Math 222 - Quiz 2 **Section:** ___________ **Name:** ___________________________

Problem 1 Calculate $\int (x^2+x+1)\, e^x\, dx$.

$$f = x^2+x+1 \rightsquigarrow f' = 2x+1$$
$$g' = e^x \rightsquigarrow g = e^x$$

$$\int (x^2+x+1)e^x\,dx = (x^2+x+1)e^x - \int (2x+1)e^x\,dx$$

$$f = 2x+1 \rightsquigarrow f' = 2$$
$$g' = e^x \rightsquigarrow g = e^x$$

$$= (x^2+x+1)e^x - \left[(2x+1)e^x - \int 2e^x\,dx\right]$$
$$= (x^2+x+1)e^x - (2x+1)e^x + 2e^x + C$$
$$= \boxed{(x^2-x+2)e^x + C}$$

Problem 2 Prove the formula:

$$\int x^m (\ln x)^n\, dx = \frac{x^{m+1}(\ln x)^n}{m+1} - \frac{n}{m+1}\int x^m (\ln x)^{n-1}\, dx$$

$$f = (\ln x)^n \rightsquigarrow f' = n(\ln x)^{n-1}\cdot\frac{1}{x}$$
$$g' = x^m \rightsquigarrow g = \frac{1}{m+1}x^{m+1}$$

$$\int x^m(\ln x)^n\,dx = \frac{x^{m+1}(\ln x)^n}{m+1} - \int n(\ln x)^{n-1}\cdot\frac{1}{\cancel{x}}\cdot\frac{1}{m+1}\cdot x^{m+\cancel{1}}\,dx$$

$$\Rightarrow \boxed{\int x^m(\ln x)^n\,dx = \frac{x^{m+1}(\ln x)^n}{m+1} - \frac{n}{m+1}\int x^m(\ln x)^{n-1}\,dx}$$