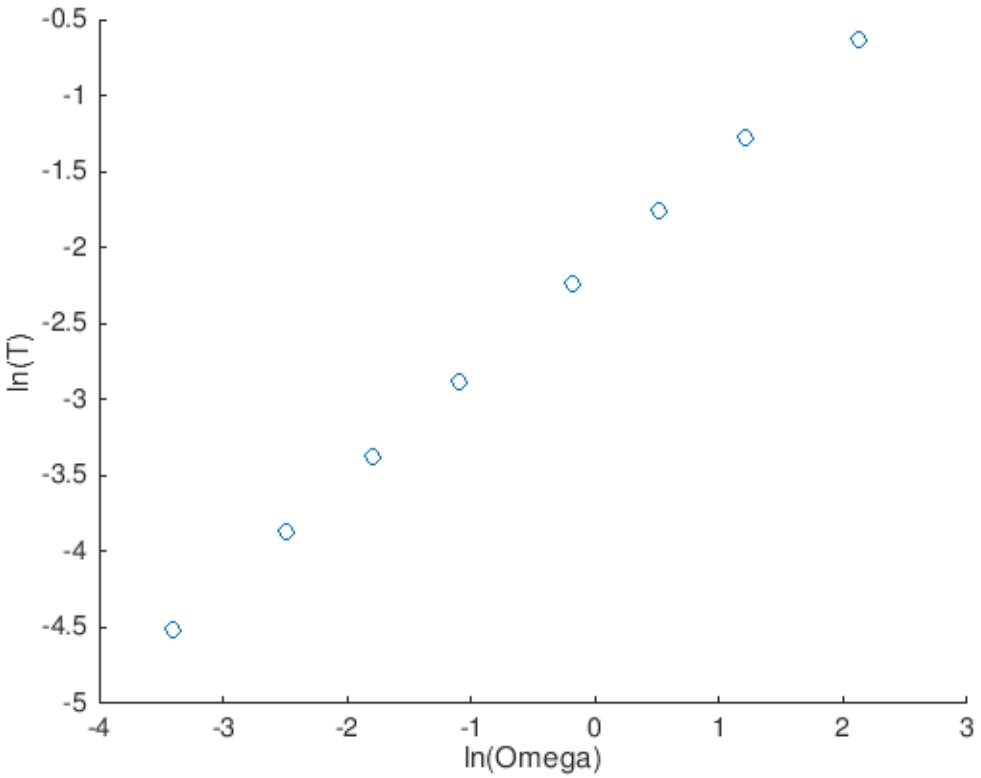
```
% Kathryn Atherton
% ABE 457
% Homework 3
```

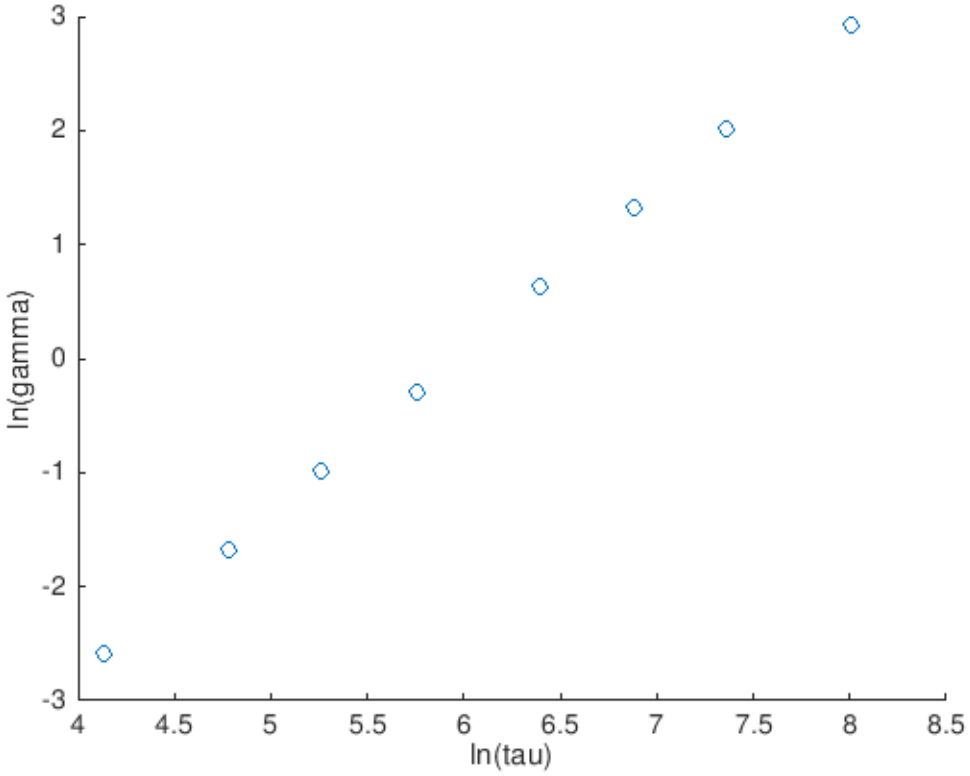
Problem 1

```
radius_inner = 0.015; % meters
radius_outer = 0.020; % meters
length = 0.25; % meters

T_yield = 3.534 * 10^-4; % Newton.meters

rpm = [2, 5, 10, 20, 50, 100, 200, 500] ./ 60; % radians/minute -->
 radians/second
T = [0.011, 0.021, 0.034, 0.056, 0.106, 0.172, 0.279, 0.530]; %
 Newton.meters

fprintf('(i) Yield stress:\n');
tau_yield = T_yield / (length * pi * radius_inner ^ 2) % Newtons/
meter^2

fprintf('(ii) Shear stress at inner cylinder:\n');
tau = T ./ (length * pi * radius_inner ^ 2) % Newtons/meter^2

fprintf('(iii) Flow behavior index:\n');
lnT = log(T);
lnomega = log(rpm);
figure
scatter(lnomega,lnT);
xlabel('ln(Omega)');
ylabel('ln(T)');
p = polyfit(lnomega,lnT,1);
n = p(1)

fprintf('(iv) Wall shear rate at inner cylinder:\n');
gamma = (2 .* rpm) ./ (n * ((radius_inner / radius_outer) ^ (-2 / n) -
 1))

fprintf('(v) Consistency index of fluid:\n');
lntau = log(tau);
lngamma = log(gamma);
figure
scatter(lntau, lngamma);
xlabel('ln(tau)');
ylabel('ln(gamma)');
p = polyfit(lntau,lngamma,1);
k = exp(p(2))
```

```
(i) Yield stress:

tau_yield =
```

```
    1.9998
(ii) Shear stress at inner cylinder:
tau =
   1.0e+03 *
  Columns 1 through 7
    0.0622    0.1188    0.1924    0.3169    0.5998    0.9733    1.5788
  Column 8
    2.9992
(iii) Flow behavior index:
n =
    0.7018
(iv) Wall shear rate at inner cylinder:
gamma =
  Columns 1 through 7
    0.0748    0.1870    0.3739    0.7479    1.8697    3.7395    7.4790
  Column 8
   18.6974
(v) Consistency index of fluid:
k =
   2.0670e-04
```


-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
ln(T)
-4
-3
-2
-1
0
1
2
3
ln(Omega)

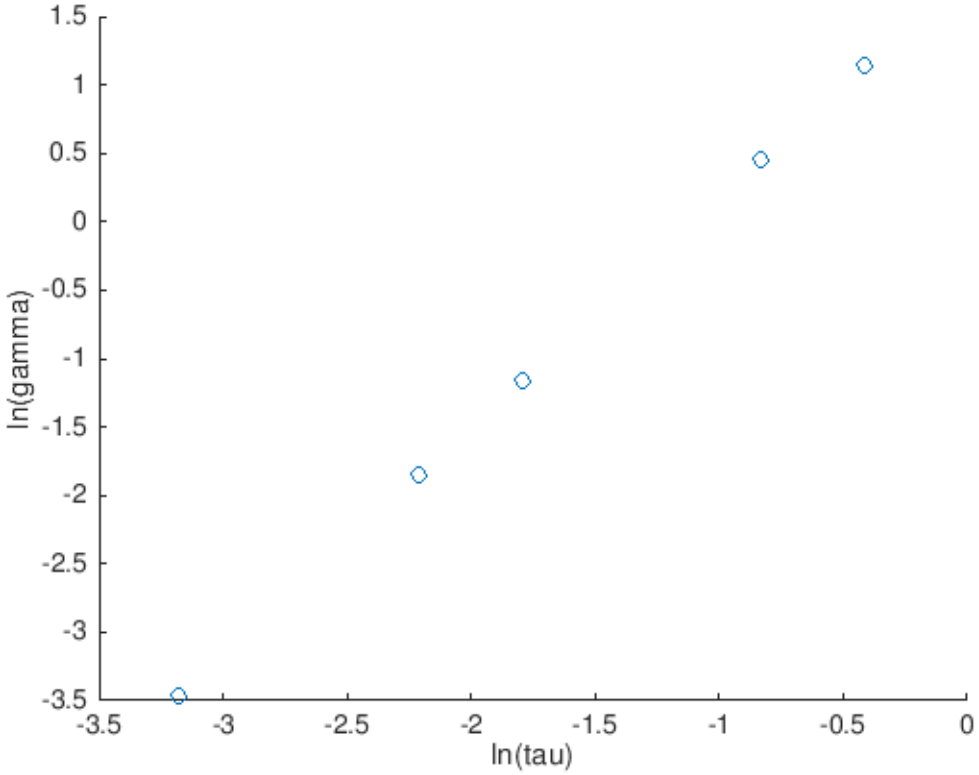

3
2
1
0
-1
-2
-3
ln(gamma)
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
ln(tau)

Problem 2

```
radius_inner = 1 / 100; % cm --> m
radius_outer = 1.05 / 100; % cm --> m
length = 5 / 100; % cm --> m

rpm = [0.1, 0.5, 1.0, 5.0, 10.0] ./ 60; % radians/minute --> radians/
second
T = [0.000000655, 0.00000172, 0.00000261, 0.00000685, 0.0000104]; %
 Newton.meters

fprintf('(i) Wall shear stress:\n');
tau = T ./ (length * pi * radius_inner ^ 2) % Newtons/meter^2

fprintf('(ii) Wall shear rate:\n');
lnT = log(T);
lnomega = log(rpm);
p = polyfit(lnomega,lnT,1);
n = p(1);
gamma = (2 .* rpm) ./ (n * ((radius_inner / radius_outer) ^ (-2 / n) -
 1))

fprintf('(iii) Rheological parameters:\n');
lntau = log(tau);
lngamma = log(gamma);
figure
scatter(lntau, lngamma);
xlabel('ln(tau)');
ylabel('ln(gamma)');
p = polyfit(lntau,lngamma,1);
k = exp(p(2))
n = p(1)
```

```
(i) Wall shear stress:

tau =

    0.0417    0.1095    0.1662    0.4361    0.6621

(ii) Wall shear rate:

gamma =

    0.0315    0.1573    0.3146    1.5729    3.1459

(iii) Rheological parameters:

k =

    6.2594


n =
```

```
1.6658
```



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