

100) Find the complex number z in $\sin z = \cosh(-1-j)$

$$\begin{aligned}\frac{e^{zj} - e^{-zj}}{2j} &= \frac{e^{-1-j} + e^{-(1-j)}}{2} ; \quad \therefore e^{zj} - e^{-zj} = j \left(e^{-1-j} + e^{-(1-j)} \right) = e^{j\frac{\pi}{2}} \cdot \left(e^{-1-j} + e^{-(1-j)} \right) \\ \therefore e^{zj} - e^{-zj} &= e^{-1-j} \cdot e^{j\frac{\pi}{2}} + e^{-(1-j)} \cdot e^{j\frac{\pi}{2}} = e^{-1-j} \cdot e^{j\frac{\pi}{2}} - \left(-e^{-(1-j)} \cdot e^{j\frac{\pi}{2}} \right) \\ \therefore e^{zj} - e^{-zj} &= e^{-1-j} \cdot e^{j\frac{\pi}{2}} - e^{-j\pi} e^{-(1-j)} \cdot e^{j\frac{\pi}{2}} = e^{-1-j+j\frac{\pi}{2}} - e^{-j\pi-(1-j)+j\frac{\pi}{2}} \\ \therefore e^{zj} - e^{-zj} &= e^{-1-j+j\frac{\pi}{2}} - e^{-(1-j)-j\frac{\pi}{2}} = e^{-1-j+j\frac{\pi}{2}} - e^{-(1-j+j\frac{\pi}{2})} ; \quad \therefore zj = -1-j+j\frac{\pi}{2} \\ \therefore z &= \frac{-1-j+j\frac{\pi}{2}}{j} = -j \left(-1-j+j\frac{\pi}{2} \right) = -j(-1-j) - j^2 \frac{\pi}{2} = -j(-1-j) + \frac{\pi}{2} = j+j^2 + \frac{\pi}{2} = -1 + \frac{\pi}{2} + j\end{aligned}$$

101) Find the complex number z in $\cosh z = \sin(-1-j)$

$$\begin{aligned}\frac{e^z + e^{-z}}{2} &= \frac{e^{j(-1-j)} - e^{-j(-1-j)}}{2j} ; \quad \therefore e^z + e^{-z} = -j(e^{j(-1-j)} - e^{-j(-1-j)}) = e^{-j\frac{\pi}{2}}(e^{j(-1-j)} - e^{-j(-1-j)}) \\ \therefore e^z + e^{-z} &= e^{j(-1-j)} \cdot e^{-j\frac{\pi}{2}} - e^{-j(-1-j)} \cdot e^{-j\frac{\pi}{2}} = e^{j(-1-j)} \cdot e^{-j\frac{\pi}{2}} + \left(-e^{-j(-1-j)} \cdot e^{-j\frac{\pi}{2}} \right) \\ \therefore e^z + e^{-z} &= e^{j(-1-j)} \cdot e^{-j\frac{\pi}{2}} + e^{j\pi} e^{-j(-1-j)} \cdot e^{-j\frac{\pi}{2}} = e^{j(-1-j)-j\frac{\pi}{2}} + e^{j\pi-j(-1-j)-j\frac{\pi}{2}} \\ \therefore e^z + e^{-z} &= e^{j(-1-j)-j\frac{\pi}{2}} + e^{-j(-1-j)+j\frac{\pi}{2}} = e^{j(-1-j)-j\frac{\pi}{2}} + e^{-j(-1-j)-j\frac{\pi}{2}} \\ \therefore z &= j(-1-j) - j\frac{\pi}{2} = -j-j^2 - j\frac{\pi}{2} = 1+j(-1-\frac{\pi}{2})\end{aligned}$$

102) Find the complex number z in $\sin z = \cosh(-1+j)$

$$\begin{aligned}\frac{e^{zj} - e^{-zj}}{2j} &= \frac{e^{-1+j} + e^{-(-1+j)}}{2} ; \quad \therefore e^{zj} - e^{-zj} = j \left(e^{-1+j} + e^{-(-1+j)} \right) = e^{j\frac{\pi}{2}} \cdot \left(e^{-1+j} + e^{-(-1+j)} \right) \\ \therefore e^{zj} - e^{-zj} &= e^{-1+j} \cdot e^{j\frac{\pi}{2}} + e^{-(-1+j)} \cdot e^{j\frac{\pi}{2}} = e^{-1+j} \cdot e^{j\frac{\pi}{2}} - \left(-e^{-(-1+j)} \cdot e^{j\frac{\pi}{2}} \right) \\ \therefore e^{zj} - e^{-zj} &= e^{-1+j} \cdot e^{j\frac{\pi}{2}} - e^{-j\pi} e^{-(-1+j)} \cdot e^{j\frac{\pi}{2}} = e^{-1+j+j\frac{\pi}{2}} - e^{-j\pi-(-1+j)+j\frac{\pi}{2}} \\ \therefore e^{zj} - e^{-zj} &= e^{-1+j+j\frac{\pi}{2}} - e^{-(1-j)-j\frac{\pi}{2}} = e^{-1+j+j\frac{\pi}{2}} - e^{-(1-j+j\frac{\pi}{2})} ; \quad \therefore zj = -1+j+j\frac{\pi}{2} \\ \therefore z &= \frac{-1+j+j\frac{\pi}{2}}{j} = -j \left(-1+j+j\frac{\pi}{2} \right) = -j(-1+j) - j^2 \frac{\pi}{2} = -j(-1+j) + \frac{\pi}{2} = -j+j^2 + \frac{\pi}{2} = -1 + \frac{\pi}{2} - j\end{aligned}$$

103) Find the complex number z in $\cosh z = \sin(-1+j)$

$$\begin{aligned}\frac{e^z + e^{-z}}{2} &= \frac{e^{j(-1+j)} - e^{-j(-1+j)}}{2j} ; \quad \therefore e^z + e^{-z} = -j(e^{j(-1+j)} - e^{-j(-1+j)}) = e^{-j\frac{\pi}{2}}(e^{j(-1+j)} - e^{-j(-1+j)}) \\ \therefore e^z + e^{-z} &= e^{j(-1+j)} \cdot e^{-j\frac{\pi}{2}} - e^{-j(-1+j)} \cdot e^{-j\frac{\pi}{2}} = e^{j(-1+j)} \cdot e^{-j\frac{\pi}{2}} + \left(-e^{-j(-1+j)} \cdot e^{-j\frac{\pi}{2}} \right) \\ \therefore e^z + e^{-z} &= e^{j(-1+j)} \cdot e^{-j\frac{\pi}{2}} + e^{j\pi} e^{-j(-1+j)} \cdot e^{-j\frac{\pi}{2}} = e^{j(-1+j)-j\frac{\pi}{2}} + e^{j\pi-j(-1+j)-j\frac{\pi}{2}} \\ \therefore e^z + e^{-z} &= e^{j(-1+j)-j\frac{\pi}{2}} + e^{-j(-1+j)+j\frac{\pi}{2}} = e^{j(-1+j)-j\frac{\pi}{2}} + e^{-j(-1+j)-j\frac{\pi}{2}} \\ \therefore z &= j(-1+j) - j\frac{\pi}{2} = j+j^2 - j\frac{\pi}{2} = -1+j(1-\frac{\pi}{2})\end{aligned}$$

104) Find the complex number z in $\sin z = \cosh(1-j)$

$$\begin{aligned}\frac{e^{zj} - e^{-zj}}{2j} &= \frac{e^{1-j} + e^{-(1-j)}}{2} ; \quad \therefore e^{zj} - e^{-zj} = j \left(e^{1-j} + e^{-(1-j)} \right) = e^{j\frac{\pi}{2}} \cdot \left(e^{1-j} + e^{-(1-j)} \right) \\ \therefore e^{zj} - e^{-zj} &= e^{1-j} \cdot e^{j\frac{\pi}{2}} + e^{-(1-j)} \cdot e^{j\frac{\pi}{2}} = e^{1-j} \cdot e^{j\frac{\pi}{2}} - \left(-e^{-(1-j)} \cdot e^{j\frac{\pi}{2}} \right) \\ \therefore e^{zj} - e^{-zj} &= e^{1-j} \cdot e^{j\frac{\pi}{2}} - e^{-j\pi} e^{-(1-j)} \cdot e^{j\frac{\pi}{2}} = e^{1-j+j\frac{\pi}{2}} - e^{-j\pi-(1-j)+j\frac{\pi}{2}} \\ \therefore e^{zj} - e^{-zj} &= e^{1-j+j\frac{\pi}{2}} - e^{-(1-j)-j\frac{\pi}{2}} = e^{1-j+j\frac{\pi}{2}} - e^{-(1-j+j\frac{\pi}{2})} ; \quad \therefore zj = 1-j+j\frac{\pi}{2} \\ \therefore z &= \frac{1-j+j\frac{\pi}{2}}{j} = -j \left(1-j+j\frac{\pi}{2} \right) = -j(1-j) - j^2 \frac{\pi}{2} = -j(1-j) + \frac{\pi}{2} = -j+j^2 + \frac{\pi}{2} = -1 + \frac{\pi}{2} - j\end{aligned}$$

105) Find the complex number z in $\cosh z = \sin(1-j)$

$$\begin{aligned}\frac{e^z + e^{-z}}{2} &= \frac{e^{j(1-j)} - e^{-j(1-j)}}{2j} ; \quad \therefore e^z + e^{-z} = -j(e^{j(1-j)} - e^{-j(1-j)}) = e^{-j\frac{\pi}{2}}(e^{j(1-j)} - e^{-j(1-j)}) \\ \therefore e^z + e^{-z} &= e^{j(1-j)} \cdot e^{-j\frac{\pi}{2}} - e^{-j(1-j)} \cdot e^{-j\frac{\pi}{2}} = e^{j(1-j)} \cdot e^{-j\frac{\pi}{2}} + \left(-e^{-j(1-j)} \cdot e^{-j\frac{\pi}{2}} \right) \\ \therefore e^z + e^{-z} &= e^{j(1-j)} \cdot e^{-j\frac{\pi}{2}} + e^{j\pi} e^{-j(1-j)} \cdot e^{-j\frac{\pi}{2}} = e^{j(1-j)-j\frac{\pi}{2}} + e^{j\pi-j(1-j)-j\frac{\pi}{2}} \\ \therefore e^z + e^{-z} &= e^{j(1-j)-j\frac{\pi}{2}} + e^{-j(1-j)+j\frac{\pi}{2}} = e^{j(1-j)-j\frac{\pi}{2}} + e^{-j(1-j)-j\frac{\pi}{2}} \\ \therefore z &= j(1-j) - j\frac{\pi}{2} = j+j^2 - j\frac{\pi}{2} = -1+j(1-\frac{\pi}{2})\end{aligned}$$