

AP/Honors HW: Intuitive Kinematics

Full Name - Period:

due 1/21

You must **show all work** for all problems in order to receive full credit.

1 Learning to read

1.1 Reference frames and time translation symmetry

1. If some dude's position is $\vec{r} = -10 \text{ m}\hat{x}$ and the dude is moving away from the origin, but is slowing down, which of these are true about the dude's velocity and acceleration?
 - A. Both are positive
 - B. Velocity is positive, but acceleration is negative
 - C. Velocity is negative, but acceleration is positive
 - D. Both are negative.
2. Morty and Rick travel to the same location. Morty starts 15 seconds before Rick. Morty has a constant velocity of $\frac{5}{2} \frac{\text{m}}{\text{s}}\hat{x}$ and Rick has an unknown constant acceleration. Rick arrives 25 s before Morty. Rick's total travel time is 40 s.
 - (a) How far away was the destination?
 - (b) What was Rick's acceleration?
3. A man is standing on the top of a very tall building. At $t = 0$ he drops a bowling ball off the building, at $t = t_1$ he drops a golf ball. Neglect air resistance. Gravity acts in the $\hat{z}$ direction.
 - (a) While the objects are in free-fall, which of the following will be constant and non-zero?
 - A. The difference in their positions
 - B. The difference in their velocities
 - C. The difference in their accelerations
 - D. None of these.
 - (b) Write an equation for the position of the golf ball in the bowling ball's reference frame valid while both balls are in the air. Use g for the acceleration due to gravity.
 - (c) Rewrite your equation for the case where, instead of being dropped, the bowling ball was thrown with $\vec{v}_b = v_{xb}\hat{x}$ and the golf ball was thrown with $\vec{v}_g = v_{xg}\hat{x}$

2 Pacing around the oval office

1. A president is walking along a circle with radius 1 m in the $x-y$ plane. Mr. President's initial position was $-1\text{ m}\hat{y}$ and travels clockwise. He completes one journey around the circle every 10 seconds. You may want to draw a diagram.

(a) When the president's position is $-1\text{ m}\hat{x}$, what is his displacement vector?

(b) When the president's position is $+1\text{ m}\hat{y}$, what is his distance traveled?

(c) When the president's position is $+1\text{ m}\hat{x}$, what is his velocity vector?

(d) When the president's position is $-1\text{ m}\hat{y}$, in what direction does his acceleration vector point?

3 Another Problem

(AP only) You apply a force F to the edge of a disk with radius R . You have another disk with the same density and thickness, but half the radius. If you apply the same force F to the edge of that disk, what will be the ratio of the angular speeds of the disks at time t ? What will be the ratio of their angular displacements?