Example

1. Rewrite the right-hand side of the equation \( y = 600(2.9)^x \) in terms of the base \( e \).

**ANSWER:** \[ y = 600e^{x \ln(2.9)} \]

We need to convert \((2.9)^x\) into \( e \) raised to some power. To do this, we will use the fact that \( e^{\ln M} = M \), for any \( M > 0 \). If we plug \((2.9)^x\) in for \( M \), then we end up with the following:

\[
\begin{align*}
    e^{\ln M} &= M \\
    e^{\ln[(2.9)^x]} &= (2.9)^x
\end{align*}
\]

Now we need to simplify the left-hand side. Let’s just look at what’s in the exponent of the \( e \): It’s \( \ln [(2.9)^x] \). Using properties of exponents, we can pull the \( x \) down and we have

\[
    \ln [(2.9)^x] = x \ln(2.9)
\]

So then going back to the original problem, we have

\[
\begin{align*}
    e^{\ln M} &= M \\
    e^{\ln[(2.9)^x]} &= (2.9)^x \\
    e^{x \ln(2.9)} &= (2.9)^x
\end{align*}
\]

Now we have found a way to write \((2.9)^x\) in terms of the base \( e \). All we need to do is substitute it into the given equation and we are done.

\[
\begin{align*}
    y &= 600 \cdot (2.9)^x \\
    y &= 600 \cdot e^{x \ln(2.9)}
\end{align*}
\]

This gives us our final answer, \( y = 600e^{x \ln(2.9)} \).

Note that the \( y = \) is already provided in WeBWorK. If this were your problem in WeBWorK, then you would type in the box:

\[
600e^{x \ln(2.9)}
\]

Of course, you could say \( \ln(2.9)x \) instead of \( x \ln(2.9) \), but using the form \( x \ln(2.9) \) will decrease the possibility of confusion or of a mistake.
2. Now round the exponent to three decimal places.

**ANSWER:** \[ y = 600e^{1.065x} \]

Now we just use a calculator to evaluate \( \ln(2.9) \) to three decimal places:

\[
\ln(2.9) \approx 1.06471
\]

Since we round to three decimal places, then we have \( \ln(2.9) \approx 1.065 \). Putting this in the answer to the previous part gives us \( y = 600e^{1.065x} \).