- **Iterated integrals**: evaluate an integral multiple times, treating other variables as constant in each step.
- **Double integrals**:
  - $\iint_D f(x,y)dA = \lim_{(m,n)\to(\infty,\infty)} \sum_{i=1}^{m}\sum_{j=1}^{n} f(x_{ij}^*, y_{ij}^*)\Delta A_{ij}$
  - Geometric meaning - volume under the surface $f(x,y)$.
  - Area of a region in a plane: $\iint_D dA$
  - May be approximated using a double Riemann sum:
    $\iint_D f(x,y)dA \approx \sum_{i=1}^{m}\sum_{j=1}^{n} f(x_{ij}^*, y_{ij}^*)\Delta A_{ij}$
  - Average value of a function of two variables: $= \dfrac{\iint_D f(x,y)dA}{\iint_D dA}$
  - Flip order of integration or use change of variables if necessary.
- **Triple integrals**:
  - $\iiint_E f(x,y,z)dV = \lim_{(l,m,n)\to(\infty,\infty,\infty)} \sum_{i=1}^{l}\sum_{j=1}^{m}\sum_{k=1}^{n} f(x_{ij}^*, y_{ij}^*, z_{ij}^*)\Delta V_{ij}$
  - Volume of a solid: $\iiint_E dV$
  - May be approximated using a triple Riemann sum:
    $\iiint_E f(x,y,z)dV \approx \sum_{i=1}^{l}\sum_{j=1}^{m}\sum_{k=1}^{n} f(x_{ij}^*, y_{ij}^*, z_{ij}^*)\Delta V_{ij}$
  - Average value of a function of three variables: $= \dfrac{\iiint_E f(x,y,z)dV}{\iiint_E dV}$
  - Change order of integration or use change of variables if necessary.
- **Fubini's Theorem**:
  - For a double integral: If $f(x,y)$ is continuous on the rectangle $R=[a,b]\times[c,d]$, then $\iint_D f(x,y)dA = \int_a^b\int_c^d f(x,y)dydx = \int_c^d\int_a^b f(x,y)dxdy$.
  - Can also be done with other iterated integrals.
  - You can change the order of integration.
- Applications:
  - Mass and total charge
  - Centers of mass or centroids of laminas and solids