Calculus II
Homework on Lecture 3

1. Evaluate the indefinite integral. Illustrate the steps of your solutions.

   (a) $\int x \sin x \mathrm{d}x$.

   (b) $\int x e^{-x} \mathrm{d}x$.

   (c) $\int x^2 e^{x} \mathrm{d}x$.

   (d) $\int x \sin(-2x) \mathrm{d}x$.

   (e) $\int x^2 \cos(3x) \mathrm{d}x$.

   (f) $\int x^2 e^{-2x} \mathrm{d}x$.

   (g) $\int x \sin(2x) \mathrm{d}x$.

   (h) $\int x \cos(3x) \mathrm{d}x$.

   (i) $\int x^2 e^{2x} \mathrm{d}x$.

   (j) $\int x^3 e^{x} \mathrm{d}x$.

2. Evaluate the indefinite integral. Illustrate the steps of your solutions.

   (a) $\int x^2 \cos(2x) \mathrm{d}x$.

   (b) $\int x^2 e^{ax} \mathrm{d}x$, where a is a constant.

   (c) $\int x^2 e^{-ax} \mathrm{d}x$, where a is a constant.

   (d) $\int x^2 \dfrac{(e^{ax}+e^{-ax})^2}{4} \mathrm{d}x$, where a is a constant.

   (e) $\int \dfrac{1}{\cos^2 x} \mathrm{d}x$. (Hint: This problem does not require integration by parts. What is the derivative of $\tan x$?)

   (f) $\int (\tan^2 x) \mathrm{d}x$. (Hint: This problem does not require integration by parts. We can use $\tan^2 x = \frac{1}{\cos^2 x} - 1$ and the previous problem.)

   (g) $\int x \tan^2 x \mathrm{d}x$. (Hint: $\tan^2 x \mathrm{d}x = \mathrm{d}(F(x))$, where $F(x)$ is the answer from the preceding problem).

   (h) $\int e^{-\sqrt{x}} \mathrm{d}x$.

   (i) $\int \cos^2 x \, \mathrm{d}x$.

   (j) $\int \dfrac{x}{1+x^2} \mathrm{d}x$ (Hint: use substitution rule, don't use integration by parts)

   (k) $\int (\arctan x) \mathrm{d}x$.

   (l) $\int (\arcsin x) \mathrm{d}x$.

   (m) $\int (\arcsin x)^2 \mathrm{d}x$. (Hint: Try substituting $x = \sin y$.)

   (n) $\int \arctan\left(\dfrac{1}{x}\right) \mathrm{d}x$.

   (o) $\int \sin x e^{x} \mathrm{d}x$

   (p) $\int \cos x e^{x} \mathrm{d}x$

   (q) $\int \sin(\ln(x)) \mathrm{d}x$.

   (r) $\int \cos(\ln(x)) \mathrm{d}x$.

   (s) $\int \ln x \mathrm{d}x$

   (t) $\int x \ln x \, \mathrm{d}x$.

   (u) $\int \dfrac{\ln x}{\sqrt{x}} \mathrm{d}x$.

   (v) $\int (\ln x)^2 \mathrm{d}x$.

   (w) $\int (\ln x)^3 \mathrm{d}x$.

   (x) $\int x^2 \cos^2 x \mathrm{d}x$. (This problem is related to Problem 2.d as $\cos x = \frac{e^{ix}+e^{-ix}}{2}$).

3. Compute $\int x^n e^x \mathrm{d}x$, where n is a non-negative integer.