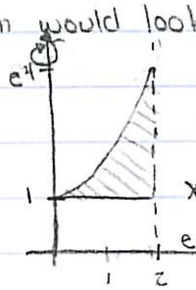
Jorie Cooper

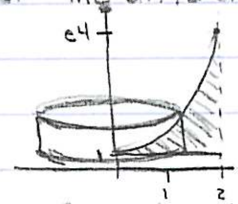
Written Problem 7

1. Given that we are asked to evaluate $\int_1^{e^4} \pi(4-\ln y)dy$ in a different way we must 1st identify the formula for the equation that is given. This is the washer method where $\int_a^b \pi(R^2-r^2)\,dx$. So knowing this we get that $R=2$ because $\sqrt{4}=2$ and $r=\sqrt{\ln y}$ because of the same reason. The graph of the function would look like



Given the graph we know that $y=1$, $y=e^4$, $x=2$ and $x=\sqrt{\ln y}$. Therefore, in the equation given we are going to revolve this figure around the y-axis.

2. Now we can choose to use the shell method for the different method. Graphed the shell method would look like:



and the equation would look like:

$\int_0^2 2\pi x(e^{x^2}-1)dx$ where the bounds are from 0 to 2 because the graph starts at 0 on the x-axis and end at 2 on the same axis. The function integrate is e^{x^2} because when we have $x=\sqrt{\ln y}$ we solve for y by $x^2=\ln y$ then $e^{x^2}=y$. The -1 is added because it is 1 up from 0.

3. Now is the point where we integrate $\int_0^2 2\pi x(e^{x^2}-1)\,dx$. From here we destribute the $2\pi x$ so it looks like $\int_0^2(2\pi x e^{x^2}-2\pi x)dx$. Then we can seperate it into 2 intergrals $\int_0^2 2\pi x e^{x^2}dx - \int_0^2 2\pi x\,dx$. Then we should destribute out the π in both cases $\pi\int_0^2 2xe^{x^2}dx - \pi\int_0^2 2x\,dx$. In the first integral u-substitution is used so $u=x^2$ and $du=2x\,dx$. The other can just be integrateded so $\pi[x^2]_0^2 = 4\pi$. The 1st integral would be $\pi\int_0^2 e^u\,du$ which $=\pi[e^{x^2}]_0^2$ so $\pi(e^4-e^0)=\pi(e^4-1)$. altogether we have $\pi e^4 - \pi - 4\pi = \pi e^4 - 5\pi$ then w/ the π take the answer is $\pi(e^4-5)$