Fundamental Mathematics for Robotics
Homework Set #11-1, Dr.T

[1] Find the following anti-derivatives.
- (a) $\int sin3t \cdot cos3t\, dt$
- (b) $\int cos^2 u\, du$
- (c) $\int sin2x \cdot sin3x\, dx$
- (d) (Extra) $\int sin^3\theta\, d\theta$

[2] Evaluate the following integrals.
- (a) $\int \sqrt{x^3+2}x^2 dx$
- (b) $\int sin^2\theta\, cos\,\theta\, d\theta$
- (c) $\int 12(e^x+1)^5 e^x\, dx$
- (d) (Extra) $\int x^2\sqrt{x+1}\, dx$

[3] Evaluate the following integrals.
- (a) $\int_{-1}^{1}(2-x^2)\, dx$
- (b) $\int_{0}^{2}(2-x)^2\, dx$
- (c) $\int_{1}^{4}\frac{1}{\sqrt{x}} dx$
- (d) $\int_{-1}^{1}(e^t+e^{-t})\, dt$
- (e) $\int_{0}^{2\pi} sin\, x\, dx$
- (f) (Extra) $\int_{0}^{2\pi} sin^2 x\, dx$

[4] Let us compute the improper definite integral $I(n)=\int_0^\infty t^{n-1}e^{-t}dt$ through the following steps.
- (a) Compute $I(1)$.
- (b) Compute $I(2)$. (Hint: The last problem of HW Set #10)
- (c) Find the relationship between $I(2)$ and $I(1)$.
- (d) Find the relationship between $I(n+1)$ and $I(n)$.
- (e) Use the result in part (d) recursively to find $I(n+1)$.