Newton-Ralphson Method (ref sosmath.com/calculus/diff/der07/der07.html)

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$Fn(a,b,x) := \cot(x) + a\cdot x + \frac{b}{x} \qquad Dfn(a,b,x) := \frac{d}{dx}\left(\cot(x) + a\cdot x + \frac{b}{x}\right) \rightarrow a - \frac{b}{x^2} - \cot(x)^2 - 1$$

Preliminary efforts

Find the values of a and b for your example

Given

$$\cot(0.9842) + a\cdot 0.9842 + \frac{b}{0.9842} = 0$$

$$\cot(3.429) + a\cdot 3.429 + \frac{b}{3.429} = 0$$

$$Find(a,b) = \begin{pmatrix} -1.014546 \\ 0.328604 \end{pmatrix} \qquad a \equiv -1.014546 \qquad b \equiv 0.328604$$

$j := 0..17$ ***Set up to find the first 18 roots***

$X_{0,j} := j\cdot\pi + \frac{0.1}{j + 0.1}$ ***The real trick is getting the initial guesses right so the iteration collapses to independent roots***

$$X_{i,j} := X_{i-1,j} - \frac{Fn\left(a,b,X_{i-1,j}\right)}{Dfn\left(a,b,X_{i-1,j}\right)}$$

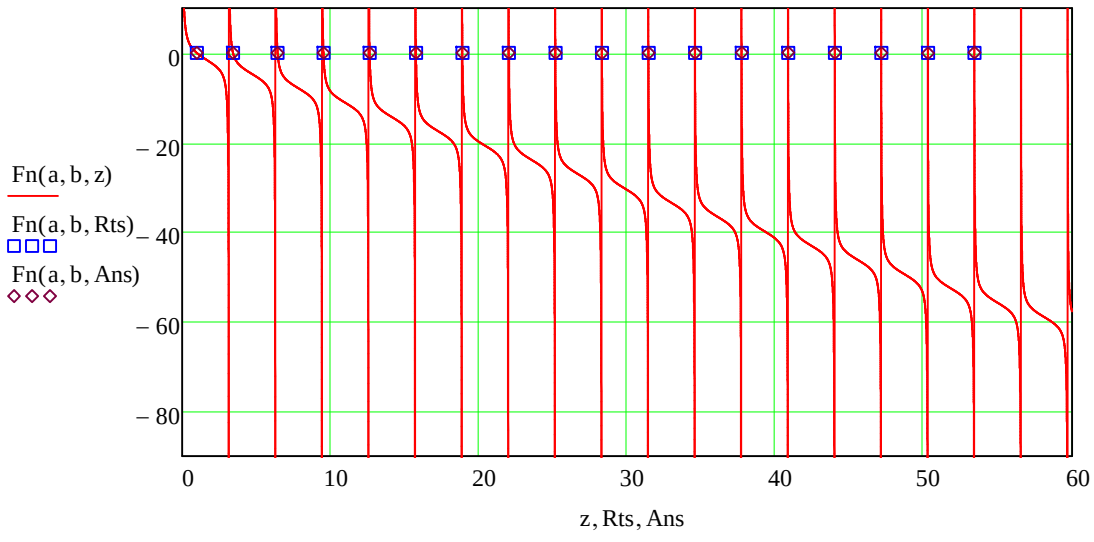
$Rts := \left(X^T\right)^{\langle rows(X)-1\rangle}$ ***Take the last calculation for each root***

$Rts := sort(Rts)$

Answers from your post.

$$Rts = \begin{pmatrix} 0.9842 \\ 3.429 \\ 6.4363 \\ 9.5282 \\ 12.6443 \\ 15.7705 \\ 18.9017 \\ 22.0359 \\ 25.1719 \\ 28.3092 \\ 31.4473 \\ 34.586 \\ 37.7252 \\ 40.8648 \\ 44.0047 \\ 47.1448 \\ 50.2851 \\ 53.4255 \end{pmatrix} \qquad Ans := \begin{pmatrix} 0.9842 \\ 3.4290 \\ 6.4363 \\ 9.5282 \\ 12.6443 \\ 15.7705 \\ 18.9017 \\ 22.0359 \\ 25.1719 \\ 28.3092 \\ 31.4473 \\ 34.5860 \\ 37.7252 \\ 40.8648 \\ 44.0047 \\ 47.1448 \\ 50.2851 \\ 53.4255 \end{pmatrix}$$

$z := 0, 0.001 .. 60$



rows(Ans) = 18