How to find $\Delta\left(C \mu_{0} N I\right)$, by Matthew S . Norton
We have

$$
\begin{equation*}
b=\log \left[\frac{C \mu_{0} N I}{2 a}\right] \tag{1}
\end{equation*}
$$

Solve this for $C \mu_{0} N I$

$$
\begin{equation*}
C \mu_{0} N I=2 a 10^{b} \tag{2}
\end{equation*}
$$

We have to use the annoying equation on page A-9 of your lab book

$$
\begin{equation*}
\Delta f=\sqrt{\left(\frac{\partial f}{\partial x_{1}} \Delta x_{1}\right)^{2}+\left(\frac{\partial f}{\partial x_{2}} \Delta x_{2}\right)^{2}} \tag{3}
\end{equation*}
$$

For our case here, $f=C \mu_{0} N I$, (I'll just call it $x$ in the calculations) $x_{1}=b$, and $x_{2}=a$. So we have

$$
\begin{equation*}
\Delta x=\sqrt{\left(\frac{\partial x}{\partial b} \Delta b\right)^{2}+\left(\frac{\partial x}{\partial a} \Delta a\right)^{2}} \tag{4}
\end{equation*}
$$

Now

$$
\begin{align*}
& \frac{\partial x}{\partial b}=2 \ln (10) a 10^{b}  \tag{5}\\
& \frac{\partial b}{\partial a}=2 \cdot 10^{b} \tag{6}
\end{align*}
$$

Which simplifies to

$$
\begin{equation*}
\Delta x=\sqrt{\left[\Delta b \cdot\left(2 \ln (10) a 10^{b}\right)\right]^{2}-\left[\Delta a \cdot\left(2 \cdot 10^{b}\right)\right]^{2}} \tag{7}
\end{equation*}
$$

Putting $C \mu_{0} N I$ back in, we get

$$
\begin{equation*}
\Delta\left(C \mu_{0} N I\right)=\sqrt{\left[\Delta b \cdot\left(2 \ln (10) a 10^{b}\right)\right]^{2}-\left[\Delta a \cdot\left(2 \cdot 10^{b}\right)\right]^{2}} \tag{8}
\end{equation*}
$$

Where $a$ is the radius of the coil, $\Delta a$ is the uncertainty in the radius of the coil, either $\pm 0.5 \mathrm{~mm}$ or $\pm 1.0 \mathrm{~mm}$, your choice, $b$ is the y -intercept, and $\Delta b$ is what you get from the LINEST function as the uncertainty in the y-intercept.

