MATH 277 OFFICIAL FORMULA SHEET

A: BASIC INTEGRALS

Let r , a , $b \in \mathbb{R}$, $r \neq -1$, and $a \neq 0$.

1. $\int x^r \, dx = \frac{x^{r+1}}{r+1} + C$ 2. $\int \frac{1}{ax+b} \, dx = \frac{1}{a} \ln | ax + b | + C$ 3. $\int e^{ax} \, dx = \frac{1}{a} e^{ax} + C$

4. $\int \sin(ax) \, dx = -\frac{1}{a} \cos(ax) + C$ 5. $\int \cos(ax) \, dx = \frac{1}{a} \sin(ax) + C$

B: BASIC TRIGONOMETRIC IDENTITIES

(i) $\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$ (ii) $\cot(\theta) = \frac{\cos(\theta)}{\sin(\theta)}$ (iii) $\sec(\theta) = \frac{1}{\cos(\theta)}$ (iv) $\csc(\theta) = \frac{1}{\sin(\theta)}$

(v) $\cos^2(\theta) + \sin^2(\theta) = 1$ (vi) $1 + \tan^2(\theta) = \sec^2(\theta)$ (vii) $\cot^2(\theta) + 1 = \csc^2(\theta)$

$(viii)$ $\sin(2\theta) = 2\sin(\theta)\cos(\theta)$ (ix) $\cos(2\theta) = 2\cos^2(\theta) - 1$ (x) $\cos(2\theta) = 1 - 2\sin^2(\theta)$

C: BASIC HYPERBOLIC IDENTITIES

(i) $\tanh(x) = \frac{\sinh(x)}{\cosh(x)}$ (ii) $\coth(x) = \frac{\cosh(x)}{\sinh(x)}$ (iii) $\operatorname{sech}(x) = \frac{1}{\cosh(x)}$ (iv) $\operatorname{csch}(x) = \frac{1}{\sinh(x)}$

(v) $\cosh^2(x) - \sinh^2(x) = 1$ (vi) $1 - \tanh^2(\theta) = \operatorname{sech}^2(\theta)$ (vii) $\coth^2(\theta) - 1 = \operatorname{csch}^2(\theta)$

$(viii)$ $\sinh(2x) = 2\sinh(x)\cosh(x)$ (ix) $\cosh(2x) = 2\cosh^2(x) - 1$ (x) $\cosh(2x) = 1 + 2\sinh^2(x)$

C: Other Formulae

Let $\vec{\mathbf{v}}(t)$, $\vec{\mathbf{a}}(t)$ and $\mathbf{v}(t)$ be respectively **velocity** , **acceleration** and **speed** of a moving object in three space.

The unit Tangent $\vec{\mathbf{T}}$, the Principal unit Normal $\vec{\mathbf{N}}$, the unit Binormal $\vec{\mathbf{B}}$, the curvature $\boldsymbol{\kappa}$, the radius of curvature $\boldsymbol{\rho}$ and the Torsion $\boldsymbol{\tau}$ are given by :

(i) $\vec{\mathbf{T}} = \frac{\vec{\mathbf{v}}(t)}{\mathbf{v}(t)}$ (ii) $\vec{\mathbf{N}} = \vec{\mathbf{B}} \times \vec{\mathbf{T}}$ (iii) $\vec{\mathbf{B}} = \frac{\vec{\mathbf{v}}(t) \times \vec{\mathbf{a}}(t)}{\| \vec{\mathbf{v}}(t) \times \vec{\mathbf{a}}(t) \|}$ (iv) $\boldsymbol{\kappa} = \frac{\| \vec{\mathbf{v}}(t) \times \vec{\mathbf{a}}(t) \|}{\mathbf{v}^3}$

(v) $\boldsymbol{\rho} = \frac{1}{\boldsymbol{\kappa}}$ (vi) $\boldsymbol{\tau} = \frac{\left[\vec{\mathbf{v}}(t) \times \vec{\mathbf{a}}(t) \right] \cdot \frac{d\vec{a}(t)}{dt}}{\| \vec{\mathbf{v}}(t) \times \vec{\mathbf{a}}(t) \|^2}$ (vii) $a_{\mathbf{T}} = \frac{d\mathbf{v}}{dt}$ $(viii)$ $a_{\mathbf{N}} = \boldsymbol{\kappa}\, \mathbf{v}^2$

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