

**Multiple Integration**  
***Iteration of Double Integrals***

**Question**

Calculate the given double integral by iteration.

$$\iint_T (x - 3y) dA$$

With  $T$  being the triangle having vertices  $(0, 0)$ ,  $(a, 0)$  and  $(0, b)$ .

**Answer**

$$\begin{aligned} & \iint_T (x - 3y) dA \\ &= \int_0^a dx \int_0^{b(1-(x/a))} (x - 3y) dy \\ &= \int_0^a dx \left( xy - \frac{3}{2}y^2 \right) \Big|_{y=0}^{y=b(1-(x/a))} \\ &= \int_0^a \left[ b \left( x - \frac{x^2}{a} \right) - \frac{3}{2}b^2 \left( 1 - \frac{2x}{a} + \frac{x^2}{a^2} \right) \right] dx \\ &= \left( b \frac{x^2}{2} - \frac{b}{a} \frac{x^3}{3} - \frac{3}{2}b^2 x + \frac{3}{2} \frac{b^2 x^2}{a} - \frac{1}{2} \frac{b^2}{x^3} a^2 \right) \Big|_0^a \\ &= \frac{a^2 b}{6} - \frac{ab^2}{2} \end{aligned}$$