Intro-2-Astro-2025
Assignment-2 (Exoplanet detection)

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Question-1

(a)

The inclination of GJ 8999 b is very close to 90^0 since it is obeserved by transit method.

(b)

Period of the planet=$\frac{25}{5}$ days = 5 days.

(c)

Dip in the flux=$\frac{1-0.9975}{1} \times 100\%$ =0.25%
Now,

$$\text{dip} = \left(\frac{R_p}{R_s}\right)^2 = 0.25 \times 10^{-2}$$

$$\Rightarrow R_p = 10^{-2} R_\odot$$

So, radius of the planet=$10^{-2} R_\odot$

(d)

From the graph, **K= 2** ms^{-1}

(e)

Using the relation

$$K = M_p sin(i) \left(\frac{2\pi G}{PM_s^2}\right)^{\frac{1}{3}}$$

$$\Rightarrow M_p = \frac{K}{sin(i)} \left(\frac{PM_s^2}{2\pi G}\right)^{\frac{1}{3}}$$

$$= 2 \times \left(\frac{5 \times 3600 \times 24 \times (0.2 \times 2 \times 10^{30})^2}{2\pi \times 6.67 \times 10^{-11}} \right)^{\frac{1}{3}} = 10.95 \times 10^{24} \text{ kg} = 1.83 \ M_{\oplus}$$

Also, $R_p = 0.01 R_{\odot} = 1.09 R_{\oplus}$

Observing from the graph, the planet lies in the curve representing the **100 % rock line**.