(*Note that $w=v^{\alpha}*$)

$$\begin{aligned} & \text{w}(\cdot) = \text{Solve} \left[1^2 \, w^2 + w^4 \, v^2 + 21 \, w^3 \, v \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right] - m^2 \equiv \theta, \, w \right] \\ & \text{out} : = \left\{ \left\{ w \to -\frac{1 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]}{2 \, \text{t}} - \frac{1}{2} \, \sqrt{\left[-\frac{21^2}{3 \, \tau^2} + \frac{1^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2}{\tau^2} + \frac{1}{\tau^2} \right]} + \right. \\ & \left. \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, v^2 \right) \right) \, / \, \left[3 \, v^2 \, \left(21^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2 + \right. \\ & \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, v^2 \right)^3 + \left(21^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2 + \\ & \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, v^2 \right)^3 + \left(21^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2 \right)^{1/3} \right) - \\ & \frac{1}{2} \, \sqrt{\left[\frac{41^2}{3 \, \tau^2} + \frac{21^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2}{\tau^2} - \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, v^2 \right) \right) / \right.} \\ & \left[3 \, v^2 \, \left[2 \, 1^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 + \right. \\ & \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, v^2 \right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 + \right. \\ & \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, v^2 \right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2 \right. \\ & \left. \left. \left(\frac{8 \, 1^3 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]}{v^3} \right) - \frac{8 \, 1^3 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^3}{v^3} \right) / \, \left(4 \, \sqrt{\left(\frac{21^2}{3 \, \tau^2} + \frac{1^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2} \right)^{1/3} - \right. \\ & \left. \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, v^2 \right) \right) / \, \left(3 \, v^2 \, \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2 \right)^{1/3} - \right. \\ & \left. \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, v^2 \right) \right) / \left(3 \, v^2 \, \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2 \right)^{1/3} - \right. \\ & \left. \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, v^2 \right) \right) / \left(3 \, v^2 \, \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 - 108 \, 1^2 \, m^2 \, v^2 \, \text{CoS} \left[\frac{\pi \, \alpha}{2} \right]^2 \right)^2 \right)^{1/3} \right. \\ & \left. \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, v^2 \right) \right) \right.$$

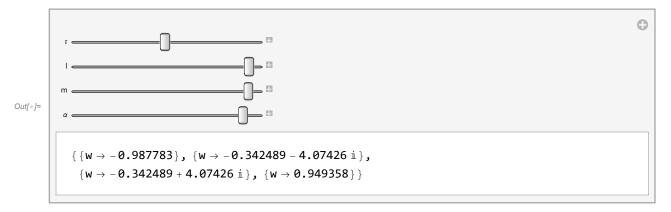
$$\begin{split} \sqrt{-4 \left(1^4 - 12 \, m^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{n \, \alpha}{2}\right]^2\right)^{1/3}} \right) \right) \right\}, \\ \left\{ \text{W} \to -\frac{1 \, \text{Cos} \left[\frac{n \, \alpha}{2}\right]}{2 \, \tau} - \frac{1}{2} \, \sqrt{\left(-\frac{2 \, 1^2}{3 \, \tau^2} + \frac{1^2 \, \text{Cos} \left[\frac{n \, \alpha}{2}\right]^2}{c^2} + \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)\right) / \right)} \right. \\ \left. \left(3 \, \tau^2 \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)\right) / \right. \\ \left. \left(3 \, \tau^2 \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2 \right)^{1/3} \right\} + \\ \frac{1}{2} \, \sqrt{\left(\frac{4 \, 1^2}{3 \, \tau^2} + \frac{2 \, 1^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2}{\tau^2} - \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)\right) / \left(3 \, \tau^2 \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \left(2^{1/3} \, \tau^2\right)^2 + \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)^3 + \left(2^{1/3} \, + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2 \right)^{1/3} - \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)^3 + \left(2^{1/3} \, + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2 \right)^{1/3} - \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)\right) / \left(3 \, \tau^2 \left(2^{1/3} + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2 \right)^{1/3} + \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)\right) / \left(3 \, \tau^2 \left(2^{1/3} + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2 \right)^{1/3} \right) + \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2\right)\right) / \left(3 \, \tau^2 \left(2^{1/3} + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2 \right)^{1/3} \right) + \left(2^{1/3} \, \left(1^4 - 12$$

$$\begin{split} \left\{ w > \frac{1 \cos \left[\frac{\pi \alpha}{2} \right]}{2 \, \tau} + \frac{1}{2} \, \sqrt{ \left[\frac{2 \, 1^2}{3 \, \tau^2} + \frac{1^2 \cos \left[\frac{\pi \alpha}{2} \right]^2}{\tau^2} + \left(2^{1/3} \left(1^4 - 12 \, m^2 \, \tau^2 \right) \right) / \right.} \\ \left. \left(3 \, \tau^2 \left[2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 + \right. \\ \left. \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, \tau^2 \right)^3 + \left[2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 + \right. \\ \left. \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, \tau^2 \right)^3 + \left[2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 + \right. \\ \left. \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, \tau^2 \right)^3 + \left[2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 + \right. \\ \left. \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, \tau^2 \right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 \right) \right]^{1/3} \right) - \\ \left. \frac{1}{2} \, \sqrt{\left[\frac{4 \, 1^2}{3 \, \tau^2} + \frac{2 \, 1^2 \, \cos \left[\frac{\pi \alpha}{2} \right]^2}{\tau^2} - \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, \tau^2 \right) \right) / \right. \\ \left. \left(3 \, \tau^2 \, \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 + \right. \\ \left. \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, \tau^2 \right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 \, - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 \right)^2 \right)^{1/3} + \\ \left. \left(\frac{8 \, 1^3 \, \cos \left[\frac{\pi \alpha}{2} \right]}{\tau^3} - \frac{8 \, 1^3 \, \cos \left[\frac{\pi \alpha}{2} \right]^3}{\tau^3} \right) / \left[4 \, \sqrt{\left[-\frac{2 \, 1^2}{3 \, \tau^2} + \frac{1^2 \, \cos \left[\frac{\pi \alpha}{2} \right]^2}{\tau^2} + \frac{1^2 \, \cos \left[\frac{\pi \alpha}{2} \right]^2}{\tau^2} + \right. \\ \left. \sqrt{-4} \, \left(1^4 - 12 \, m^2 \, \tau^2 \right) \right) / \left[3 \, \tau^2 \, \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 \right)^2 \right)^{1/3} + \\ \left. \frac{1}{3 - 2^{1/3} \, \tau^2} \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 \right)^2 \right)^{1/3} \right) \right\} \right\} \\ \left. \frac{1}{3 - 2^{1/3} \, \tau^2} \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 - 108 \, 1^2 \, m^2 \, \tau^2 \, Cos \left[\frac{\pi \alpha}{2} \right]^2 \right) \right\} \right)^{1/3} \right) \right\} \right\} \right\}$$

$$\left(3 \ \tau^2 \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \right. \\ \left. \sqrt{-4 \ \left(1^4 - 12 \ m^2 \ \tau^2\right)^3 + \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3} \right) + \\ \left. \frac{1}{3 \cdot 2^{1/3} \ \tau^2} \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \right. \right. \\ \left. \sqrt{-4 \ \left(1^4 - 12 \ m^2 \ \tau^2\right)^3 + \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3} \right) + \\ \left. \frac{1}{2} \sqrt{\left(-\frac{4 \ 1^2}{3 \ \tau^2} + \frac{2 \ 1^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2}{\tau^2} - \left(2^{1/3} \ \left(1^4 - 12 \ m^2 \ \tau^2\right)\right) / } \right. \\ \left. \left(3 \ \tau^2 \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2\right)^{1/3} \right) + \\ \left. \sqrt{-4 \ \left(1^4 - 12 \ m^2 \ \tau^2\right)^3 + \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2}\right)^{1/3} \right) - \\ \left. \frac{1}{3 \cdot 2^{1/3} \ \tau^2} \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2\right)^{1/3} + \\ \left. \left(\frac{8 \ 1^3 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]}{\tau^3} - \frac{8 \ 1^3 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^3}{\tau^3}\right) / \left(4 \ \sqrt{\left(-\frac{2 \ 1^2}{3 \ \tau^2} + \frac{1^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3} + \\ \left. \left(2^{1/3} \ \left(1^4 - 12 \ m^2 \ \tau^2\right)\right) / \left(3 \ \tau^2 \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2\right)^{1/3} \right) + \\ \frac{1}{3 \times 2^{1/3} \ \tau^2} \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2\right)^{1/3} \right) + \\ \left. \sqrt{-4 \ \left(1^4 - 12 \ m^2 \ \tau^2\right)^3 + \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2}\right)^{1/3}} \right) + \\ \frac{1}{3 \times 2^{1/3} \ \tau^2} \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^{1/3}}\right) + \\ \left. \sqrt{-4 \ \left(1^4 - 12 \ m^2 \ \tau^2\right)^3 + \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2}\right)^{1/3}} \right) + \\ \frac{1}{3 \times 2^{1/3} \ \tau^2} \left(2 \ 1^6 + 72 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 - 108 \ 1^2 \ m^2 \ \tau^2 \ \text{Cos} \left[\frac{$$

(*Only Fourth root is positive for different 1, m, τ and α *)

In[*]:= Manipulate
$$\left[\text{NSolve} \left[1^2 \text{ w}^2 + \text{w}^4 \text{ } \tau^2 + 21 \text{ w}^3 \text{ } \tau \text{ Cos} \left[\frac{\pi \alpha}{2} \right] - \text{m}^2 == 0, \text{ w} \right],$$
 $\{\tau, 0, 5\}, \{1, 0, 10\}, \{m, 0, 10\}, \{\alpha, 0, 1\} \right]$



(*Expression for $g(\tau)$ in terms of 1, m, α and $\tau*$)

In[5]:=
$$g[1_, m_, \alpha_, \tau_] :=$$

$$\left\{\operatorname{ArcCos}\left[-\frac{1}{\mathfrak{m}} \operatorname{1} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right] \left(-\frac{1 \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]}{2 \, \tau} + \frac{1}{2} \, \sqrt{\left(-\frac{2 \, 1^{2}}{3 \, \tau^{2}} + \frac{1^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}}{\tau^{2}} + \left(2^{1/3} \, \left(1^{4} - 12 \, \operatorname{m}^{2} \, \tau^{2}\right)\right)\right/}\right.$$

$$\left(3 \, \tau^{2} \left(2 \, 1^{6} + 72 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2} + \frac{1^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}}{\sqrt{-4} \left(1^{4} - 12 \, \operatorname{m}^{2} \, \tau^{2}\right)^{3} + \left(2 \, 1^{6} + 72 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}\right)^{4}}\right) + \frac{1}{3 \times 2^{1/3} \, \tau^{2}} \left(2 \, 1^{6} + 72 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2} + \frac{1}{\sqrt{-4} \left(1^{4} - 12 \, \operatorname{m}^{2} \, \tau^{2}\right)^{3} + \left(2 \, 1^{6} + 72 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}\right)^{1/3}}\right) + \frac{1}{2} \, \sqrt{\left(-\frac{4 \, 1^{2}}{3 \, \tau^{2}} + \frac{2 \, 1^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}}{\tau^{2}} - \left(2^{1/3} \left(1^{4} - 12 \, \operatorname{m}^{2} \, \tau^{2}\right)\right)\right) \left(3 \, \tau^{2} + \frac{1}{\sqrt{-4} \left(1^{4} - 12 \, \operatorname{m}^{2} \, \tau^{2}\right)^{3} + \left(2 \, 1^{6} + 72 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}\right)^{2}}\right)^{1/3}}\right) - \frac{1}{3 \times 2^{1/3} \, \tau^{2}} \left(2 \, 1^{6} + 72 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}\right)^{2}\right)^{1/3}\right) + \frac{1}{3 \times 2^{1/3} \, \tau^{2}}}\right)^{1/3} + \frac{1}{3 \times 2^{1/3} \, \tau^{2}}\left(2 \, 1^{6} + 72 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} - 108 \, 1^{2} \, \operatorname{m}^{2} \, \tau^{2} \operatorname{Cos}\left[\frac{\pi \alpha}{2}\right]^{2}\right)^{2}\right)^{1/3}}\right) + \frac{1}{3 \times 2^{1/3} \, \tau^{2}}}$$

$$\begin{split} \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \text{v}^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \text{v}^2 - 168 \, 1^2 \, \text{m}^2 \, \text{v}^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^{2/3}} \, + \\ & \left(\frac{8 \, 1^3 \, \text{Cos} \left[\frac{\pi \alpha}{2}\right]}{\tau^3} - \frac{8 \, 1^3 \, \text{Cos} \left[\frac{\pi \alpha}{2}\right]^3}{\tau^3}\right) \bigg/ \, \left(4 \, \sqrt{\left(-\frac{2 \, 1^2}{3 \, \tau^2} + \frac{1^2 \, \text{Cos} \left[\frac{\pi \alpha}{2}\right]^2}{\tau^2} + \frac{1}{\tau^2}} \right)} \\ & \left(2^{1/3} \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)\right) \bigg/ \, \left(3 \, \tau^2 \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right) + \\ & \sqrt{-4} \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2} \\ & \frac{1}{3 \times 2^{1/3} \, \tau^2} \left[2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2 + \\ & \sqrt{-4} \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2} \right)^{1/3} \right] \right] \\ & \frac{1}{m} \, \tau \left(-\frac{1 \, \text{Cos} \left[\frac{\pi \alpha}{2}\right]}{2 \, \tau} + \frac{1}{2} \, \sqrt{\left(-\frac{21^2}{3 \, \tau^2} + \frac{1^2 \, \text{Cos} \left[\frac{\pi \alpha}{2}\right]^2}{\tau^2} + \left(2^{1/3} \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)\right) / \left(3 \, \tau^2 \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2\right)^{1/3}} \right) + \\ & \frac{1}{3 \times 2^{1/3} \, \tau^2} \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2\right)^{1/3} \right) + \\ & \frac{1}{2} \, \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2} \right)^{1/3}} + \\ & \frac{1}{2} \, \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2} \right)^{1/3}} \right) + \\ & \frac{1}{3 \times 2^{1/3} \, \tau^2} \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2\right)^{1/3}} + \\ & \frac{1}{3 \times 2^{1/3} \, \tau^2} \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2\right)^{1/3}} \right) - \\ & \frac{1}{3 \times 2^{1/3} \, \tau^2} \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 - 168 \, 1^2 \, \text{m}^2 \, \tau^2 \cos \left[\frac{\pi \alpha}{2}\right]^2\right)^2\right)$$

$$\begin{split} \sqrt{-4 \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \cos\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3} + \\ \left(\frac{8 \, 1^3 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]}{r^3} - \frac{8 \, 1^3 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^3}{r^3}\right) \bigg/ \left(4 \, \sqrt{\left(-\frac{2 \, 1^2}{3 \, r^2} + \frac{1^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2}{r^2} + \frac{1}{r^2}} \right)} \\ \left(2^{1/3} \, \left(1^4 - 12 \, m^2 \, r^2\right)\right) \bigg/ \left(3 \, r^2 \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 108 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right) + \frac{1}{r^2} \right) \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 108 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3}} + \\ \frac{1}{2} \, \sqrt{\left(-\frac{4 \, 1^2}{3 \, r^2} + \frac{21^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2 + 2 \, r^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \\ \sqrt{-4 \, \left(1^4 - 12 \, m^2 \, r^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3}} + \\ \frac{1}{3 \, x \, 2^{1/3} \, r^2} \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3} \right) + \\ \frac{1}{3 \, x \, 2^{1/3} \, r^2} \left(2 \, 1^6 + 72 \, 1^2 \, m^2 \, r^2 - 168 \, 1^2 \, m^2 \, r^2 \, \text{Cos}\left[\frac{\pi \, \alpha}{2}\right]^2\right) + \frac{1}{r^2} \, r^2 \,$$

$$\sqrt{-4 \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 108 \, 1^2 \, \text{m}^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3} +$$

$$\left(\frac{8 \, 1^3 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]}{\tau^3} - \frac{8 \, 1^3 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^3}{\tau^3}\right) \bigg/ \left(4 \, \sqrt{\left(-\frac{2 \, 1^2}{3 \, \tau^2} + \frac{1^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2}{\tau^2} + \frac{1}{\tau^2}\right)} \right)^2 +$$

$$\left(2^{1/3} \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)\right) \bigg/ \left(3 \, \tau^2 \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 108 \, 1^2 \, \text{m}^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \frac{1}{\tau^2}\right)^2 +$$

$$\sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 108 \, 1^2 \, \text{m}^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2\right)^2} \right)^{1/3} \right) +$$

$$\frac{1}{3 \times 2^{1/3} \, \tau^2} \left(2 \, 1^6 + 72 \, 1^2 \, \text{m}^2 \, \tau^2 - 108 \, 1^2 \, \text{m}^2 \, \tau^2 \, \text{Cos} \left[\frac{\pi \, \alpha}{2}\right]^2 + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2\right)^2 + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2\right)^2 + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2\right)^2} \right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2\right)^2 + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2\right)^2} + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2\right)^2} \right)^3 + \left(2 \, 1^6 + 12 \, 1^6 + 12 \, \text{m}^2\right)^2 + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2 \, \tau^2\right)^3 + \left(2 \, 1^6 + 12 \, \text{m}^2\right)^2} \right)^3 + \left(2 \, 1^6 + 12 \, 1^6 + 12 \, \text{m}^2\right)^2} + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2\right)^2} + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2\right)^2} + \sqrt{-4 \, \left(1^4 - 12 \, \text{m}^2\right)^2} \right)^3 + \left(2 \, 1^6 + 12 \, 1^6$$

(*If we have to find out the root where $g(\tau)$ intersect with τ then suppose if we fix l= 0.9, m=3, α =0.2 then if we want to find the intersection point of τ near 1 then, *)

ln[7]:= FindRoot[g[0.9, 3, 0.2, τ] - τ , { τ , 1}]

Out[7]= $\{ \tau \rightarrow 1.75459 \}$