AP Calculus AB - Worksheet 35 **Derivatives of Trigonometric Functions**

Know the following Theorems

$\frac{d}{dx}\tan\square = \sec^2\square\cdot\frac{d\square}{dx}$	$\frac{d}{dx}\cot\square = -\csc^2\square\cdot\frac{d\square}{dx}$	$\frac{d}{dx}\sec\square = \sec\square\tan\square\cdot\frac{d\square}{dx}$	$\frac{d}{dx}\csc\square = -\csc\square\cot\square\cdot\frac{d\square}{dx}$

Examples

1. $y=\tan 5x$ $y=\tan\boxed{5x}$ $y'=\sec^2\boxed{5x}\cdot 5$ $y'=5\sec^2\boxed{5x}$	2. $y=\sec 5x$ $y=\sec\boxed{5x}$ $y'=\sec\boxed{5x}\tan\boxed{5x}\cdot 5$ $y'=5\sec\boxed{5x}\tan\boxed{5x}$	3. $y=\cot^4 3x$ $y=\boxed{\cot\boxed{3x}}^4$ $y'=4\boxed{\cot\boxed{3x}}^3\left[-\csc^2\boxed{3x}\right]\cdot 3$ $y'=-12\boxed{\cot\boxed{3x}}^3\csc^2\boxed{3x}$	4. $y=\csc^3 2x$ $y=\boxed{\csc\boxed{2x}}^3$ $y'=3\boxed{\csc\boxed{2x}}^2\left[-\csc\boxed{2x}\cot\boxed{2x}\right]\cdot 2$ $y'=-6\boxed{\csc\boxed{2x}}^3\cot\boxed{2x}$

Use the **quotient rule** to **prove** the derivative of: [Hint: change into sin x and cos x and then take derivative]

1. $\tan x$ 2. $\cot x$ 3. $\sec x$ 4. $\csc x$

Directions: Find dy/dx.

5. $y = \sec 4x$	6. $y = \tan 3x - \cot 3x$	7. $y = \cot 5x + \csc 5x$
8. $y = \csc^3(2x)$	9. $y = \tan x + \cot x$	10. $y = 4\sec x - 2\csc x$
11. $y = 3\sec x(\tan x)$	12. $y = \sin x(\tan x)$	13. $y = \cot x(\csc x)$
14. $y = \cos x(\cot x)$	15. $y = \frac{2\cos x}{x+1}$	16. $y = \frac{\sin x}{x}$
17. $y = \frac{\sin x}{1-\cos x}$	18. $y = \frac{x+2}{\cos x}$	19. $y = \frac{\tan x}{\cos x - 4}$
20. $y = \frac{\cot x}{1-\sin x}$		

Answers:

1. $\sec^2 x$	2. $-\csc^2 x$	3. $\sec x\tan x$
4. $-\csc x\cot x$	5. $4\sec 4x\tan 4x$	6. $3\left(\sec^2 3x+\csc^2 3x\right)$
7. $-5\csc 5x\left(\csc 5x+\cot 5x\right)$	8. $-6\csc^3(2x)\cot(2x)$	9. $\sec^2 x-\csc^2 x$
10. $2(2\sec x\tan x+\csc x\cot x)$	11. $3\sec x\left(\tan^2 x+\sec^2 x\right)$	12. $\sin x(1+\sec^2 x)$
13. $-\csc x(\csc^2 x+\cot^2 x)$	14. $-\cos x(1+\csc^2 x)$	15. $\frac{-2(x\sin x+\sin x+\cos x)}{(x+1)^2}$
16. $\frac{x\cos x-\sin x}{x^2}$	17. $\frac{1}{\cos x-1}$	18. $\frac{\cos x+x\sin x+2\sin x}{\cos^2 x}$
19. $\frac{\sec x-4\sec^2 x+\tan x\sin x}{(\cos x-4)^2}$	20. $\frac{-\csc^2 x+\csc x+\cot x\cos x}{(1-\sin x)^2}$	