

## Caltech Connections Program - Mentor Expectations

What are the [learning goals](#) for this project?

What is the process by which the mentee will accomplish these learning goals?

What is the end product of the project?

What prerequisite skills or certifications are critical to the completion of the project as it is written? (e.g., coding, laboratory safety training, coursework background)

Are there any of these that the mentee can complete prior to your first meeting? (e.g., an online laboratory safety course)

If a mentee is missing these skills or certifications, can the project scope be changed to accommodate this while still meeting the learning goals of the project?

## Example Sheet for “Finding Exoplanets with the Radial Velocity and Transit Techniques”

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### **What are the learning goals for this project?**

To use Newtonian physics (Kepler’s laws of orbital motion) to determine the mass and radius of a transiting exoplanet. The mentee will learn to work with real stellar radial velocity measurements to fit a Keplerian orbit model to the data and determine the planet’s mass. The mentee will then use brightness measurements of the star to find when the planet transits in front of it and use these to measure the radius of the planet.

### **What is the process by which the mentee will accomplish these learning goals?**

The mentee will generally use python to analyze two types of timeseries datasets: a timeseries of stellar radial velocity measurements and one of stellar brightness measurements. The analysis will involve determining the period of variations in the measurements, fitting orbit models to the two sets of measurements, and comparing the results to existing literature.

### **What is the end product of the project?**

The end product of the project will be a (possibly novel) set of planetary orbit parameters for a known exoplanet. This will be presented as a poster at the end of the term.

### **What prerequisite skills or certifications are critical to the completion of the project as it is written? (e.g., coding, laboratory safety training, coursework background)**

Prerequisites are minimal: some familiarity with Kepler’s laws and comfort using a computer. Ideally, the mentee will have experience with python and will have some experience working with scientific literature.

### **Are there any of these that the mentee can complete prior to your first meeting? (e.g., an online laboratory safety course)**

A brief review of orbital mechanics will be helpful so that the student is comfortable picturing and describing orbits in 3D. If the student does not have

python installed, they should attempt to install it before beginning the project, but that is not required.

**If a mentee is missing these skills or certifications, can the project scope be changed to accommodate this while still meeting the learning goals of the project?**

The mentee's degree of comfort with orbital mechanics, python, and navigating scientific literature will determine the level of detail and freedom in the project details. For example, a student who has worked with python before may be encouraged to write their own function to fit the orbit parameters, or may be given a dataset that is more challenging to analyze. A student with less experience will not be expected to pursue their own dataset or write their own fitting technique.