

**BRIEF MATHEMATICAL TABLES FOR ECE 220**

**A. INTEGRALS**

$$1. \int \frac{dx}{\sqrt{x^2 \pm a^2}} = \ln(x + \sqrt{x^2 \pm a^2})$$

$$2. \int \frac{x dx}{\sqrt{x^2 \pm a^2}} = \sqrt{x^2 \pm a^2}$$

$$3. \int \frac{x^2 dx}{\sqrt{x^2 \pm a^2}} = \frac{x}{2} \sqrt{x^2 \pm a^2} \mp \frac{a^2}{2} \ln(x + \sqrt{x^2 \pm a^2})$$

$$4. \int \frac{dx}{(\sqrt{x^2 \pm a^2})^3} = \frac{\pm x}{a^2 \sqrt{x^2 \pm a^2}}$$

$$5. \int \frac{x dx}{(\sqrt{x^2 \pm a^2})^3} = \frac{-1}{\sqrt{x^2 \pm a^2}}$$

$$6. \int \frac{x^2 dx}{(\sqrt{x^2 \pm a^2})^3} = \frac{-x}{\sqrt{x^2 \pm a^2}} + \ln(x + \sqrt{x^2 \pm a^2})$$

$$7. \int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right)$$

$$8. \int \frac{x dx}{x^2 + a^2} = \frac{1}{2} \ln(x^2 + a^2)$$

$$9. \int \sin^n x dx = -\left[\frac{\sin^{n-1} x \cos x}{n}\right] + \frac{n-1}{n} \int \sin^{n-2} x dx, \quad n > 1$$

$$10. \int \cos^n x dx = \left[\frac{\cos^{n-1} x \sin x}{n}\right] + \frac{n-1}{n} \int \cos^{n-2} x dx, \quad n > 1$$

**B. BINOMIAL SERIES:**

$$(1 \pm x)^n = 1 \pm nx + \frac{1}{2!} n(n-1)x^2 \pm \frac{1}{3!} n(n-1)(n-2)x^3 + \dots \quad \text{for } x^2 < 1$$

$$(1 \pm x)^{-n} = 1 \mp nx + \frac{1}{2!} n(n+1)x^2 \mp \frac{1}{3!} n(n+1)(n+2)x^3 + \dots \quad \text{for } x^2 < 1$$

**C. HYPERBOLIC IDENTITIES:**

$$\ln[\sqrt{x^2 + 1} + x] = \sinh^{-1}(x),$$

$$\ln[\sqrt{x^2 - 1} + x] = \cosh^{-1}(x)$$