

Math Xb Spring 2005

Course Introduction and Implicit Differentiation

February 7, 2005

1 Goals

- To understand goals and structure of the course
- To review selected concepts from the first semester of Math X
- To be able to follow logarithmic differentiation

2 New Terms

- Logarithmic differentiation

3 Differentiating x^x

If we try to differentiate $f(x) = x^x$, we find that neither the power rule nor the exponential rule produces a correct result.

Two correct approaches to finding this derivative are shown below.

1.

$$f(x) = x^x = e^{\ln x^x}$$
$$f'(x) = e^{\ln x^x} \frac{d}{dx}(\ln x^x) = x^x \frac{d}{dx}(x \ln x) = x^x(1 + \ln x)$$

2.

$$f(x) = x^x$$
$$\ln(f(x)) = \ln(x^x)$$
$$\ln(f(x)) = x \ln x$$
$$\frac{f'(x)}{f(x)} = 1 + \ln x$$
$$f'(x) = x^x(1 + \ln x)$$

4 References

Section 17.1 in *Calculus: An Integrated Approach to Functions and Their Rates of Change*.