Evaluate the following integrals using integration by parts, and *check your answers!!*

1. $\int x \ln(x) \, dx$

2. $\int xe^x \, dx$

3. $\int x^3 e^{x^2} \, dx$ (Hint: $u = x^2$ and $dv = xe^{x^2} dx$)

4. $\int \ln(x) \, dx$ (Hint: $u = \ln(x)$ and $dv = dx$)

5. $\int e^x \cos(x) \, dx$