

Prelim Revision**Differentiation 1**

Differentiate

- 1) (a) $y = e^{x^3+1}$ (b) $y = 4e^{2x}$ (c) $y = 2e^{-3x}$
- (d) $y = 3e^{x^2+1}$ (e) $y = 5e^{2x^3}$ (f) $y = \frac{3}{e^{4x}}$
- (g) $y = e^{5x} + \frac{2}{x^2}$ (h) $y = 2e^{3x} + 3e^x$ (i) $y = e^{4x} + 2e^{2x}$
- (j) $y = 2e^{x^2} - \frac{4}{e^x}$ (k) $y = \ln(2x+1)$ (l) $y = \ln(x^2+4)$
- (m) $y = \ln(\cos x)$ (n) $y = \ln(x^3+1)$ (o) $y = \ln(e^{2x}+1)$
- (p) $y = \ln(x^2+2x-1)$ (q) $y = \sec 5x$ (r) $y = \sec(x^2+1)$
- (s) $y = \cos(x^4)$ (t) $y = \tan(2-3x)$ (u) $y = \cot 2x$
- (v) $y = \tan(4x^2+1)$ (w) $y = \sec\left(2x + \frac{\pi}{3}\right)$ (x) $y = \operatorname{cosec} 6x$

Use the chain, product or quotient rule as appropriate.

- 2 (a) $y = e^{2x} \cos 4x$ (b) $y = e^{-2x} \sin 2x$ (c) $y = x^4 e^{x^2}$
- (d) $y = \frac{x^2}{e^x}$ (e) $y = \frac{e^{2x}}{x}$ (f) $y = \frac{x^3}{e^{2x}}$
- (g) $y = e^{x^2} \ln x$ (h) $y = \frac{\ln x}{x}$ (i) $y = x^3 \tan 2x$
- (j) $y = \frac{\sin 2x}{x^2}$ (k) $y = 2x \tan 3x$ (l) $y = \frac{x}{\tan x}$
- (m) $y = x^2 \tan^2 x$ (n) $y = e^{2x} \sec x$ (o) $y = \cos^5 3x$
- (p) $y = \tan^6 2x$

3) Find the equation of the tangent to the curve $y = (x+1)e^x$ at the point where $x = 0$.

4) If $y = \frac{\sin x}{\sin x + \cos x}$, find the value of the second derivative $\frac{d^2y}{dx^2}$ when $x = \frac{\pi}{2}$.

Answers

- 1a) $3x^2 e^{x^3+1}$ (b) $8e^{2x}$ (c) $-6e^{-3x}$
 (d) $6xe^{x^2+1}$ (e) $30x^2 e^{2x^3}$ (f) $-\frac{12}{e^{4x}}$
 (g) $5e^{5x} - \frac{4}{x^3}$ (h) $6e^{3x} + 3e^x$ (i) $4e^{4x} + 4e^{2x}$
 (j) $4xe^{x^2} + \frac{4}{e^x}$ (k) $\frac{2}{2x+1}$ (l) $\frac{2x}{x^2+4}$
 (m) $-\tan x$ (n) $\frac{3x^2}{x^3+1}$ (o) $\frac{2e^{2x}}{e^{2x}+1}$
 (p) $\frac{2(x+1)}{x^2+2x-1}$ (q) $5\sec 5x \tan 5x$ (r) $2x \sec(x^2+1) \tan(x^2+1)$
 (s) $-4x^3 \sin(x^4)$ (t) $-3\sec^2(2-3x)$ (u) $-2\operatorname{cosec}^2 2x$
 (v) $8x \sec^2(4x^2+1)$ (w) $2\sec\left(2x + \frac{\pi}{3}\right) \tan\left(2x + \frac{\pi}{3}\right)$
 (x) $-6\operatorname{cosec} 6x \cot 6x$
- 2 (a) $2e^{2x}(\cos 4x - 2\sin 4x)$ (b) $2e^{-2x}(\cos 2x - \sin 2x)$
 (c) $2x^3(x^2+2)e^{x^2}$ (d) $\frac{x(2-x)}{e^x}$ (e) $\frac{(2x-1)e^{2x}}{x^2}$
 (f) $\frac{x^2(3-2x)}{e^{2x}}$ (g) $e^{x^2}\left(\frac{1}{x} + 2x \ln x\right)$ (h) $\frac{1-\ln x}{x^2}$
 (i) $x^2(2x \sec^2 2x + 3 \tan 2x)$ (j) $\frac{2(x \cos 2x - \sin 2x)}{x^3}$
 (k) $2(3x \sec^2 3x + \tan 3x)$ (l) $\frac{\tan x - x \sec^2 x}{\tan^2 x}$
 (m) $2x \tan x(x \sec^2 x + \tan x)$ (n) $e^{2x} \sec x(\tan x + 2)$
 (o) $-15 \cos^4 3x \sin 3x$ (p) $12 \tan^5 2x \sec^2 2x$

3) $y = 2x + 1$

4) $\frac{d^2 y}{dx^2} = 2$ when $x = \frac{\pi}{2}$