**ENEL102, fall term 2018**

**Assignment 3**

**Polynomials and curve fitting Chapter 8**

**Due date Oct 16**

For this assignment fill out this word template with your answers.

Submit a pdf version of your assignment on D2L or submit a hardcopy in the assignment drop box for ENEL102.

In all assignment question all angles are in radians unless explicitly indicated otherwise.

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**Q1.** Consider the polynomial of



Use polyval() to plot this curve for a range of 0<x<3.

**(Matlab input, must be based on polyval() )**

y = polyval([.01 -.02 0 .1 1 3], linspace(0,3))

plot(linspace(0,3), y);

xlabel("x")

ylabel(".01x^5 -.02x^4 +.1x^2 +x +3")

**(Matlab Response)**

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**Q2.** Consider the function of



Use polyval() to plot this curve for a range of 0<x<3.

**(Matlab input, must be based on polyval() )**

x = linspace(0,3);

f = sin(x).^5 + 3\*sin(x);

p = polyfit(x,f,5);

y = polyval(p,x);

plot(x,y)

**(Matlab Response)**



**Q3.** The roots can be determined of the polynomial of f(x) in Q1 by using roots(). Doing this results in a set of complex valued roots and a real root. Write a routine that picks out the real valued root. Verify that the real root is accurately determined by roots() by using polyval().

**(Matlab input)**

r = roots([.01 -.02 0 .1 1 3])

t = 0;

for x = 1:5

if imag(r(x)) == 0

t = r(x);

end

end

y = polyval([.01 -.02 0 .1 1 3], t)

**(Matlab Response)**

t =

-2.3088

y = 1.7764e-15

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**Q4.** Write a Matlab program using conv() to determine the coefficients of the polynomial



**(Matlab input, mut be based on conv() )**

f = [1 0 1.1 2]

conv(f,f)

conv(ans,f)

conv(ans,f)

conv(ans,f)

**(Matlab Response)**

ans =

Columns 1 through 8

1.0000 0 5.5000 10.0000 12.1000 44.0000 53.3100 72.6000

Columns 9 through 16

139.3205 133.2400 146.8105 190.6410 133.2400 96.8000 88.0000 32.0000

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**Q5 Suppose we have the points of**



Determine the fourth order polynomial that passes through these points. Then plot the fourth order interpolated polynomial that passes through these points as determined by polyfit. Indicate the five points with red x’s and label axis. List the code to find the coefficients and plot the curve as well as the plot.

**(Matlab input)**

p =[0 1; 1 1.5; 2 4; 4 7; 5 4]

c = polyfit(p(:,1)', p(:,2)', 4)

y = polyval(c, linspace(0,6))

plot((linspace(0,6)), y)

hold on;

for i = 1:5

plot(p(i,1), p(i,2), 'xr')

end

xlabel("x")

ylabel("Fourth order interpolated polynomial")

**(Matlab Response)**

c =

0.0083 -0.3917 2.1167 -1.2333 1.0000



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**Q6** Read in the data in the binary file of Q6data.mat (see content area in D2L). It is known that this data fits the model of



Use polyfit() to generate the least square regression curve fit to this data determining the unknown coefficients of a, b and c. Then plot the data points and superimpose the regression curve fit on top of this.

**(Matlab input – must be based on polyfit)**

data = load('Q6data.mat');

data.x = sort(data.x);

data.y = sort(data.y);

plot(data.x,data.y,'xm');

xn = sin(data.x);

p = polyfit(xn,data.y,2)

func = @(x) p(3) + p(2)\*sin(x) + p(1)\*((sin(x)).^2);

y = func(data.x)

hold on;

plot(data.x, y);

**(Matlab Response)**

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**Q7** Determine the standard deviation of the error (difference between the interpolated value of y and the data values of y) of the regression curve fit in **Q6**.

**(Matlab input)**

err = data.y - y;

std(err)

**(Matlab Response)**

ans =

0.5972