

Exercise #1: Measuring Distances to Stars and Galaxies

1<sup>st</sup> Task: Here are 3 ways for measuring the distance to stars and galaxies. Express each of these methods as equations or formulas using common astronomical notation.

2<sup>nd</sup> Task: Research the Recommended Science Olympiad Resources and identify 3 or more ways.

Advanced Task: After arranging the results of the 1<sup>st</sup> and 2<sup>nd</sup> Tasks in the order of the most effective for nearest-to-farthest away objects, research current astronomy news reports of what cutting-edge techniques are being for pushing the envelope to get the most accurate detection of the most distant galaxies.

Measurements of the distance to the stars and galaxies:

**1. Triangulation**

Based on **parallax** shifts, apparent changes in a star's location when viewed from different locations. The parallax of a star measured from earth's surface is one-half the angular shift produced over 2 AU, or six months. In short, it is the angle subtended by 1 AU. The parallax decreases as distance increases. A star's distance in parsecs (one arcsecond) is equal to  $1/\text{parallax}$ .

Needed Info:	Angular shift as measured $\frac{1}{2}$ year apart
Equation:	

Note: Parallax can only be used to measure stars up to 1000 parsecs away (I.E. 3,200 ly)

**2. Luminosity distance equation**

The luminosity distance equation uses the relationship between absolute and apparent magnitude to determine the distance.

Needed Info:	Absolute Magnitude
	Apparent Magnitude
Equation:	
Apply to an example:	

Note: Luminosity distance equation can be used to measure stars and galaxies \_\_\_\_\_ parsecs (\_\_\_\_\_ ly) away.

### 3. Using Cepheids and RR Lyrae

Cepheids and RR Lyrae are two types of variable stars that are especially good for finding distances to galaxies or other groups of stars **because** they have **direct correlations between luminosity and period**. Once the period is found, the luminosity can be calculated and through other formulas, the distance.

Needed Info:	Period of light curve on Cepheids.	Period of light curve on RRLyrae
Correlation to Luminosity:		
Apply to an example.		

### 4. Method \_\_\_\_\_

Needed Info:	
Equation:	
Apply to an example.	

### 5. Method \_\_\_\_\_

<b>Needed Info:</b>	
<b>Equation:</b>	
<b>Apply to an example.</b>	

**6. Method** \_\_\_\_\_

Needed Info:	
Equation:	
Apply to an example:	

**Create the Ladder of Distance Measurement Methods - from the near-to-far away measurements.**

	Method	Distance/Useful Range
1		
2		
3		
4		
5		
6		
7		
8		

**Research of Current Astronomy Reports of How Measurement Methods are being used and pushed to their limits.**

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