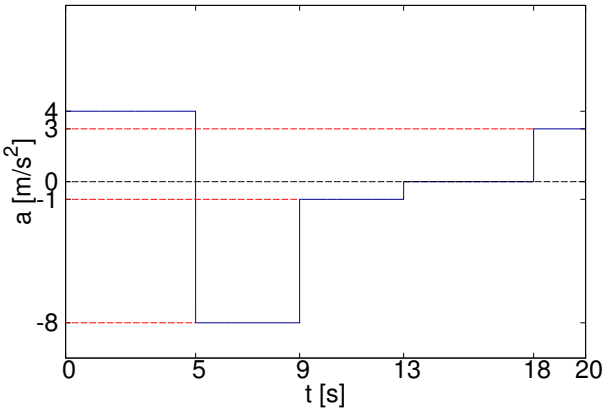
PHY 9A Discussion 1, Spring 2018

1. Acceleration to Position

Consider a car moving on a straight line. The car initially had a velocity of $v_0 = 3$ [m/s], and the diagram to the right shows the acceleration of the car as a function of time.



i. Draw a diagram for the velocity as a function of time. At what time does the velocity become zero?

ii. Find time intervals in which the direction of motion and the direction of acceleration differ from each other.

iii. Draw a diagram for the position as a function of time. What is the distance to the farthest position of the car measured from its original position?

2. Throwing a Ball Upward

In this problem, we ignore air resistance, and also consider every person/object as point-like.

When Alice jumped vertically, and then threw a very light ball straight up at the time she reached the maximum height of 1 [m], the ball went as high as $y = 8$ [m].

i. What is the initial velocity of the ball (relative to Alice)?

ii. When Alice touched the ground, at what height was the ball? Was it still moving upward or on the way to the ground?

iii. If Alice had thrown the ball with the same relative velocity before she reached the maximum height, would the ball have gone higher/lower than 8 [m]? Explain.

3. A Ball on an Inclined Ramp

Bob can run at a constant velocity $v = 10$ [m/s] for the first four seconds, but can only run as fast as $v = 6$ [m/s] afterward. Now Bob runs the 100-meter dash against a ball on an inclined ramp which makes an angle of θ with the ground. (Thus the ball actually runs the more-than-100-meter dash.) The ball is initially at rest, and we assume that there is no friction nor air resistance.

i. What is the record time of Bob?

ii. Find the relationship between θ and the record time of the ball.

iii. What is the maximum angle with which Bob still doesn't lose the race? Is there any way that Bob can win the race regardless of θ? Explain.