

WORKSHEET: PRODUCT AND QUOTIENT RULES

Names and student IDs: _____

Suppose $y = 3x^2 + 5x$ expresses y as a function of x .

1. Find $\frac{dy}{dx}$.

2. Find $\frac{d}{dx}(7x^3 + 2x)$.

3. Find $\frac{dy}{dx}(7x^3 + 2x)$. Don't multiply out.

Recall the most recent differentiation rules we have seen:

- (1) If f and g are differentiable, and $j(x) = f(x)g(x)$ for all x (in a suitable open interval), then $j'(x) = f'(x)g(x) + f(x)g'(x)$.
- (2) Quotient rule: If f and g are differentiable, $g(x)$ is never zero (on a suitable open interval), and

$$j(x) = \frac{f(x)}{g(x)}$$

for all x (in a suitable open interval), then

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

- (3) The functions \sin and \cos are differentiable everywhere, and (using **radians!**)

$$\sin'(x) = \cos(x) \quad \text{and} \quad \cos'(x) = -\sin(x)$$

for all x .

Now differentiate the following functions, or else tell me that no differentiation rule you have seen so far applies:

4. If $s(x) = x^3 \sin(x)$ then $s'(x) =$

5. If $w(t) = (3t^2 + t) \cos(t) + t^6$ then $w'(t) =$

6. If $s(x) = \frac{\sin(x)}{x^2 + 1}$ then $s'(x) =$

Continued on back.

Date: 9 April 2025.

7. $\frac{d}{dx}(7^x) =$

8. $\frac{d}{dx}((x^2 + 3x)(11x^7 - 102x^3)) =$

9. (Be careful here! Use the answer to Problem 4.) If $q(x) = \frac{x^3 \sin(x)}{x^2 + 1}$ then $q'(x) =$