Problem 3 in Section 7.3. Find the Laplace transform of $f(t) = e^{-2t} \sin 3\pi t$.

Solution. We use: if $\mathcal{L}(f(t)) = F(s)$, then $\mathcal{L}(e^{at} f(t)) = F(s-a)$. We also use $\mathcal{L}(\sin kt) = \frac{k}{s^2+k^2}$. It follows that

$$\mathcal{L}(\sin 3\pi t) = \frac{3\pi}{s^2 + 9\pi^2}$$

and

$$\mathcal{L}(e^{-2t} \sin 3\pi t) = \boxed{\frac{3\pi}{(s+2)^2 + 9\pi^2}}.$$