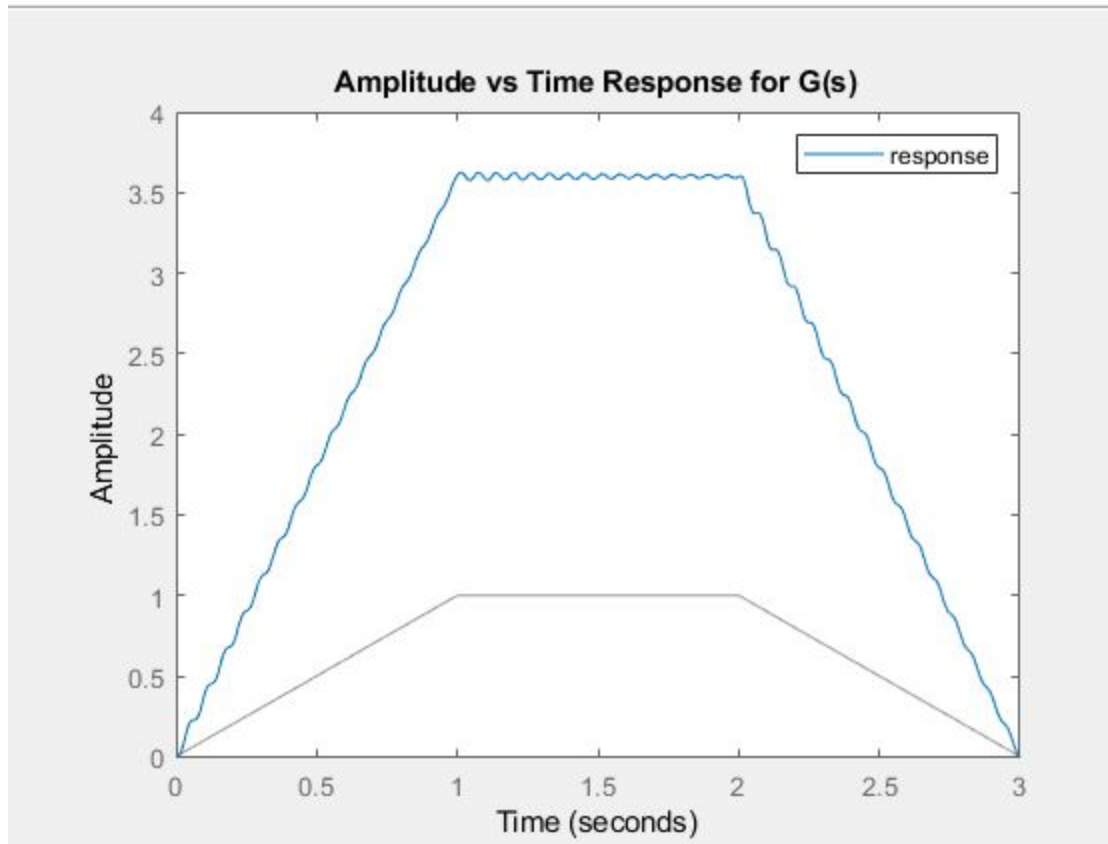ME EN 6200
Homework 2
Ryan Dalby

Problem 5
(a) Show a plot of output vs. time, label all axes.

(b) Briefly describe the response based on the input from Part (a) -- what's happening?
The response ramps up to approximately 3.5 from t=0 to t=1 then stays at approximately 3.5 from t=1 to t=2. The response finally goes back down to 0 from t=2 to t=3.The response is essentially the same signal as the input signal but amplified by a gain of around 3.5.

(c) Now suppose the input is a unit step instead of the input u(t) shown above. Simulate the response and provide a plot of output vs. time. Label all axes appropriately.
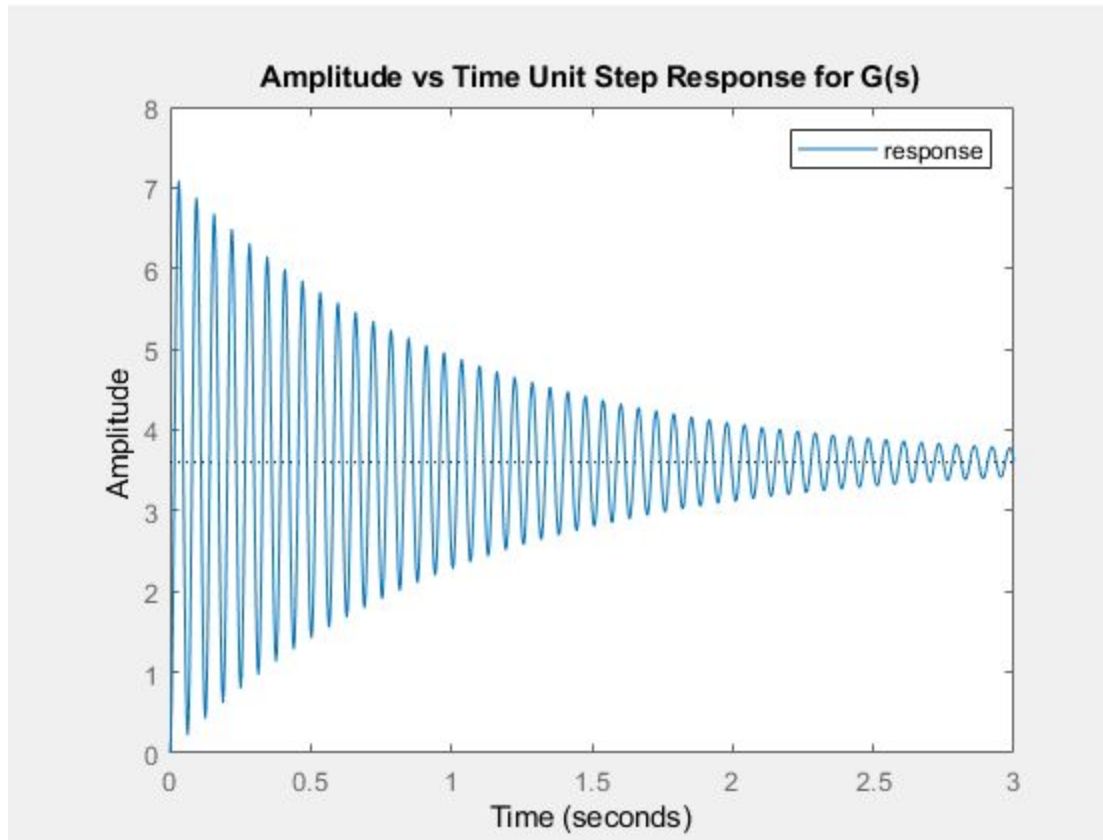
(d) For Part (c), what is the final value?

```
The final value of the unit step response is 3.61
```

(e) Rather than get the final value from the plot in Part (c), how else could you have done it?

Since the final value at t=3 is close to the settled value I could have used the final value theorem for u(s)*G(s). I could use this because all the poles for s*u(s)*G(s) = G(s) are in the open left half plane which is because the roots of the denominator of G(s), which is s^2 + 2s + 10000, have a negative real part.

(f) Provide print out of your Matlab code (m-file, Simulink model, etc.) to justify how you created your plots.

```matlab
%% ME EN 6200 Homework 2 Ryan Dalby
%%
clear;
close all;
%% Problem 5
omega_n = 100; % Hz natural frequency
zeta = 0.01; % Damping constant
K = 3.6;

G = tf((K*omega_n^2),[1, (2*zeta*omega_n), (omega_n^2)]);
u = @(t) t.*heaviside(t) - t.*heaviside(t-1) + heaviside(t-1) -
heaviside(t-2) - (t-3).*heaviside(t-2) + (t-3).*heaviside(t-3);
dt = 0.001;
t_vals = 0:dt:3;

% a
figure;
lsim(G,u(t_vals),t_vals);
title('Amplitude vs Time Response for G(s)');
legend('response');

% c
figure;
step(G,3);
title('Amplitude vs Time Unit Step Response for G(s)');
legend('response');

% d
step_response = step(G,3);
fprintf('The final value of the unit step response is
%.2f\n',step_response(end));
```