

Finding Distances for Accelerated Motion



$$a = \frac{\Delta v}{\Delta t}$$

$$v_{av} = \frac{v_1 + v_2}{2}$$

$$v_{av} = \frac{\Delta d}{\Delta t}$$

Name: _____ Date: _____

The Adventures of Super Turtle!

Super turtle is out fighting crime one day. He decides that he would like to do some physics, just for fun. Super turtle is interested in finding out how he can determine how far he has run if he knows his acceleration and speeds.

>> Follow the analysis to find out the **total distance** the super turtle runs while he is out fighting crime.

- a) Super Turtle starts from rest chasing his arch enemy and accelerates for 40 seconds at an acceleration of 4 m/s/s. Calculate Super Turtle's ① **final speed** after the 40 seconds. Also, draw this motion on a speed-time graph.

- b) Calculate Super Turtles ② **average speed** over the 40 seconds. (hint: use the v_2 from part a)

- c) Using the ③ **average speed equation** calculate the distance that super turtle travels in this 40 second time period. Also, calculate the area underneath the graph from $t=0$ to $t=40$ seconds and compare this to your first result.

Physics of Motion

- d) Super Turtle at this point sees his enemy ahead of him. He begins to decelerate at a rate of -2 m/s/s for 30 seconds. How far does he travel in this time period?
- Use steps ①②③ to do this.
 - Calculate the area underneath the curve from $t=40$ to $t=70$ and compare to your first result.
- e) Super Turtle approaches his enemy for 20 seconds at the *constant speed* found in the previous step (the v_2 from the previous step).
- Calculate the distance he travels in this 20 second interval.
 - Calculate the area underneath the curve from $t=70$ to $t=90$ s and compare.

Physics of Motion

- f) Super Turtle is very close to his enemy now and comes screeching to a stop in 10 seconds.
- Calculate his acceleration during the stopping phase.
 - Calculate the distance traveled during the stopping stage using two methods (average speed and area)
- g) When Super Turtle started his chase how far away was he from his arch enemy? Put your answer in kilometres.
- h) Plot the speed-time graph for this situation. Determine the total distance travelled by determining the area under the line for each section of travel. Compare this value with your answer from part g). Do all of your work on the graph paper provided.

Who is Super Turtle's arch enemy? Include a sketch.


