Name: _____   Group #: _____

1. Prove the derivative rule of $f(x) = \cot(x)$

$$\frac{d}{dx}\cot(x) = -\csc^2(x)$$

by using the quotient rule.

Use derivative rules to find the derivatives of the following functions. Simplify by combining like terms and canceling common factors.

2. $f(t) = (7 + t^7)\left(\dfrac{3}{\sqrt[3]{t}} + 3t\right)$

3. $r(\theta) = \dfrac{\sin\theta}{1 + \csc\theta}$

Diff., Prod., & Quot. Rules;

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4. Find an equation of the line tangent to the function $g(x) = 2x \sin x$ at $x = \dfrac{3\pi}{2}$.

5. Suppose there exists a function, $f(x)$, such that $f(1) = 5$ and $f'(1) = 4$.
   Let $h(x) = \dfrac{f(x)}{x+1}$. Find the equation of the tangent line to $h(x)$ at $x = 1$.

6. Find the third derivative of $f(t) = 4t^3 - \dfrac{3}{t^5}$

Diff., Prod., & Quot. Rules;

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7. Find the 42nd and 55th derivative of $f(x) = \cos x$.

8. Use this table to find the following:

x	**2**	**3**	**4**	**5**
$f(x)$	2	3	4	3
$g(x)$	7	3	-1	2
$f'(x)$	5	7	-1	-2
$g'(x)$	3	-2	1	8

(a) $\dfrac{d}{dx}\left[-2f(x) \right]\Big|_{x=5}$

(b) $\dfrac{d}{dx}\left[x^2 f(x) \right]\Big|_{x=3}$

(c) Find the equation of the tangent line to $y = \dfrac{g(x)}{f(x)}$ at $x = 4$.