5.1

Calculus 5.1 Notes- Estimating with Finite Sums

Consider a train moving at a constant velocity of 70 mph for 2 hours.
Graph the velocity.

What is the total distance traveled by the train?

Where does the distance traveled show itself in the graph?

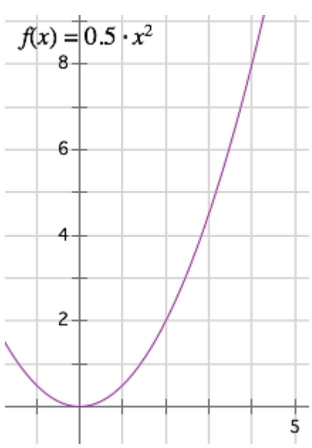
What appears to be the relationship between the velocity curve and distance traveled?

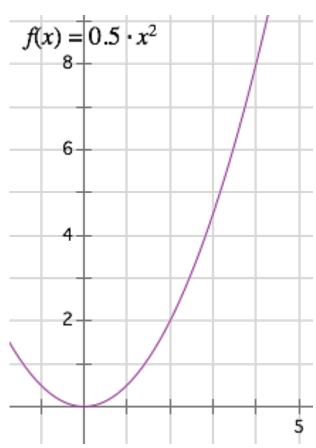
Now consider a train moving at a changing velocity for 2 hours.
Is the same relationship still true? Why or why not?

***The area under any rate of change graph is the net change amount***

The graph of $y = \frac{1}{2}x^2$ over [0,4] is given.

How can we approximate the area "under the curve"?



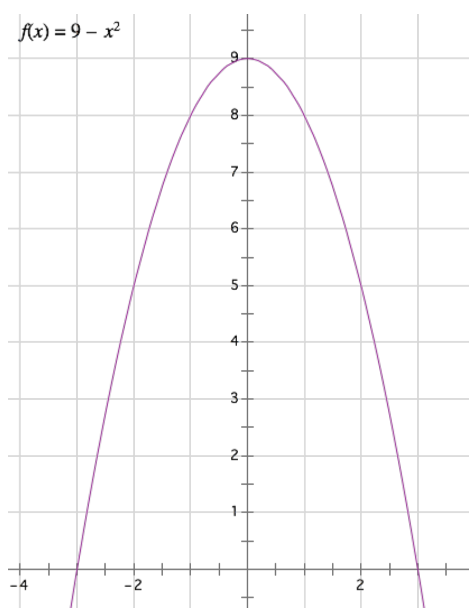
# Rectangle Approximation Method (RAM)

LRAM-

RRAM-

MRAM-

Approximate the area under the curve $y = 9 - x^2$ over [-3,3] using LRAM, MRAM, and RRAM with 6 subintervals.



Calculator

Approximate the area under the curve $y = 9 - x^2$ over [-3,3] using LRAM, MRAM, and RRAM with 20 subintervals.

The table shown represents the velocity of a car moving along a road. Estimate the distance traveled by the car using LRAM and RRAM.

| Time | Velocity |
|---|---|
| 0hr | 30 mph |
| .5 hr | 40 mph |
| 1 hr | 45 mph |
| 1.5 hr | 25 mph |
| 2 hr | 20 mph |

# 5.1

17. ***Distance Traveled Upstream*** You are walking along the bank of a tidal river watching the incoming tide carry a bottle upstream. You record the velocity of the flow every 5 minutes for an hour, with the results shown in the table below. About how far upstream does the bottle travel during that hour? Find the **(a)** LRAM and **(b)** RRAM estimates using 12 subintervals of length 5.

| Time (min) | Velocity (m/sec) | Time (min) | Velocity (m/sec) |
|---|---|---|---|
| 0 | 1 | 35 | 1.2 |
| 5 | 1.2 | 40 | 1.0 |
| 10 | 1.7 | 45 | 1.8 |
| 15 | 2.0 | 50 | 1.5 |
| 20 | 1.8 | 55 | 1.2 |
| 25 | 1.6 | 60 | 0 |
| 30 | 1.4 | | |

24. ***Volume of a Nose Cone*** The nose "cone" of a rocket is a *paraboloid* obtained by revolving the curve $y = \sqrt{x}$, $0 \le x \le 5$ about the $x$-axis, where $x$ is measured in feet. Estimate the volume $V$ of the nose cone by partitioning $[0, 5]$ into five subintervals of equal length, slicing the cone with planes perpendicular to the $x$-axis at the subintervals' left endpoints, constructing cylinders of height 1 based on cross sections at these points, and finding the volumes of these cylinders. (See the accompanying figure.)