In-class Activity 8

Logarithmic Differentiation

Question 1 Complete the following differentiation formulas:

- $\dfrac{\mathrm{d}}{\mathrm{d}x}c =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\sin(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\cos(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}e^x =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\ln(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\tan(x) =$
- $\dfrac{\mathrm{d}}{\mathrm{d}x}\sec(x)$
- $(f(x)+g(x))' =$
- $(f(x)-g(x))' =$
- $(cf(x))' =$
- $(f(x)g(x))' =$
- $\left(\dfrac{f(x)}{g(x)}\right)' =$
- $\Big(f(g(x))\Big)'$

Question 2
Using logarithmic differentiation, find the derivative of the following functions:

- $y = x^{5x}$

- $f(x) = \sin(x)^{\cos(x)}$

- $y = \sqrt{x}^{\frac{1}{x}}$

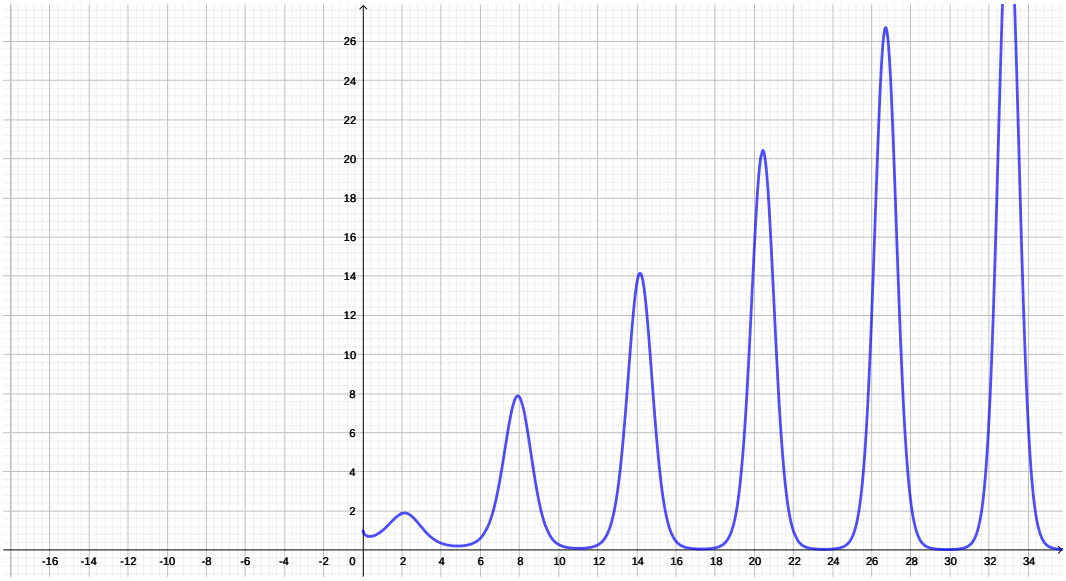
- $f(x) = a^x$

Question 3
Using logarithmic differentiation, find the derivative of the following function:

$$f(x) = \frac{(x^2+1)^5 e^x}{\sqrt{x^3+1}}.$$

Question 4
Prove the **quotient rule** by using logarithmic differentiation.

Question 5



Above is the graph of the curve described by the equation

$$y = x^{\sin(x)}.$$

a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$.

*) Do you think there are any points where the tangent to the graph is horizontal?
If so, find at least an interval containing one such point. Can you rigorously prove that in the interval you provided there is indeed a point where the tangent is horizontal?