

## **BSc 2 Software Design (Game/Web Dev)**

### **Integral Calculus Tutorial I**

#### **Integration by Parts**

Evaluate each of the following integrals:

1.  $\int_0^{\pi/2} 3x^2 \cos(x) dx$
2.  $\int \cosh(x) e^{2x} dx$
3.  $\int \sin(x) \sinh(x) dx$
4.  $\int_0^{\pi} (6x^2 - 4x + 2) \sin(x) dx$

#### **Integration by Substitution**

Evaluate each of the following integrals:

1.  $\int 3x^2 \sin(x^3) dx$
2.  $\int \frac{2x}{\sqrt{1-x^2}} dx$
3.  $\int e^{\sin(x)} \cos(x) dx$
4.  $\int_0^{\pi} \cos^{2n}(x) \sin(x) dx; \quad \forall n \in \mathbb{N}$

#### **Miscellaneous**

Evaluate each of the following

1. Prove that

$$\int e^{ax} \cos(bx) dx = \frac{e^{ax}}{a^2 + b^2} (a \cos(bx) + b \sin(bx)) + C; \quad \forall a, b, C \in \mathbb{R}, a^2 + b^2 \neq 0.$$

2. Evaluate

$$\int_0^{\pi/2} (\cos(x))^{2n} dx \quad \forall n \in \mathbb{N}$$

3. Show that

$$\int_0^{\pi/2} \sin^{2n}(x) dx = \frac{2n-1}{2n} \times \frac{2n-3}{2n-2} \times \dots \times \frac{3}{4} \times \frac{\pi}{4} \quad \forall n \in \mathbb{N}$$

4. Show that

$$\int \frac{1}{ax^2 + bx + c} dx = \frac{2}{\sqrt{4ac - b^2}} \left( \tan^{-1} \left( \frac{2ax + b}{\sqrt{4ac - b^2}} \right) \right) + C \Leftrightarrow 4ac > b^2$$