Name _____ **More Derivatives**

Use the following for 1-4:

$f(2) = -3$ $g(2) = 5$ $f'(2) = 4$ $g'(2) = -2$ $f'(5) = 6$

Find the derivative of the following at x = 2:

1. Find $h'(2)$ if $h(x) = \dfrac{f(x)}{g(x)}$

$h'(x) = \dfrac{g \cdot f' - f \cdot g}{g^2}$ $h'(2) = \dfrac{g(2) \cdot f'(2) - f(2) \cdot g'(2)}{g(2)^2}$

$= \dfrac{5 \cdot 4 - (-3)(-2)}{5^2} = \dfrac{20-6}{25} = \dfrac{14}{25}$

2. $f + g$ $f' + g' = f'(2) + g'(2)$ $= 4 + -2 = 2$

3. $f \cdot g$

$= f \cdot g' + g \cdot f'$

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

$= (-3)(-2) + (5)(4) = 6 + 20 = 26$

4. $f(g(x))$

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

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

$= f'(5) \cdot g'(2) = 6 \cdot -2 = -12$

5. The position function of a moving particle is given by $s(t) = 3t^3 + 2t - 1$, where s is measured in feet and t is measured in seconds. Find the instantaneous acceleration at t=2.5 seconds.

$a(t) = s''(t)$ $s'(t) = 9t^2 + 2$

$s''(t) = 18t$

$a(2.5) = s''(2.5) = (18)(2.5) = \dfrac{18}{1}\left(\dfrac{5}{2}\right) = 45$ ft/s²

6. A coin is dropped from a height of 850 ft (s_o). $s(t) = -16t^2 + s_o$. $s(t) = -16t^2 + 850$

a) Find the average velocity on the interval [2,3].

$\dfrac{s(3) - s(2)}{3-2} =$

b) Find the instantaneous velocity at t=1.5 seconds.

$v(t) = s'(t) = -32t$

$v(1.5) = -32(1.5) = \dfrac{-32}{1}\left(\dfrac{3}{2}\right) = -48$ ft/sec

For problems 7 -89, let f(2) = 4, f '(2) = 8, g(2) = 5, and g '(2) = $\dfrac{1}{2}$.

7. Find h '(2) if $h(x) = \dfrac{f(x)}{g(x)}$.

$h'(x) = \dfrac{g \cdot f' - f \cdot g'}{g^2} = \dfrac{g(2) \cdot f'(2) - f(2) \cdot g'(2)}{(g(2))^2}$

$= \dfrac{5 \cdot 8 - 4 \cdot \frac{1}{2}}{5^2} = \dfrac{40-2}{25} = \dfrac{38}{25}$

8. Find h '(2) if $h(x) = f(x)g(x)$.

$h' = f \cdot g' + g \cdot f'$

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

$= 4 \cdot \frac{1}{2} + 5 \cdot 8 = 2 + 40 = 42$

Find the derivative of each of the following functions.

9. $f(x) = \sqrt[4]{x} + \sqrt[3]{x} = x^{1/4} + x^{1/3}$

$f'(x) = \frac{1}{4}x^{-3/4} + \frac{1}{3}x^{-2/3}$

$= \dfrac{1}{4\sqrt[4]{x^3}} + \dfrac{1}{3\sqrt[3]{x^2}}$

10. $f(t) = \dfrac{2t}{t^3+1}$ $f'(t) = \dfrac{(t^3+1)(2) - (2t)(3t^2)}{(t^3+1)^2}$

$= \dfrac{2t^3 + 2 - 6t^3}{(t^3+1)^2} = \dfrac{2 - 4t^3}{(t^3+1)^2}$

11. $f(x) = \sqrt[3]{x}(4x^2 + 1)$ $\frac{1}{3}x^{-2/3}$ $8x$

$f'(x) = 8x \cdot x^{1/3} + \frac{1}{3}x^{-2/3}(4x^2+1) = 8x^{4/3} + \dfrac{4x^2+1}{3x^{2/3}}$

12. $m(x) = 3\csc x \cot x$ $-3\csc x \cot x$ $-\csc^2 x$

$m'(x) = -3\csc^3 x - 3\csc x \cot^2 x$

$= -3\csc x(\csc^2 x + \cot^2 x)$

13. If $f(x) = -2x^4 + 4x^3 + 8x + 3$, find $f''(x)$.

$f'(x) = -8x^3 + 12x^2 + 8$

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

14. If $f(x) = 3x^2 + 5x + \cos x$, find $f''(x)$.

$f'(x) = 6x + 5 - \sin x$

$f''(x) = 6 - \cos x$