



### Learning Math with Lichens

*You can use monarchs to teach about many things! Stone Mountain Memorial Association (SMMA) uses the monarch butterfly to help students apply their knowledge in other contexts and to different disciplines. The activities relate a grade-level specific GPS to monarch life, habitat or migration.*

*GPS correlation: M3N3 Solve problems involving subtraction and addition. M3P1 (a,b) Build math knowledge through problem solving. Solve math problems in other contexts. M3P4(c) Recognize and apply math in other contexts.*

#### **Preparation:**

Read the background information. Print the worksheet, or make an overhead or display on your Interactive white board. Make copies for each.

#### **Background Information:**

Monarchs spend spring and summer in Canada and the United States and overwinter in Mexico. Each habitat contains different rocks on which lichen grows. In this lesson we use math to answer questions a scientist may have if working with different types of rock.

Lichens are two organisms, algae and fungi, living in a symbiotic relationship. Lichens are the first organisms to grow on bare rock. Like water and wind they are responsible for breaking down, or weathering, rocks. Lichens prefer cool temperatures and adequate moisture since they cannot store water.

Lichen growth rate is extremely slow. We can only estimate from limited studies the growth rate of lichens. The rate is influenced by moisture and temperature. One place to observe lichens beginning to grow is a quarry. Quarries are areas of rock with enough economic value that people will cut or blast out stone. Some quarries can operate for decades and cut fresh stone daily. Other quarries may be closed because the stone is no longer in demand allowing lichens and plants to grow.

One type of rock that lichens grow on is granite, like the rock that makes up Stone Mountain. Stone Mountain's granite quarries operated for 100 years. They were located at five different areas around the mountain. Most closed in 1950 because the land was sold to the state of Georgia for use as a park. Once the quarries were closed, the lichen began to grow back.

Lichen can also grow on volcanic rock like that found in the Transvolcanic Mountains in Mexico. The geology of this Mexican range consists of very high, old volcanic mountains. The volcanic rock, usually known as scoria, is very jagged, rough and has many small holes. Still it has been quarried and used for centuries in construction. A recently reconstructed ancient ceremonial site, called Tzintzuntzan, has round ceremonial platforms and a huge, rectangular council house platform built of this volcanic rock.

#### **Activity:**

Tell the students the background information. Read them the essential question so they understand the focus of the lesson.



**Essential Question:**

How can I use math to solve problems in science, such as how long does lichen take to grow on fresh rock?

Stone Mountain Granite Quarry Site

We first saw lichen growing in 1935

We blasted off the rock in 1910

Lichen grows on granite in \_\_\_\_\_ years

Tzintzuntzan Ceremonial Site of Scoria

We first saw lichen growing in 1972

We rebuilt the ceremonial site in 1962

Lichen grows on scoria in \_\_\_\_\_ years

**Essential Question:**

In what year would we first expect to see lichen growing on a rock we scraped clean?

Stone Mountain Granite Quarry Site

We cleaned lichen off granite in 1935

Lichen grows on granite in + \_\_\_\_\_ years

We expect to see lichens in year \_\_\_\_\_

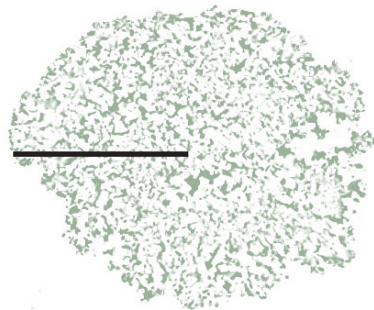
Tzintzuntzan Ceremonial Site of Scoria

We rebuilt the house platform in 1973

Lichen grows on scoria in + \_\_\_\_\_ years

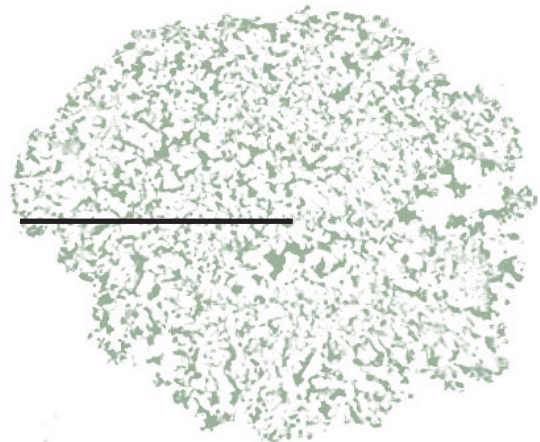
We expect to see lichens in year \_\_\_\_\_

What size lichen may a scientist see at each spot?



Radius = 2 inches

What is the diameter?



Radius = 4 inches

What is the diameter?



Stone Mountain Granite Quarry Site  
Lichen grows on granite in   25   years.

Tzintzuntzan Ceremonial Site of Scoria  
Lichen grows on scoria in   10   years.

Stone Mountain Granite Quarry Site  
Lichen grows on granite in +   25   years.  
We expect to see lichens in year  1960 .

Tzintzuntzan Ceremonial Site of Scoria  
Lichen grows on scoria in +   10   years.  
We expect to see lichens in year  1983 .

What size would you see at each spot?  
4 inches  
8 inches