Example

Use the exponential decay model for carbon-14, \( A = A_0 e^{-0.000233t} \), to solve this exercise.

Some cave paintings were discovered today in a cave in Switzerland. The paint contained 62% of the original carbon-14. Estimate the age of the paintings. Round your answer to the nearest whole number (no decimals).

**ANSWER:** The paintings are approximately \([2052]\) years old.

We do not know the original amount of carbon-14, but we do not need to know it. All we know is that 62% of the original amount remains. If the original amount is \( A_0 \), then the amount that remains is \( 0.62A_0 \). This means we want to find the value of \( t \) such that

\[
0.62A_0 = A_0 e^{-0.000233t}
\]

Since \( A_0 \neq 0 \), we can divide both sides of the equation by \( A_0 \) and go from there:

\[
0.62 = e^{-0.000233t}
\]

\[
\ln(0.62) = \ln \left( e^{-0.000233t} \right)
\]

\[
\ln(0.62) = -0.000233t
\]

\[
\frac{\ln(0.62)}{-0.000233} = t
\]

\[
t \approx 2051.6558
\]

Since we round to the nearest whole number, then \( t \approx 2052 \) and we have that the paintings are approximately \([2052]\) years old.