*Find the derivative of the function. Simplify where possible.*[1]

$$y = \cos^{-1}\left(\sin^{-1}(t)\right)$$

Let's just do the straightforward derivative:

$$\begin{aligned}\frac{\mathrm{d}y}{\mathrm{d}t} &= -\frac{1}{\sqrt{1-\left(\sin^{-1}(t)\right)^2}} \cdot \frac{\mathrm{d}}{\mathrm{d}t}\left[\sin^{-1}(t)\right] \\ &= -\frac{1}{\sqrt{1-\left(\sin^{-1}(t)\right)^2}} \frac{1}{\sqrt{1-t^2}} \\ &= -\frac{1}{\sqrt{1-t^2}\sqrt{1-\left(\sin^{-1}(t)\right)^2}}\end{aligned}$$

Another possibility is to use implicit differentiation.

$$y = \cos^{-1}\left(\sin^{-1}(t)\right)$$

so

$$\begin{aligned}\cos(y) &= \cos\left(\cos^{-1}\left(\sin^{-1}(t)\right)\right) \\ \cos(y) &= \sin^{-1}(t)\end{aligned}$$

Now we differentiate both sides

$$\begin{aligned}\frac{\mathrm{d}}{\mathrm{d}t}\left[\cos(y)\right] &= \frac{\mathrm{d}}{\mathrm{d}t}\left[\sin^{-1}(t)\right] \\ -\sin(y) \cdot \frac{\mathrm{d}y}{\mathrm{d}t} &= \frac{1}{\sqrt{1-t^2}}\end{aligned}$$

so

$$\frac{\mathrm{d}y}{\mathrm{d}t} = -\frac{1}{\sin(y)\sqrt{1-t^2}}$$

Which form of the derivative we choose would depend on how we are going to use it.

[1] Stewart, *Calculus, Early Transcendentals*, p. 216, #58.