AP Calculus AB

Derivatives of Sine & Cosine

1) $y = \sin(3x^2 - 4x)$

$y' = \cos\,[3x^2-4x]\; d\,[3x^2-4x]$

$y' = (6x-4)\cos(3x^2-4x)$

2) $y = -5\cos(x^3)$

$y' = 5\sin\,[x^3]\; d\,[x^3]$

$y' = 5\sin(x^3)\cdot(3x^2)$

$y' = 15x^2\sin(x^3)$

3) $f(x) = \cos^2 x$

$f(x) = [\cos[x]]^2$

$f'(x) = 2\,[\cos[x]]\cdot d\,[\cos[x]]$

$f'(x) = 2\cos x\cdot(-\sin[x]\cdot d[x])$

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

4) $y = [\sin x]\cos x$

$y' = [\sin x]\; d\cos x + \cos x\; d\,[\sin x]$

$y' = \sin x(-\sin x) + \cos x(\cos x)$

$y' = -\sin^2 x + \cos^2 x$

5) $y = [2x]\cos x$

$y' = [2x]\; d\cos x + \cos x\; d\,[2x]$

$y' = 2x(-\sin x) + 2\cos x$

$y' = -2x\sin x + 2\cos x$

6) $f(x) = \frac{1}{x} + 5\sin x$

$f(x) = x^{-1} + 5\sin x$

$f'(x) = -x^{-2} + 5\cos x$

7) $y = \frac{[x]}{\cos x}$

$y' = \frac{\cos x\; d\,[x] - [x]\; d\cos x}{(\cos x)^2}$

$y' = \frac{\cos x + x\sin x}{\cos^2 x}$

DON'T CANCEL!!

8) $f(x) = \frac{\cos x}{1+\sin x}$

$f'(x) = \frac{(1+\sin x)(-\sin x) - (\cos x)(\cos x)}{(1+\sin x)^2}$

$f'(x) = \frac{-\sin x - \sin^2 x - \cos^2 x}{(1+\sin x)^2}$

$= \frac{-1\,(\sin x + \sin^2 x + \cos^2 x)}{(1+\sin x)^2}$

$= \frac{-1\,(\sin x + 1)}{(1+\sin x)^2}$

$f'(x) = \frac{-1}{1+\sin x}$

9) $y = (1+\cos[2x])^3$

$y' = 3\,[1+\cos 2x]^2\; d\,[1+\cos[2x]]$

$3(1+\cos 2x)^2\cdot(-\sin[2x]\; d[2x])$

$= 3(1+\cos 2x)^2(-\sin(2x)\cdot 2)$

$= -6(1+\cos 2x)^2\sin 2x$

10) $y = \sin^2(3\pi t - 2) = [\sin(3\pi t - 2)]^2$

$y' = 2[\sin(3\pi t-2)] \cdot d[\sin(3\pi t-2)]$

$\cdot \cos(3\pi t-2) \cdot d(3\pi t-2)$

$\boxed{y' = 2\sin(3\pi t-2) \cdot \cos(3\pi t-2) \cdot (3\pi)}$

11) $f(x) = \sin(x) + 3 \quad x = \frac{\pi}{6}$

point: $\left(\frac{\pi}{6}, \frac{7}{2}\right)$

slope: $f'(x) = \cos x$

$f'\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$

$y - \frac{7}{2} = \frac{\sqrt{3}}{2}\left(x - \frac{\pi}{6}\right)$

12) $f(x) = \sin x + \cos x \quad x = \pi$

point: $(\pi, -1)$

slope: $f'(x) = \cos x - \sin x$

$f'(\pi) = -1$

Normal: $y + 1 = 1(x - \pi)$

13) $f(x) = \cos x$ Horizontal tangents $\rightarrow f'(x) = 0$

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

$-\sin x = 0$

$\boxed{x = \pi}$