

## Unit 3 Worksheet 2

### AP Calculus AB

Find  $f'(x)$  for each of the following.

1.  $f(x) = 4x^3 \cos x$   
 $f'(x) = 4x^3(-\sin x) + 12x^2 \cos x$   
 $f'(x) = -4x^3 \sin x + 12x^2 \cos x$   
 $f'(x) = 12x^2 \cos x - 4x^3 \sin x$  or  $f'(x) = 4x^2(3 \cos x - x \sin x)$

2.  $f(x) = \frac{x^5}{\tan x}$   
 $f'(x) = \frac{\tan x \cdot 5x^4 - x^5 \sec^2 x}{(\tan x)^2}$   
 $f'(x) = \frac{5x^4 \tan x - x^5 \sec^2 x}{\tan^2 x}$   
 $f'(x) = \frac{x^4(5 \tan x - x \sec^2 x)}{\tan^2 x}$

3.  $f(x) = \sin x + \cot x$   
 $f'(x) = \cos x - \csc^2 x$

4.  $f(x) = \sin x \cos x$   
 $f'(x) = \sin x \cdot (-\sin x) + \cos x \cdot \cos x$   
 $f'(x) = -\sin^2 x + \cos^2 x$   
 $f'(x) = \cos^2 x - \sin^2 x$  or  $f'(x) = \cos(2x)$

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

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

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

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

$$f'(x) = \frac{\cos x - \sin x}{e^x}$$

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

$$f'(x) = 24x^2 - (-\sin x) + \sec^2 x$$

$$f'(x) = 24x^2 + \sin x + \sec^2 x$$

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

$$f'(x) = \sec x \tan x + 30x$$

8.  $f(x) = (3x-1)^4 \cot x$

$$f'(x) = (3x-1)^4 \cdot -\csc^2 x + 4(3x-1)^3 \cdot 3 \cdot (\cot x)$$

$$f'(x) = -(3x-1)^3 [(3x-1)(\csc^2 x) - 12 \cot x]$$

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

$$f'(x) = 8x^3 \sec x \tan x + 24x^2 \sec x$$

$$f'(x) = 8x^2 \sec x (x \tan x + 3)$$

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

$$f'(x) = \frac{\csc x \cdot 15x^4 - 3x^5 (-\csc x \cot x)}{\csc^2 x}$$

$$f'(x) = \frac{15x^4 \csc x + 3x^5 \csc x \cot x}{\csc^2 x}$$

$$f'(x) = \frac{3x^4 \csc x (5 + x \cot x)}{\csc^2 x}$$

$$f'(x) = \frac{3x^4 (5 + x \cot x)}{\csc x}$$

Key

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

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

$$f(x) = \sec x$$

$$f'(x) = \sec x \tan x$$

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

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

$$f(x) = \tan x$$

$$f'(x) = \sec^2 x$$

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

$$f(x) = \left( \frac{\sin x}{\cos x} \cdot \frac{\cos x}{1} \right) \cdot \left( \frac{\cos x}{\sin x} \cdot \frac{\sin x}{1} \right)$$

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

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

$$- \sin^2 x + \cos^2 x$$

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

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

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

$$f(x) = \frac{1}{\sin x} = \csc x$$

$$f'(x) = -\csc x \cot x$$

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

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

$$= \frac{\cos^2 x}{\cos x}$$

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

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

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

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

$$f(x) = \cot x$$

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

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

$$f(x) = \frac{\cos x}{\sin x} \cdot \frac{1}{\cos x} \cdot \frac{\sin^2 x}{1}$$

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

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

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

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

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

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

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

$$f(x) = \frac{\sin^2 x}{\cos^2 x} \cdot \frac{1}{\sin^2 x} \cdot \frac{\cos x}{1}$$

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

$$f(x) = \sec x$$

$$f'(x) = \sec x \tan x$$

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

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

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