

LIST OF USEFUL IDENTITIES

1. DERIVATIVES

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|---|---|
| (1) $\frac{d}{dx} x^n = nx^{n-1}$ | (7) $\frac{d}{dx} \csc x = -\csc x \cot x$ |
| (2) $\frac{d}{dx} \sin x = \cos x$ | (8) $\frac{d}{dx} e^x = e^x$ |
| (3) $\frac{d}{dx} \cos x = -\sin x$ | (9) $\frac{d}{dx} \ln x = \frac{1}{x}$ |
| (4) $\frac{d}{dx} \tan x = \sec^2 x$ | (10) $\frac{d}{dx} \arcsin x = \frac{1}{\sqrt{1-x^2}}$ |
| (5) $\frac{d}{dx} \cot x = -\csc^2 x$ | (11) $\frac{d}{dx} \arccos x = \frac{-1}{\sqrt{1-x^2}}$ |
| (6) $\frac{d}{dx} \sec x = \sec x \tan x$ | (12) $\frac{d}{dx} \arctan x = \frac{1}{1+x^2}$ |

2. TRIGONOMETRY

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|---|---|
| (1) $\sin^2 x + \cos^2 x = 1$ | (5) $\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$ |
| (2) $\tan^2 x + 1 = \sec^2 x$ | (6) $\sin^2 x = \frac{1-\cos 2x}{2}$ |
| (3) $1 + \cot^2 x = \csc^2 x$ | (7) $\cos^2 x = \frac{1+\cos 2x}{2}$ |
| (4) $\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$ | |

3. SPACE CURVES

For a parametric space curve given by $\vec{r}(t)$

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|---------------------------------------|---|
| (1) Curvature | $\kappa = \frac{ r'(t) \times r''(t) }{ r'(t) ^3}.$ |
| (2) Tangent component of acceleration | $a_T = r'(t) ' = \frac{r'(t) \cdot r''(t)}{ r'(t) }.$ |
| (3) Normal component of acceleration | $a_N = \kappa r'(t) ^2 = \frac{ r'(t) \times r''(t) }{ r'(t) }.$ |