

## Approximations 1 – Distance

**Example 1:** A car is speeding up during a time period from  $t = 0$  to  $t = 4$  seconds. Values of the velocity are given in the table below for selected values of  $t$ .

Time (seconds)	0	1	2	3	4
Velocity (feet/sec)	12	20	28	36	40

- (1) Estimate the distance traveled by the car during these 4 seconds. (Show your method.)
  
- (2) Find an underestimate for the distance the car traveled. (Show your method.)
  
- (3) Find an overestimate for the distance the car traveled. (Show your method.)

Now, more data is actually known.

Time	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Velocity	12	15	20	23	28	34	36	39	40

- (4) Using this data, find an underestimate for the distance the car traveled.
  
- (5) Using this data, find an overestimate for the distance the car traveled.
  
- (6) How do your answers to (2) and (3) compare to your answers from (4) and (5)? Explain.

**Example 2:** Water is leaking out of a container. It leaks out quickly at first and then slows with time. The rate of leakage, given by the number of liters lost per minute, is given for selected values of time  $t$  in the table below.

time (minutes)	0	2	5	6
liters per minute	5.3	4.1	2.7	1.8

- (1) Using the data in the table, find an underestimate for the amount of water that may have leaked out of the container during the 6 minutes. (Show your method.)
- (2) Using the data in the table, find an overestimate for the amount of water that may have leaked out of the container during the 6 minutes. (Show your method.)
- (3) What would be necessary to make better estimates?

**Quick Summary:**

- (1) How do your under- and over-estimates change if you have more data?
- (2) How did your method for finding the under- and overestimates change from the distance problem to the water problem? What about the data caused this to change?
- (3) On the first problem, obviously, an underestimate for the distance traveled would have been 0 feet, even if that wouldn't have been particularly useful. If the velocity had both increased and decreased during those four seconds, would you have been able to find a more useful under- and overestimates? Explain.