**Task:** Find the derivative of

$$y = \frac{\mathrm{t} \cdot \sin t}{1 + t}$$

**Solution:** The derivative of $y$ is $y'(t)$:

$$y'(t) = \frac{d}{dt}\left(\frac{\mathrm{t} \cdot \sin t}{1 + t}\right)$$

Use the quotient rule, $\frac{d}{dt}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dt} - u\frac{dv}{dt}}{v^2}$, where $u = t \cdot \sin t$ and $v = t + 1$:

$$y'(t) = \frac{(1 + t)\left(\frac{d}{dt}(t \cdot \sin t)\right) - t \cdot \sin t\left(\frac{d}{dt}(1 + t)\right)}{(1 + t)^2}$$

$$y'(t) = \frac{(1 + t)\left(\frac{d}{dt}(t \cdot \sin t)\right) - t \cdot \sin t}{(1 + t)^2}$$

To find $\frac{d}{dt}(t * \sin t)$ we use the product rule $\frac{d}{dt}(uv) = v\frac{du}{dt} + u\frac{dv}{dt}$, where $u = t$ and $v = \sin t$:

$$y'(t) = \frac{(1 + t)\left(t \cdot \frac{d}{dt}(\sin t) + \sin t \cdot \frac{d}{dt}(t)\right) - t \cdot \sin t}{(1 + t)^2}$$

$$y'(t) = \frac{(1 + t)(t \cdot \cos t + \sin t) - t \cdot \sin t}{(1 + t)^2}$$

So, we can open the brackets:

$$y'(t) = \frac{(1 + t)(t \cdot \cos t + \sin t) - t \cdot \sin t}{(1 + t)^2}$$

$$y'(t) = \frac{t \cdot \cos t + \sin t + t^2 \cdot \cos t + t \cdot \sin t - t \cdot \sin t}{(1 + t)^2}$$

**Answer:** the derivative of $y = \frac{\mathrm{t} \cdot \sin t}{1 + t}$ is

$$y'(t) = \frac{\sin t + t \cdot (1 + t) \cdot \cos t}{(1 + t)^2}$$