

Unit 3: Derivatives of Trigonometric Functions

Name: _____

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

$$f'(x) = \lim_{h \rightarrow 0} \frac{\sin(x+h) - \sin x}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\sin x \cosh + \cos x \sinh - \sin x}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\sin x \cosh - \sin x}{h} + \frac{\cos x \sinh}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{-\sin x(-\cosh + 1)}{h} + (\cos x) \left(\frac{\sinh}{h} \right)$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{-\sin x(1 - \cosh)}{h} + (\cos x) \left(\frac{\sinh}{h} \right)$$

$$f'(x) = (-\sin x)(0) + \cos x(1)$$

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

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

$$f'(x) = \lim_{h \rightarrow 0} \frac{\cos(x+h) - \cos x}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\cos x \cosh - \sin x \sinh - \cos x}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\cos x \cosh - \cos x}{h} - \frac{\sin x \sinh}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} (-\cos x) \left(\frac{-\cosh + 1}{h} \right) - (\sin x) \left(\frac{\sinh}{h} \right)$$

$$f'(x) = (-\cos x)(0) - (\sin x)(1)$$

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

With $f'(x)$ for both sine and cosine, what is the derivative for $f(x) = \tan x$?

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Derivative Shortcuts

Derivatives of Reciprocal Trigonometric Functions

What is the derivative for $f(x) = \csc x$? (Remember: $\csc x =$)

What is the derivative for $f(x) = \sec x$? (Remember: $\sec x =$)

What is the derivative for $f(x) = \cot x$? (Remember: $\cot x =$)

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Derivatives of Trigonometric Functions

$\frac{d}{dx} \sin(x) = \cos(x)$	$\frac{d}{dx} \csc(x) = -\csc(x) \cot(x)$
$\frac{d}{dx} \cos(x) = -\sin(x)$	$\frac{d}{dx} \sec(x) = \sec(x) \tan(x)$
$\frac{d}{dx} \tan(x) = \sec^2(x)$	$\frac{d}{dx} \cot(x) = -\csc^2(x)$

Examples:

For each equation find $\frac{dy}{dx}$

1. $f(x) = 7x^2 \sin x$

2. $g(x) = \frac{\cot x}{6x^3}$

3. $h(x) = \sec x - \sin x$

4. $f(x) = \tan x \cdot \csc x \cdot \cos^2 x$

5. $f(x) = \sin^3 x + \frac{\sin x}{\sec^2 x}$

6. $f(x) = \frac{\cos x + \sin x}{\sin x}$

Unit 3 Worksheet 2

AP Calculus AB**Find $f'(x)$ for each of the following.**

1. $f(x) = 4x^3 \cos x$

2. $f(x) = \frac{x^5}{\tan x}$

3. $f(x) = \sin x + \cot x$

4. $f(x) = \sin x \cos x$

5. $f(x) = \frac{\sin x}{e^3}$

6. $f(x) = 8x^3 - \cos x + \tan x$

7. $f(x) = \sec x + 15x^2$

8. $f(x) = (3x - 1) \cot x$

9. $f(x) = 8x^3 \sec x$

10. $f(x) = \frac{3x^5}{\csc x}$

11. $f(x) = \tan x \csc x$

12. $f(x) = \cot x \cos^2 x + \cot x \sin^2 x$

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13. $f(x) = \frac{\sec x}{\csc x}$

14. $f(x) = \cot x \sec x \sin^2 x$

15. $f(x) = \left(\frac{\tan x}{\sec x} \right) \cdot \left(\frac{\cot x}{\csc x} \right)$

16. $f(x) = \sec^2 x \sin^2 x \cot x + \cos^2 x \sec x$

17. $f(x) = \frac{\cos^2 x}{\sin x} + \csc x \sin^2 x$

18. $f(x) = \tan^2 x \csc^2 x \cos x$

19. $f(x) = \frac{(1 + \sin x)(1 - \sin x)}{\cos x}$

20. $f(x) = \frac{\sin^2 x - \cos^2 x}{\sin x - \cos x}$