

Worksheet: Section 1.6, 3.8 and 3.10 The Chain Rule and Implicit Differentiation

I. Evaluate each of the following expressions.

1. $\log_2 8 =$

2. $\log_4 2 =$

3. $\log_{10} .001 =$

II. Solve the equations for x .

1. $\ln x = 5$

2. $e^{2x+1} = 10$

III. What is the domain of each of the following functions? (Remember that the domain of $\ln(x)$ is all $x > 0$).

1. $\ln(x - 3)$

2. $\ln(\ln(\ln(x)))$

IV. Write the expression in terms of the natural exponential and log functions, and then take the derivative.

1. $\frac{d}{dx} 2^{\sin(x)}$

2. $\frac{d}{dx} 10^{\sqrt{x^3+x}}$

V. Differentiate.

1. $f(x) = \ln(x^2 + 10)$

2. $g(x) = \cos(\ln(x))$

3. $h(x) = \sqrt{x} \ln(x)$

4. $k(x) = x \ln(1 + e^x)$

5. $l(x) = \ln(\ln(\ln(x)))$

6. $m(x) = (\ln(1 + 3x^2))^3$

VI. Use logarithmic differentiation to find the derivative:

- i. Set $y = f(x)$.
- ii. Take the natural log of both sides and use the laws of logs to simplify.
- iii. Take the derivative of the equation.
- iv. Solve for y' .

1. $f(x) = (2x + 1)^5(x^4 - 3)^6$.

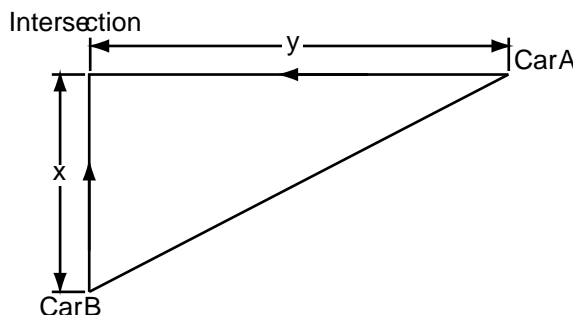
2. $f(x) = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2}$

3. $f(x) = x^{\cos(x)}$

VII. Combining old stuff and new stuff: Use implicit differentiation to find dy/dx , if $y = \ln(x^2 + y^2)$.

VIII. Combining old stuff and new stuff: Find the equation of the tangent line to the curve $y = \ln(\ln(x))$ when $x = e$.

Car A is travelling west at 50 mi/hr and car B is travelling north at 60 mi/hr. Both are headed for the intersection of the two roads. At what rate are the cars approaching the intersection when car A is .3 mi and car B is .4 mi from the intersection?



Write the letters you will use for each of the following variables. Mark the ones that are given, and say what their given value is.

Variables:

Distance from car A to the intersection at a given time: _____

Distance from car B to the intersection at a given time: _____

Distance from car A to car B at a given time: _____

Rate at which car A approaches the intersection: _____

Rate at which car B approaches the intersection: _____

Rate at which car A and car B are approaching each other: _____

What is the question asking for, in terms of your variables?

Use Pythagoras' Theorem to find a relationship between your variables.

Use implicit differentiation with respect to t to differentiate your equation.

Plug in the information given in the problem to answer the question. You will have to use Pythagoras theorem again to get all of the information.