

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	2π	5

Evaluate the derivatives with respect to x

$$A) \quad 2f(x) \text{ at } x=2$$

$$B) \quad f(x) + g(x) \text{ at } x=3$$

$$\begin{aligned} C) \quad & f(x)g'(x) + g(x)f'(x) \\ & f(2)g'(2) + g(2)f'(2) \\ & (3)(5) + (-4)(2\pi) \end{aligned}$$

$$15 - 8\pi$$

$$\begin{aligned} \frac{d}{dx}(2f(x)) &= 2f'(x) \\ &= 2f'(2) \\ &= 2\left(\frac{1}{3}\right) \\ &= \frac{2}{3} \end{aligned}$$

$$\begin{aligned} \frac{d}{dx}(f(x) + g(x)) &= f'(x) + g'(x) \\ &= f'(3) + g'(3) \\ &= 2\pi + 5 \end{aligned}$$

$$C) \quad f(x)g(x) \text{ at } x=3$$

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

$$\begin{aligned} \frac{24 + \frac{2}{3}}{(2)^2} &= \frac{24^{\frac{2}{3}}}{4} \\ &= \frac{\left(\frac{74}{3}\right)}{4} \\ &= \frac{74}{12} \end{aligned}$$

$$\frac{d}{dx} (\sin(5x))$$

$$\cos(5x) \cdot 5$$

$$E) f(g(x)) \text{ at } x=2$$

$$\begin{aligned}\frac{d}{dx} (f(g(x))) &= f'(g(x)) \cdot g'(x) \\ &= f'(g(2)) \cdot g'(2) \\ &= f'(2) \cdot g'(2) \\ &= \frac{1}{3} \cdot (-3)\end{aligned}$$

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

$$\begin{aligned}\frac{d}{dx} \sqrt{f(x)} &= \frac{d}{dx} (f(x))^{1/2} \\ \frac{1}{2} [f(x)]^{-1/2} \cdot f'(x) &\quad \boxed{\frac{1+f'(x)}{2\sqrt{f(x)}}}\end{aligned}$$

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

$$\begin{aligned}\frac{d}{dx} \left[\frac{1}{g^2(x)} \right] &= \frac{d}{dx} \left[g(x) \right]^{-2} \\ &= -2 \left[g(x) \right]^{-3} \cdot g'(x) = \frac{-2g'(x)}{[g(x)]^3}\end{aligned}$$

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

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

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