

Flow rate and accumulation

Consider a tank of water with a faucet and a drain. The volume of water in the tank can change at different rates depending on how the faucet and drain valves are set. There can be a net flow of water into the tank at some times and a net flow of water out of the tank at other times. Let t be time (measured in minutes) and $f(t)$ be the rate of change (measured in gallons per minute) in the volume of water in the tank. Note that a positive value for $f(t)$ means that the volume of water in the tank is increasing and a negative value of $f(t)$ means that the volume of water in the tank is decreasing.

1. The table below gives measured rates for various times in a five minute interval. Use this data to estimate how much water accumulates in the tank during this five minute interval.

t (min)	$f(t)$ (gal/min)
0.0	3.96
1.0	14.52
2.0	19.60
3.0	9.74
4.0	1.78
5.0	0.12

2. The table below gives more data for the measured rates during the same five minute time interval as 1. Use this data to estimate how much water accumulates in the tank during this five minute interval.

t (min)	$f(t)$ (gal/min)
0.0	3.96
0.5	8.60
1.0	14.52
1.5	19.12
2.0	19.60
2.5	15.65
3.0	9.74
3.5	4.71
4.0	1.78
4.5	0.52
5.0	0.12

3. Each of the accompanying plots shows a graph of the rate of change for a different five minute interval. Units on the horizontal axis are minutes and units on the vertical axis are gallons per minute. Use this data to compute or estimate how much water accumulates in the tank during this five minute interval.

