

Name: _____

Discussion Section: _____

Solutions should show all of your work, not just a single final answer.

3.2: The Product and Quotient Rules

1. Compute the derivative of each function below using the methods from Sections 3.1 and 3.2 (**not other methods**).

(a) $f(x) = \frac{x}{x+3}$ (simplify numerator in final answer)

(b) $f(x) = \frac{e^x}{1+e^x}$ (simplify numerator in final answer)

(c) $f(x) = \sqrt{x}e^x$

(d) $f(x) = \frac{e^x}{x^n}$ for constant n , in two ways: (i) quotient rule and (ii) product rule

(e) $f(x) = \frac{1}{x} + \frac{1}{1-x}$ (in final answer, use a common denominator and simplify numerator)

2. In the function $h(x)$ below, defined in terms of $f(x)$ and $g(x)$, determine $h'(2)$ in each case if

(a) $h(x) = 2f(x) + 5g(x)$

(b) $h(x) = f(x)g(x)$

(c) $h(x) = \frac{f(x)}{g(x)}$

(d) $h(x) = \frac{g(x)}{f(x) + 2}$

3.3: Derivatives of Trigonometric Functions

3. Compute the derivative of each function below using differentiation rules.

(a) $f(x) = x^3 \cos x$

(b) $f(x) = \frac{1 + \sin x}{1 + \cos x}$

(c) $f(x) = e^x \tan x$

(d) $f(x) = \frac{\sec x}{\sqrt{x}}$ (Compute (d) in **two ways**, using (i) the quotient rule and (ii) the product rule.)

4. Find the equation of the tangent line to the curve $y = \sin x \cos x$ at $x = \frac{\pi}{4}$. (Your coefficients must be exact, not approximations.)

5. Find the higher derivative $\frac{d^{1881}}{dx^{1881}}(2 \cos x)$ by finding the first eight derivatives and observing the pattern that occurs.

6. Determine the following limits by making a change of variables to allow you to use the relation $\lim_{t \rightarrow 0} \frac{\sin t}{t} = 1$.

(a) $\lim_{x \rightarrow 0} \frac{\sin 4x}{x}$

(b) $\lim_{x \rightarrow 0} \frac{\sin 7x}{5x}$