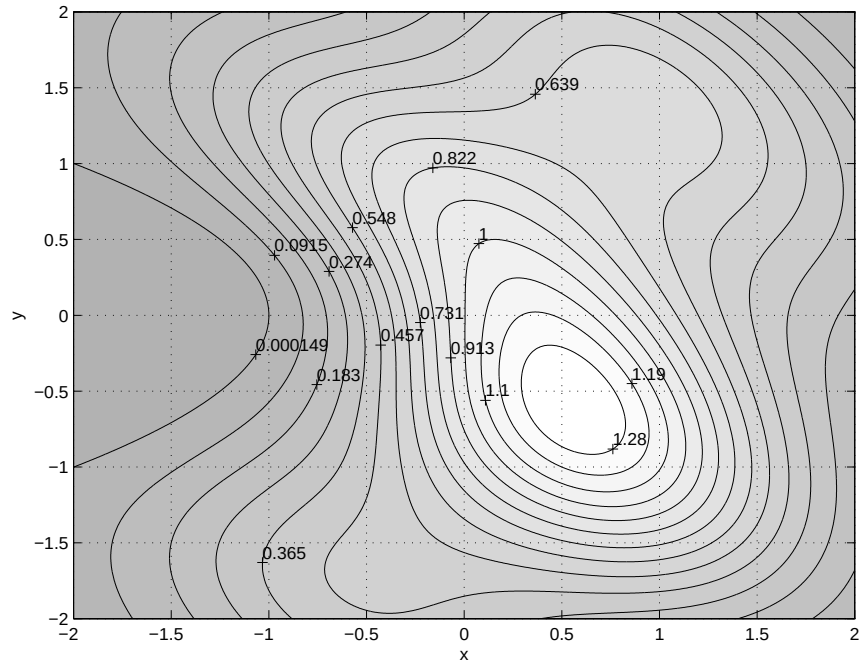
MA205 - Integral Calculus
Lesson 21: Estimations Using Data and Functions I

1. The graph below represents a topographical map of a mountain. All units are measured in miles. Estimate the volume of the mountain using the following methods.



(a) Sample points: lower left corners; 4 regions.

(b) Sample points: midpoints; 4 regions.

(c) Upper estimate; 4 regions.

(d) Lower estimate; 4 regions.

2. We can also approximate volume from a data table. Consider an industrial plant located at the precise center of a town. Pollutants are dispersed in such a manner that the concentration of pollutants C in milligrams per square mile at any point (x, y) within the town is given by the following table:

$x \setminus y$	0	1	2	3	4
0	24000	21000	12000	3000	24000
1	21000	18000	9000	6000	27000
2	12000	9000	0	15000	36000
3	3000	6000	15000	30000	51000
4	24000	27000	36000	51000	72000

(a) Estimate the total amount of pollutants in the town.

(b) How can you use this to estimate the average number of pollutants per square mile?

3. The population density function for a coastal town is given by $P(x, y) = \dfrac{120000}{(2 + x + y)^3}$ in people per square mile, where x and y are in miles and $0 \leq x \leq 2$, $0 \leq y \leq 2$.

(a) Estimate the total population of the town.

(b) Use part (a) to estimate the average population of the town per square mile.

(c) If the coastline is the x axis, how many people live within one mile of the shore?