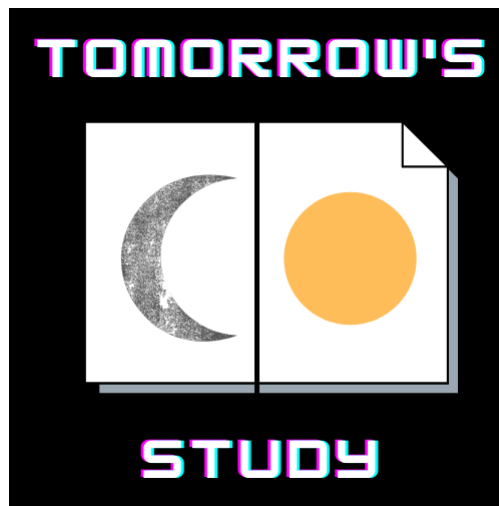


Calculus 1 Formulas

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Version Final



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1 Trigonometric Identities

Theorem 1 (Pythagorean Identity)

- $\cos^2 \theta + \sin^2 \theta = 1$
- $\sec^2 \theta - \tan^2 \theta = 1$

Theorem 2 (Range)

- $-1 \leq \cos \theta \leq 1$
- $-1 \leq \sin \theta \leq 1$

Theorem 3 (Periodicity)

- $\cos(\theta \pm 2\pi) = \cos \theta$
- $\sin(\theta \pm 2\pi) = \sin \theta$

Theorem 4 (Symmetry)

- $\cos(-\theta) = \cos \theta$
- $\sin(-\theta) = -\sin \theta$

Theorem 5 (Sum and Difference Identities)

- $\cos(A + B) = \cos A \cos B - \sin A \sin B$
- $\cos(A - B) = \cos A \cos B + \sin A \sin B$
- $\sin(A + B) = \sin A \cos B + \cos A \sin B$
- $\sin(A - B) = \sin A \cos B - \cos A \sin B$

Theorem 6 (Complementary Angle Identities)

- $\cos(\frac{\pi}{2} - \theta) = \sin \theta$
- $\sin(\frac{\pi}{2} - \theta) = \cos \theta$

Theorem 7 (Double Angle Identities)

- $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$
- $\sin 2\theta = 2 \sin \theta \cos \theta$

Theorem 8 (Half-Angle Identities)

- $\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$
- $\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$

2 Derivatives

Theorem 9 (Differentiation Rules)

Function	Derivative
$f(x) = cx^a, a \neq 0, c \in \mathbb{R}$	$f'(x) = cax^{a-1}$
$f(x) = \sin(x)$	$f'(x) = \cos(x)$
$f(x) = \cos(x)$	$f'(x) = -\sin(x)$
$f(x) = \tan(x)$	$f'(x) = \sec^2(x)$
$f(x) = \sec(x)$	$f'(x) = \sec(x) \tan(x)$
$f(x) = \arcsin(x)$	$f'(x) = \frac{1}{\sqrt{1-x^2}}$
$f(x) = \arccos(x)$	$f'(x) = -\frac{1}{\sqrt{1-x^2}}$
$f(x) = \arctan(x)$	$f'(x) = \frac{1}{1+x^2}$
$f(x) = e^x$	$f'(x) = e^x$
$f(x) = a^x$ with $a > 0$	$f'(x) = a^x \ln(a)$
$f(x) = \ln(x)$ for $x > 0$	$f'(x) = \frac{1}{x}$

Theorem 10 (Antiderivatives)

$\int x^n dx = \frac{x^{n+1}}{n+1} + C$
$\int \frac{1}{x} dx = \ln(x) + C$
$\int e^x dx = e^x + C$
$\int \sin(x) dx = -\cos(x) + C$
$\int \cos(x) dx = \sin(x) + C$
$\int \sec^2(x) dx = \tan(x) + C$
$\int \frac{1}{1+x^2} dx = \arctan(x) + C$
$\int \frac{1}{\sqrt{1-x^2}} dx = \arcsin(x) + C$
$\int \frac{-1}{\sqrt{1-x^2}} dx = \arccos(x) + C$
$\int \sec(x) \tan(x) dx = \sec(x) + C$

Theorem 11 (n-th degree Taylor Polynomial for f centered at $x = a$)

$$\begin{aligned}
 T_{n,a}(x) &= \sum_{k=0}^n \frac{f^{(k)}(a)}{k!} (x-a)^k \\
 &= f(a) + f'(a)(x-a) + \frac{f''(a)}{2!} (x-a)^2 + \dots + \frac{f^{(n)}(a)}{n!} (x-a)^n
 \end{aligned}$$