26. (***Ashwin and Hemanth***) Determine the symbol/stability of the Trapezoidal rule.

trapezoid: $x_{n+1} = x_n + \frac{h}{2}\left(f(t_n, x_n) + f(t_{n+1}, x_{n+1})\right)$

Let $f(t_n, x_n) = \lambda x_n$. Then

$$x_{n+1} = x_n + \frac{h}{2}\left(\lambda x_n + \lambda x_{n+1}\right)$$

$$= x_n + \frac{\lambda h}{2} x_n + \frac{\lambda h}{2} x_{n+1}$$

$$\Rightarrow x_{n+1} - \frac{\lambda h}{2} x_{n+1} = x_n + \frac{\lambda h}{2} x_n$$

$$\Rightarrow x_{n+1}\left(1 - \frac{\lambda h}{2}\right) = x_n\left(1 + \frac{\lambda h}{2}\right)$$

$$\Rightarrow x_{n+1} = x_n\left(\frac{1 + \frac{\lambda h}{2}}{1 - \frac{\lambda h}{2}}\right)$$

$\Rightarrow$ symbol is $\dfrac{1 + \frac{z}{2}}{1 - \frac{z}{2}}$