Table of Contents


```
% ALL COMMENTS IN CAPS ARE FOR GUIDING YOU TO WRITE A PROPER PROGRAM
% THE COMMENTS THAT ARE IN ALL CAPS ARE NOT EXPECTED WHEN YOU SUBMIT
% YOUR PROGRAM.

% SEE HOW THERE IS AN INTRODUCTION PART AND IT HAS THESE
% COMPONENTS OF REVISED, PURPOSE, KEYWORD, AUTHOR
```

Introduction

Revised: May 7, 2020

```
% Purpose
%       This program will demonstrate the appropriate format to be
%       used for submissions. This is not a MATLAB tutorial. In
 addition,
%       it demonstrates finding the flow rate in a pipe when
%       the velocity vs radius data is given.

% Keywords
%       Sample Format; Water Flow; Regression; Flow rate

% Author
%       Autar Kaw
%       Semester: Fall 2015

% SEE THE USE OF CLC, CLF AND CLEAR ALL
% SEE THE IDENTIFICATION OF THE AUTHOR AND PROJECT TITLE
clc
clf
clear all
disp ('Computational Methods')
disp ('EML3041')
disp ('Fall 2015')
disp ('Autar Kaw')
disp('Project Name: Flow rate in a pipe')
```

```
disp('**************************************************************************')
disp('  ')
```

```
Computational Methods
EML3041
Fall 2015
Autar Kaw
Project Name: Flow rate in a pipe
**************************************************************************
```

Problem 1

SEE HOW EACH PROBLEM IS IDENTIFIED EVEN IF IT IS NOT MATLAB RELATED DO NOT FORGET THE SPACE AFTER %% See attached sheet for typed input data

```
disp('Problem 1')
disp('See typed document in the report')
disp('**************************************************************')
disp(' ')
% SEE HOW THE COMMENTS ARE WRITTEN AND THEY ARE SUFFICIENT BUT NOT
% REDUNDANT
% THEY ARE ALWAYS IN THEIR OWN LINE NOT APPENDED TO A MATLAB STATEMENT
```

```
Problem 1
See typed document in the report
```

```
**********************************************************************
```

Problem 2

Attached is the data taken in the lab velocity (ft/s) vs radial location (ft) data

```
radial =   [0  0.083  0.17  0.25  0.33  0.42  0.5];
velocity= [10  9.72   8.88  7.5     5.6      3.1    0];
% Radius of pipe (inches)
Radius=6;
% APPRECIATE THE IDENTIFICATION OF PROBLEM NUMBER AND
% USE OF DISP STATEMENTS
% ALL INPUT DATA IS DISPLAYED USING PROPER DISP AND FPRINTF STATEMENTS
disp ('Problem 2')
disp('_____________________________________')
disp('   Radial    Velocity' )
disp('  Location      ' )
disp('    (ft)      (ft/s)' )
disp('_____________________________________')
dataval=[radial;velocity]';
disp(dataval)
disp('_____________________________________')
fprintf('The radius of the pipe is =%g inches',Radius)
disp('   ')
disp('**********************************************************************')
disp ('  ')
```

```
Problem 2
_____________________________________
   Radial    Velocity
  Location
    (ft)      (ft/s)
_____________________________________
         0   10.0000
    0.0830    9.7200
    0.1700    8.8800
    0.2500    7.5000
    0.3300    5.6000
    0.4200    3.1000
    0.5000         0


_____________________________________
The radius of the pipe is =6 inches
**********************************************************************
```

Problem 3

Changing units of needed variables to USCS

```
Radius_ft=Radius/12;
```

```
% SEE HOW LINES ARE SKIPPED SO THAT THE MFILE CAN BE READ NICELY AS
 WELL
```

Problem 4

SEE HOW THE PROGRAM IS WRITTEN CLEARLY WITH VARIABLE NAMES THAT MAKE SENSE, COMMENTS PRECEEDING NEW VARIABLES, ETC THIS PROBLEM IS AN EXAMPLE OF A CALCULATION PROBLEM Using regression formula to find the velocity profile

```
n=length(radial);
% Using the regression formula for velocity profile
C_Numer=sum(velocity.*(1-radial.^2/Radius_ft^2));
C_Denom=sum((1-radial.^2/Radius_ft^2).^2);
C=C_Numer/C_Denom;
disp('Problem 4')
fprintf('The velocity profile is %g(1-r^2/%g)',C,Radius_ft^2)
disp('   ')
disp('**********************************************************************')
disp ('  ')
```

```
Problem 4
The velocity profile is 10.0132(1-r^2/0.25)
**********************************************************************
```

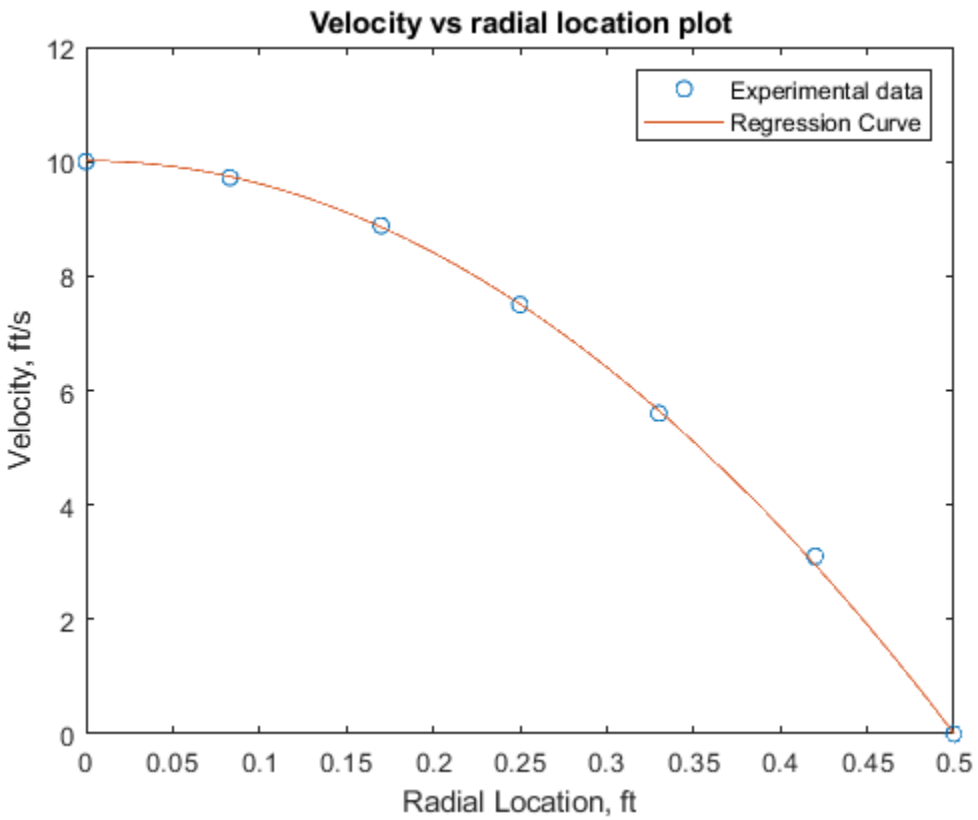
Problem 5

Plot of velocity profile as a function of radial location defining radial locaton, r as a symbolic variable

```
syms r

% Velocity profile
vel_profile=C*(1-r^2/Radius_ft^2);

% Determing points for the plot
r_val=radial(1):(radial(n)-radial(1))/1000:radial(n);
v_val=subs(vel_profile,r,r_val);

% LOOK AT HOW THE PLOT IS LABELED WITH AXES AND LEGEND
% plotting radial location vs velocity
plot(radial,velocity,'o',r_val,v_val,'-');
xlabel('Radial Location, ft')
ylabel('Velocity, ft/s')
title ('Velocity vs radial location plot')
legend('Experimental data','Regression Curve')

disp('Problem 5')
disp('See Figure 1 for velocity profile')
disp('**********************************************************************')
disp ('  ')
```

```
Problem 5
See Figure 1 for velocity profile
```

```
**********************************************************************
```



Problem 6

Finding the flow rate from the regression curve Integrating to find the flow rate from Equation (1)

```
flow_rate=vpaintegral(2*pi*r*vel_profile,r,0,Radius_ft);
flow_rate=double(flow_rate);
disp('Problem 6')
fprintf ('The flow rate from the regression curve is=  %g  ft^3/s',...
    flow_rate)
disp('  ')
disp('**********************************************************************')
disp ('  ')
```

```
Problem 6
The flow rate from the regression curve is=  3.93216  ft^3/s
**********************************************************************
```

Problem 7

Finding the flow rate from the average velocity x Area method Average Velocity

```
avg_vel=mean(velocity);
```

```
% Area of pipe
Area=pi*Radius_ft^2;
flow_rate=avg_vel*Area;
flow_rate=double(flow_rate);
disp('Problem 7')
fprintf('The flow rate from the average velocity method is= %g ft^3/
s',...
    flow_rate)
disp('  ')
disp('**********************************************************************')
disp ('  ')
```

```
Problem 7
The flow rate from the average velocity method is= 5.02655 ft^3/s
**********************************************************************
```

Problem 8

Using trapezoidal rule with unequal segments to find flow rate Using equation (1) to find te integrand

```
flow_rate_alt=0;
for i=1:1:n-1
    fun_up=2*pi*radial(i+1)*velocity(i+1);
    fun_low=2*pi*radial(i)*velocity(i);
    flow_annulus=(radial(i+1)-radial(i))/2*(fun_up+fun_low);
    flow_rate_alt=flow_rate_alt+flow_annulus;
end

disp('Problem 8')
disp('Using trapezoidal rule with unequal segments to find flow rate')
fprintf ('The flow rate from an alternative method is=  %g  ft^3/
s',...
    flow_rate_alt)
disp('  ')
disp('**********************************************************************')
disp ('  ')
```

```
Problem 8
Using trapezoidal rule with unequal segments to find flow rate
The flow rate from an alternative method is=  3.84767  ft^3/s
**********************************************************************
```

Problem 9

See typed document in the report

```
disp('Problem 9')
disp('See typed document in the report')
disp('**********************************************************************')
disp ('  ')
```

```
Problem 9
```

```
See typed document in the report
**********************************************************************
```

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