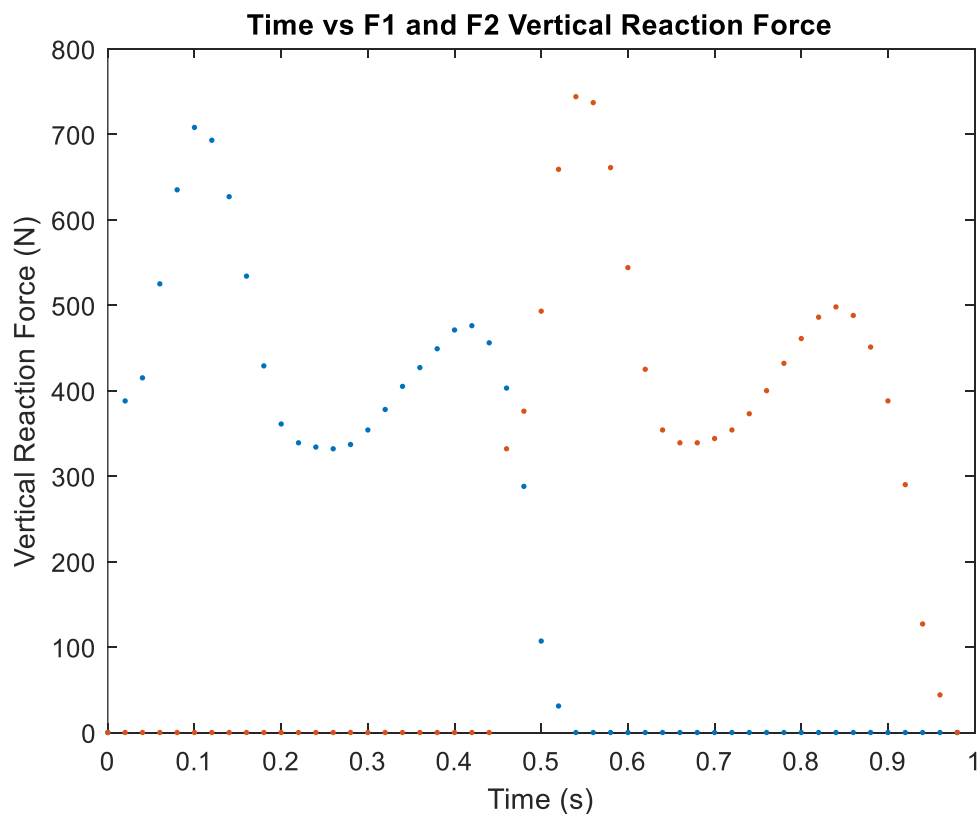


1.1)

```
force_plate_data = readmatrix('woman gait analysis data.xlsx','Sheet','force plate data');
time = force_plate_data(:,1);
f1 = force_plate_data(:,2);
f2 = force_plate_data(:,3);
```

```
figure(1)
plot(time, f1, ".", time, f2, ".")
title('Time vs F1 and F2 Vertical Reaction Force')
xlabel('Time (s)')
ylabel('Vertical Reaction Force (N)')
```



1.2)

```
frequency = 1 / (time(2) - time(1));
fprintf("The frequency is %g Hz.\n", frequency);
The frequency is 50Hz.
```

1.3)

```
for i=1:length(time)
    if f1(i) > f2(i)
        fprintf("The woman steps on plate 1 first.\n")
        break
    elseif f1(i) < f2(i)
```

```
        fprintf("The woman steps on plate 2 first.\n")
    break
end
end
```

The woman steps on plate 1 first.

1.4)

```
f1_max = max(f1);
f2_max = max(f2);
force_diff = f1_max - f2_max;
if force_diff > 0
    fprintf("The right foot max force is %gN, max left foot force is %gN, and the max right foot exerts %gN
more.\n", f1_max, f2_max, abs(force_diff))
else
    fprintf("The right foot force is %gN, max left foot force is %gN, and the max left foot exerts %gN
more.\n", f1_max, f2_max, abs(force_diff))
end
```

The right foot max force is 708N, max left foot force is 744N, and the max left foot exerts 36N more.

1.5)

```
f1_ratio = f1_max / 62;
f2_ratio = f2_max / 62;
if f1_max > f2_max
    mgf_ratio = f1_max / (62*9.81);
else
    mgf_ratio = f2_max / (62*9.81);
end
```

```
fprintf("The right foot ground force as a percentage of body weight is %gN/kg and the left foot ground
force is %gN/kg and the max ground force as body weights is %g.\n", f1_ratio, f2_ratio, mgf_ratio)
```

The right foot ground force as a percentage of body weight is 11.4194N/kg and the left foot ground force is 12N/kg and the max ground force as body weights is 1.22324.

1.6)

```
f1_indexes = find(f1);
f1_duration = time(f1_indexes(end)) - time(f1_indexes(1));

f2_indexes = find(f2);
f2_duration = time(f2_indexes(end)) - time(f2_indexes(1));

fprintf("The right foot stance phase is %gs and the left foot stance duration is %gs.\n",f1_duration,f2_duration)
```

The right foot stance phase is 0.5s and the left foot stance duration is 0.5s.

1.7)

```
if abs(f1_duration - f2_duration)/f1_duration > 0.1
    fprintf("The woman has gait asymmetry.\n")
else
    fprintf("The woman displays no signs of gait asymmetry.\n")
end
```

The woman displays no signs of gait asymmetry.

1.8)

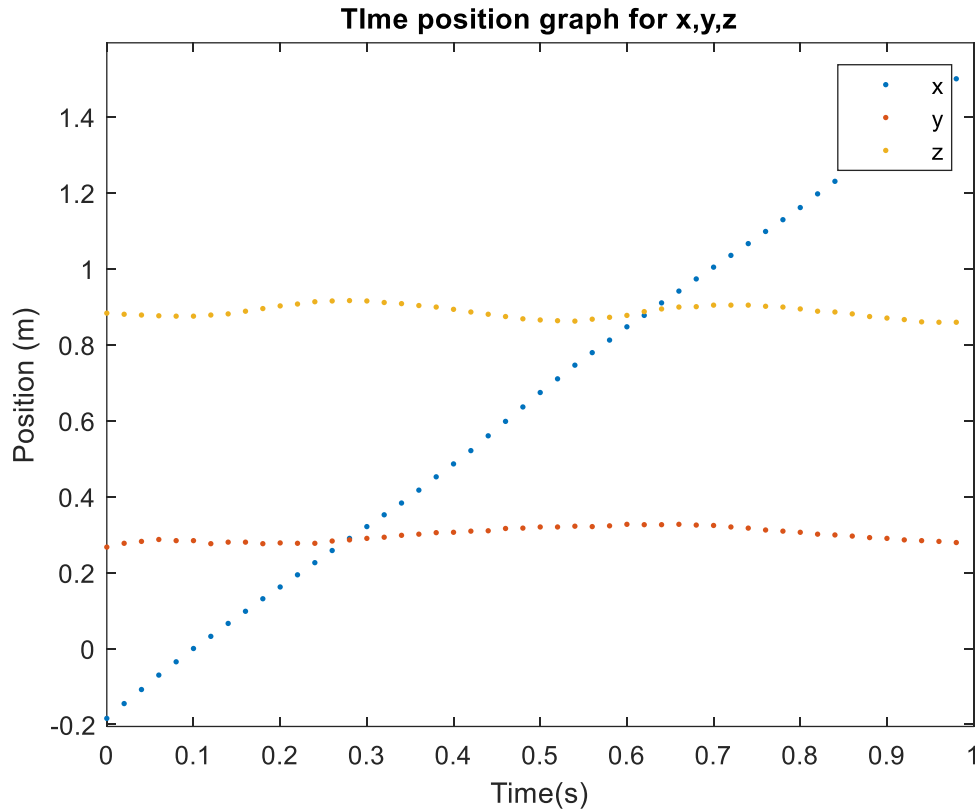
```
ds_indexes = intersect(f1_indexes,f2_indexes);
ds_duration = time(ds_indexes(end)) - time(ds_indexes(1));
fprintf("The right foot double stance phase is %gs.\n\n",ds_duration)
```

The right foot double stance phase is 0.06s.

2.1)

```
position_data = readmatrix('woman gait analysis data.xlsx','Sheet','Sacrum marker data');
time = position_data(:,1);
x = position_data(:,2);
y = position_data(:,3);
z = position_data(:,4);

figure(2)
plot(time, x, ".", time, y, ".", time, z, ".")
xlabel("Time(s)")
ylabel("Position (m)")
legend("x","y","z")
title("Time position graph for x,y,z")
```



2.2)

```
fprintf("x = forward_progression\ny = medial_lateral\nz = vertical\n")
```

x = forward_progression

y = medial_lateral

z = vertical

x = forward progression because it is a linear line

y = medial lateral because it is the only available option

z = vertical because of the slight oscillations

2.3)

```
end_index = find(time<=0.98);
x_displacement = x(end) - x(1);
x_velocity = x_displacement / 0.98;
```

```
fprintf("The x displacement from 0 to 0.98 seconds is %gm and an average velocity of %gm/s.\n",  
x_displacement, x_velocity)
```

The x displacement from 0 to 0.98 seconds is 1.684m and an average velocity of 1.71837m/s.

2.4)

```
medial_lat_dis = max(y) - min(y);  
vertical_dis = max(z) - min(z);  
fprintf("The woman's vertical range of motion is %gm and the woman's medical lateral displacement is  
%gm.\n", vertical_dis, medial_lat_dis)
```

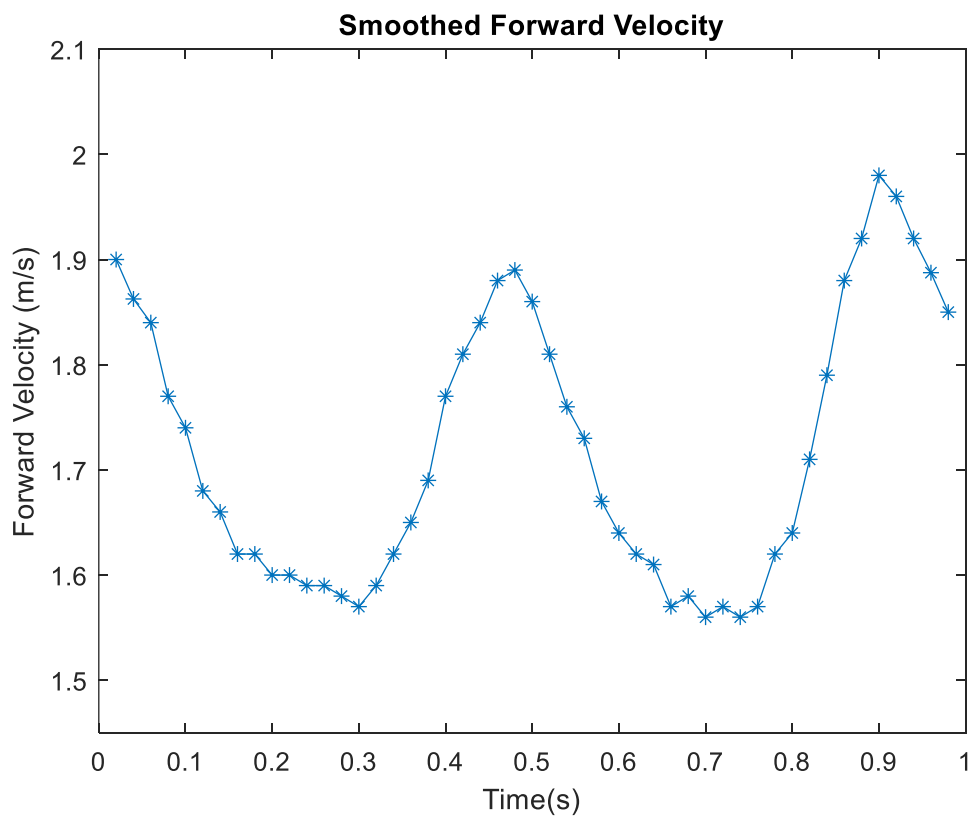
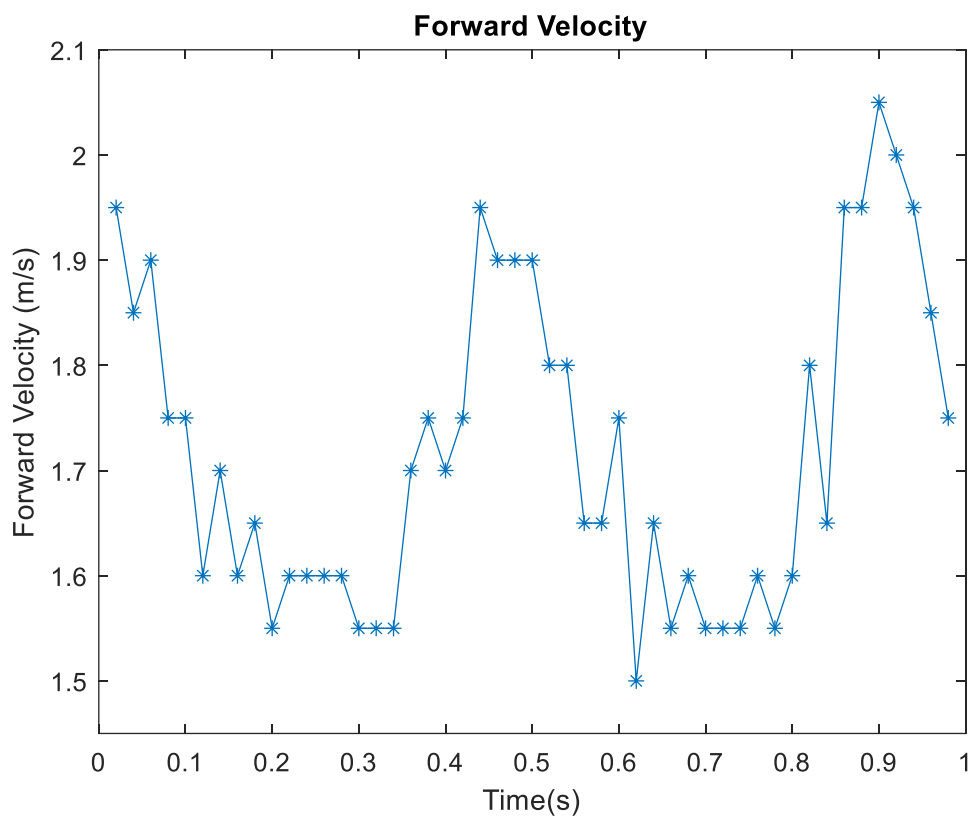
The woman's vertical range of motion is 0.057m and the woman's medical lateral displacement is 0.06m.

2.5)

```
vel = zeros(1,length(time)-1);  
for i=1:length(time)-1  
    vel(i) = (x(i+1) - x(i))/(time(i+1) - time(i));  
end
```

```
figure(3)  
plot(time(2:end),vel, "*-")  
title("Forward Velocity")  
xlabel("Time(s)")  
ylabel("Forward Velocity (m/s)")  
ylim([1.45,2.1])  
s_vel = smoothdata(vel,'movmean', 5);
```

```
figure(4)  
plot(time(2:end),s_vel, "*-")  
title("Smoothed Forward Velocity")  
xlabel("Time(s)")  
ylabel("Forward Velocity (m/s)")  
ylim([1.45,2.1])  
fprintf("The filtered max forward velocity is %gm/s and the minimum forward velocity is %gm/s.\n",  
max(s_vel), min(s_vel))
```



The filtered max forward velocity is 1.98m/s and the minimum forward velocity is 1.56m/s.

The filter was a moving average filter with a 5-point window.

3.1)

```
fprintf("You would use the 3 marker triads on the thigh and shank to build their respective technical coordinate systems.\n")
```

You would use the 3 marker triads on the thigh and shank to build their respective technical coordinate systems.

3.2)

```
fprintf("Thigh = greater trochanter, the lateral epicondyle, and the medial epicondyle\nshank = lateral malleolus, the medial malleolus, and the fibular head \n")
```

Thigh = greater trochanter, the lateral epicondyle, and the medial epicondyle

shank = lateral malleolus, the medial malleolus, and the fibular head

3.3)

```
fprintf("You can use the first few frames to calculate the offset between the shank and the thigh in the technical coordinate system and then in all frames were you lack the thigh you can generate it based off that offset from the shank because both are in the technical coordinate system.\n")
```

You can use the first few frames to calculate the offset between the shank and the thigh in the technical coordinate system and then in all frames were you lack the thigh you can generate it based off that offset from the shank because both are in the technical coordinate system.