

Instructions. (10 points) Answer each of the following questions in the space provided.

(10pts) 1. Consider the following integral:

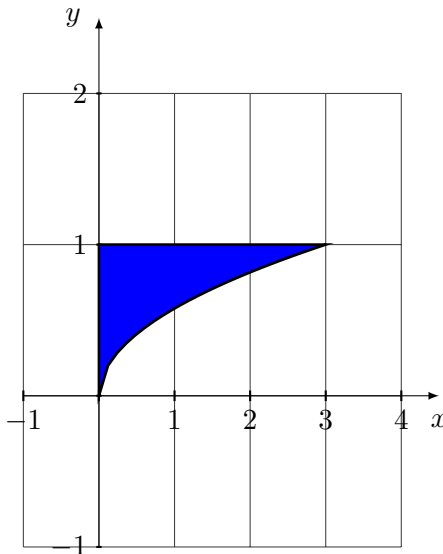
$$\int_0^3 \int_{\sqrt{x/3}}^1 e^{y^3} dy dx$$

Sketch the region of integration, reverse the order of integration, then evaluate the resulting integral.

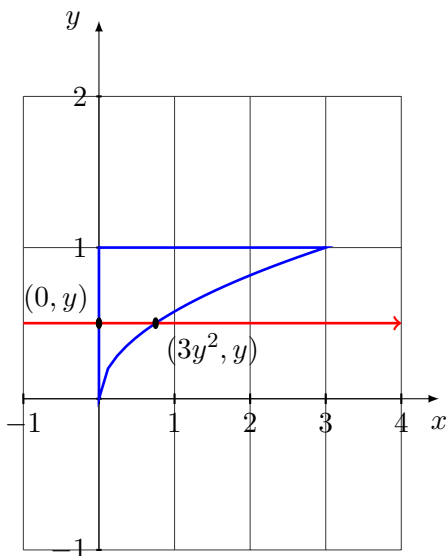
Solution: In the integral

$$\int_0^3 \int_{\sqrt{x/3}}^1 e^{y^3} dy dx,$$

x is fixed between 0 and 3, then y runs from $y = \sqrt{x/3}$ to $y = 1$. This provides us with the following region of integration.



Now we reverse the order of integration.



Reversing the bounds, the integral becomes

$$\int_0^3 \int_0^{3y^2} e^{y^3} dx dy.$$

Integrate.

$$\begin{aligned} \int_0^3 \int_0^{3y^2} e^{y^3} dx dy &= \int_0^3 x e^{y^3} \Big|_0^{3y^2} dy \\ &= \int_0^3 3y^2 e^{y^3} dy \\ &= e^{y^3} \Big|_0^3 \\ &= e - 1 \end{aligned}$$