15.2, number 53: **Sketch the region of integration for**

$$\int_0^3 \int_1^{e^y} (x+y)\,dx\,dy.$$

Set up the integral over the same region, with the order of integration reversed.

Answer: The region for this integral is described by: for each fixed y with $0 \le y \le 3$, x goes from $x = 1$ to $x = e^y$. To make $x = e^y$ look more familiar, we take $\ln$ of both sides and see that $x = e^y$ is another way of saying $\ln x = y$. The picture is on the next page.

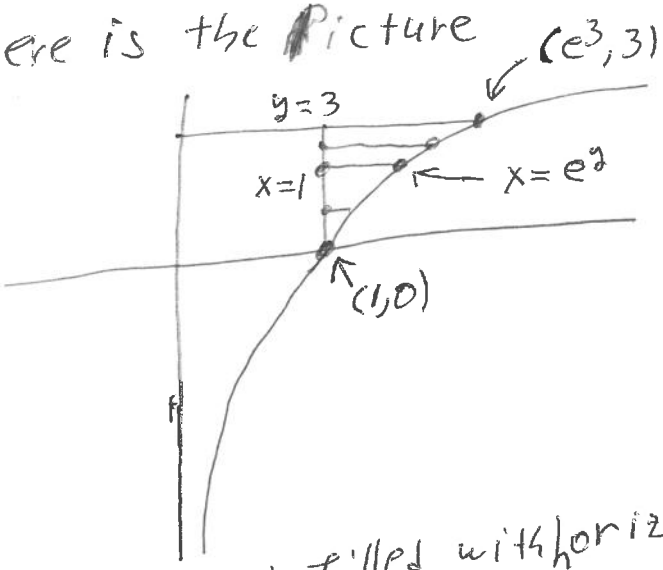
Picture 15.2 Number 53

$$\int_0^3 \int_1^{e^y} (x+y)\,dx\,dy$$

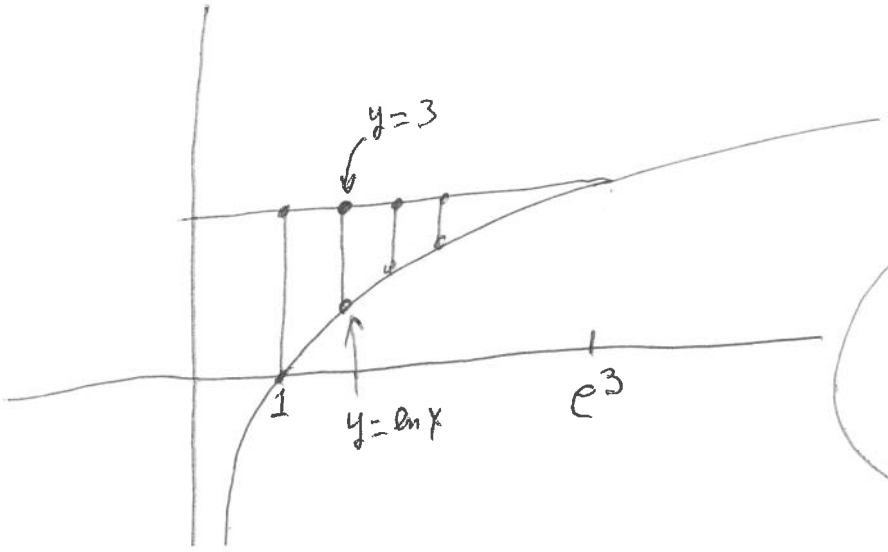
For each fixed y with $0 \le y \le 3$, x goes from $x=1$ to $x=e^y$.

$x=e^y$ is the same as $\ln x = y$.

Here is the picture



The region is filled with horizontal lines. We can fill the region with vertical lines!



For each fixed x with $1 \le x \le e^3$, y goes from $y = \ln x$ to $y = 3$

$$\int_1^{e^3} \int_{\ln x}^{3} (x+y)\,dy\,dx$$