Compute the following integrals using either u-substitution or integration by parts.

1. $\displaystyle\int \frac{\ln x}{x^{3/2}}\, dx$

   $u = \ln x, dv = x^{-3/2}$, this yields

$$-2x^{-1/2}\ln x - \int (-x^{-1/2})\frac{1}{x}dx = -\frac{2\ln x}{\sqrt{x}} + \int x^{-3/2}dx = -\frac{2\ln x}{\sqrt{x}} - \frac{2}{\sqrt{x}} + C$$

2. $\displaystyle\int \arctan x\, dx$

   $u = \arctan x, dv = dx$ this yields

$$x\arctan x - \int \frac{x}{1+x^2}dx = x\arctan x - \frac{1}{2}\ln(1+x^2) + C.$$

3. $\displaystyle\int \arcsin(x)\, dx$

   $u = \arcsin x, dv = dx$ this yields

$$x\arcsin x - \int \frac{x}{\sqrt{1-x^2}}dx = x\arcsin x + \sqrt{1-x^2} + C$$

4. $\displaystyle\int e^x \ln(1+e^x)\sqrt{1+e^x}\, dx$

   First make substitution $t = 1 + e^x$. This gives

$$\int \ln(t)\sqrt{t}dt$$

   Now let $u = \ln t, dv = \sqrt{t}$, this yields

$$\frac{2}{3}t^{3/2}\ln t - \frac{2}{3}\int t^{3/2}\frac{1}{t}dt = \frac{2}{3}t^{3/2}\ln t - \frac{4}{9}t^{3/2} + C$$

   Now change back to $t = 1 + e^x$

$$\frac{2}{3}(1+e^x)^{3/2}\ln(1+e^x) - \frac{4}{9}(1+e^x)^{3/2} + C$$

5. $\displaystyle\int x^2 e^{\frac{x}{2}}\, dx$. Do integration by parts twice and be careful. Should get some variant of

$$2e^{x/2}(x^2 - 4x + 8) + C$$