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$$R_p = \frac{R_p}{R_*} R_*$$

$$\frac{\sigma_{R_p}}{R_p} = \left[\left(\frac{\sigma_{R_p/R_*}}{(R_p/R_*)}\right)^2 + \left(\frac{\sigma_{R_*}}{R_*}\right)^2 + \frac{2\,\sigma_{R_p/R_*,\,R_*}}{R_p\,(R_p/R_*)} \right]^{1/2}$$

$$\delta = (R_p/R_*)^2$$

$$\frac{\sigma_\delta}{\delta} = \left[2 \left(\frac{\sigma_{R_p/R_*}}{(R_p/R_*)}\right)^2 \right]^{1/2}$$

$$f = a\cos(bA)$$

$$\sigma_f \approx |ab\sin(bA)\,\sigma_A|$$

$$b = \frac{a}{R_*}\cos i$$

$$\frac{\sigma_b}{b} = \left[\left(\frac{\sigma_{a/R_*}}{a/R_*}\right)^2 + \left(\frac{\sigma_{\cos i}}{\cos i}\right)^2 \right]^{1/2}$$

for

$$\cancel{\frac{\sigma_{\cos i}}{\cos i}} = \sigma_{\cos i} = |\sin(i)\,\sigma_i|$$

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example: arctan — let $f(x) = \arctan(x)$

then $\frac{df}{dx} = \frac{1}{1+x^2}$

therefore $\Delta f \approx \frac{\Delta x}{1+x^2}$, for Δ_f the absolute propagated uncertainty (sigma, in my notation)

so $\frac{\Delta f}{\arctan(x)} = \frac{1}{\arctan(x)} \frac{\Delta x}{(1+x^2)}$

$\cancel{\sigma_f = \frac{1}{f}\frac{\Delta x}{1+x^2}}$

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transit durations:

$$T_{bot} = \frac{P}{\pi} \arcsin\left(\underbrace{\frac{1}{(a/R_*)} \cdot \frac{\left((1+(\frac{R_p}{R_*}))^2 - b^2\right)^{1/2}}{\sin i}}_{y} \right)$$

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$$T_{tot} = \frac{P}{\pi} \arcsin(y)$$

$$\frac{\sigma_{T_{tot}}}{T_{tot}} = \frac{1}{\pi} \cdot \left[\left(\frac{\sigma_P}{P}\right)^2 + \left(\frac{\sigma_{\arcsin y}}{(\arcsin y)}\right)^2\right]^{1/2}$$

for

$$\sigma_{\arcsin y} = \frac{\sigma_y}{(1-y^2)^{1/2}},$$

and

$$\frac{\sigma_y}{y} = \left[\left(\frac{\sigma_{a/R_*}}{a/R_*}\right)^2 + \left(\frac{\sigma_{\sin i}}{\sin i}\right)^2 + \left(\frac{\sigma_z}{z}\right)^2\right]^{1/2}$$

for $\quad z = \left(\left(1 + \left(\frac{R_p}{R_*}\right)^2\right) - b^2\right)^{1/2}$

$$\sigma_z = \frac{1}{2}\left[2\cdot\left(\frac{\sigma_{R_p/R_*}}{(R_p/R_*)}\right)^2 + 2\cdot\left(\frac{\sigma_b}{b}\right)^2\right]^{1/2}$$

note

$$\frac{d \arcsin(y)}{dy} = \frac{1}{(1-y^2)^{1/2}}$$

$$\therefore \sigma_{\arcsin y} = \frac{\sigma_y}{(1-y^2)^{1/2}}$$