Multiple Integration
Iteration of Double Integrals

Question
Calculate the given double integral by iteration.
$\iint_R (x^2 + y^2)\, dA$
With R being the area $0 \leq x \leq a$, $0 \leq y \leq b$.
Answer

$$\begin{aligned}
\iint_R (x^2 + y^2)\, dA &= \int_0^a dx \int_0^b (x^2 + y^2)\, dy \\
&= \int_0^a dx \left(x^2 y + \frac{y^3}{3} \right) \Bigg|_{y=0}^{y=b} \\
&= \int_0^a \left(bx^2 + \frac{1}{3} b^3 \right) dx \\
&= \frac{1}{3} \left| (bx^3 + b^3 x) \right|_0^a \\
&= \frac{1}{3} (a^3 b + a b^3)
\end{aligned}$$