$$P^2 = \frac{4\pi^2}{G(M+m)}\, a^3$$

$$M + m = \frac{4\pi^2}{P^2}\, a^3$$

$$\frac{d_1}{d_2} = \frac{m}{M}$$

$$\frac{m}{M} = \frac{d_1}{d_2}$$

$$M = \left(\frac{4\pi^2 a^3}{GP^2}\right) \left[\frac{d_2}{d_1 + d_2}\right]$$

$$m = \left(\frac{4\pi^2 a^3}{GP^2}\right) \left[\frac{d_1}{d_1 + d_2}\right]$$

$$\gamma \equiv \frac{m}{M}$$

$$P^2 = \frac{4\pi^2}{GM(1+\gamma)}\; d_1^3 \left(1 + \frac{1}{\gamma}\right)^3$$

$$\frac{(1+\frac{1}{\gamma})^3}{1+\gamma} = \frac{GMP^2}{4\pi^2\, d_1^3}$$

$$\text{true mass of planet } m = \frac{m_{\rm obs}}{\sin(i)} \geq m_{\rm obs}$$

$$\text{eccentricity } \; e = \sqrt{1 - \frac{b^2}{a^2}}$$

$$\text{center to focus } \; f = ae$$