

# DERIVATIVE RULES HOMEWORK

106-116 evens: Calculate  $f'(x)$ .

106.  $f(x) = x^7 + 10$

Sol:  $f'(x) = \frac{d}{dx}[x^7 + 10] = \frac{d}{dx}[x^7] + \frac{d}{dx}[10] = 7x^6 + 0 = 7x^6$   $\square$

108.  $f(x) = 4x^2 - 7x$

Sol:  $f'(x) = \frac{d}{dx}[4x^2 - 7x] = \frac{d}{dx}[4x^2] - \frac{d}{dx}[7x]$   
 $= 4 \frac{d}{dx}[x^2] - 7 \frac{d}{dx}[x] = 4 \cdot 2x - 7 \cdot 1 = 8x - 7$   $\square$

110.  $f(x) = x^4 + \frac{2}{x} = x^4 + 2x^{-1}$

Sol:  $f'(x) = \frac{d}{dx}[x^4 + 2x^{-1}] = \frac{d}{dx}[x^4] + \frac{d}{dx}[2x^{-1}]$   
 $= \frac{d}{dx}[x^4] + 2 \frac{d}{dx}[x^{-1}] = 4x^3 + 2 \cdot (-1)x^{-2} = 4x^3 - 2x^{-2}$   $\square$

112.  $f(x) = (x+2)(2x^2-3)$

Sol A:  $f'(x) = \frac{d}{dx}[(x+2)(2x^2-3)] = \frac{d}{dx}[x+2](2x^2-3) + (x+2) \frac{d}{dx}[2x^2-3]$   
 $= (\frac{d}{dx}[x] + \frac{d}{dx}[2])(2x^2-3) + (x+2)(\frac{d}{dx}[2x^2] - \frac{d}{dx}[3])$   
 $= (\frac{d}{dx}[x] + \frac{d}{dx}[2])(2x^2-3) + (x+2)(2 \frac{d}{dx}[x^2] - \frac{d}{dx}[3])$   
 $= (1 + 0)(2x^2-3) + (x+2)(2(2x) - 0)$   
 $= 2x^2 - 3 + (x+2) \cdot 4x$   
 $= 2x^2 - 3 + 4x^2 + 8x = 6x^2 + 8x - 3$   $\square$

Sol B:  $f(x) = (x+2)(2x^2-3) = 2x^3 - 3x + 4x^2 - 6 = 2x^3 + 4x^2 - 3x - 6$

$f'(x) = \frac{d}{dx}[2x^3 + 4x^2 - 3x - 6] = \frac{d}{dx}[2x^3] + \frac{d}{dx}[4x^2] - \frac{d}{dx}[3x] - \frac{d}{dx}[6]$   
 $= 2 \frac{d}{dx}[x^3] + 4 \frac{d}{dx}[x^2] - 3 \frac{d}{dx}[x] - \frac{d}{dx}[6] = 2 \cdot 3x^2 + 4 \cdot 2x - 3 \cdot 1 - 0$   
 $= 6x^2 + 8x - 3$   $\square$

$$\underline{114.} \quad f(x) = \frac{x^3 + 2x^2 - 4}{3} = \frac{1}{3}x^3 + \frac{2}{3}x^2 - \frac{4}{3}$$

$$\begin{aligned} \underline{\text{Sol:}} \quad f'(x) &= \frac{d}{dx} \left[ \frac{1}{3}x^3 + \frac{2}{3}x^2 - \frac{4}{3} \right] = \frac{d}{dx} \left[ \frac{1}{3}x^3 \right] + \frac{d}{dx} \left[ \frac{2}{3}x^2 \right] - \frac{d}{dx} \left[ \frac{4}{3} \right] \\ &= \frac{1}{3} \frac{d}{dx} [x^3] + \frac{2}{3} \frac{d}{dx} [x^2] - \frac{d}{dx} \left[ \frac{4}{3} \right] = \frac{1}{3} \cdot 3x^2 + \frac{2}{3} \cdot 2x - 0 \\ &= x^2 + \frac{4}{3}x \quad \square \end{aligned}$$

$$\underline{116.} \quad f(x) = \frac{x^2 + 4}{x^2 - 4}$$

$$\begin{aligned} \underline{\text{Sol:}} \quad f'(x) &= \frac{d}{dx} \left[ \frac{x^2 + 4}{x^2 - 4} \right] = \frac{(x^2 - 4) \frac{d}{dx} [x^2 + 4] - (x^2 + 4) \frac{d}{dx} [x^2 - 4]}{(x^2 - 4)^2} \\ &= \frac{(x^2 - 4)(2x) - (x^2 + 4)(2x)}{(x^2 - 4)^2} = \frac{-16x}{(x^2 - 4)^2} \quad \square \end{aligned}$$

128. The functions  $f$  and  $g$  are differentiable

and have the values given in the table.

Calculate  $h'(3)$  if  $h(x) = 2x + f(x)g(x)$ .

$x$	1	2	3	4
$f(x)$	3	5	-2	0
$g(x)$	2	3	-4	6
$f'(x)$	-1	7	8	-3
$g'(x)$	4	1	2	9

$$\begin{aligned} \underline{\text{Sol:}} \quad h'(x) &= \frac{d}{dx} [2x + f(x)g(x)] = \frac{d}{dx} [2x] + \frac{d}{dx} [f(x)g(x)] \\ &= 2 \frac{d}{dx} [x] + (f'(x)g(x) + f(x)g'(x)) \\ &= 2 \cdot 1 + f'(x)g(x) + f(x)g'(x) \end{aligned}$$

$$\therefore h'(3) = 2 + f'(3)g(3) + f(3)g'(3) = 2 + 8 \cdot (-4) + (-2) \cdot 2 = 2 - 32 - 4 = -34 \quad \square$$

Prob: Calculate  $\frac{d}{dx} [\tan(x)]$ .

$$\begin{aligned} \underline{\text{Sol:}} \quad \frac{d}{dx} [\tan(x)] &= \frac{d}{dx} \left[ \frac{\sin(x)}{\cos(x)} \right] \\ &= \frac{\cos(x) \frac{d}{dx} [\sin(x)] - \sin(x) \frac{d}{dx} [\cos(x)]}{(\cos(x))^2} \\ &= \frac{\cos(x) \cdot \cos(x) - \sin(x) \cdot (-\sin(x))}{\cos^2(x)} \\ &= \frac{\cos^2(x) + \sin^2(x)}{\cos^2(x)} = \frac{1}{\cos^2(x)} = \sec^2(x) \quad \square \end{aligned}$$