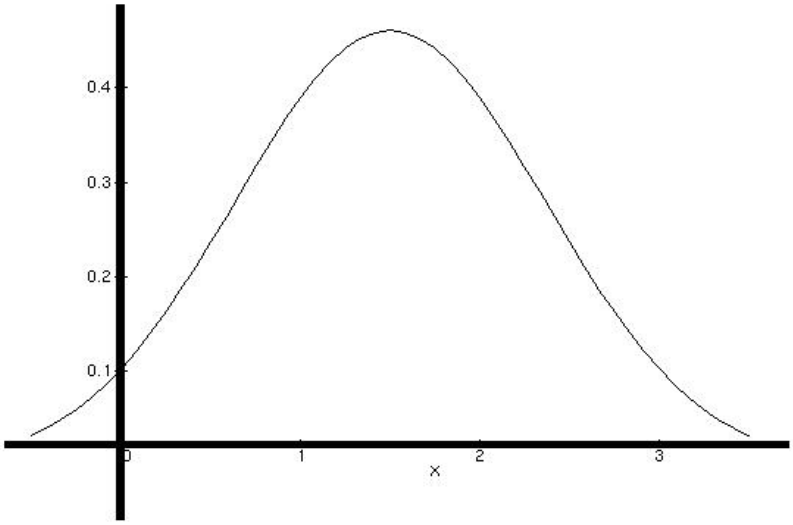
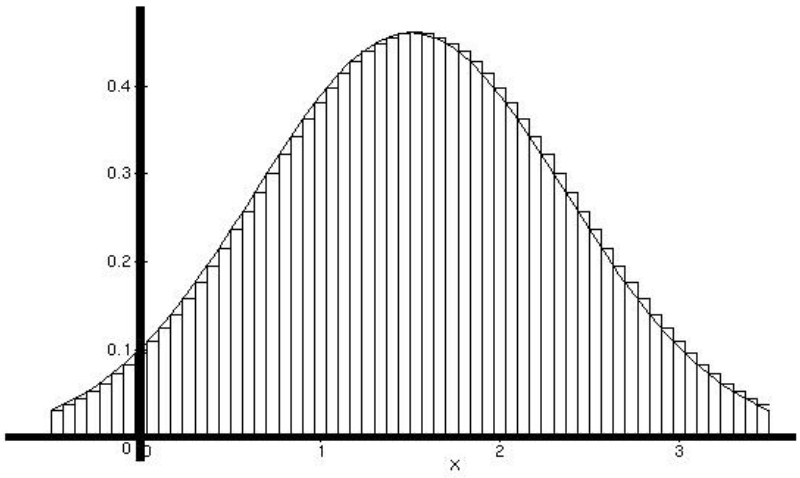
$$\text{Area under the curve} = \int_a^b f(x)\ dx$$

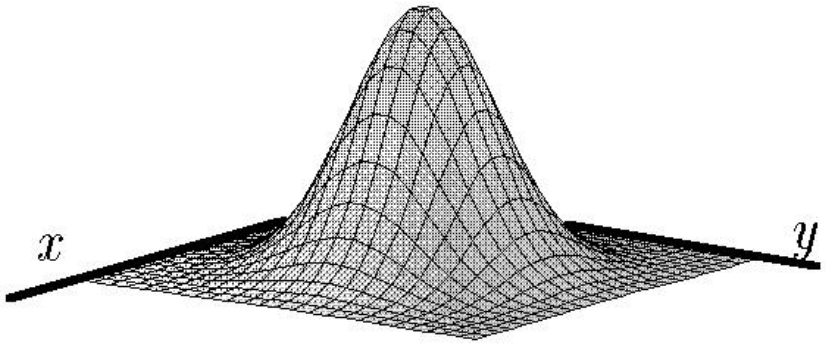


$$\int_a^b f(x)\ dx = \lim_{n\to\infty} \sum_{i=1}^{n} f(x_i)\,\Delta x$$

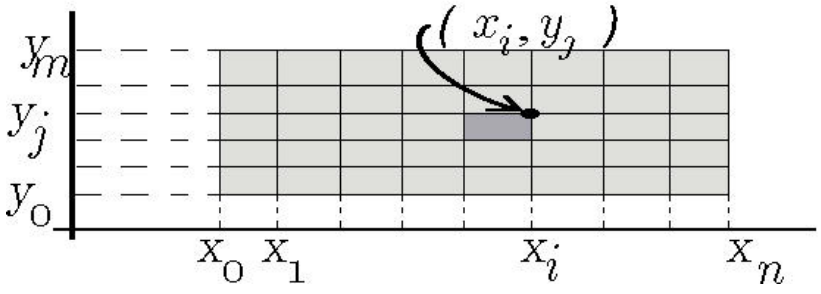


Find the volume under a section of a surface

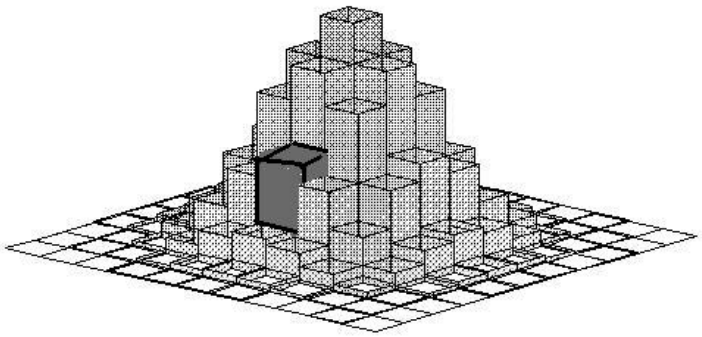
$$z = f(x, y)$$



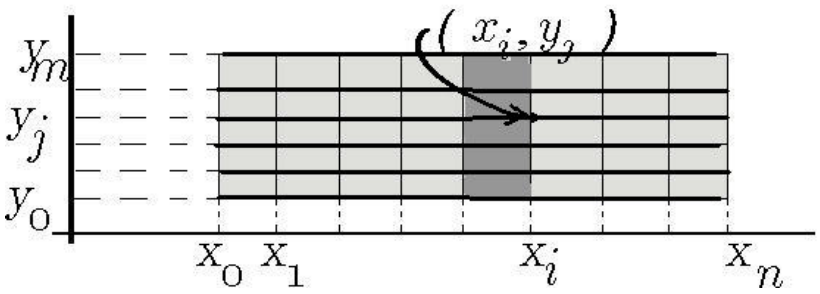
Take the section directly underneath the section of the surface that we are interested in. Subdivide it into a grid.



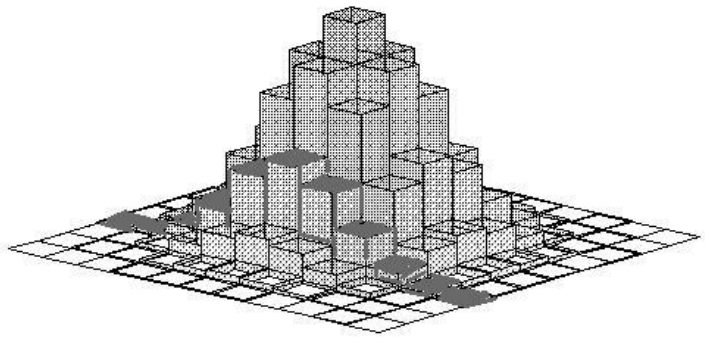
Volume of One Section $= f(x_i,\ y_j)\,\Delta x\,\Delta y$



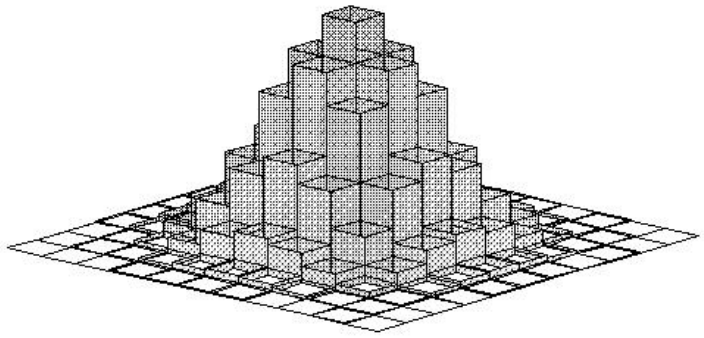
Repeat the procedure along an entire column in the grid



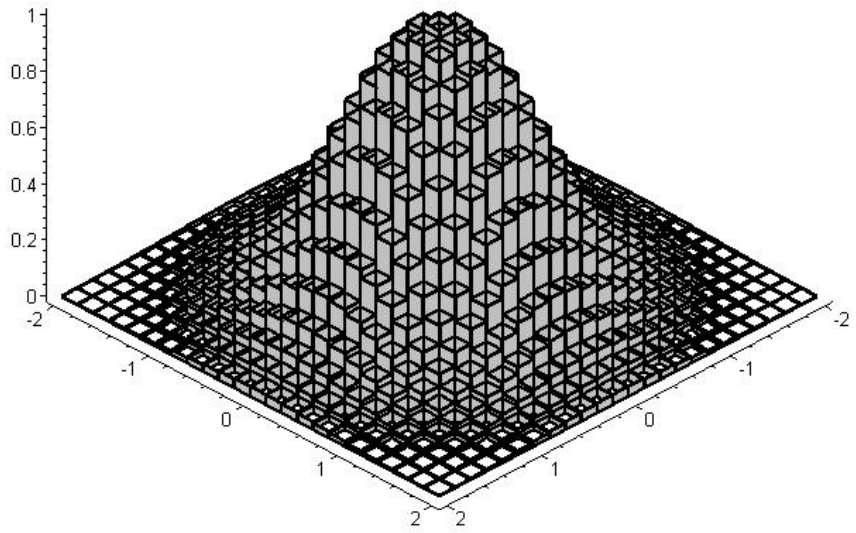
$$\text{Volume Over Grid Column} = \sum_{j=1}^{m} f(x_i,\ y_j)\,\Delta x\,\Delta y$$



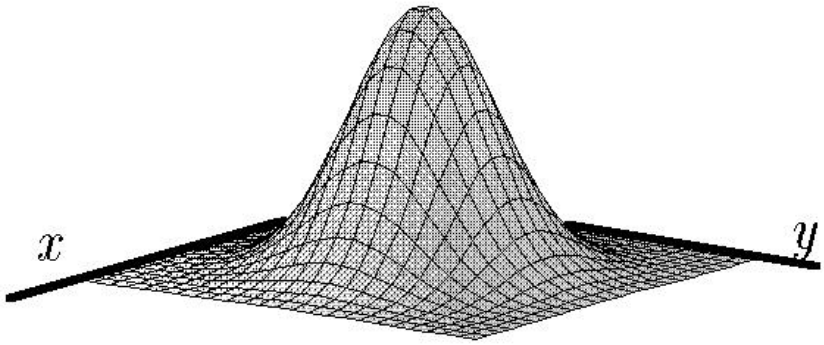
$$\text{Total Volume} \approx \sum_{i=1}^{n} \sum_{j=1}^{m} f(x_i,\ y_j)\, \Delta x\, \Delta y$$



$$\text{Total Volume} = \lim_{n,m\to\infty} \sum_{i=1}^{n} \sum_{j=1}^{m} f(x_i,\ y_j)\, \Delta x\, \Delta y$$



$$\iint_R f(x,y)\,dx\,dy = \lim_{n,m\to\infty} \sum_{i=1}^{n}\sum_{j=1}^{m} f(x_i,\ y_j)\,\Delta x\,\Delta y$$



$$\iint_R f(x,y)\,dA = \lim_{n,m\to\infty} \sum_{i=1}^{n}\sum_{j=1}^{m} f(x_i,\ y_j)\,\Delta A$$