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2.4 Derivatives of Trigonometric Functions

$f(x)$	$f'(x)$
$\sin u$	$u' \cos u$
$\cos u$	$-u' \sin u$
$\tan u$	$u' \sec^2 u$
$\cot u$	$-u' \csc^2 u$
$\sec u$	$u' \sec u \cdot \tan u$
$\csc u$	$-u' \csc u \cdot \cot u$

Exercise :

(a) If $f(x) = \sin 3x$, $find\ f'(x)$

Solution

$$f'(x) = 3\cos 3x$$

(b) If $f(x) = \cos x^2$, $find\ f'(x)$

Solution

$$f'(x) = -2x \sin x^2$$

(c) If $f(x) = \sec 5x^3$, $find\ f'(x)$

Solution

$$f'(x) = 15x^2 \sec 5x^3 \cdot \tan 5x^3$$

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Example 1 : Find $D_x(3\sin x - 2\cos x)$

Solution

$$D_x(3\sin x - 2\cos x) = \mathbf{3\cos x + 2\sin x}$$

Example 2 : Find the equation of the tangent line to the graph of $y = 3\sin x$ at the point $(\pi, 0)$

Solution

- Equation of tangent line :

$$\boldsymbol{y - y_1 = y'(x - x_1)}$$

Thus:

$$y' = 3\cos x = 3\cos\pi = -3$$

$\therefore$ Equation of tangent line:

$$y - 0 = -3(x - \pi)$$

$$\boldsymbol{y = -3x + 3\pi}$$

Example 3 : Find $D_x(x^2\sin x)$

Solution

$$D_x(x^2\sin x) = \mathbf{2x\sin x + x^2\cos x}$$

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Example 4 : Find $\frac{d}{dx}\left(\frac{1+\sin x}{\cos x}\right)$

Solution

$$\frac{d}{dx}\left(\frac{1+\sin x}{\cos x}\right) = \frac{[(\cos x)(\cos x)] - [(1+\sin x)(-\sin x)]}{\cos^2 x}$$

$$= \frac{[\cos^2 x] - [-\sin x - \sin^2 x]}{\cos^2 x} = \frac{\cos^2 x + \sin x + \sin^2 x}{\cos^2 x}$$

$$= \frac{\mathbf{1+\sin x}}{\mathbf{\cos^2 x}}$$