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

1. $\displaystyle\int (\ln(x))^2 \, dx$

2. $\displaystyle\int x \sec^2(x) \, dx$

3. $\displaystyle\int x^3 e^{x^2} \, dx$

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

5. $\displaystyle\int \arctan(x) \, dx$