

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

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

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

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

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

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

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

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

for

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

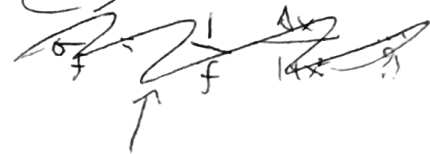
example: arctan -

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

$$\text{therefore } \Delta f \approx \frac{\Delta x}{1+x^2}$$

$$\text{let } f(x) = \arctan(x)$$

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



for  $\Delta f$  the absolute propagated uncertainty.  
(sigma, in notation)

transit duration:

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

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

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

for

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

and

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

for

$$z = \left( 1 + \left( \frac{R_p}{R_s} \right)^2 - b^2 \right)^{1/2}$$

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

note

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

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