AP Physics C Name: _____

Unit 1: Kinematics Test

Direction: Answer each question below with either sufficient explanation or mathematical work to justify your answer. You are graded for your method and reasoning rather than the final answer. Whenever necessary, use $g = 10\,\frac{m}{s^2}$. Work on a separate sheet of paper. Take a picture of your final test and upload it to Google Classroom when completed.

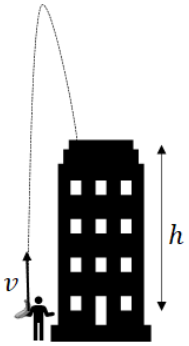
1. (10 points) There are times in the course of human events where it becomes necessary to drop bananas off a buildings. Dave the Dude drops a banana off of a tall building at time t = 0 s. At time t = 1 s (one second later), he drops a second banana off the building. Bob the Bro makes the following claim:

"Both bananas will gain the same amount of speed per second so they will both fall the same the distance from t = 1 s to t = 2 s."

a) What aspect(s) of Bob's reasoning(if any) are correct?

b) What aspect(s) of Bob's reasoning(if any) are incorrect? If he's correct, justify why. If anything is incorrect, explain how it is incorrect.

2. (24 points) Bananas were not meant to be on the ground. Dave the Dude throws a banana straight upwards at a speed of $v = 50\,\frac{m}{s}$. It lands on the top of a building with a height of $h = 100\ m$.

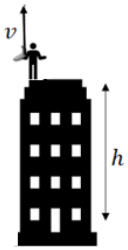


a) Calculate the time the banana is in the air.

b) Calculate the speed at which the banana strikes the building.

c) Dave the Dude constructs a velocity vs. time graph for the entire motion of the banana. For what part of the motion would the graph show a line approaching the x-axis?

d) Suppose Dave the Dude has instead thrown the stapler up at the same speed, but from the top of the building and it hits the ground below.



i. Would the time in the air increase, decrease, or remain the same compared to part a). Justify your answer conceptually WITHOUT using numbers.

ii. Would the final speed increase, decrease, or remain the same compared to part b). Justify your answer conceptually WITHOUT using numbers.

3. (18 points) Donkey Kong races towards the scene to stop this absolute travesty. At time t = 0, Donkey Kong is at the origin (x=0) and running in the positive direction with a velocity of +10 m/s. He does this for 5 s. At t = 5 s, Donkey Kong slows down with acceleration of -0.5 m/s^2 until he stops.

a) Calculate the total time Donkey Kong is in motion.

b) Calculate the total distance Donkey Kong travels.

c) Sketch graphs of the acceleration, velocity, and position of Donkey Kong as a function of time.

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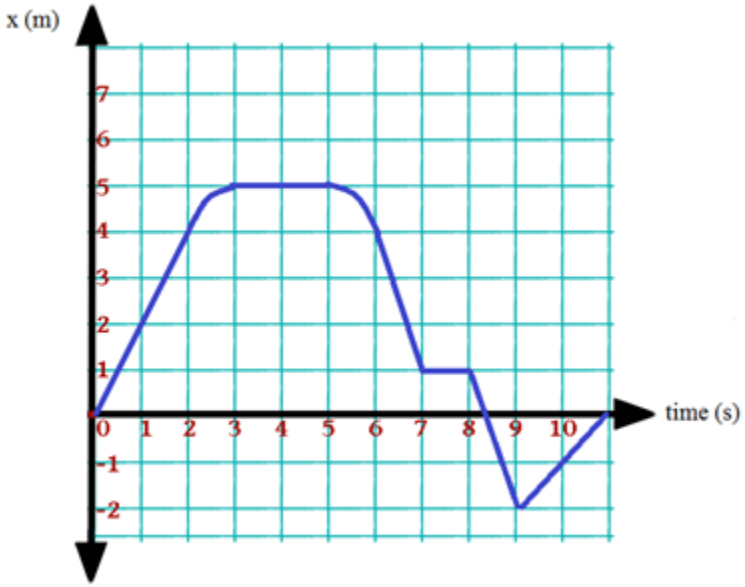
4. (18 points) Donkey Kong now follows a motion in which his position as a function of time is given by the graph below.



a) What at time(s) is Donkey Kong at rest?
b) At what time(s) does Donkey Kong switch direction?
c) Name a time when Donkey Kong has a non-zero acceleration.
d) Calculate Donkey Kong's displacement from his starting position at t = 9 s.
e) Calculate the total distance Donkey Kong travels from his starting position to t = 11 s.
f) Construct a velocity vs. time graph for this motion.

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