

Cheetah and Antelope Individual Activity

Name: _____ ID: _____

Objective: Determine the time and position at which a fast animal (e.g. cheetah) will overtake a slow animal (e.g. antelope) when the slow animal begins a distance ahead of the fast animal. Assume both animals travel in the same direction and linear dimension.

You will be assigned the following values:

$$\bar{v}_{antelope} = \text{_____ m/s} \quad \bar{v}_{cheetah} = \text{_____ m/s}$$

$$x_{i,antelope} = \text{_____ m} \quad x_{i,cheetah} = \text{_____ m}$$

First you will create two constant velocity equations $x_f = \bar{v}t + x_i$, one for each animal. \bar{v} and x_i are given quantities and will differ within the two equations. x_f and t are unknown quantities and will remain represented as variables until you solve for them.

x_f denotes final position; x_i denotes initial position; t represents the elapsed time from when the cars begin to move until colliding head on. Fill in the blanks below.

Antelope

Cheetah

$$x_f = \bar{v}t + x_i$$

$$x_f = \bar{v}t + x_i$$

$$x_{f,slow} = \bar{v}_{slow}t + x_{i,slow}$$

$$x_{f,fast} = \bar{v}_{fast}t + x_{i,fast}$$

$$x_{f,slow} = \text{_____}t + \text{_____}$$

$$x_{f,fast} = \text{_____}t + \text{_____}$$

Since x_f will be the same in both equations, you can set expressions equal to one another and then solve for *time*. Carry decimals to the hundredths place.

$$x_{f,slow} = x_{f,fast}$$

$$\bar{v}_{slow}t + x_{i,slow} = \bar{v}_{fast}t + x_{i,fast}$$

$$\text{_____}t + \text{_____} = \text{_____}t + \text{_____}$$

$$t = \text{_____} \text{ seconds}$$

Once you have solved for t using the correct steps, you can choose either the slow or fast animal original constant velocity equation in order to solve for x_f which is the position at which the cheetah reaches the antelope. For practice and to verify your answer, use both original constant velocity equations to find x_f .

$$x_{f,slow} = \bar{v}_{slow}t + x_{i,slow}$$

$$x_{f,fast} = \bar{v}_{fast}t + x_{i,fast}$$

$$x_{f,slow} = \text{_____}t + \text{_____}$$

$$x_{f,fast} = \text{_____}t + \text{_____}$$

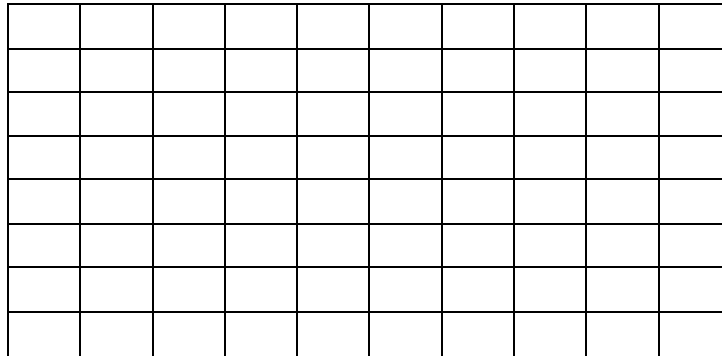
$$x_{f,slow} = \text{_____} \text{ meters}$$

$$x_{f,fast} = \text{_____} \text{ meters}$$

Verify your time and final position numbers with the instructor.

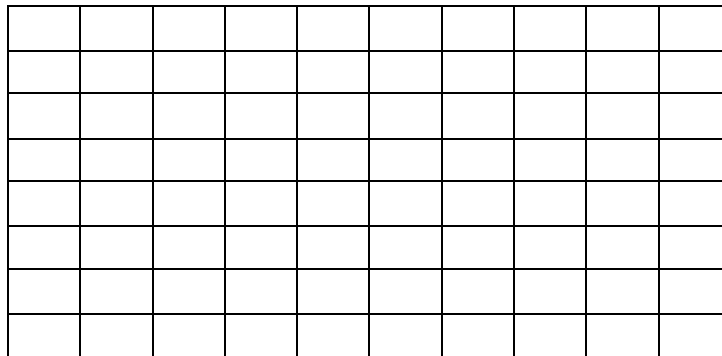
On the grid lines provided below, sketch the x-t and v-t graphs of each animal. Remember that the average velocity \bar{v} is the slope and can either be positive or negative; x_i is the y-intercept.

Position



Time

Velocity



Time