

Calculus I

Homework Chain Rule

Lecture 11

1. Compute the derivative using the chain rule.

(a) $f(x) = \sqrt{1+x^2}$

(b) $f(x) = \sqrt{3x^2 - x + 2}$.

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

(d) $f(x) = \sqrt{1 - \sqrt{x}}$.

(e) $y = (\cos x)^{\frac{1}{2}}$

(f) $f(x) = \sin^3 x$.

(g) $y = (1 + \cos x)^2$.

(h) $f(x) = \frac{1}{\sin^3 x}$.

(i) $f(x) = \sqrt[3]{4 + 3 \tan x}$.

(j) $f(x) = (\cos x + 3 \sin x)^4$.

(k) $y = \sin(\sqrt{x})$

(l) $y = \cos(4x)$

(m) $\sec^2(3x^2)$.

(n) $\csc^2(3x^2)$.

(o) e^{2x} .

(p) e^{-x^2}

(q) $e^{\sqrt{x}}$

(r) $f(x) = e^{-\frac{1}{x}}$.

(s) 5^x .

(t) e^{2^x} .

(u) 2^{3^x} .

(v) 3^{2^x} .

(w) $y = \sqrt{\sec(4x)}$

(x) $y = x^2 \tan(5x)$

(y) $y = \frac{1 + \sin(x^2)}{1 + \cos(x^2)}$.

2. Compute the derivative.

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

(b) $f(x) = (4x - x^2)^{100}$.

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

(d) $f(x) = (x^2 + 1)^3(x^2 + 2)^6$.

(e) $f(x) = (3x - 1)^4(2x + 1)^{-3}$.

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

(g) $f(x) = \left(\frac{x^2 + 1}{x^2 - 1}\right)^3$.

(h) $f(x) = (x + 1)^{\frac{2}{3}}(2x^2 - 1)^3$.

(i) $f(x) = \sqrt{1 - 2x}$.

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

(k) $f(x) = 3 \cot(2x)$.

(l) $f(x) = \frac{1}{(1 + \sec x)^2}$.

(m) $f(x) = \sqrt[3]{1 + \tan x}$.

(n) $f(x) = \cos(2 + x^3)$.

(o) $f(x) = \cos\left(\frac{1}{x}\right) \sin(x^2)$.

(p) $f(x) = x \sec(kx)$.

3. Differentiate.

(a) $f(x) = \sin(\tan(2x))$.

(b) $f(x) = \sec^2(mx)$.

(c) $f(x) = \sec^2 x + \tan^2 x$.

(d) $f(x) = x \sin\left(\frac{1}{x}\right)$.

(e) $f(x) = \left(\frac{1 - \cos(2x)}{1 + \cos(2x)}\right)^4$.

(f) $f(x) = \sqrt{\frac{x}{x^2 + 4}}$.

(g) $f(t) = \cot^2(\sin t)$.

(h) $f(x) = \left(ax + \sqrt{x^2 + b^2}\right)^{-2}$.

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

(j) $f(x) = \sin(\sin(\sin x))$.

(k) $f(x) = \sqrt{x + \sqrt{x}}$.

(l) $f(x) = \sqrt{x + \sqrt{x + \sqrt{x}}}$.

(m) $f(x) = (2r \sin(rx) + n)^p$.

(n) $f(x) = \cos^4(\sin^3 x)$.

(o) $f(x) = \cos \sqrt{\sin(\tan(\pi x))}$.

(p) $f(x) = (x + (x + \sin^2 x)^3)^4$.

4. Compute the second derivative.

(a) $f(x) = \sin(-5x)$.

(b) $f(x) = \cot(2x)$.

(c) $f(x) = e^{-3x}$.

(d) $f(x) = e^{\frac{1}{x}}$.

(e) $f(x) = e^{\sqrt{x}}$.

(f) $f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$

(g) $f(x) = \frac{1}{2} \ln \left(\frac{1+x}{1-x} \right)$