Greek Alphabet

| α | A | alpha |
| β | B | beta |
| γ | Γ | gamma |
| δ | Δ | delta |
| ε | E | epsilon |
| ζ | Z | zeta |
| η | H | eta |
| θ | Θ | theta |
| ι | I | iota |
| κ | K | kappa |
| λ | Λ | lambda |
| μ | M | mu |
| ν | N | nu |
| ξ | Ξ | xi |
| ο | O | omicron |
| π | Π | pi |
| ρ | P | rho |
| σ | Σ | sigma |
| τ | T | tau |
| υ | Υ | upsilon |
| ϕ | Φ | phi |
| χ | X | chi |
| ψ | Ψ | psi |
| Ω | Ω | omega |

Notation

\[
U'' = \frac{d^2u}{dx^2}
\]

\[
u' = \frac{du}{dx}\]

\[
u^{(r)} = \frac{d^ru}{dx^r}\]

\[
\ddot{u} = \frac{d^2u}{dt^2}
\]

Properties of trigonometric functions

\[
\tan x = \frac{\sin x}{\cos x} \quad \cot x = \frac{\cos x}{\sin x} \]

\[
\sec x = \frac{1}{\cos x} \quad \cosec x = \frac{1}{\sin x} \]

\[
\cos^2 x + \sin^2 x = 1 \quad 1 + \tan^2 x = \sec^2 x \]

\[
\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B \quad \sin 2A = 2 \sin A \cos A \]

\[
\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B \quad \cos 2A = 2 \cos^2 A - 1 = 1 - 2 \sin^2 A
\]

\[
\sin A + \sin B = 2 \sin \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B) \]

\[
\sin A - \sin B = 2 \sin \frac{1}{2}(A - B) \cos \frac{1}{2}(A + B) \]

\[
\cos A + \cos B = 2 \cos \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B) \]

\[
\cos A - \cos B = 2 \sin \frac{1}{2}(A + B) \sin \frac{1}{2}(B - A) \]

Rules for differentiation

If \( f(x) = x^n \) then \( f'(x) = nx^{n-1} \)

Product rule \( \frac{d}{dx}(fg) = \frac{df}{dx}g + \frac{dg}{dx}f \)

Quotient rule \( \frac{d}{dx}\left(\frac{f}{g}\right) = \frac{\frac{df}{dx}g - \frac{dg}{dx}f}{g^2} \)

Function of a function. If \( f(x) = F(u(x)) \) then \( \frac{df}{dx} = \frac{dF}{du} \frac{du}{dx} \)

Derivatives of common functions

\[
\frac{d}{dx}\sin x = \cos x \quad \frac{d}{dx}\cos x = -\sin x
\]

\[
\frac{d}{dx}\tan x = \sec^2 x \quad \frac{d}{dx}\ln x = \frac{1}{x}
\]

\[
\frac{d}{dx}e^x = e^x
\]
Taylor Series

\[ f(x) = f(a) + f'(a)(x-a) + \frac{1}{2} f''(a)(x-a)^2 + \frac{1}{3!} f'''(a)(x-a)^3 + \cdots \]

\[ f(a + h) = f(a) + f'(a)h + \frac{1}{2} f''(a)h^2 + \frac{1}{3!} f'''(a)h^3 + \cdots \]

Maclaurin series

\[ f(x) = f(0) + f'(0)x + \frac{1}{2} f''(0)x^2 + \frac{1}{3!} f'''(0)x^3 + \cdots \]

Standard expansions:

\[ \frac{1}{1-x} = 1 + x + x^2 + x^3 + \cdots \quad (-1 < x < 1) \]

\[ (1 + x)^a = 1 + ax + \frac{a(a-1)}{2} x^2 + \frac{a(a-1)(a-2)}{3!} x^3 + \cdots \quad (-1 < x < 1) \]

\[ \ln(1 + x) = x - \frac{1}{2} x^2 + \frac{1}{3} x^3 - \frac{1}{4} x^4 + \cdots \quad (-1 < x \leq 1) \]

\[ e^x = 1 + x + \frac{1}{2} x^2 + \frac{1}{3!} x^3 + \frac{1}{4!} x^4 + \cdots \]

\[ \sin x = x - \frac{1}{3!} x^3 + \frac{1}{5!} x^5 - \cdots \]

\[ \cos x = 1 - \frac{1}{2} x^2 + \frac{1}{4!} x^4 - \cdots \]

\[ \tan x = x + \frac{1}{3} x^3 + \frac{2}{15} x^5 + \cdots \quad \left( -\frac{\pi}{2} < x < \frac{\pi}{2} \right) \]

Standard integrals

<table>
<thead>
<tr>
<th>( f(x) )</th>
<th>( \int f(x) , dx )</th>
<th>( f(x) )</th>
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<tbody>
<tr>
<td>( x^a )</td>
<td>( \frac{1}{a+1} x^{a+1} ) ( a \neq -1 )</td>
<td>( e^{kx} )</td>
<td>( \frac{1}{k} e^{kx} )</td>
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<td>( \cos kx )</td>
<td>( \frac{1}{k} \sin kx )</td>
<td>( \ln</td>
<td>x</td>
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<tr>
<td>( \sin kx )</td>
<td>( -\frac{1}{k} \cos kx )</td>
<td>( (x^2 - a^2)^{-\frac{1}{2}} )</td>
<td>( \ln [x + \sqrt{(x^2 + b)}] )</td>
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<tr>
<td>( \tan kx )</td>
<td>( -\frac{1}{k} \ln</td>
<td>\cos kx</td>
<td>)</td>
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<tr>
<td>( \cot kx )</td>
<td>( -\frac{1}{k} \ln</td>
<td>\sin kx</td>
<td>)</td>
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<td>( \sec^2 kx )</td>
<td>( \frac{1}{k} \tan kx )</td>
<td>( \ln</td>
<td>f(x)</td>
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<td>( \csc^2 kx )</td>
<td>( -\frac{1}{k} \cot kx )</td>
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