

Homework Set 9: Derivatives of Trigonometric Functions

Find $f'(x)$:

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

2. $f(x) = 3x \sin x$ $f'(x) = 3x \cdot \cos x + (\sin x) 3$

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

4. $f(x) = \sec x + 3 \tan x$ $f'(x) = \sec x \tan x + 3 \cdot \sec^2 x$

5. $f(x) = \cot x - 4 \csc x$ $f'(x) = -\csc^2 x - 4(-\csc x \cot x) = \csc x(4 \cot x - \csc x)$

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

7. $f(x) = \sec x \sin x \tan x$ $f'(x) = \sec x \cdot [\sin x \cdot \sec^2 x + \tan x \cdot \cos x] + \sin x \tan x \cdot \sec x \tan x$

8. $f(x) = \frac{\tan x}{1 - \csc x}$ $f'(x) = \frac{(1 - \csc x) \cdot \sec^2 x - \tan x (-\csc x \cot x)}{(1 - \csc x)^2} = \frac{(1 - \csc x) \sec^2 x + \csc x}{(1 - \csc x)^2}$

9. $f(x) = \sin^2 x + \cos^2 x = 1$ $\therefore f'(x) = 0$

10. $f(x) = \frac{\sin x \cos x}{x - \tan x}$ $f'(x) = \frac{(x - \tan x) [\sin x \cdot -\sin x + \cos x \cdot \cos x] - \sin x \cos x (1 - \sec^2 x)}{(x - \tan x)^2}$

Find $\frac{dy}{dx}$:

11. $y = 3 \cos x + 2 \sec x - 4 \cot x$ $\frac{dy}{dx} = 3 \cdot -\sin x + 2 \cdot \sec x \tan x - 4 \cdot -\csc^2 x$
 $\quad \quad \quad = -3 \sin x + 2 \sec x \tan x + 4 \csc^2 x$

12. $y = x^2 \cot x$ $\frac{dy}{dx} = x^2 \cdot -\csc^2 x + \cot x \cdot 2x = x(2 \cot x - x \csc^2 x)$

13. $y = \sec x \tan x$ $\frac{dy}{dx} = \sec x \cdot \sec^2 x + \tan x \cdot \sec x \tan x = \sec x (\sec^2 x + \tan^2 x)$

14. Find $\frac{d^2}{dx^2} [\sec x] = \frac{d}{dx} [\sec x \tan x] = \sec x (\sec^2 x + \tan^2 x)$ ↑

15. Find $\frac{d^2}{dx^2} [\tan x] = \frac{d}{dx} [\sec^2 x] = 2 \sec x \cdot \sec x \tan x = 2 \sec^2 x \tan x$

16. If $y = \sin x$ find $\frac{dy}{dx}, \frac{d^2 y}{dx^2}, \frac{d^3 y}{dx^3}, \frac{d^4 y}{dx^4}$ and $\frac{d^5 y}{dx^5}$.

