Loss :- 0.004097728229404574

x :- 0.9680093969183833

y :- 2.5983627461290855

Let A → Point of Avg. sun { angles calculated as β in code }

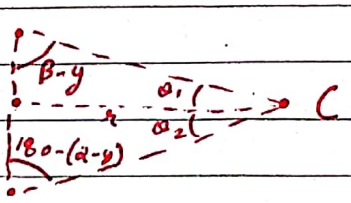
B → " " sun { " " " α " " }.

C → " " Mars

Val1 = x sin(β-y)

Val2 = sin(α-y).

Val3 = cos(α-β)



using the sin rule in smaller Δ's

$$\frac{x}{\sin\theta_1} = \frac{r}{\sin(\beta-y)} \Rightarrow \boxed{r\sin\theta_1 = x\sin(\beta-y)} \quad (1)$$

$$\Rightarrow \cos\theta_1 = \sqrt{1-\frac{x^2 Val1^2}{r^2}}$$

$$\frac{1}{\sin\theta_2} = \frac{r}{\sin(180-(\alpha-y))} \Rightarrow \boxed{r\sin\theta_2 = \sin(\alpha-y)} \quad (2)$$

$$\cos\theta_2 = \sqrt{1-\frac{Val2^2}{r^2}}$$

$\theta_1 + \theta_2 = 180 - \beta + y - 180 + \alpha - y$

$= \alpha - \beta$

From 1 and 2 and $\cos(\theta_1+\theta_2) = \cos\theta_1\cos\theta_2 - \sin\theta_1\sin\theta_2$ {calculating cos θ from 1 and 2}

$$\Rightarrow \underbrace{\cos(\alpha-\beta)}_{Val3} = \sqrt{\left(1-\frac{Val1^2}{r^2}\right)\left(1-\frac{Val2^2}{r^2}\right)} - \frac{Val1}{r}\cdot\frac{Val2}{r}$$

$$Val3 + \frac{Val1\,Val2}{r^2} = \sqrt{\frac{(r^2-Val1^2)(r^2-Val2^2)}{r^4}}$$

squaring and solving.

$$r^4(1-Val3^2) = 2r^2\,Val1\,Val2\,Val3 + Val1^2 r^2 + Val2^2 r^2$$

$$\Rightarrow \boxed{r = \sqrt{\frac{Val1^2 + Val2^2 + 2\,Val1\,Val2\,Val3}{1-Val3^2}}}$$