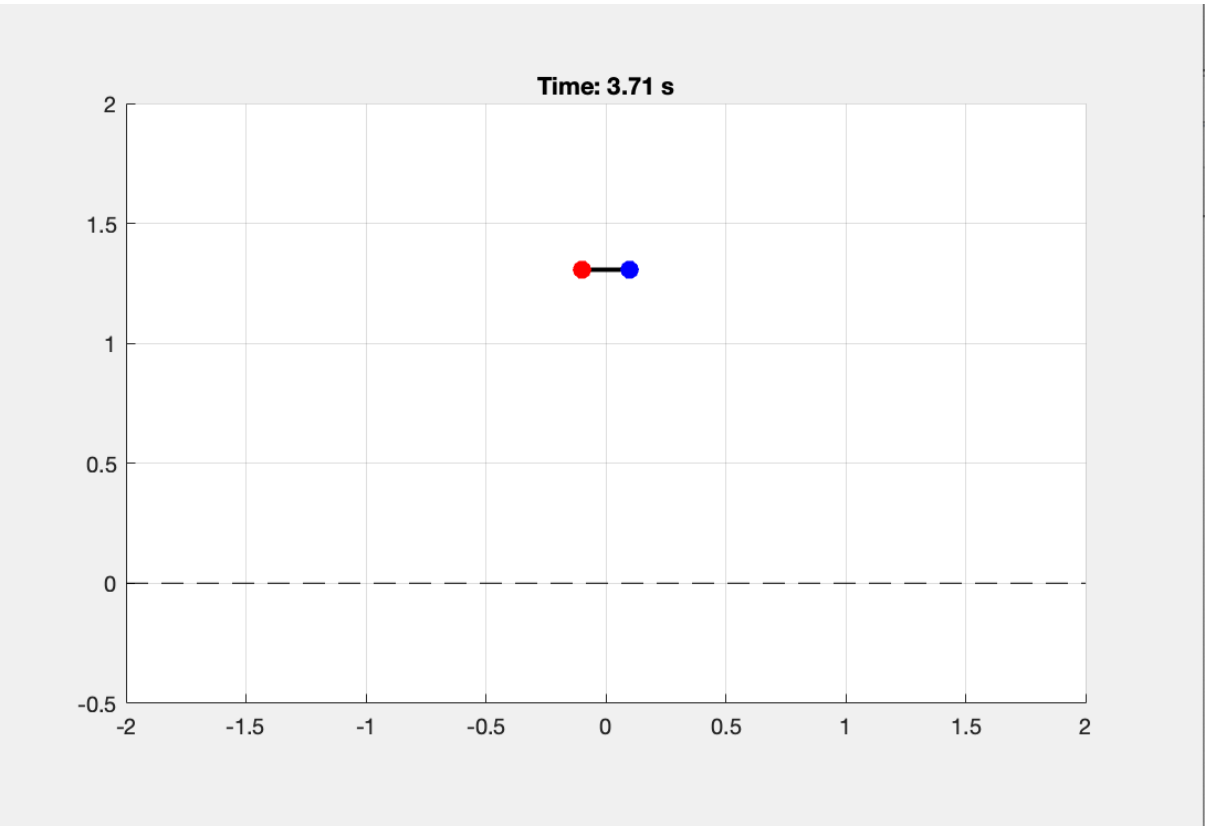
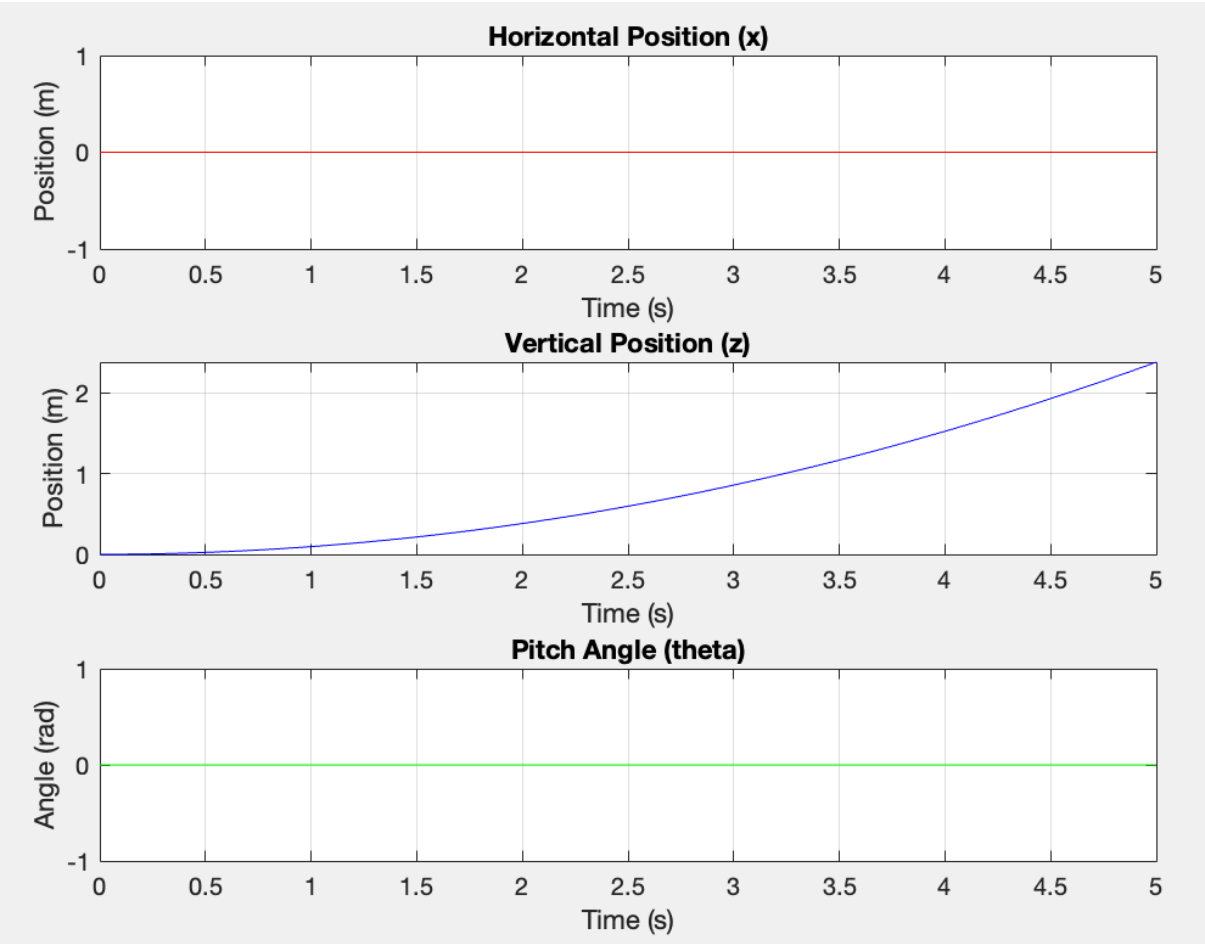
Team: Network Ninjas

Test Code 1

```
m = 1.0;

g = 9.81;
I = 0.01;
L = 0.1;
dt = 0.01;
T = 5;

state = [0; 0; 0; 0; 0; 0];

f1 = 5;
f2 = 5;

time = 0:dt:T;
data = zeros(6, length(time));

for t = 1:length(time)
    x = state(1);
    z = state(2);
    theta = state(3);
    x_vel = state(4);
    z_vel = state(5);
    ang_vel = state(6);

    x_accel = -(f1 + f2) * sin(theta) / m;
    z_accel = -(m * g) + (f1 + f2) * cos(theta) / m;
    ang_accel = L * (f2 - f1) / I;

    x = x + x_vel * dt;
    z = z + z_vel * dt;
    theta = theta + ang_vel * dt;
    x_vel = x_vel + x_accel * dt;
    z_vel = z_vel + z_accel * dt;
    ang_vel = ang_vel + ang_accel * dt;

    state = [x; z; theta; x_vel; z_vel; ang_vel];
    data(:, t) = state;
end

figure;

subplot(3, 1, 1);
plot(time, data(1, :), 'r');
title('Horizontal Position (x)');
xlabel('Time (s)'); ylabel('Position (m)');

grid on;

subplot(3, 1, 2);
plot(time, data(2, :), 'b');
title('Vertical Position (z)');
xlabel('Time (s)'); ylabel('Position (m)');
```

```
grid on;

subplot(3, 1, 3);
plot(time, data(3, :), 'g');
title('Pitch Angle (theta)');
xlabel('Time (s)'); ylabel('Angle (rad)');

grid on;

figure;
for i = 1:10:length(time)
    clf; %we use this to clear the figure
    hold on;

    plot([data(1, i) - L*cos(data(3, i)), data(1, i) + L*cos(data(3, i))],
[data(2, i) - L*sin(data(3, i)), data(2, i) + L*sin(data(3, i))], 'k',
'LineWidth', 2);

    plot(data(1, i) - L*cos(data(3, i)), data(2, i) - L*sin(data(3, i)),
'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r');

    plot(data(1, i) + L*cos(data(3, i)), data(2, i) + L*sin(data(3, i)),
'bo', 'MarkerSize', 8, 'MarkerFaceColor', 'b');

    plot([-5, 5], [0, 0], 'k--');

    axis equal;
    xlim([-2, 2]);
    ylim([-0.5, 2]);
    grid on;
    title(sprintf('Time: %.2f s', time(i)));
    pause(0.01);
end
```


Time: 3.71 s
2
1.5
1
0.5
0
-0.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2


Horizontal Position (x)
Position (m)
Time (s)
Vertical Position (z)
Position (m)
Time (s)
Pitch Angle (theta)
Angle (rad)
Time (s)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5