

1. Calculate the derivatives of the following functions:

(a) $y = \sqrt{x^2 + e^x}$

(b) $y = \ln x^{500}$

(c) $\cos(xy) = \sin(xy)$

(d) $\frac{y^2 + 5 \tan x - \frac{x}{y}}{x^4} = x$

(e) $24x^3 - 3x^{-7} = y$

(f) $f(x) = (e^x + \arcsin x) \left(\frac{3}{x^2} \right)$

(g) $y = x^3 - 3x^2 - 1$

(h) $f(x) = 7x - 3$

(i) $f(x) = e^\pi$

(j) $f(x) = \frac{1}{\sqrt{x}}$

(k) $f(x) = 5\sqrt[3]{x} + 6x^2 - e$

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

(m) $f(x) = \sin 3$

(n) $f(x) = x^2 \sin 2$

(o) $f(x) = x^e + x^\pi$

2. Compute the following derivatives:

(a) $\frac{d}{dx} \left(\frac{x^3}{2} \right)$

(b) $\frac{d}{dx} \left(\frac{3x + 2}{2x - 11} \right)$

(c) $\frac{d}{dx} (\sqrt{\sin^2 x})$

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

(e) $\frac{d}{dx} (\tan(\cos(\sin x)))$

(f) $\frac{d}{dx} ((\tan x)(\cos x)(\sin x))$

(g) $\frac{d}{dx} ((4x + 3)^4(x + 1)^{-1})$

(h) $\frac{d}{dx} \left(\sin \left(\frac{3\pi x}{x} \right) + \cos \left(\frac{3\pi x}{2} \right) \right)$

(i) $\frac{d}{dx} (x \tan x)$

(j) $\frac{d}{dx} ((x^2 + 1) \sec x)$

- (k) $\frac{d}{dx} (x(x^2 + 1) \tan x \sec x)$
- (l) $\frac{d}{dx} (x \sin^{-1} x + \sqrt{-x^2})$
- (m) $\frac{d}{dt} (\cot^{-1} \sqrt{t-1})$
- (n) $\frac{d}{ds} (\tan^{-1} \sqrt{x^2-1} + \sin^{-1} x)$
- (o) $\frac{d}{dx} (3^{\sin x})$
- (p) $\frac{d}{dx} (\ln(x^2 + 1))$
- (q) $\frac{d}{dx} (e^{\sin x})$
- (r) $\frac{d}{dx} (x^{\sin x})$
- (s) $\frac{d}{dx} \left(\sqrt[5]{\frac{(x-3)^4(x^2+1)}{(2x+5)^3}} \right)$
- (t) $\frac{d}{dx} (x \sin x + e^x + \pi^x + x^\pi)$
- (u) $\frac{d}{dx} (\ln 2 \cdot \log_2 x)$
- (v) $\frac{d}{dx} (\ln 10^x)$
- (w) $\frac{d}{dt} \left(\frac{t^2 + 3t}{t} \right)$
- (x) $\frac{d}{dx} (x \ln x)$
- (y) $\frac{d}{dx} \left(\frac{e^x}{e^{-x} + 1} \right)$

3. Find $\frac{dy}{dx}$ for each of the following;

(a) $xy + 2x + 3y = 1$

(b) $\sqrt{xy} + y^2 = 1$

(c) $\sin^2 x + \cos^2 y = 1$

(d) $\frac{x^3 - xy}{x} = 3y$

(e) $x(t) = 2t^7 - 4t^2 + 5$

$y(t) = 3t^2 + 5$

(f) $x(t) = \cos(5t^2 + t)$

$y(t) = \cos^2(7t^3 - t^2)$