Name:

3.3 Product and Quotient Rules

Product Rule: $\dfrac{d}{dt}\left[f(t)g(t)\right] =$

Quotient Rule: $\dfrac{d}{dt}\left[\dfrac{f(t)}{g(t)}\right] =$

1. Compute the following derivatives.

   (a) $\dfrac{d}{dx}\left(\sqrt{x}2^x\right) =$

   (b) $\dfrac{d}{dx}\left(\left(x^2+3\right)e^x\right) =$

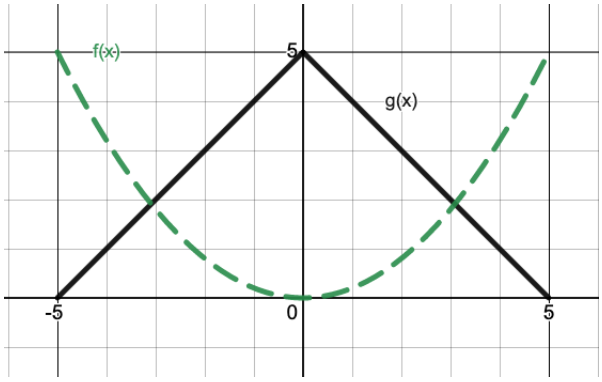
   (c) $\dfrac{d}{dx}\left(\dfrac{x}{e^x}\right) =$

   (d) $\dfrac{d}{dx}\left(\dfrac{x+1}{x^2}\right) =$

   (e) $\dfrac{d}{dx}\left(\dfrac{3^x x^4}{3x-2}\right) =$

   (f) $\dfrac{d}{dx}\left(2^x 3^x 4^x\right) =$

2. Suppose $f(x)$ is the curved, dotted line function and $g(x)$ is the piecewise-straight solid function. If $h(x) = f(x)\,g(x)$, find the following, or explain why it doesn't exist.



   (a) $h'(-2)$

   (b) $h'(0)$

   (c) $h'(2)$

3. The density of veins on leaves tells us about a region's past climate. Scientists measure vein density, V, in mm per mm^2, by estimating the average distance, x, in mm, between veins on a leaf, and using the formula:

$$V = f(x) = \frac{0.629}{x} + 1.073$$

   (a) Calculate $f'(x)$ using the power rule.

   (b) Calculate $f'(x)$ using the quotient rule.

   (c) What are the units of $f'(x)$?

   (d) Calculate $f'(x)$ and interpret the meaning of your answer in practical terms.

4. For what intervals is $g(t) = \dfrac{1}{t^2+1}$ concave down? Check using Desmos.

5. Find a possible formula for a function $y = f(x)$ such that $f'(x) = 10x^9e^x + x^{10}e^x$. Are other formulas possible?