4.1. Numerical Values

Example #1. Use the table to evaluate, at $x=4$,

x	$u(x)$	$v(x)$	$u'(x)$	$v'(x)$
2	1	13	15	11
4	2	7	5	3
7	4	6	8	9

(a) $\frac{d}{dx}[u \cdot v]$

(b) $\frac{d}{dx}\left[\frac{u}{v}\right]$

(c) $\frac{d}{dx}[u(v(x))]$

(d) $\frac{d}{dx}[v(u(x))]$

SOLUTION:

(a) $\left.\frac{d}{dx}[u \cdot v]\right|_{x=4} = u'(4)v(4) + u(4)v'(4) = 5 \cdot 7 + 2 \cdot 3 = 41$

(b) $\left.\frac{d}{dx}\left[\frac{u}{v}\right]\right|_{x=4} = \frac{u'(4)v(4) - u(4)v'(4)}{[v(4)]^2} = \frac{5 \cdot 7 - 2 \cdot 3}{7^2} = \frac{29}{49}$

(c) $\left.\frac{d}{dx}[u(v(x))]\right|_{x=4} = \left.\frac{du}{dv}\right|_{\substack{x=4 \\ v=7}} \cdot \left.\frac{dv}{dx}\right|_{x=4} = u'(7) \cdot v'(4) = 8 \cdot 3 = 24$

(d) $\left.\frac{d}{dx}[v(u(x))]\right|_{x=4} = \left.\frac{dv}{du}\right|_{\substack{x=4 \\ u=2}} \cdot \left.\frac{du}{dx}\right|_{x=4} = v'(2) \cdot u'(4) = 11 \cdot 5 = 55$

CLASS WORK

Use the table to evaluate, at $x=3$,

x	$u(x)$	$v(x)$	$u'(x)$	$v'(x)$
3	17	9	13	8
9	4	7	3	11
17	6	2	12	5

(a) $\frac{d}{dx}[u \cdot v]$

(b) $\frac{d}{dx}\left[\frac{u}{v}\right]$

(c) $\frac{d}{dx}[u(v(x))]$

(d) $\frac{d}{dx}[v(u(x))]$

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SOLUTIONS

(a) $\left.\frac{d}{dx}[u \cdot v]\right|_{x=3} = u'(3)v(3) + u(3)v'(3) = 13 \cdot 9 + 17 \cdot 8 = 253$

(b) $\left.\frac{d}{dx}\left[\frac{u}{v}\right]\right|_{x=3} = \frac{u'(3)v(3) - u(3)v'(3)}{[v(3)]^2} = \frac{13 \cdot 9 - 17 \cdot 8}{9^2} = -\frac{19}{81}$

(c) $\left.\frac{d}{dx}[u(v(x))]\right|_{x=3} = \left.\frac{du}{dv}\right|_{\substack{x=3 \\ v=9}} \cdot \left.\frac{dv}{dx}\right|_{x=3} = u'(9) \cdot v'(3) = 3 \cdot 8 = 24$

(d) $\left.\frac{d}{dx}[v(u(x))]\right|_{x=3} = \left.\frac{dv}{du}\right|_{\substack{x=3 \\ u=17}} \cdot \left.\frac{du}{dx}\right|_{x=3} = v'(17) \cdot u'(3) = 5 \cdot 13 = 65$