Finishing $(\sin t)y'' - 2(\cos t)y' - \sin t\, y = 0 \quad (0<t<\pi$

$$\ln|W| = \int \frac{W'}{W}\,dw = \int \frac{2}{\sin t\cos t}\,dt$$

$$= \int \frac{2\cos t}{\sin t\cos^2 t}\,dt$$

$$= \int \frac{2\cos t}{\sin t\,(1-\sin^2 t)}\,dt$$

$$= \int \frac{2}{u(1-u^2)}\,du = \int \frac{A}{1-u} + \frac{B}{1+u} + \frac{C}{u}\,du$$

$$\frac{A}{1-u} + \frac{B}{1+u} + \frac{C}{u} = \frac{2}{u(1-u^2)} \Rightarrow A(1+u)u + B(1-u)u + C(1+u)(1-u) = 2$$

let $u=0 \Rightarrow C=2$

$u=1 \Rightarrow A=1$

$u=-1 \Rightarrow B=-1$

so $$= \int \frac{1}{1-u}\ \frac{-1}{1+u} + \frac{2}{u}\,du = -\ln|1-\sin t| - \ln|1+\sin t| + 2\ln|$$

$$= \ln\left|\frac{\sin^2 t}{1-\sin^2 t}\right| = \ln|\tan^2 t|$$

$\Rightarrow \quad W = \tan^2 t$

$\Rightarrow \quad v' = \tan^2 t \quad \Rightarrow \quad v = \int \tan^2 t\,dt$

$$= \int \frac{\sin^2 t}{\cos^2 t}\,dt = \int \frac{1-\cos^2 t}{\cos^2 t}\,dt = \int \sec^2 t - 1\,dt = \underline{\underline{\tan t - t}}$$

$\Rightarrow$ can take $v = \tan t - t$

then $y_2 = (\tan t - t)\cos t$

and $\quad y = c_1\cos t + c_2(\tan t - t)\cos t \quad //$