YORK UNIVERSITY
SCHOOL OF KINESIOLOGY AND HEALTH SCIENCE

MIDTERM #1 Section M

HH KINE 3030 3.0
INTRODUCTION TO THE BIOMECHANICS OF HUMAN MOVEMENT

February 5, 2016

NAME: _____

STUDENT NUMBER: _____

INSTRUCTIONS:

1. Do not open exam until instructed to start.
2. Answer ALL multiple choice questions on the "scantron" sheet using a pencil. Answer all short answer on the midterm question sheet.
3. Exam length is 45 minutes
4. Clear all objects from desk except pencils/pens, calculators, protractors, ID and rulers.
5. Store all personal belongings under desk.
6. Make sure your name is *on all pages* and scantron sheet and your student number is properly marked on the scantron.

8 pages including cover

Total Marks - 38
Part I - 20 Part II - 18

Name_____

Part I MULTIPLE CHOICE: Circle the letter that represents the best answer.

1. The redesign of the figure skate boot as described in Hall is primarily an example of:
   A. Occupational Biomechanics
   B. Clinical Biomechanics
   C. Sport Biomechanics
   D. Forensic Biomechanics

2. Plantar flexion/Dorsiflexion is:
   A. Rotation around a mediolateral axis in the sagittal plane at the knee
   B. Rotation around a mediolateral axis in the frontal plane at the ankle
   C. Rotation around an anteroposterior axis in the frontal plane at the knee
   D. Rotation around an anteroposterior axis in the sagittal plane at the ankle
   E. Rotation around a mediolateral axis in the sagittal plane at the ankle
   F. Rotation around an anteroposterior axis in the frontal plane at the ankle

3. You are interested in measuring the shoulder abduction/adduction angle during a jumping jack. You set up the camera in front of the participant and film a trial jump. After reviewing the film, you realize you cannot see the shoulders in the frame for the whole jump. You:
   A. move the camera away from the participant to increase the field of view and increase the resolution.
   B. move the camera away from the particpant to increase the field of view and decrease the resolution.
   C. move the camera to the side of the participant.
   D. move the camera closer to the participant, decreasing the field of view and increasing the resolution

4. Tools typically used in biomechanics to collect kinetic quantities do not include:
   A. Electromyography
   B. Force plates
   C. Motion Capture Systems
   D. Hand Grip Dynamometers

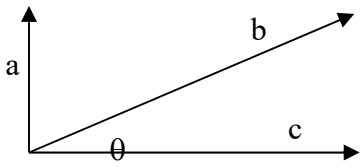
5. An 80 Kg person travels to planet Q which has ¼ the acceleration due to gravity found on earth. Their mass on planet Q is:
   A. 80 Kg
   B. 784.8 N
   C. 20 Kg
   D. 196.2 N
   E. 196.2 Kg

6. "The patient exhibits 10 degrees of hip abduction" is an example of a _____ assessment?
   A. static
   B. quantitative
   C. cartesian
   D. dynamic
   E. qualitative

Name_____

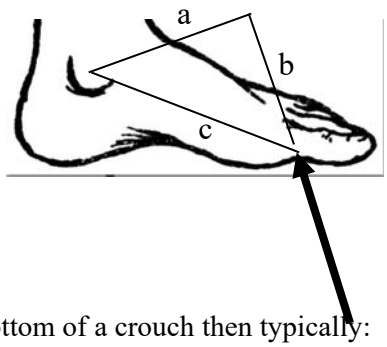
7. The angle of the trunk at landing is an example of ?
   A. A Relative angle
   B. An Absolute angle
   C. linear displacement
   D. angular velocity

8. In the figure shown 'b' represents velocity of the centre of gravity of a high jumper at take-off and 'a' is vertical. Which of the following statements are true?
   A. b is the resultant of a and c
   B. the horizontal component = b x cos θ
   C. $c = \sqrt{(b^2 + a^2)}$
   D. A and B are correct
   E. all of the choices are correct



9. If the horizontal component of the shotput velocity is 5 m/s when released at a height of 1 m, then assuming no air resistance the horizontal component of the velocity when landing will be
   A. greater than 5 m/s
   B. less than 5 m/s
   C. 5 m/s
   D. not possible to predict

10. A physiotherapist exerts a force on a patient's foot represented by the arrow on the diagram. If the axis of rotation is the ankle, which line represent the moment arm?
   A. a
   B. b
   C. c
   D. none of the above



11. Assuming downwards is considered negative, as a person approaches the bottom of a crouch then typically:
   A. Their vertical velocity is negative and their vertical acceleration is negative
   B. Their vertical velocity is positive and their vertical acceleration is negative
   C. Their vertical velocity is positive and their vertical acceleration is positive
   D. Their vertical velocity is negative and their vertical acceleration is positive

12. A wheelchair marathoner has a speed of 7 m/s after rolling down a small hill in 2 s. If the wheelchair underwent a constant acceleration of 3 m/s/s during the descent, what was the marathoner's speed at the top of the hill:
   A. 1 m/s
   B. 6 m/s
   C. 2.33 m/s
   D. 3.5 m/s
   E. 1.5 m/s

Name_____

13. In a '10 K' road race, the finish line is also the starting line. What does '10 K' represent?

A. displacement
B. distance
C. speed
D. velocity
E. acceleration

14. A gymnast spinning at an angular velocity of -6 rad/s changes the velocity in a 2 s time interval to a rate of -2 rad/s. What is the rate of angular acceleration?

A. 3 rad/s^2
B. -3 rad/s
C. 2 rad/s^2
D. - 2 rad/s^2
E. 2 rad/s

15. A ball is kicked with an initial velocity of 7 m/s at an angle of 30°. Neglecting air resistance, what is the speed of the ball at landing on the soccer field?

A. 7 m/s
B. 7 m/s multiplied by the sine of 30 degrees
C. 7 m/s multiplied by the cosine of 30 degrees
D. none of the choices are correct

16. Hammer throw involves holding the hammer, spinning around and releasing the hammer at maximum angular velocity. If all other factors are held constant, what effect would longer arms have on the linear velocity of the hammer just before release?

A. increase
B. decrease
C. remain the same
D. need more information

17. A researcher will be tracking a cross-country ski race that starts off in an easterly direction and then heads north to the finish, typically 2 hours later. In estimating the average speed required of the tracking vehicle they will need, they ask for the distance of the race. Mistakenly they are given the displacement. Will the vehicle they get be:

A. Too slow
B. Too fast
C. Just right
D. Depends on the relative lengths of the two legs of the race.

18. When viewing a long jump from a frontal view, you can determine which of the following:

i) Forward take-off velocity
ii) Peak vertical height of the feet
iii) Hip adduction at peak height
iv) Shoulder abduction angle at landing

a) i and ii
b) i and iii
c) ii and iii
d) ii, iii and iv
e) i, ii and iv

Name_____

19. A speed skater increases her speed from 10 m/s to 12.5 m/s over a period of 3 seconds coming out of a curve with a radius of 20 m. What is her radial acceleration as she exits the curve?

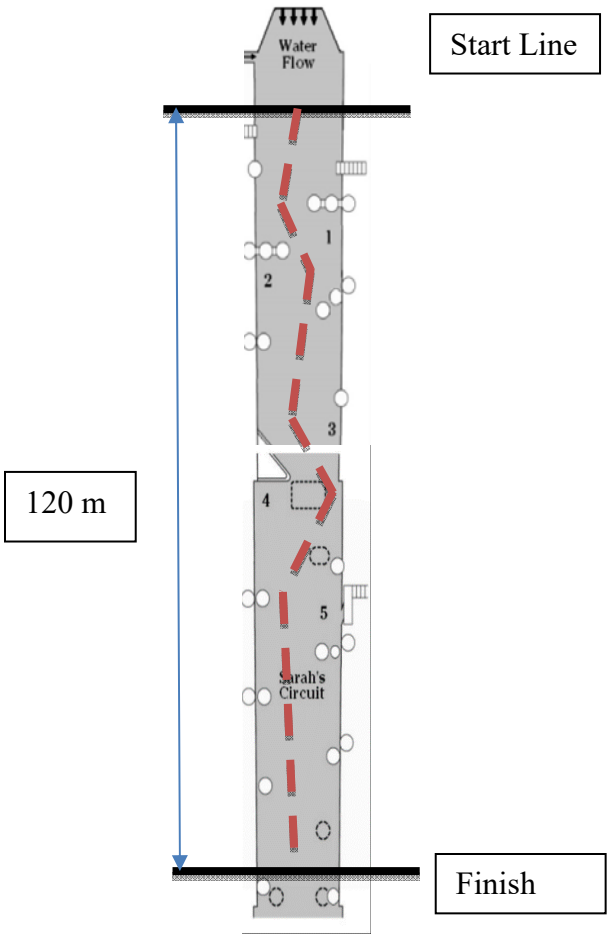
a) 7.81 m/s^2
b) 0.83 m/s^2
c) 0.625 m/s^2
d) 5 m/s^2
e) 0.5 m/s^2

20. Later in the same race, the speed skater is tiring and decreases her speed from 12.5 m/s to 11 m/s over a period of 3 seconds coming out of another curve with a radius of 20 m. What is her tangential acceleration as she exits the curve?

a) 7.81 m/s^2
b) 6.05 m/s^2
c) 0.5 m/s^2
d) 5 m/s^2
e) -0.5 m/s^2

Part II Short Answer

Please show all work, including any required units and equations.



1. The figure to the left represents a white water training facility. A young kayaker enters the course at the start line and exits at the finish line. While in the course they follow the dotted line which consists of 6 sections of: 15 m, 10 m, 30 m, 10 m, 15 m and 55 m respectively in 40 seconds. Calculate the following:

a) The distance travelled (1 mark)

15 + 10 + 30 + 10 + 15 + 55= 135m

b) The kayaker's displacement (1 mark)

120m

c) The kayaker's average speed (1 mark)

135/40= 3.375 m/s

Name_____

2. A ball is thrown at 10 m/s with a projection angle of 60 degrees. The ball is released and caught at the same height. Assuming air resistance is negligible:

a) Calculate the horizontal and vertical components of the velocity at release. (2 marks)

horizontal = v cos(a)

= 10 * cos(60)

= 5 m/s

vertical = v sin(a)

= 10 * sin(60)

= 8.66 m/s

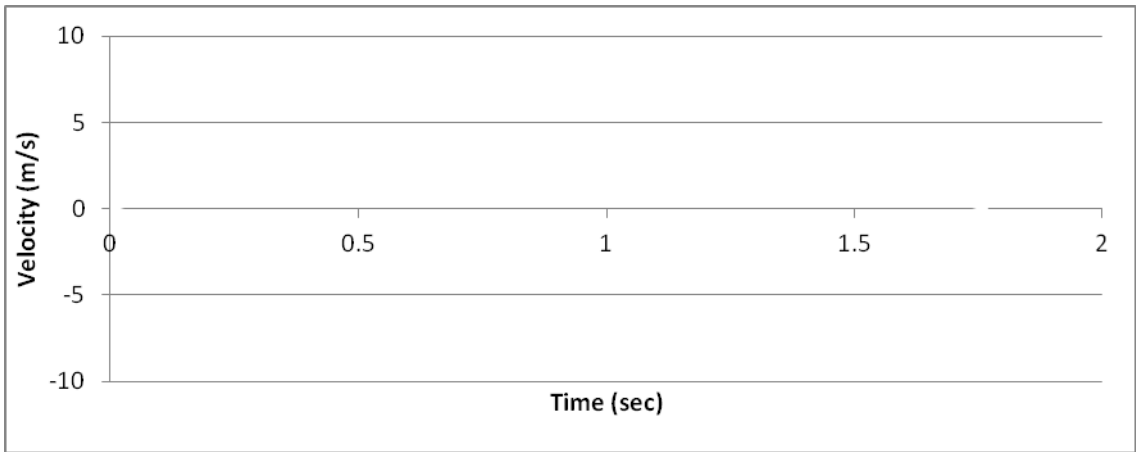
b) Given a time to the apex of 0.8828 seconds. How long will the ball be in the air? (1 mark)

Since it is released and caught at the same height, the vertex is halfway through the journey:

0.8828 * 2

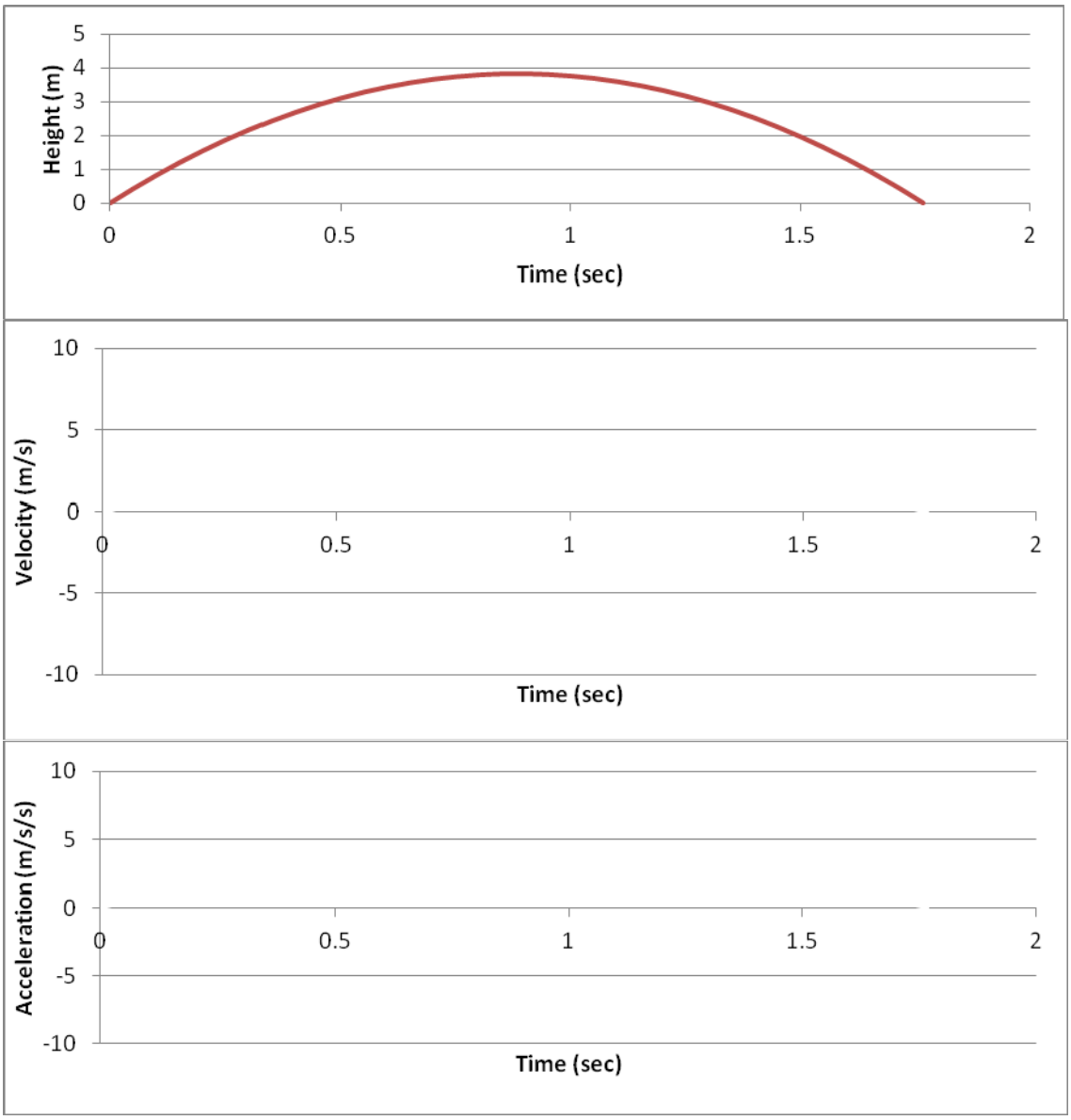
= 1.7656 seconds

c) Draw the horizontal velocity vs time graph for the time the ball is in the air on the axis below. (2 marks)



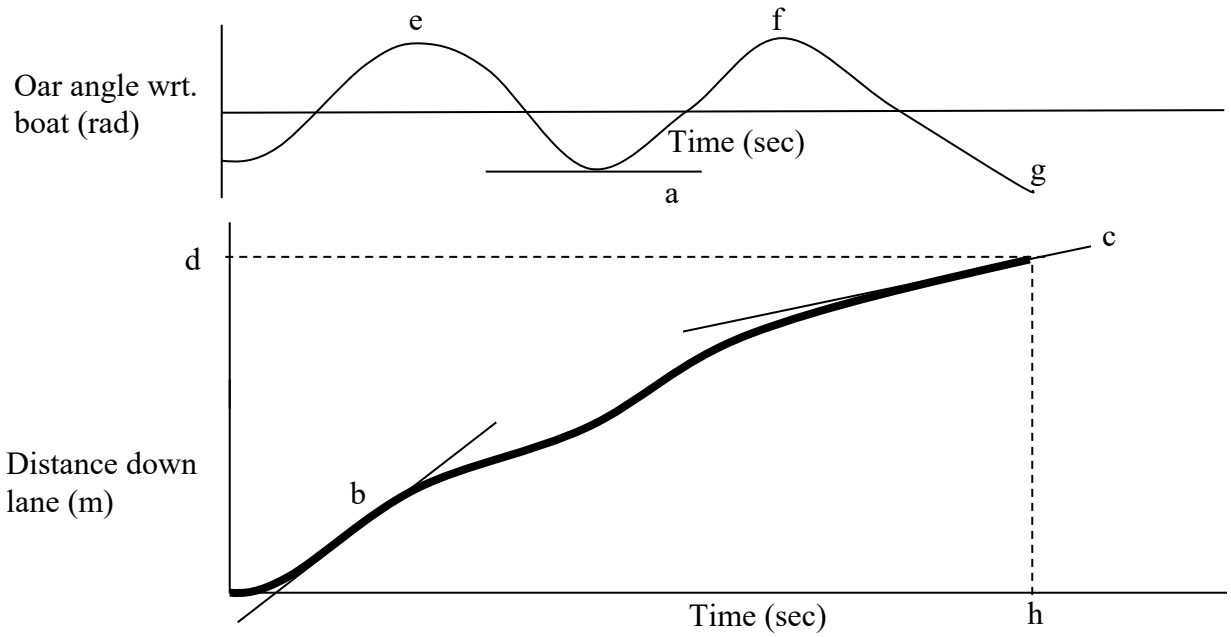
Name_____

d) Below find a graph of vertical height vs. time for the ball *while it is in the air*. Time = 0 sec represents release of the ball. Draw the instantaneous velocity and instantaneous acceleration curves over time on the axes provided. (4 marks)



Name_____

3. (6 marks) A boat for the Canadian rowing team is fully instrumented so the coach can monitor a number of kinematic and kinetic variables during training runs. Below are the print out of two variables – the angle of the oar with respect to the boat (using a 90 degree zero base). Match the columns below.



y coordinate point "g" – y coordinate point "f" V	i) Total distance traveled (m)
Slope of line "b" IV	ii) time for full sweep of oar (sec)
Point "d" I	iii) average oar velocity (rad/sec)
Slope of line "a" VIII	iv) peak instantaneous linear velocity (m/s)
x coordinate point "f" -- x coordinate point "e" II	v) oar range of motion (rad)
y coordinate point "d" / x coordinate point "h" VII	vi) lowest instantaneous linear velocity (m/s)
	vii) average linear velocity (m/s)
	viii) zero instantaneous oar angular velocity (rad/sec)
	x) oar range of motion (m)