

$$L) y = \sqrt{3x \csc x}$$

$$M) y = 3x\sqrt{\csc x}$$

$$N) \text{ Find } y'' \text{ if } y = 9 \cot\left(\frac{x}{3}\right)$$

$$y = 9 \cot\left(\frac{1}{3}x\right)$$

$$y' = 9 \left(-\csc^2\left(\frac{1}{3}x\right)\right) \cdot \frac{1}{3}$$

$$y' = -3 \left[ \csc\left(\frac{1}{3}x\right) \right]^2$$

$$y'' = -6 \left[ \right]$$

$$y'' = -6 \left( \csc\left(\frac{1}{3}x\right) \right)' \cdot \left( -\csc\left(\frac{1}{3}x\right) \cot\left(\frac{1}{3}x\right) \right) \cdot \frac{1}{3}$$

$$= 2 \csc^2\left(\frac{1}{3}x\right) \cot\left(\frac{1}{3}x\right)$$

Suppose that functions  $f$  and  $g$  and their derivatives have the following values at  $x = 2$  and  $x = 3$ .

| $x$ | $f(x)$ | $g(x)$ | $f'(x)$ | $g'(x)$ |
|-----|--------|--------|---------|---------|
| 2   | 8      | 2      | $1/3$   | -3      |
| 3   | 3      | -4     | $2\pi$  | 5       |

Evaluate the derivatives with respect to  $x$

A)  $2f(x)$  at  $x=2$

B)  $f(x)+g(x)$  at  $x=3$

Product Rule

C)  $f(x)g(x)$  at  $x=3$

$$\cancel{f'(x)g'(x)}$$

$$f(x) \cdot g'(x) + g(x) \cdot f'(x)$$

$$f(3) \cdot g'(3) + g(3) \cdot f'(3)$$

$$(3)(5) + (-4)(2\pi)$$

$$15 - 8\pi$$

Quotient Rule

D)  $\frac{f(x)}{g(x)}$  at  $x=2$

$$\frac{g(x) \cdot f'(x) - f(x)g'(x)}{[g(x)]^2}$$

$$\frac{g(2) \cdot f'(2) - f(2)g'(2)}{[g(2)]^2}$$

$$\frac{(2)\left(\frac{1}{3}\right) - (8)(-3)}{2^2}$$

$$\frac{\cancel{2} \cdot \frac{1}{3} + 24(3)}{4(3)} = \frac{2 + 72}{12}$$

$$\frac{74}{12} = \frac{37}{6}$$

$$y = \sin(5x)$$

$$y' = \cos(5x) \cdot 5$$

$\sin(5x)$

E)  $f(g(x))$  at  $x=2$

$$f'(g(x)) \cdot g'(x)$$

$$f'(g(2)) \cdot g'(2)$$

$$f'(2) \cdot g'(2)$$

$$\frac{1}{3} \cdot (-3)$$

F)  $\sqrt{f(x)}$  at  $x=2$

$$\frac{d}{dx} \left[ (f(x))^{1/2} \right]$$

$$\frac{1}{2} [f(x)]^{-1/2} \cdot f'(x)$$

$$\frac{1}{2\sqrt{f(x)}} \cdot f'(x) \quad \leftarrow \text{Algo}$$

G)  $\frac{1}{g^2(x)}$  at  $x=3$

$$\frac{d}{dx} \left[ (g(x))^{-2} \right] = -2(g(x))^{-3} \cdot g'(x) = \frac{-2g'(x)}{[g(x)]^3}$$

F)  $\sqrt{f^2(x) + g^2(x)}$  at  $x=2$

$$\frac{d}{dx} \left( [f(x)]^2 + [g(x)]^2 \right)^{1/2}$$

$$\frac{1}{2} \left( [f(x)]^2 + [g(x)]^2 \right)^{-1/2} \cdot [2f(x) \cdot f'(x) + 2g(x) \cdot g'(x)]$$

$$\frac{f(x) \cdot f'(x) + g(x) \cdot g'(x)}{\sqrt{f^2(x) + g^2(x)}}$$