Practical Review

1. **Mock on CM calculations by hand**

	Arm mean mass: 2.436 kg				
Segment	**CM (% from proximal)**	**Mass (%)**		**Proximal**	**Distal**
Forearm	45.92	35.11%		Elbow	Wrist
Upper Arm	57.54	64.89%		Shoulder	Elbow

	X	**Y**
SHOULDER	1.52	1.47
ELBOW	1.39	1.27
WRIST	1.57	1.18

$x_{cm} = x_p$ - (length of the segment in x-direction * (CM % from proximal)
$= x_p - ((x_p - x_d)$* (CM % from proximal))

$y_{cm} = y_p$ - (length of the segment in y-direction * (CM % from proximal)
$= y_p - ((y_p - y_d)$* (CM % from proximal))

$m_{segment}$ = (Mass %) * total body mass

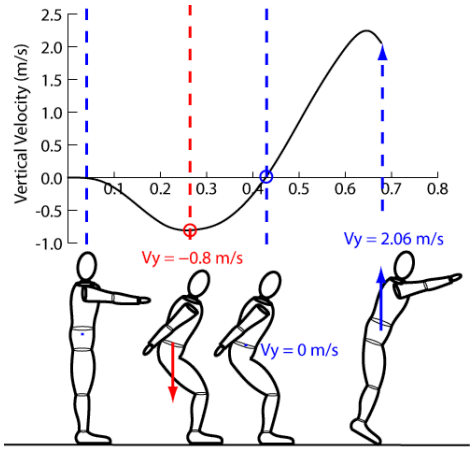
$x_{cm} = (\Sigma m_i x_i) / M$ (for i=1 to n)

$y_{cm} = (\Sigma m_i y_i) / M$ (for i=1 to n)

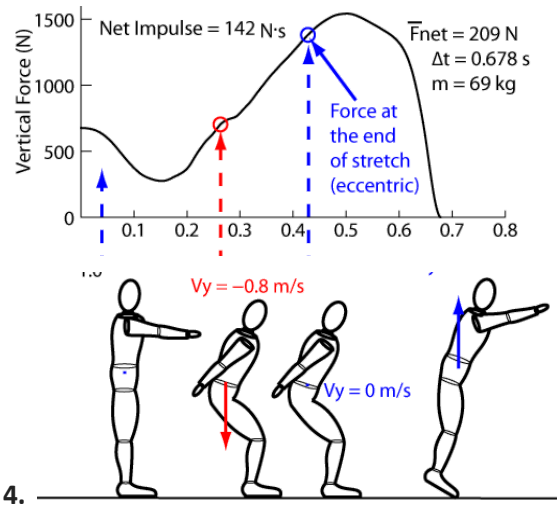
1. Given the tables above, calculate the center of mass of the **upper arm**.

2. If the forearm center of mass is (1.47, 1.23), and given your answer above, what is the center of mass of the arm?

2. **From the velocity graph below, create position, acceleration, and force graphs.**



3. **From the force graph below, create acceleration, velocity, and position graphs.**



4.

1. For each graph above, identify the location of **High**, **Low**, and **Departure**
    1. High: moment of greatest initial vertical position
    2. Low: moment of smallest initial vertical position
    3. Departure: moment the body (or object) leaves the ground

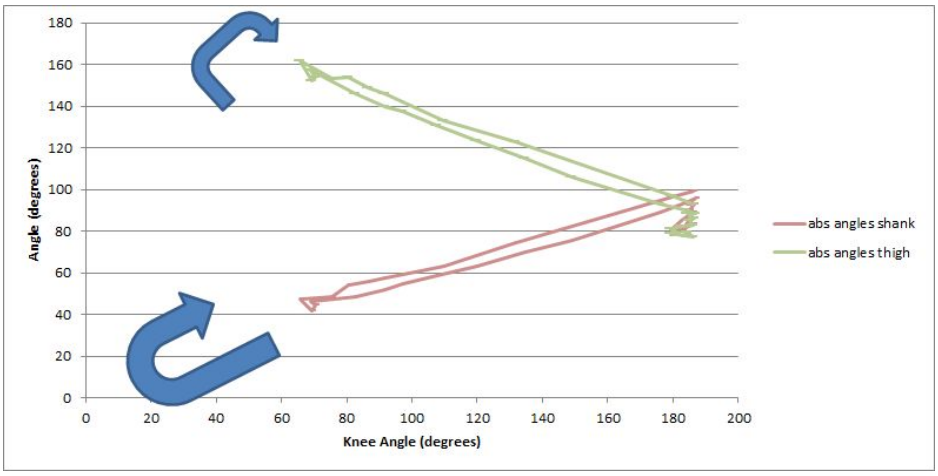
2. Place the following angles on the appropriate figure:
    Ankle, Foot, Hip, Knee, Shank, Thigh, Trunk

Absolute Angles

Relative Angles

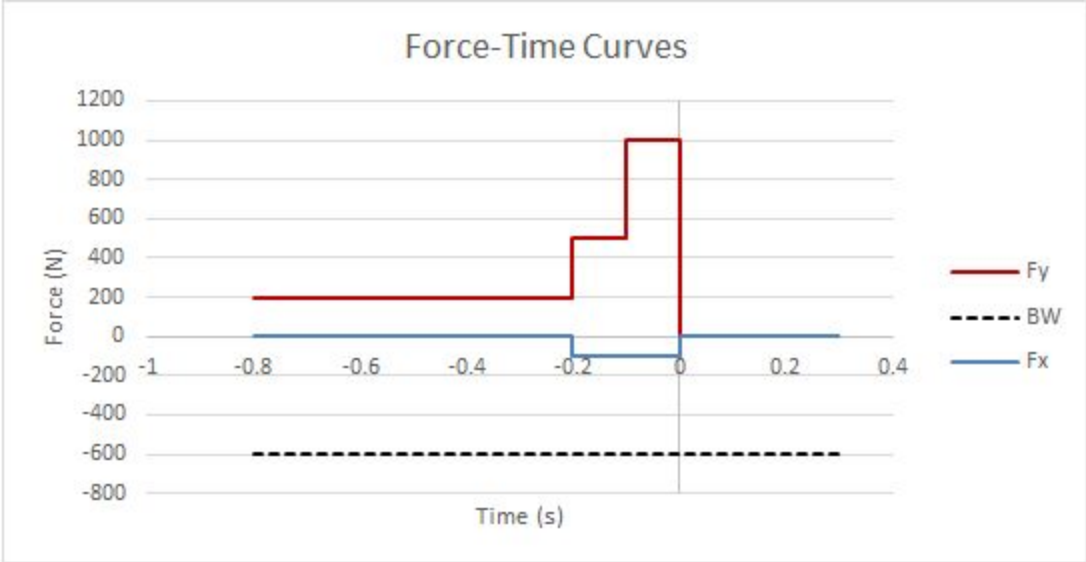
3. Calculate the thigh segment angle relative to the right horizontal line. The knee coordinate is (6, 8) and the hip coordinate is (4, 12).

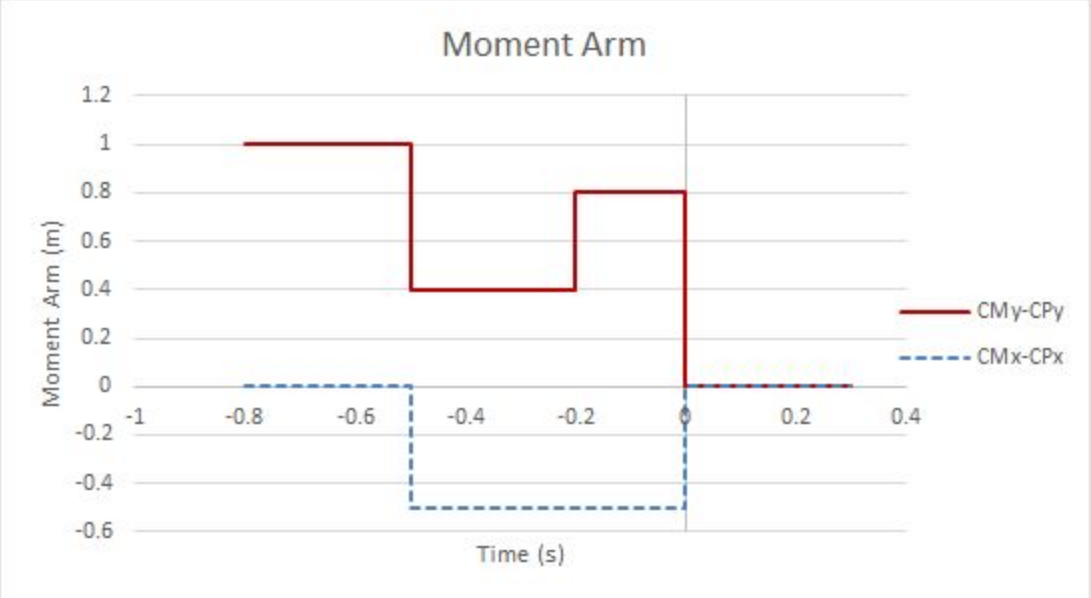
4. Calculate the range of motion for the shank, thigh, and knee angles



5. **From the graph above, which segment angle contributes more to the knee angle?**

6. **Example: Force-time and a moment arm (d) - time curve**





- Draw FBD and MAD at t=-.4s, t=-0.1

- Subject's mass

- Net vertical impulse
    - Vertical velocity at take-off

- Angular velocity at take-off

- Direction of rotation?

7. What is the equation for linear and angular impulse?

8. Linear effects on TBCM and rotational effect
    1. Review post lab 5

	Back Timer	Back	Reverse
High			
Low			
Joint Extension			
Departure			

1. Here is a table that includes Angular Impulse: due to Fx, due to Fy, and Net for the Back, Back Timer, and Reverse Dives

	Ang Imp (M due to Fx)	Ang Imp (M due to Fy)	Ang Imp (Sum of M)
Back Timer	-33.32371692	-24.09392707	-57.41764399
Back	-31.87802967	64.90585015	33.02782048
Reverse	61.14	-7.17	53.97

2. What is the overall rotational effect of the **horizontal** force observed during the **back timer** dive?

3. What is the overall rotational effect of the **vertical** force observed during the **back timer** dive?

4. What is the overall rotational effect of the **horizontal** force observed during the **back** dive?

5. What is the overall rotational effect of the **vertical** force observed during the **back** dive?

6. What is the overall rotational effect of the **horizontal** force observed during the **reverse** dive?

7. What is the overall rotational effect of the **vertical** force observed during the **reverse** dive?

8. What would be a major risk if the diver reduces his/her horizontal reaction force during the reverse rotating dive takeoff?

9. Does the back timer replicate the angular impulse generation requirements of a back dive in these three phases: load tip, push (discuss separately)?

10. The back timer should have a negative net angular impulse. Why does this make sense even though there is no negative rotation?

11. Compare the net angular impulse generated in the reverse and back dives. Discuss rotation and how it is related to the mechanical objective of the dives.

	Reverse Dive	Back Dive
Net Vertical Angular Impulse	-7.17	65.11
Net Horizontal Angular Impulse	61.138	-31.26
Net Angular Impulse	53.97	33.86

14. What would be the performance outcome if the diver reduces his vertical reaction force during the back rotating dive takeoff? Consider linear and angular effects. Include free body diagrams.

15. What would be the performance outcome if the diver reduces his vertical reaction force during the reverse dive takeoff? Consider linear and angular effects. Include free body.

9. Look at force overlay videos to get a sense of what the curves look like for diff actions