# Estimating the rotation of the Sun using SDO data

Introduction

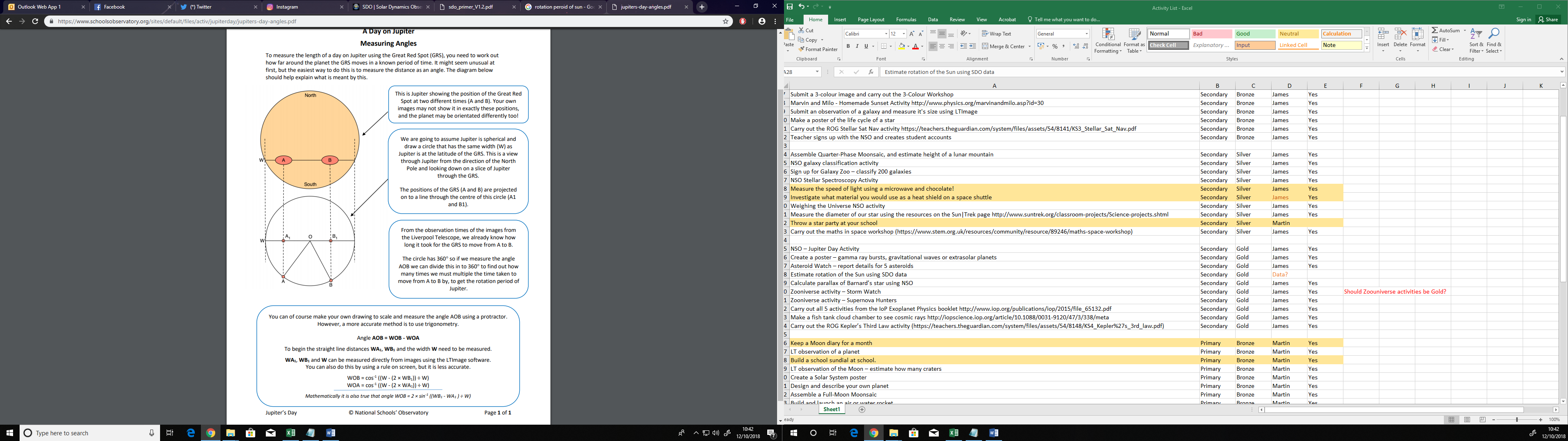
In this activity students will be looking at and analysing real sunspot data from the Solar Dynamics Observatory (SDO) in order to estimate the rotational period of the Sun (i.e. how long is a solar ‘day’?).

Resources Needed

* SDO data page: <https://sdo.gsfc.nasa.gov/data/aiahmi/>
* A ruler
* A scientific calculator or protractor (a protractor will be less accurate).

*Steps*

1. Follow the link above to view the SDO data page, where you can specify data constraints of your choosing.
2. We want to get enough solar data to track a sunspot, so try out different dates, times of year and/or different lengths of time to try and find a relatively constant and visible sunspot that you can visually track. There is no need to change any of the other options. Once you have filled in the dates, click *Submit.* You should now have a short video of the Sun’s activity.
3. To measure the length of a solar day, we need to work out how far around the Sun the chosen sunspot moves in a known period of time. It might seem unusual at first, but the easiest way to do this is to measure the distance as an angle. The diagram below should help explain what is meant by this.

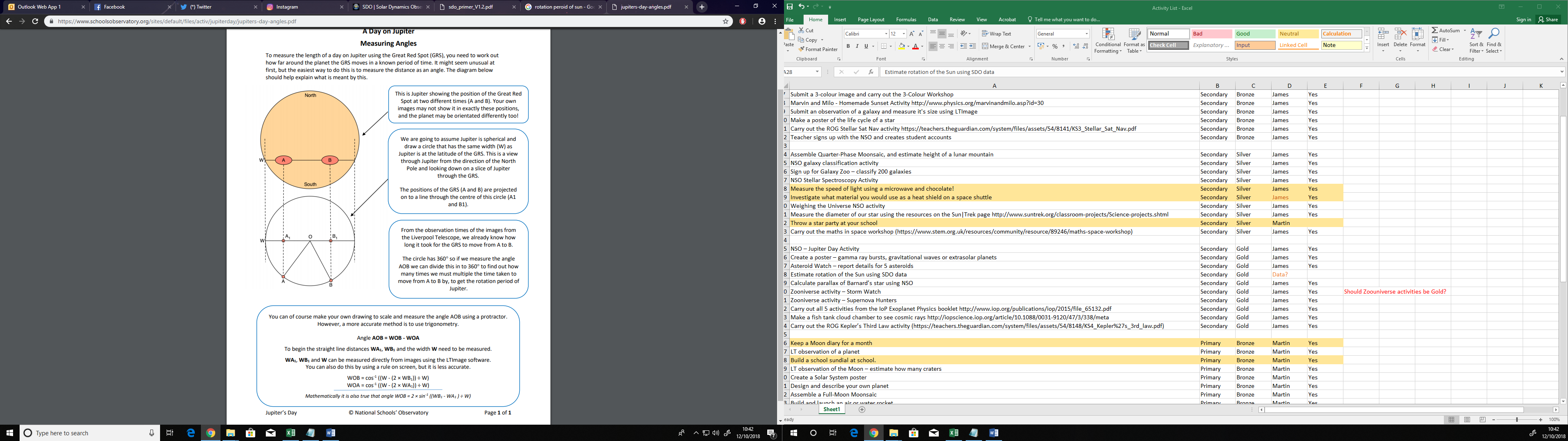


This is the Sun showing two example positions of a sunspot (A and B).

We are going to assume that the Sun is spherical and draw a circle that has the same width (W) as the Sun at the latitude of the sunspot. The positions of the sunspot (A and B) are projected onto a line through the centre of this circle (A1 and B1).

Using the observation time given (which changes when played or using the slider) we know how long it took for the sunspot to move from A to B.

The circle has 360° so if we measure the angle AOB we can divide this into 360° to find out how many times we must multiply the time taken to move from A to B, to get the rotation period of the Sun.



You can use this sheet to record the various measurements you make in this activity so they are all in one place. We have included a diagram below on which you can mark the approximate positions of the sunspot to help you work out which angles you need to measure.

If you are going to draw the distances to scale so that you can measure the angles with a protractor then you will need to do that separately on a blank sheet of paper.

1. Using a ruler on your computer screen, note down the following measurements needed to carry out the relevant trigonometry:

**Distances**

WA1 =

WB1 =

Width (W) =

**Angles**

WOA =

WOB =

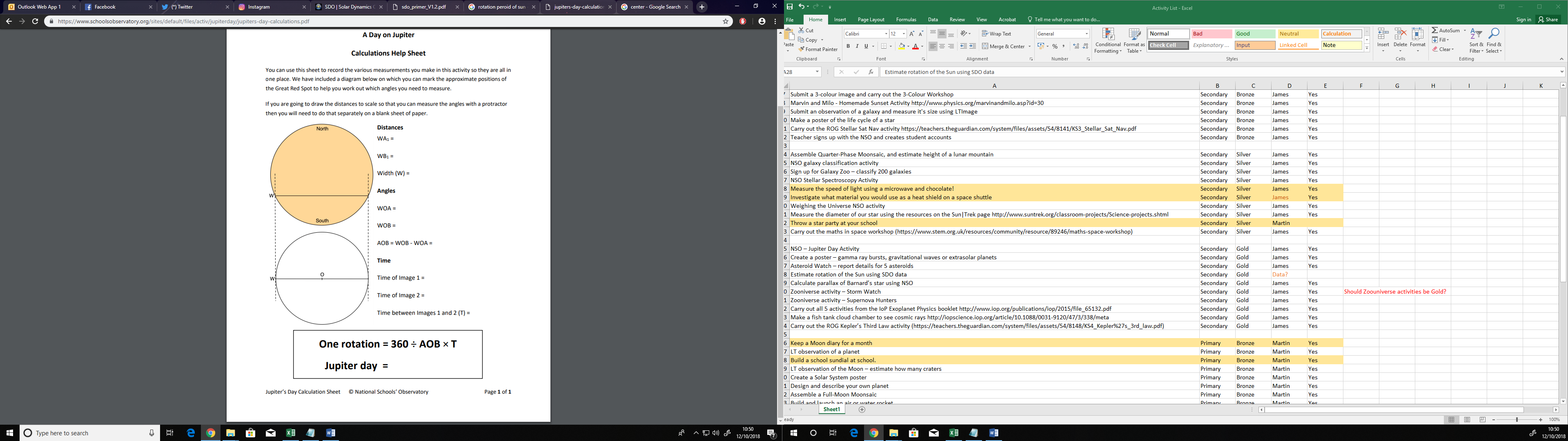
AOB = WOB - WOA =

**Time**

Time of Image 1 =

Time of Image 2 =

Time between Images 1 and 2 (T) =



1. Calculate an estimate of the rotation of the Sun using the following equation:

**One rotation = (360/AOB) x T**

**One rotation of the Sun =**

1. Compare your value by searching for the official rotation of the Sun.
2. Discuss, if your answer is different, why you might have not received the same value from your calculations;

* What possible errors could have come into play?
* What ways are there of improving the method used?
* Can you think of a different method of using sunspots to calculate the rotation period?

Extension

If you wish to carry on with this activity further, try and track (in the same way as before) sunspots which are further away from the centre and closer to the poles. You may find that your rotational period has different values at different latitudes… discuss the implications of your findings.