
AMAT112: Calculus I

Logarithmic Differentiation

1. Differentiate y in each of the following.

a) $y = \ln(t^2)$

b) $y = \ln(\sin(\theta))$

c) $y = (x^2 \ln(x))^4$

d) $y = \frac{t}{\sqrt{t}}$

e) $y = \frac{x \ln(x)}{1 + \ln(x)}$

f) $y = \ln(\ln(\ln(x)))$

g) $y = \sqrt{\ln(\sqrt{t})}$

h) $y = \ln\left(\frac{\sqrt{\sin(\theta)\cos(\theta)}}{1 + 2\ln(\theta)}\right)$

i) $y = \ln\left(\sqrt{\frac{(x+1)^5}{(x+2)^{20}}}\right)$

2. For each of the following, find the derivative of y with respect to the given independent variable.

a) $y = \sqrt{x(x+1)}$

b) $y = \sqrt{\frac{t}{t+1}}$

c) $y = \sqrt{(x^2+1)(x-1)^2}$

d) $y = \sqrt{\frac{1}{t(t+1)}}$

e) $y = \sin(\theta)\sqrt{\theta+3}$

f) $y = \tan(\theta)\sqrt{2\theta+1}$

g) $y = t(t+1)(t+2)$

h) $y = \frac{\theta+5}{\theta\cos(\theta)}$

i) $y = \frac{\theta\sin(\theta)}{\sqrt{\sec(\theta)}}$

j) $y = \frac{x\sqrt{x^2+1}}{(x+1)^{2/3}}$

k) $y = \sqrt{\frac{(x+1)^{10}}{(2x+1)^5}}$

l) $y = \sqrt[3]{\frac{x(x-2)}{x^2-1}}$

3. Find an equation for the tangent line to the following curves at the indicated points.

a) $y = \ln(x^2 - 3x + 1), \quad (3, 0)$

b) $y = \frac{e^x}{x}, \quad (1, e)$

c) $y = \sin(x)^{\ln(x)}, \quad \left(\frac{\pi}{2}, 1\right)$

d) $y = \sqrt{x^x}, \quad (2, 2)$

e) $y = \frac{(5x^3 + x^2)^2}{6\sqrt{x^3 + 3}}, \quad (1, 3)$

f) $y = \frac{x^{5/3}\sqrt{x^4+2}}{(2x+1)^5}, \quad (-1, \sqrt{3})$