Compute the following integrals using integration by parts.

(a) $\int \ln x \, dx$ with $u = \ln x$ and $dv = dx$.

(b) $\int_1^2 x \ln x \, dx$ with $u = x \ln x$ and $dv = dx$.  

(c) \( \int \arctan \, dx \) with \( u = \arctan x \) and \( dv = dx \).

(d) \( \int_{0}^{\pi/2} x^2 \cos x \, dx \) with \( u = x^2 \) and \( dv = \cos x \, dx \).