1-D Motion Questions

Jeremy Du, Arnold Mong

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These questions are all about motion in one dimension, so you should be able to solve these with only the Big 5 equations you learned. Remember - diagrams are important!

1. Arnold is flying in a straight line, initially at 10 m/s, when he uniformly increases its speed to 18 m/s while covering a distance of 40 m. What is his magnitude of acceleration? Note: Arnold is a bird.

2. Arnold is bored, so he stands on the side of the front of a stationary train. When the train starts moving with constant acceleration, it takes 5 seconds for the first car to pass Arnold. How long will it take for Arnold to watch just the 10^{th} car pass? Assume all cars are the same length.

3. Arnold is an avid hiker, but he can only walk left or right. He decides to start off walking to the right, at an average of π m/s. After two hours, he gets bored, so he turns around and starts walking to the left at a speed of 0.361 m/s. Finally, he stops. It turns out Arnold's average velocity was 0.163 m/s to the right. What was the total distance that Arnold walked?

4. Arnold and Jeremy have two cannons. The cannons are arranged vertically, with the lower cannon pointing upward (towards the upper cannon) and the upper cannon pointing downward (towards the lower cannon), 200 m above the lower cannon. Arnold's cannon is the one on the ground. Simultaneously, Arnold and Jeremy both fire. The muzzle velocity of the Arnold's cannon is 25 m/s and the muzzle velocity of the Jeremy's cannon is 55 m/s. Assume $g = 10$ m/s^2.

   How long after the cannons fire do the projectiles collide?
   How far beneath the top cannon do the projectiles collide?