MATH6103 Differential & Integral Calculus

Differentiation Practice Sheet Solutions

Please let me know if you find a mistake in these answers!

a) $y = e^x \ln x$

$$\frac{dy}{dx} = \frac{e^x}{x} + e^x \ln x$$

b) $y = \sin \sqrt{x}$

$$\frac{dy}{dx} = \frac{\cos \sqrt{x}}{2\sqrt{x}}$$

c) $y = \frac{1}{x^2} \ln x$

$$\frac{dy}{dx} = \frac{\ln x}{x^2} - \frac{2 \ln x}{x^3}$$

d) $y = \sin \frac{1}{x}$

$$\frac{dy}{dx} = -\frac{1}{x^2} \cos \frac{1}{x}$$

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

$$\frac{dy}{dx} = -\frac{1}{(x+1)^2}$$

f) $y = \cos 4x^2$

$$\frac{dy}{dx} = -8x \sin 4x^2$$

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

$$\frac{dy}{dx} = -2 \sin(2x + 1)$$

h) $y = \sin(x^2 + 3x + 4)$

$$\frac{dy}{dx} = (2x + 3) \cos(x^2 + 3x + 4)$$

i) $y = \tan \frac{1}{x}$

$$\frac{dy}{dx} = -\frac{1}{x^2}\sec^2\frac{1}{x}$$

j) $y = e^{x^2}$

$$\frac{dy}{dx} = 2xe^{x^2}$$

k) $y = e^{x^2+3x+2}$

$$\frac{dy}{dx} = (2x+3)e^{x^2+3x+2}$$

l) $y = \frac{x\sin x}{e^x}$

$$\frac{dy}{dx} = \frac{e^x(\sin x + x\cos x) - e^x x\sin x}{e^{2x}}$$

m) $y = x^3\tan x$

$$\frac{dy}{dx} = x^3\sec^2 x + 3x^2\tan x$$

n) $y = \frac{x+2}{x+2}$

$$\frac{dy}{dx} = 0$$

o) $y = \sec^2 x$

$$\frac{dy}{dx} = 2\tan 2x\sec^2 x$$

p) $y = \exp(\exp(x))$

$$\frac{dy}{dx} = e^x e^{e^x}$$

q) $y = \ln(x^7 + 4x)$

$$\frac{dy}{dx} = \frac{7x^6+4}{x^7+4x}$$

r) $y = x^4e^{2x}$

$$\frac{dy}{dx} = 2x^4e^{2x} + 4x^2e^{2x}$$

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

$$\frac{dy}{dx} = \frac{1}{x \ln x}$$

t) $y = \sin x \ln x \cos x$

$$\frac{dy}{dx} = \ln x \cos^2 x - \ln x \sin^2 x + \frac{\cos x \sin x}{x}$$

u) $y = \tan e^x$

$$\frac{dy}{dx} = e^x \sec^2 e^x$$

v) $y = \sqrt{e^{x+3}}$

$$\begin{aligned}\frac{dy}{dx} &= \frac{e^{x+3}}{2\sqrt{e^{x+3}}} \\ &= \frac{\sqrt{e^{x+3}}}{2}\end{aligned}$$

w) $y = \frac{1}{e^x}$

$$\frac{dy}{dx} = -\frac{1}{e^x}$$

x) $y = \frac{x}{e^x \sin x}$

$$\frac{dy}{dx} = x(e^x \sin x + e^x \cos x) - e^x \sin x e^{2x} \sin^2 x$$

y) $y = \ln \sqrt{x}$

$$\frac{dy}{dx} = \frac{1}{2x}$$

z) $y = 3^\pi$

$$\frac{dy}{dx} = 0$$