```
% Project 2
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clear all
clc
clf

% Initial values
L = 10;
e = 0.25/1000;
p = 1000;
u = 0.001;
D1 = 0.2;
g = 9.81;
A1 = ((D1/2)^2)*pi();
RR1 = e/(D1);
data1 = [];
data2 = [];
d_steps = linspace(0.03, 0.5, 60);
m_steps = linspace(0,5,500);

% Mass flow rate, Friction factor, Reynolds number, Head loss
for j = 1:length(d_steps)
    D2 = d_steps(j);
    A2 = ((D2/2)^2)*pi;
    HL1_Diff = intmax;
    m1_accum = 0;
    for i = 1:length(m_steps)
        m1 = m_steps(i);
        m2 = 5-m1;

        % Calculating Mass flow rate
        v1 = m1/(p*A1);
        v2 = m2/(p*A2);

        % Calculating Reynolds number
        Re1 = p*v1*D1/u;
        Re2 = p*v2*D2/u;

        % Calculating Friction factor
        y1 = @(f) 1 / sqrt(f) + 2*log10( (e/D1)/3.7 + 2.51/
(Re1*sqrt(f)));
        dy1 = @(f) (-.5/f^1.5) - (1.09*D1)/(f*(0.073467 *
 e*Re1*sqrt(f) + 2.51*D1));

        y2 = @(f) 1 / sqrt(f) + 2*log10( (e/D2)/3.7 + 2.51/
(Re2*sqrt(f)));
        dy2 = @(f) (-.5/f^1.5) - (1.09*D2)/(f*(0.073467 *
 e*Re2*sqrt(f) + 2.51*D2));
```
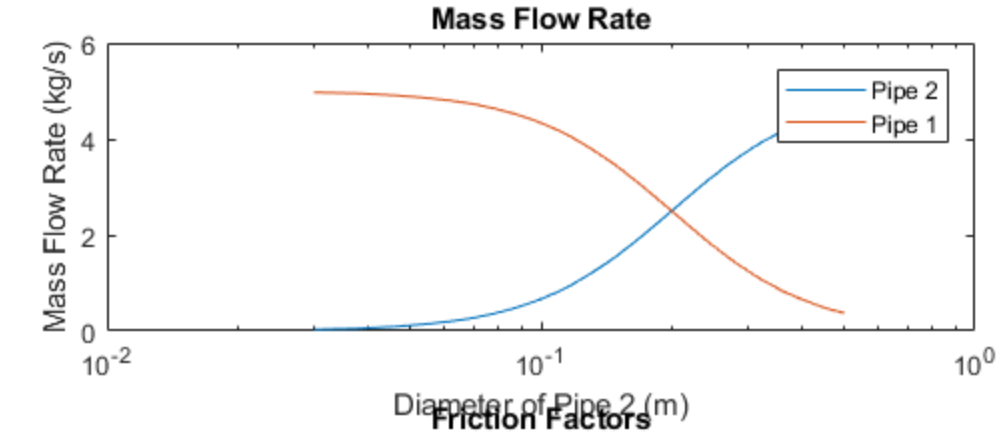
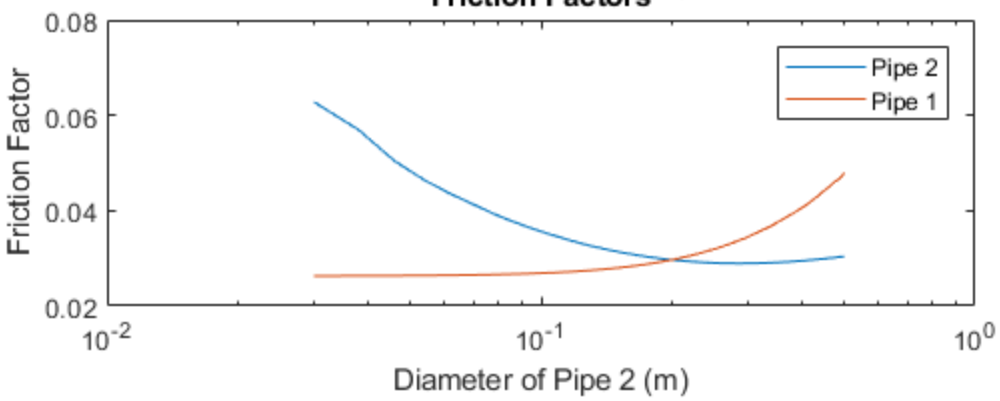
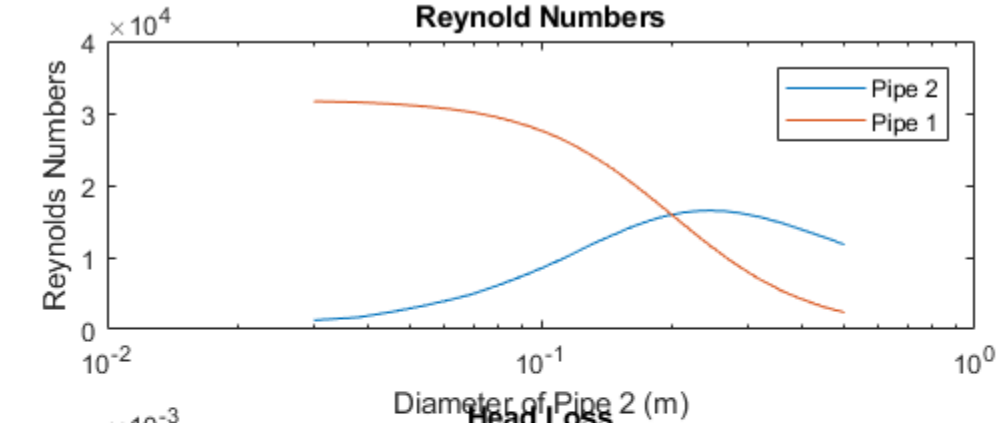
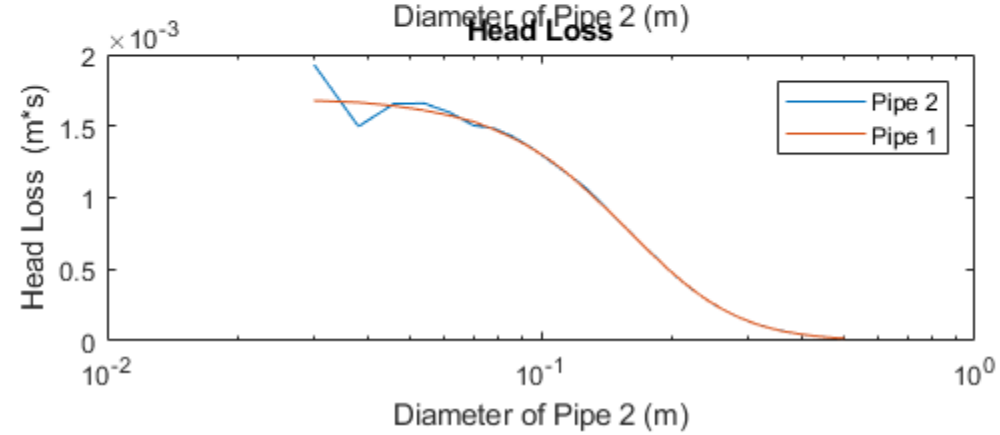

```
            fy1 = newton_rhapson(y1, dy1, 0.04, 5, 0.001);
            a = size(fy1);
            fy1_num = fy1(a(1),2);
            fy2 = newton_rhapson(y2, dy2, 0.04, 5, 0.001);
            b = size(fy2);
            fy2_num = fy2(b(1),2);

            % Calculating Head Loss
            HL1 = fy1_num*L*(v1^2)/(D1*2*g);
            HL2 = fy2_num*L*(v2^2)/(D2*2*g);
            if abs(HL1-HL2) < HL1_Diff
                m1_accum = m1;
                m2_accum = m2;
                HL1_accum = HL2;
                HL2_accum = HL1;
                HL1_Diff = abs(HL1-HL2);
                Re1_accum = Re2;
                Re2_accum = Re1;
                f1_accum = fy2_num;
                f2_accum = fy1_num;
            end
        end

        data1 = [data1; D1 m1_accum f2_accum Re2_accum HL2_accum];
        data2 = [data2;D2 m2_accum f1_accum Re1_accum HL1_accum];

    end
    figure(1)
    subplot(2, 2, [1 2]);
    grid on
    semilogx(data2(:,1),data2(:,2))
    hold on
    semilogx(data2(:,1),data1(:,2))
    title('Mass Flow Rate')
    xlabel('Diameter of Pipe 2 (m)')
    ylabel('Mass Flow Rate (kg/s)')
    legend('Pipe 2','Pipe 1')
    hold off


    subplot(2, 2, [3 4]);
    grid on
    semilogx(data2(:,1),data2(:,3))
    hold on
    semilogx(data2(:,1),data1(:,3))
    title('Friction Factors')
    xlabel('Diameter of Pipe 2 (m)')
    ylabel('Friction Factor')
    legend('Pipe 2','Pipe 1')

    hold off

    figure(2)
    subplot(2, 2, [1 2]);
```

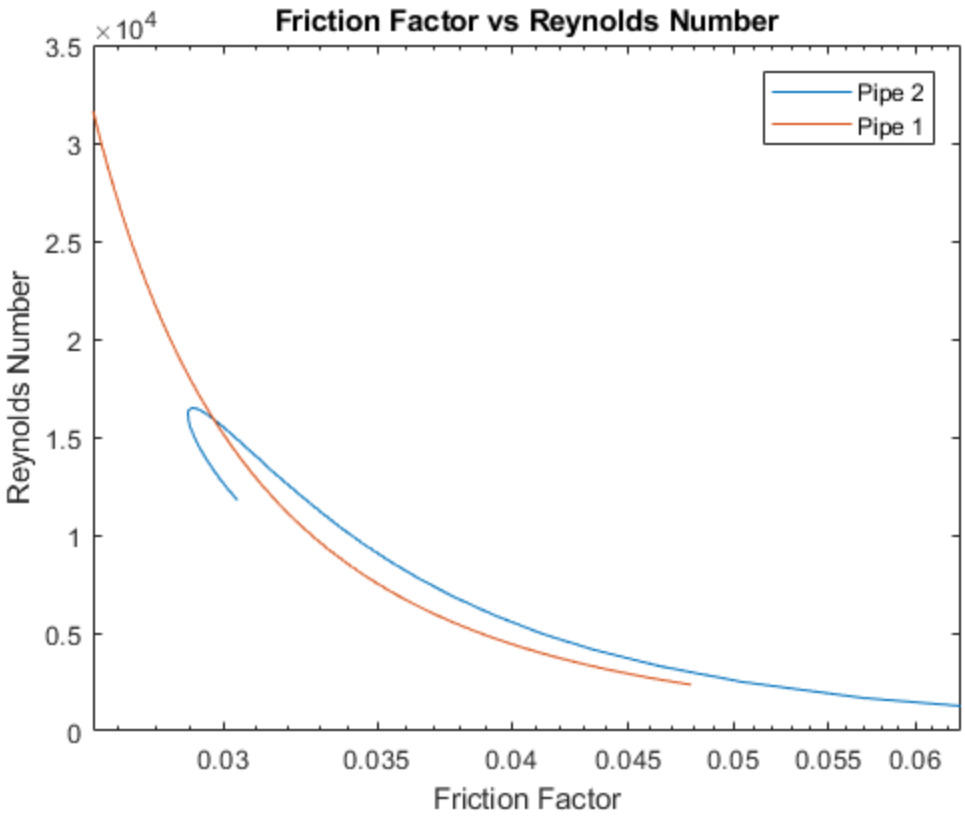
```
grid on
semilogx(data2(:,1),data2(:,4))
hold on
semilogx(data2(:,1),data1(:,4))
title('Reynold Numbers')
xlabel('Diameter of Pipe 2 (m)')
ylabel('Reynolds Numbers')
legend('Pipe 2','Pipe 1')
hold off

subplot(2, 2, [3 4]);
grid on
semilogx(data2(:,1),data2(:,5))
hold on
semilogx(data2(:,1),data1(:,5))
title('Head Loss')
xlabel('Diameter of Pipe 2 (m)')
ylabel('Head Loss  (m*s)')
legend('Pipe 2','Pipe 1')
hold off

figure(3)
grid on
semilogx(data2(:,3),data2(:,4))
hold on
semilogx(data1(:,3),data1(:,4))
title('Friction Factor vs Reynolds Number')
xlabel('Friction Factor')
ylabel('Reynolds Number')
legend('Pipe 2','Pipe 1')
hold off
```


Mass Flow Rate
Mass Flow Rate (kg/s)
Pipe 2
Pipe 1
Diameter of Pipe 2 (m)


Friction Factors
Friction Factor
Pipe 2
Pipe 1
Diameter of Pipe 2 (m)


Reynold Numbers
Reynolds Numbers
Pipe 2
Pipe 1
Diameter of Pipe 2 (m)


Head Loss
Head Loss (m*s)
Pipe 2
Pipe 1
Diameter of Pipe 2 (m)



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