

Math 199, Fall 2023  
Yigal Kamel  
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### Participation assignment 4 - The product rule

**Estimated time:** 45-60 minutes.

**Point value:** 3 points.

**Goals:** Understand how to apply the product (and quotient) rule, and get practice doing this.

1) For your own reference, write down the product rule for computing the derivative of  $f(x)g(x)$ .

2) Use the product rule to derive the quotient rule, i.e. apply the product rule to  $f(x) \cdot \frac{1}{g(x)} = \frac{f(x)}{g(x)}$ .

3) Use the product rule to write down a formula for the derivative of  $f(x)g(x)h(x)$ .

4) Calculate the derivative of  $f(x) = \frac{3x^2e^x}{x^3 - 2x}$ .

5) Given the fact that the function  $f(x) = x^a e^{x-1}$  is tangent to the function  $g(x) = 3x + b$  at  $x = 1$ , find  $a$  and  $b$ .

6) Write down a formula for the second derivative of  $f(x)g(x)$ .

7) Write down a formula for the third derivative of  $f(x)g(x)$ .

8) Let  $f(x) = x^3 + 2x^2 - 3x + 4$ . Compute  $f'(x)$ ,  $f''(x)$ ,  $f'''(x)$ . Plot (and label) all four of these functions.