PRODUCT AND QUOTIENT RULES

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In each of the problems, use the

Product Rule. If f and g are differentiable functions, then

$$\frac{\mathrm{d}}{\mathrm{d}x}\big(f(x)g(x)\big) = f'(x)g(x) + f(x)g'(x)$$

and

Quotient Rule. If f and g are differentiable functions, then

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$$

to compute the derivative. Use proper notation and simplify your final answers. In some cases it might be advantageous to simplify/rewrite first. **Do not use rules found in later sections.**

1. Let $f(x) = g(x)h(x)$, $g(10) = -4$, $h(10) = 560$, $g'(10) = 0$, $h'(10) = 4$. Find $f'(10)$.

2. Let $z(-3) = 6$, $z'(-3) = 15$, and $y(x) = \dfrac{z(x)}{1+x^2}$. Find $y'(-3)$.

3. $f(x) = \left(1 + \sqrt{x}\right) x^3$

4. $g(t) = \left(\frac{2}{t} + t^5\right)(t^3 + 1)$

5. $h(y) = \frac{1}{y^3 + 2y + 1}$

Compute the following derivatives using

$$\frac{\mathrm{d}}{\mathrm{d}x}\sin(x) = \cos(x) \qquad \text{and} \qquad \frac{\mathrm{d}}{\mathrm{d}x}\cos(x) = -\sin(x)$$

and the trigonometric identities

$$\tan(x) = \frac{\sin(x)}{\cos(x)} \qquad \sec(x) = \frac{1}{\cos(x)}$$
$$\cot(x) = \frac{1}{\tan(x)} = \frac{\cos(x)}{\sin(x)} \qquad \csc(x) = \frac{1}{\sin(x)}$$

6. $\dfrac{\mathrm{d}}{\mathrm{d}x}\tan(x)$

7. $\dfrac{\mathrm{d}}{\mathrm{d}x}\cot(x)$

8. $\dfrac{\mathrm{d}}{\mathrm{d}x}\sec(x)$

9. $\dfrac{\mathrm{d}}{\mathrm{d}x}\csc(x)$