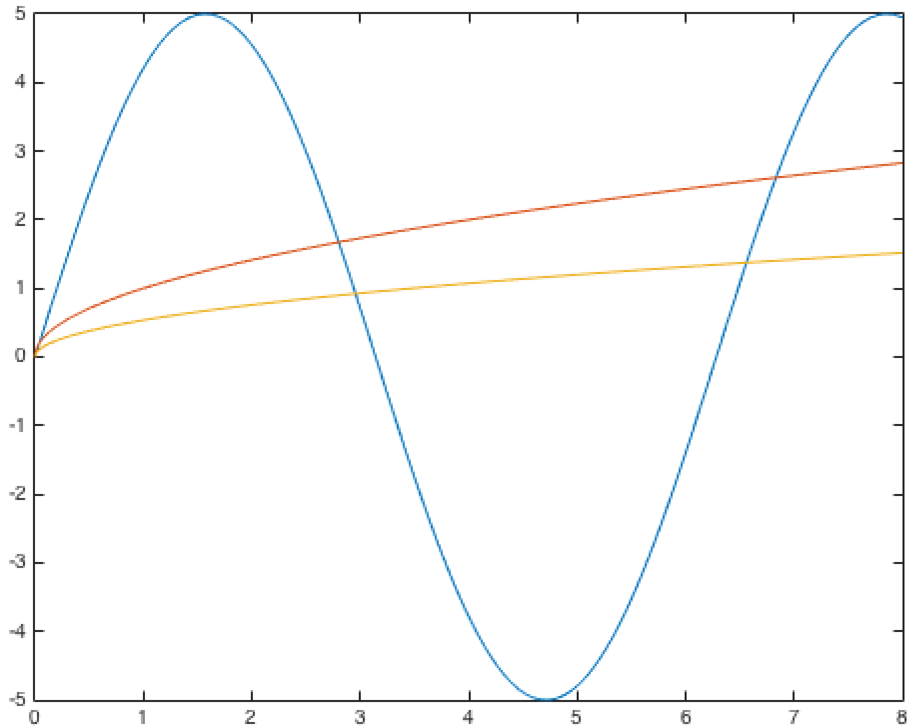
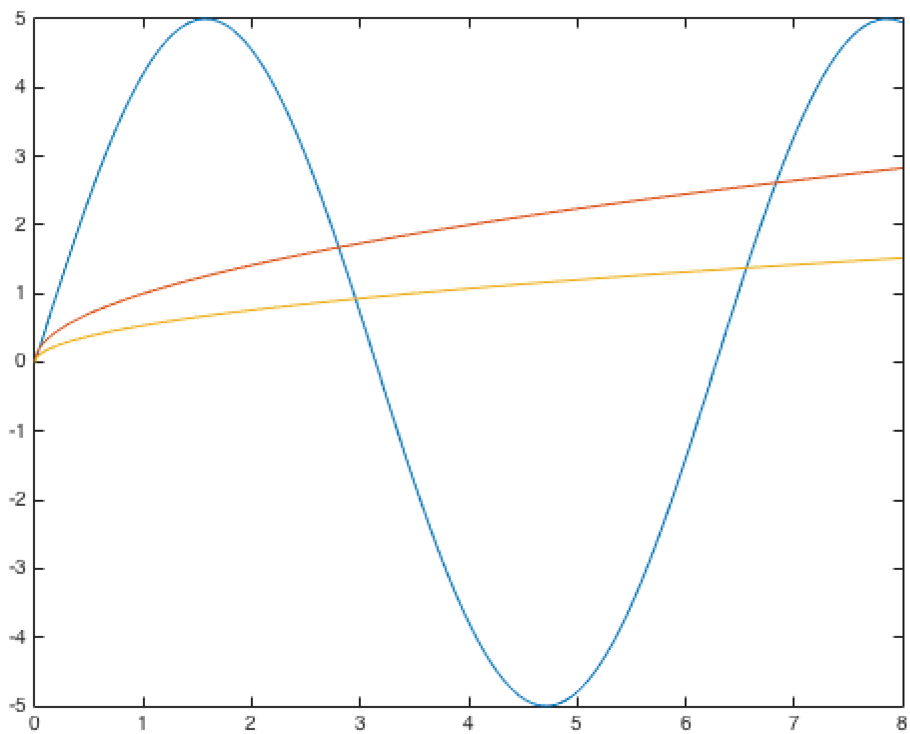
Question 3

Multiple plots, maxima, minima and comparators: For t = 0 to 8 and each each signal s1 = 5sint, s2 = 2? t and s3 = 0.4?(1.8t)

a) Plot the 3 signals on the same time axes, use: *figure, hold, plot(t, s# , ?colour letter?) and/or plot(t, [s1; s2; s3])*

```
t = 0: .01 : 8; % t=linspace(0,8,1000)
y1 = 5*sin(t);
y2=sqrt(t); %y2=t^0.5;
y3=0.4*(1.8*t).^0.5; %y3=0.4*sqrt(1.8*t);
figure
plot(t,y1); hold on; plot(t,y2);
plot(t,y3)
figure
plot(t,[y1;y2;y3])
```

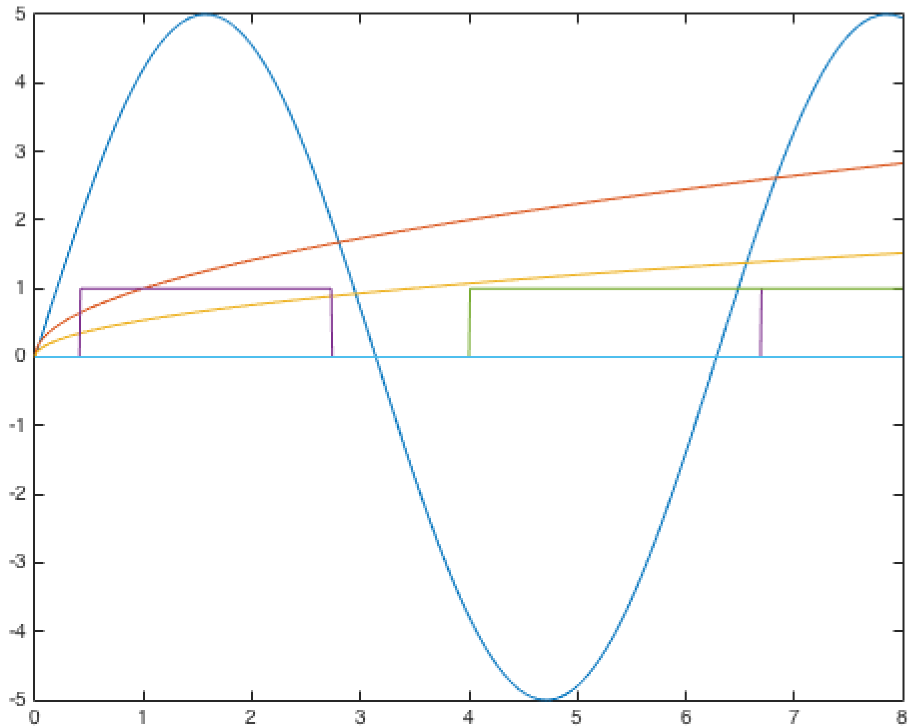

5
4
3
2
1
0
-1
-2
-3
-4
-5
0
1
2
3
4
5
6
7
8


5
4
3
2
1
0
-1
-2
-3
-4
-5
0
1
2
3
4
5
6
7
8

b) >>max(s#) , min(s#) % Confirm the maximum and minimum values

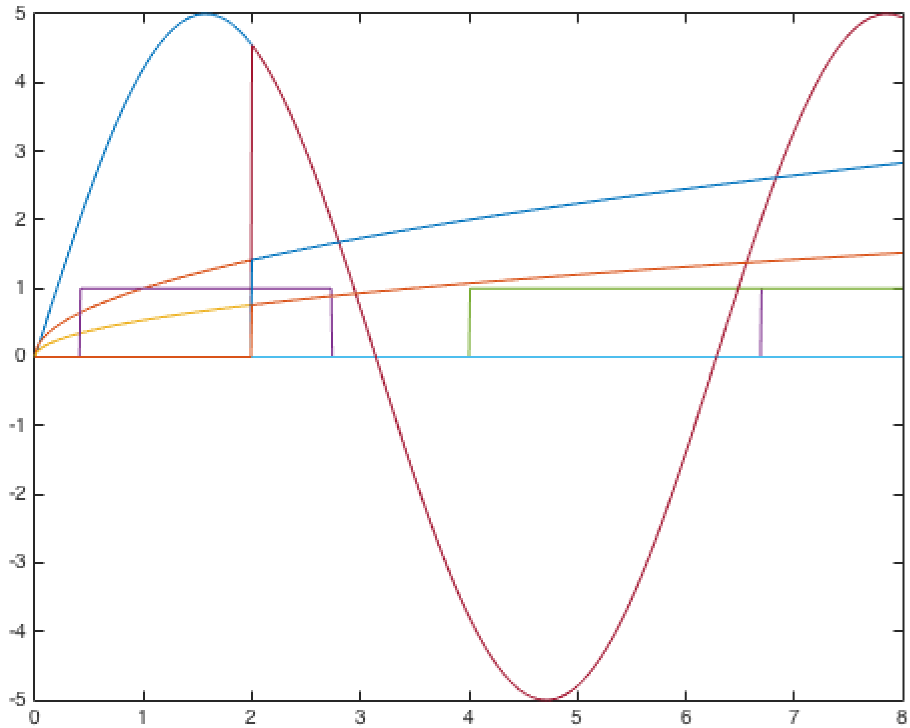
c) >>plot(t , s#>=2) and explain the output

```
hold on
plot(t,[y1;y2;y3]>2)% binary output 0 false, 1 true
```



d) >>plot(t , s#.*(t>=2)) and explain the output

```
plot(t,[y1;y2;y3].*([t;t;t]>=2))%turn on at t>=2;
```



Question 4

The roots of a polynomial f(x) are the values of x, such that f(x) = 0. Obtain the roots of the following polynomials:

a) $x^3 - 4.5x^2 + 5x - 1.5 = 0$

```
F1=[1 -4.5 5 -1.5];
root=roots(F1) %3 real roots (0.5, 1, 3)


root =

    3.0000
    1.0000
    0.5000
```

b) $x^3 - 7x^2 + 40x - 34 = 0$

```
F2=[1 -7 40 -34];
root=roots(F2) %2 complex roots (1, 3+- 5i)


root =
```

```
   3.0000 + 5.0000i
   3.0000 - 5.0000i
   1.0000 + 0.0000i
```

Question 5

Plot the above polynomials to confirm if the roots were located correctly by

a) calculating $f(x)$ using array operators for x=[-10:0.2:10]; then plot(x,f)

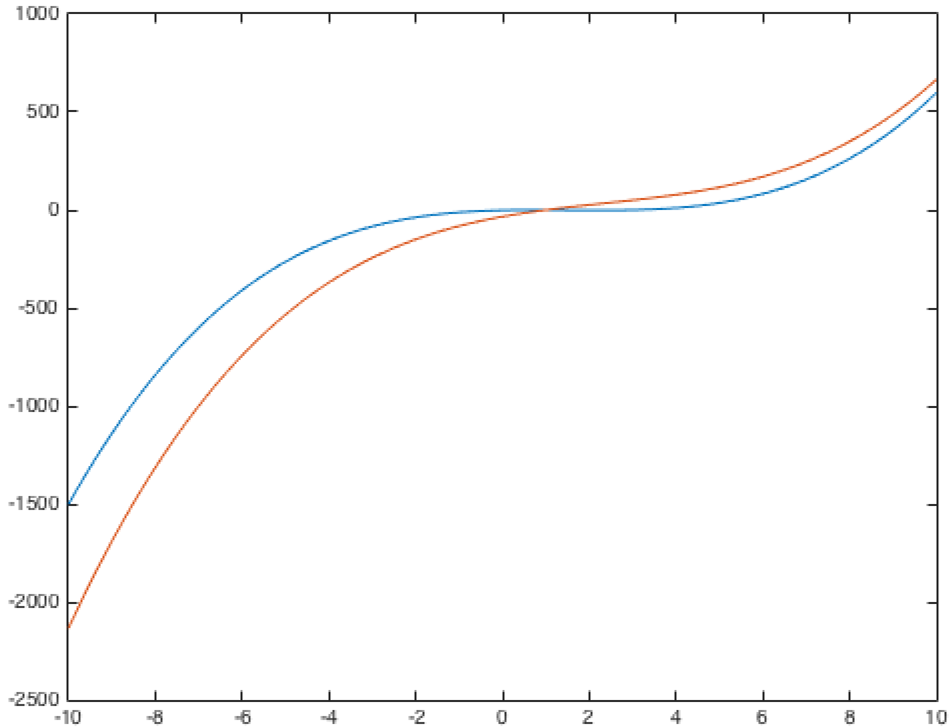
```
x= -10:.2:10 ;
f1=x.^3 - 4.5*x.^2 + 5*x -1.5;
f2=x.^3 - 7*x.^2 + 40*x -34;
```

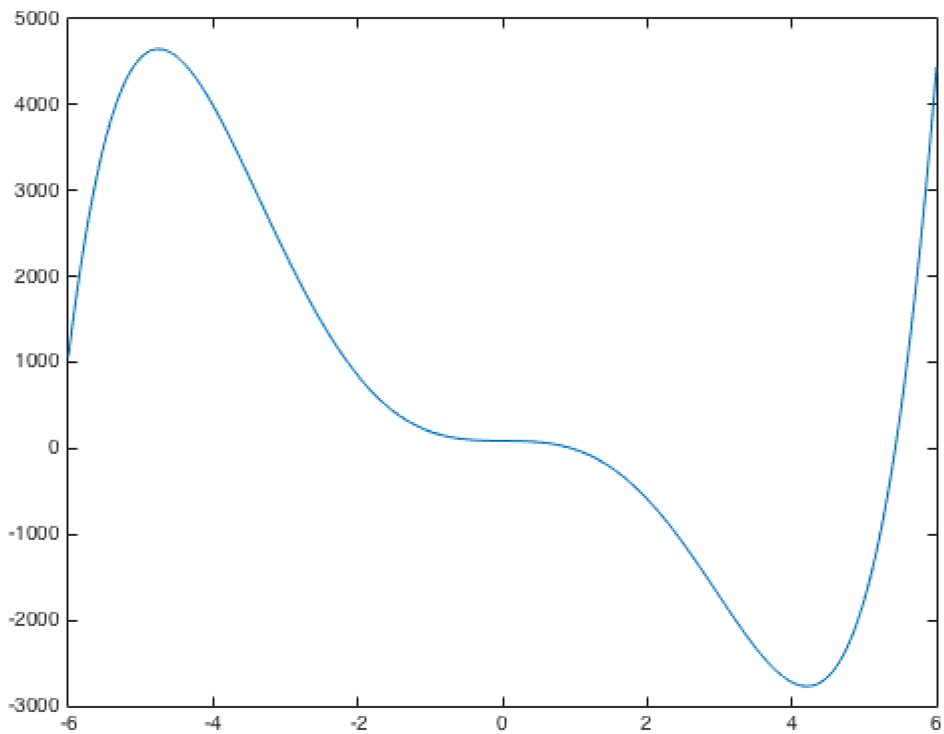
b) using polyval(), e.g. plot(x,polyval([1 -4.5 5 -1.5], x))

```
figure
plot(x,[f1 ; f2])
figure
plot(x,[polyval(F1,x);polyval(F2,x)])
F=[3 2 -100 2 -7 90];
root=roots(F)
x=linspace(-6,6,1000);
plot(x,polyval(F,x));
```

```
root =

  -6.1423 + 0.0000i
   5.4298 + 0.0000i
   0.9630 + 0.0000i
  -0.4586 + 0.8507i
  -0.4586 - 0.8507i
```


1000
500
0
-500
-1000
-1500
-2000
-2500
-10
-8
-6
-4
-2
0
2
4
6
8
10


5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-6
-4
-2
0
2
4
6

Use Matlab to compute the roots of $3x^5 + 2x^4 ? 100x^3 + 2x^2 ? 7x + 90$ and plot the polynomial for x = -6 to 6.

Question 6

Linear Algebraic Equations: Use the left-division method to solve the following set of linear, algebraic equations, i.e. find **u** (i.e. [x; y; z]) when **Au=y** , *Hint:* A=3x3matrix, v=1x3, >> `helpwin ops;` >> `helpwin mldivide;` >> `A*u` $3x + 2y - 9z = -65$ $-9x - 5y + 2z = 16$ $6x + 7y + 3z = 5$

```
A=[3 2 -9; -9 -5 2; 6 7 3]
y=[-65;16;5]
u=A\y %2 -4 -9
wrong=A/y' %note difference between this and above
check=A*u %check, e.g. 3*2 + 2*-4 + -9*7= 6-8-63=-65
check=A*wrong
```

```
A =

     3     2    -9
    -9    -5     2
     6     7     3


y =

   -65
    16
     5


u =

    2.0000
   -4.0000
    7.0000


wrong =

   -0.0462
    0.1143
   -0.0584


check =

  -65.0000
   16.0000
    5.0000


check =
```

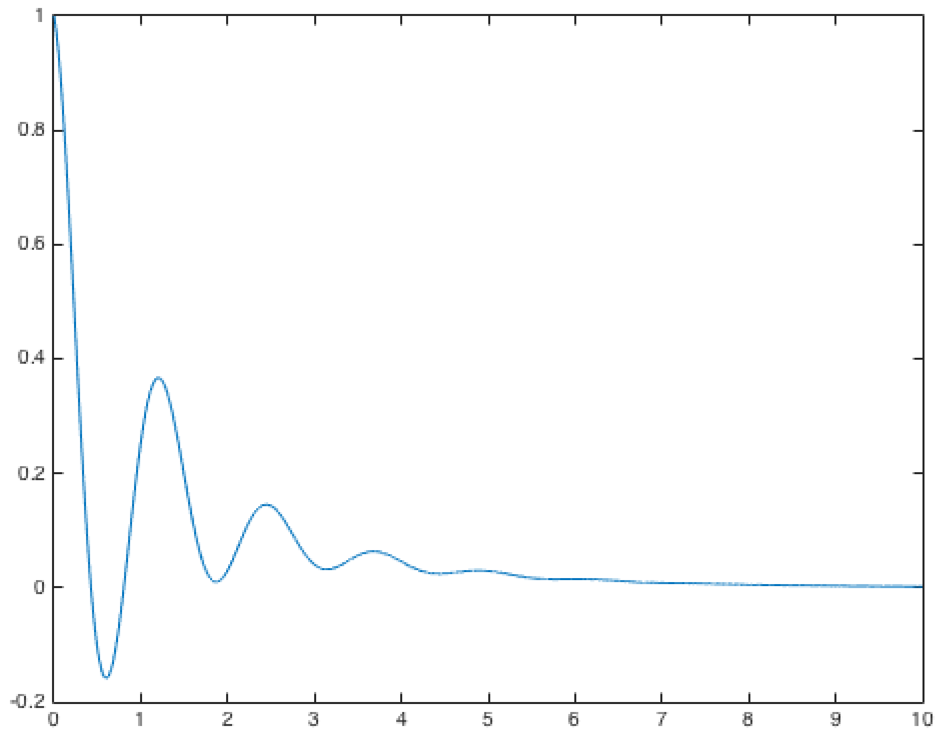
```
 0.6154
-0.2727
 0.3480
```

Question 7

An engineering system has a differential equation with the initial condition solution given by $y(t) = c_1e^{d_1t} + c_2e^{d_2t} + c_3e^{d_3t}$ where $c_1 = 0.3, c_2 = 0.35, and c_3 = 0.35$ weigh the effects of the roots of the characteristic equation $d_1 = -0.5, d_2 = -1 + 5i, and d_3 = -1 - 5i$. Using **MATLAB** , plot the intitial condition response over the period from $t = 0$ to $t = 10$ seconds. Determine the maximum response amplitude between 1 and 2 seconds.

- *Extension* * (for later): you ay like to learn to write a function witharguments to solve this for any parameters.

```
t=linspace(0,10,10001);
c1=0.3;c2=0.35;c3=0.35;
d1=-0.5;d2=-1+5i;d3=-1-5i;
y=c1*exp(d1.*t)+c2*exp(d2.*t)+c3*exp(d3.*t);
plot(t,y)
```



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