Questions

What are the dates of extreme length and direction of a stick's shadows at various locations?

Materials Needed

For this activity, you will need the following materials:

- a simulation of a stick's shadow
- a ruler
- a pencil (do not use ink)
- the ability to read and follow directions
- you must have previously completed either Activity0201 or Activity0202 (but not both) and Activity0203

Points To Remember

All of the advice from the previous activities applies to this activity. The instructions in this activity are open-ended compared to instructions in previous activities. That is because by now, you should be familiar with how to plan a procedure to answer a question that has been asked of you. You will likely be frustrated by this activity, but the experience is very important.

1 Extreme Shadows

We define an *extreme shadow* as one that vanishes, one that has a nonzero minimum length, or one that has a maximum length. For this activity, we are concerned with the lengths of noontime shadows. We could also consider a sunrise or sunset shadow's extreme directions, maximum angle north of east for example, but we will not do so in this activity.

2 Inquiry

2.1 Vanishing Noontime Shadows

Set the latitude to 0°. If possible, determine the date(s) on which a stick's **noontime** shadow vanishes and record the date(s). Recall from a previous activity that *noon* has nothing to do with the reading on a clock.

Are there any special days you may have previously heard about on or near the date(s) you found? If so, what days?

By trial and error, determine the **maximum** latitude north (if you are on the northern hemisphere) or south (if you are on the southern hemisphere) of the equator for which a stick's **noontime** shadow vanishes on any date and record that latitude. It may help to bracket your search between a latitude for which the noontime shadow vanishes and a latitude for which it does not vanish.

Does the value of the maximum latitude you just determined look or sound familiar to you? Is it equal to or close to a value that you may have previously heard about? If so, what and where?

At the maximum latitude you just determined, determine the date(s) on which a stick's noontime shadow vanishes and record the date(s).

2.2 Extremely Long Noontime Shadows

Set the latitude to 0°. Determine the date(s) on which a stick's **noontime** shadow's length is a maximum and record the date(s). Recall from a previous activity that *noon* has nothing to do with the reading on a clock.

Are there any special days you may have previously heard about on or near the date(s) you found? If so, what days?

Set the latitude to the maximum latitude you determined earlier. Determine the date(s) on which a stick's **noontime** shadow's length is a maximum and record the date(s).

Are there any special days you may have previously heard about on or near the date(s) you found? If so, what days?

Set the latitude to that of your current location. Determine the date(s) on which a stick's **noontime** shadow's length is a maximum and record the date(s).

Are there any special days you may have previously heard about on or near the date(s) you found? If so, what days?

Make a prediction about the date(s) on which a stick's **noontime** shadow's length is a maximum regardless of location.

2.3 Extremely Short Noontime Shadows

Set the latitude to 0°. Determine the date(s) on which a stick's **noontime** shadow's length is a minimum and record the date(s). Recall from a previous activity that *noon* has nothing to do with the reading on a clock.

Are there any special days you may have previously heard about on or near the date(s) you found? If so, what days?

Set the latitude to the maximum latitude you determined earlier. Determine the date(s) on which a stick's **noontime** shadow's length is a minimum and record the date(s).

Are there any special days you may have previously heard about on or near the date(s) you found? If so, what days?

Set the latitude to that of your current location. Determine the date(s) on which a stick's **noontime** shadow's length is a minimum and record the date(s).

Are there any special days you may have previously heard about on or near the date(s) you found? If so, what days?

Make a prediction about the date(s) on which a stick's **noontime** shadow's length is a minimum regardless of location.

3 Conclusions, Discussion, and Predictions

What could be done to make this activity more interesting? Please be honest.