Problem 8) a) $\sin z = 0 \;\rightarrow\; [\exp(\mathrm{i}z) - \exp(-\mathrm{i}z)]/(2\mathrm{i}) = 0 \;\rightarrow\; \exp(\mathrm{i}z) = \exp(-\mathrm{i}z)$

$\rightarrow\; \exp(2\mathrm{i}z) = 1.0 \;\rightarrow\; \exp[2\mathrm{i}(x + \mathrm{i}y)] = 1.0 \;\rightarrow\; \exp(\mathrm{i}2x)\exp(-2y) = \underbrace{\exp(\mathrm{i}2n\pi)}_{1.0}$

$\rightarrow\; y = 0$ and $x = n\pi \;\rightarrow\; z = x + \mathrm{i}y = n\pi$ (for $n = 0, \pm1, \pm2, \cdots$).

b) $\cos z = 0 \;\rightarrow\; ½[\exp(\mathrm{i}z) + \exp(-\mathrm{i}z)] = 0 \;\rightarrow\; \exp(\mathrm{i}z) + \exp(-\mathrm{i}z) = 0$

$\rightarrow\; \exp(2\mathrm{i}z) = -1.0 \;\rightarrow\; \exp(\mathrm{i}2x)\exp(-2y) = \underbrace{\exp[\mathrm{i}(2n+1)\pi]}_{-1.0}$

$\rightarrow\; y = 0$ and $x = (n + ½)\pi$

$\rightarrow\; z = x + \mathrm{i}y = (n + ½)\pi$ (for $n = 0, \pm1, \pm2, \cdots$).

c) $\sinh z = 0 \;\rightarrow\; ½[\exp(z) - \exp(-z)] = 0 \;\rightarrow\; \exp(z) = \exp(-z)$

$\rightarrow\; \exp(2z) = 1.0 \;\rightarrow\; \exp(2x)\exp(\mathrm{i}2y) = \underbrace{\exp(\mathrm{i}2n\pi)}_{1.0}$

$\rightarrow\; x = 0$ and $y = n\pi$

$\rightarrow\; z = x + \mathrm{i}y = \mathrm{i}n\pi$ (for $n = 0, \pm1, \pm2, \cdots$).

d) $\cosh z = 0 \;\rightarrow\; ½[\exp(z) + \exp(-z)] = 0 \;\rightarrow\; \exp(z) + \exp(-z) = 0$

$\rightarrow\; \exp(2z) = -1.0 \;\rightarrow\; \exp(2x)\exp(\mathrm{i}2y) = \underbrace{\exp[\mathrm{i}(2n+1)\pi]}_{-1.0}$

$\rightarrow\; x = 0$ and $y = (n + ½)\pi$

$\rightarrow\; z = x + \mathrm{i}y = \mathrm{i}(n + ½)\pi$ (for $n = 0, \pm1, \pm2, \cdots$).