Evaluate the following using integration by parts

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

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

Hint:
$$u = x^2$$
 and $dv = xe^{x^2}dx$

3.
$$\int \ln(x) \ dx$$

$$4. \int \ln(x)^2 dx$$