Year 13 Science: Investigating an aspect of astronomy with real data

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. A star of radius 7.0×10^5 km dims by 0.25% during a transit. Find the planet's radius.

2. A planet orbits a Sun-like star at 4.0 AU. What is its orbital period?

3. A star has a parallax of 0.10 arcseconds. How far away is it in parsecs and light years?

4. If a planet's radius were doubled, by what factor would its transit depth change?

5. For a report on an exoplanet's radius, which is more reliable: the NASA Exoplanet Archive or a news article, and why?

Fix the mistake

6. Correct this statement: "A 1% dip means the planet is 1% of the star's radius."

7. Correct this statement: "Kepler's third law: $T = a^3$."

8. Correct this statement: "A bigger parallax means a star is further away."

9. Correct this statement: "I used five websites, so my information is reliable."

Answer key (for parents and tutors)

1. A star of radius 7.0×10^5 km dims by 0.25% during a transit. Find the planet's radius.
   $R_p \div R_s = \sqrt{0.0025} = 0.05$, so $R_p = 0.05 \times 7.0 \times 10^5 = 3.5 \times 10^4$ km.
2. A planet orbits a Sun-like star at 4.0 AU. What is its orbital period?
   $T^2 = 4.0^3 = 64$, so $T = 8.0$ years.
3. A star has a parallax of 0.10 arcseconds. How far away is it in parsecs and light years?
   $d = 1 \div 0.10 = 10$ pc $= 10 \times 3.26 = 32.6$ light years.
4. If a planet's radius were doubled, by what factor would its transit depth change?
   Depth $\propto R_p^2$, so $2^2 = 4$ times deeper.
5. For a report on an exoplanet's radius, which is more reliable: the NASA Exoplanet Archive or a news article, and why?
   The archive: it gives the measured value with its uncertainty and the peer-reviewed paper it came from, while a news article may round, simplify or misreport it.
6. Correct this statement: "A 1% dip means the planet is 1% of the star's radius."
   The dip is the ratio of areas, so $R_p \div R_s = \sqrt{0.01} = 0.1$, a tenth of the star's radius.
7. Correct this statement: "Kepler's third law: $T = a^3$."
   It is $T^2 = a^3$ (in years and AU for the Sun), so $T = a^{1.5}$.
8. Correct this statement: "A bigger parallax means a star is further away."
   $d = 1 \div p$, so a bigger parallax means a closer star.
9. Correct this statement: "I used five websites, so my information is reliable."
   Reliability comes from the kind of source (primary data, peer review, uncertainties), not the number of websites.