

Unit 4 Lesson 7: Interpreting and Using Exponential Functions

1 Halving and Doubling (Warm up)

Student Task Statement

1. A colony of microbes doubles in population every 6 hours. Explain why we could say that the population grows by a factor of $\sqrt[6]{2}$ every hour.
2. A bacteria population decreases by a factor of $\frac{1}{2}$ every 4 hours. Explain why we could also say that the population decays by a factor of $\sqrt[4]{\frac{1}{2}}$ every hour.

2 Radiocarbon Dating

Student Task Statement

Carbon-14 is used to find the age of certain artifacts and fossils. It has a half-life of 5,730 years, so if an object has carbon-14, it loses half of it every 5,730 years.

1. At a certain point in time, a fossil had 3 picograms (a trillionth of a gram) of carbon-14. Complete the table with the missing mass of carbon-14 and years.

number of years after fossil had 3 picograms of carbon-14	mass of carbon-14 in picograms
0	3
1,910	
5,730	
	0.75

2. A scientist uses the expression $(2.5) \cdot \left(\frac{1}{2}\right)^{\frac{t}{5,730}}$ to model the number of picograms of carbon-14 remaining in a different fossil t years after 20,000 BC.
 - a. What do the 2.5, $\frac{1}{2}$, and 5,730 mean in this situation?
 - b. Would more or less than 0.1 picogram of carbon-14 remain in this fossil today? Explain how you know.

3 Old Manuscripts

Student Task Statement

The half-life of carbon-14 is about 5,730 years.

1. Pythagoras lived between 600 BCE and 500 BCE. Explain why the age of a papyrus from the time of Pythagoras is about half of a carbon-14 half-life.
2. Someone claims they have a papyrus scroll written by Pythagoras. Testing shows the scroll has 85% of its original amount of carbon-14 remaining. Explain why the scroll is likely a fake.