

## Algebra II/Trig: Radioactivity

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### 1 Radioactivity

There are many kinds of atoms that are **radioactive**, and break down into other, more stable atoms. The **half-life** of an atom is the amount of time it takes for half of my radioactive atoms to decay. This is a classic example of decay.

### 2 Decay Rate

The basic equation is

$$V = V_0(\text{rate})^{t/t_{1/2}}$$

where

- $V$  is the volume of radioactive material I have left,
- $V_0$  is how much I started out with,
- $t$  is how much time has passed, and
- $t_{1/2}$  is the half life (how long it takes before half of my radioactive material is gone).

#### 2.1 Question

1. What do you think the rate should be in the above equation?

### 3 Radiocarbon Dating

All living things have carbon in them, and some of that is radioactive Carbon-14. Since plants and animals don't absorb **more** carbon after they die, we can measure how long ago something lived by how much Carbon-14 is left in it. Carbon-14 has a half-life of 5,730 years.

## 4 Questions

### 4.1 Haraldskær Woman

Discovered in 1977, the Haraldskær Woman is a body found in the bogs of Denmark



Figure 1: Dead Person

If the body was buried in 450 BCE, and the average human body contains 18 nanograms of Carbon-14 at death, how much Carbon-14 is left in the Haraldskær Woman?

### 4.2 Shroud of Turin

The Shroud of Turin is a piece of linen that some believe was the burial cloth of someone crucified around 33 CE. If the samples of linen originally contained  $V_0 = 0.02$  nanograms of Carbon-14, and they **now** contain  $V = 0.18$  nanograms of Carbon-14, how old is the shroud?

1. Using your calculator, plot the decay rate with  $V_0 = 0.02$  nanograms and  $t_{1/2} = 5730$  years.
2. On your plot, what time corresponds to  $V = 0.18$  nanograms?
3. When was the Shroud made?