## 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 had3 picograms of carbon-14
 | * mass of carbon-14in picograms
 |
| --- | --- |
| * 0
 | * 3
 |
| * 1,910
 | *
 |
| * 5,730
 | *
 |
| *
 | * 0.75
 |

1. A scientist uses the expression $\left(2.5\right)⋅\left(\frac{1}{2}\right)^{\frac{t}{5,730}}$ to model the number of picograms of carbon-14 remaining in a different fossil $t$ years after 20,000 BC.
	1. What do the 2.5, $\frac{1}{2}$, and 5,730 mean in this situation?
	2. 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.



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