James Webb Space Telescope
DEEP SPACE DIARY

ACTIVITY 4.3
CALIBRATE FOR DISCOVERY

From Chapter Four of the Deep Space Diary discoverydiaries.org/activities/calibrate-for-discovery/

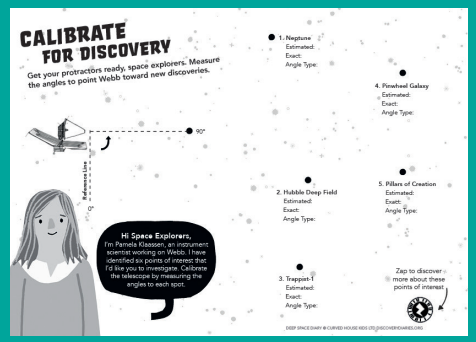
LEARNING LEVEL

KS2, P5-7, Y4-6

CURRICULUM LINKS & DIFFERENTIATION IDEAS

View detailed curriculum links for England, Scotland, Northern Ireland and Wales in the Teacher Toolkit, plus differentiation ideas for your region and year level.

discoverydiaries.org/resources/teacher-toolkit/



Learning Objective

To estimate and compare acute and obtuse angles.

Resources Required

- Smartphone/device or computer to access Zap code (optional)
- Protractors
- Rulers

Background to this Activity

The James Webb Space Telescope will study our Universe from deep space for at least five years. During this time, different researchers will use it to study specific space objects and answer scientific questions about our Universe. Scientists who want to use Webb must pitch research proposals. A peer review committee decides who gets to use the telescope, after reviewing the proposals.

In just five months, 13 different research groups will use Webb to conduct surveys of galaxies, observe the formation of stars, examine the chemistry of stars and study exoplanets. These 13 research groups represent over 250 investigators from 18 countries and 106 institutions, demonstrating that Webb is a global project with a local story.

In this activity, students are asked to take on the role of scientific investigator, 'calibrating' Webb so that it can then look objects of interest.

Running the Activity

Before completing the worksheet, ensure students know how to use a protractor (or angle measurer) to measure angles:

Place the protractor along the reference line, with the midpoint on the vertex of the angle.

Ensure that the 0 degrees line of the protractor is in line with the reference line.

Following the direction of the arrow, read the degrees where the line to the point of interest crosses the number scale.

Introduce the concept of calibration. (Calibration refers to the act of evaluating and adjusting the precision and accuracy of measurement equipment.)

Point out the vertical reference line on the worksheet and demonstrate measuring the angle from Webb's secondary mirror to the example, which has been marked on the worksheet as 90o. Model how to estimate, considering to the angle types (acute, right, obtuse). Then demonstrate how to measure the angle accurately, arriving at the answer: 90 degrees.

Now ask the class to work alongside you as you look at the next point of interest, Neptune. Note that the angle is not drawn, so model using a ruler to draw an accurate line from Webb's secondary mirror (see Activity 3.3: Blueprint for Space if you aren't familiar with Webb's structure) to the centre of the circle marking Neptune.

Discuss the type of angle and use this to help make an estimate. Allow time for students to make their own estimate. Ensure students understand that an estimate is an approximated measurement.

Model how to align the protractor to the reference line and the vertex of the angle, ensuring that the crosshairs are correctly placed. Allow time for students to measure the angle and record. Have a student demonstrate measuring the angle to the class. Check that students have used the correct scale when reading the protractor. Students should then be able to identify the type of angle.

Students should now be able to repeat these steps independently, for the remaining angles. Students could use different coloured pens or pencils to make the

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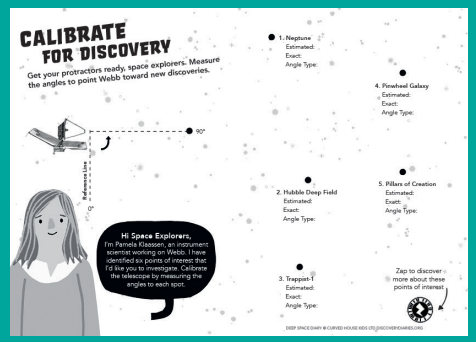

angles clearer.

Encourage students to check measurements with a partner as they progress.

Complete the activity by sharing the solutions with the students.

Solutions to the Activity

Students in Lower KS2 would be expected to be accurate to within 2 degrees.

Students in Upper KS2 would be expected to be accurate to within 1 degree.

Note that there may be some variation in results, depending on how accurately students draw lines from the secondary mirror to the centre of each point of interest.

1: Neptune

Exact: 117°
Angle Type: Obtuse
(Acceptable range: 116-119°)

2: Hubble Deep Field

Exact: 77°
Angle Type: Acute
(Acceptable range: 76-79°)

3: Trappist-1

Exact: 58°
Angle Type: Acute
(Acceptable range: 56-59o°)

4: Pinwheel Galaxy

Exact: 100°
Angle Type: Obtuse
(Acceptable range: 98-101°)

5: Pillars of Creation

Exact: 82°
Angle Type: Acute
(Acceptable range: 80-83°)

Questions for the Class

- What does calibration mean?
- Why is the calibration of the telescope so important?
- Which angle is the largest? By how many degrees is it larger than a right angle?
- Add two more angles to ensure that the calibration is as accurate as possible. What types of angles are these and what do they measure?
- Can you draw an angle of 200°? What type of angle is this?

Additional Challenges / Extension Activities

Write a research proposal pitch, arguing why it's important to study a particular space object (real or imaginary – based on the points of interest) and what you hope to learn through your research.

Ideas for Differentiation

Support:

- Draw and mark in the angles before giving the students the sheet. Ask them to name each angle and estimate its size.
- Some students may benefit from working in a guided group, working through the estimate and naming process for each angle with an adult to support.
- Provide students with the key vocabulary they will need e.g. acute, obtuse, right angle.
- Students could be provided with a range of angle measurements to select the correct measurements from.
- Lower Key Stage 2 may name and estimate the angles but not measure unless appropriate.

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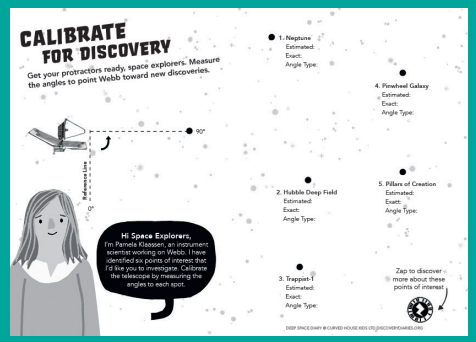

Challenge:

- Measure the angles to the exact degree.
- Students working at greater depth within age related expectations could be asked to mark in different angles including acute, obtuse and reflex.

Useful Links

This animation shows how Webb is able to observe all parts of space from its position on L2, studying different parts of the sky at different times of the year: https://webbtelescope.org/contents/media/videos/1157-Video

ZAP! Students can independently access multimedia resources using the Zappar mobile/tablet app. See Zappar instructions at the link below and note that the mobile/tablet will need to be on a WIFI connection: discoverydiaries.org/toolkit/discovery-diaries-zappar-instructions/

If you don't have access to the internet in the classroom, all Zap code content is available to download on the activity's web page (see link to the left) as a PowerPoint presentation or as bundles of images.

GET ZAPPAR
ZAP THE CODE

Find more great space-themed STEM resources at https://www.stem.org.uk/esero