Tutorial on Differentiation

1. Find the derivatives of the following functions:

(a) $y = 1$ (b) $f(x) = \pi$ (c) $g(t) = e^2$

(d) $y = x^3$ (e) $f(x) = x^5$ (f) $g(x) = x^{\frac{3}{2}}$

(g) $y = 20x^{\frac{3}{4}}$ (h) $f(x) = \sqrt{x}$ (i) $f(x) = \sqrt{x^3}$

(j) $y = \frac{7}{x^3}$ (k) $f(x) = 3\sqrt[3]{x}$ (l) $g(t) = \frac{1}{t^2}$

(m) $g(t) = \frac{5}{t^3}$ (n) $h(s) = \frac{2}{\sqrt{s}}$ (o) $h(s) = \frac{1}{3\sqrt[3]{s}}$

2. Differentiate the following with respect to x :

(a) $4x^2 + 3x + 1$ (b) $\frac{6}{\sqrt[3]{x}} - \frac{4}{\sqrt{x}}$ (c) $5x^4 + \frac{4}{x} - \pi$

(d) $3x + 2\sqrt{x} - 3$ (e) $\frac{2x^2+4x}{x}$ (f) $x(x + 4)$

(g) $4x^2\sqrt{x} - \frac{6}{\sqrt{x}}$ (h) $\frac{(1-x)(x-2)}{x}$

3. Differentiate the following functions :

(a) $y = 2x^3 - 4x^2 + x + 3$ (b) $y = \frac{1}{2x} - \frac{5}{x^2}$

(c) $g(x) = \frac{x^3+x^2-2x}{x^4}$ (d) $f(t) = 6\sqrt{t} - \frac{1}{\sqrt{t}}$

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

4. Differentiate the following functions by general power rule.

(a) $y = (2x^3 + 7)^6$ (b) $y = \sqrt{2x + 5}$ (c) $y = \frac{2}{3\sqrt{x^2-5x}}$

5. Differentiate the following functions by product rule.

(a) $y = (x + 7)^{10}(x^2 + 2)^{-7}$ (b) $y = \frac{\sqrt{t}}{t^2+4}$ (c) $y = \frac{3u-5}{3u^2+7}$

6. Differentiate the following functions by quotient rule:

(a) $y = (x + 7)^{10}(x^2 + 2)^{-7}$ (b) $y = \frac{\sqrt{t}}{t^2+4}$ (c) $y = \frac{3u-5}{3u^2+7}$

7*. Differentiate the following functions with respect to x by product or quotient rule:

(a) $y = (2ax + b)^5(5x^2 - ab)^6$ (b) $y = \frac{2ax^2+bx}{bx^3-cx}$

Answers

1.

(a) $\frac{dy}{dx} = 0$ (b) $f'(x) = 0$ (c) $g'(t) = 0$

(d) $\frac{dy}{dx} = 3x^2$ (e) $f'(x) = 5x^4$ (f) $g'(x) = \frac{3}{2}x^{\frac{1}{2}}$

(g) $\frac{dy}{dx} = 15x^{-\frac{1}{4}}$ (h) $f'(x) = \frac{1}{2}x^{-\frac{1}{2}}$ (i) $f'(x) = \frac{3}{2}x^{\frac{1}{2}}$

(j) $\frac{dy}{dx} = 21x^{-4}$ (k) $f'(x) = x^{-\frac{2}{3}}$ (l) $g'(t) = -2t^{-3}$

(m) $g'(t) = -15t^{-4}$ (n) $h'(s) = -s^{-\frac{3}{2}}$ (o) $h'(s) = -\frac{1}{9}s^{-\frac{4}{3}}$

2.

(a) $8x + 3$ (b) $-2x^{-\frac{4}{3}} + 2x^{-\frac{3}{2}}$ (c) $20x^3 - 4x^{-2}$

(d) $3 + x^{-\frac{1}{2}}$ (e) 2 (f) $2x + 4$

(g) $10x^{\frac{3}{2}} + 3x^{-\frac{3}{2}}$ (h) $\frac{2}{x^2} - 1$

3.

(a) $6x^2 - 8x + 1$ (b) $-\frac{1}{2x^2} + \frac{10}{x^3}$

(c) $-\frac{1}{x^2} - \frac{2}{x^3} + \frac{6}{x^4}$ (d) $\frac{3}{\sqrt{t}} + \frac{1}{2\sqrt{t^3}}$

(e) $20x^3 + 6x - 1$ (f) $-3x^{-4} - x^{-\frac{3}{2}}$

4.

(a) $\frac{dy}{dx} = 36x^2(2x^3 + 7)^5$ (b) $\frac{dy}{dx} = \frac{1}{\sqrt{2x+5}}$ (c) $\frac{dy}{dx} = \frac{5-2x}{3(x^2-5x)^{\frac{3}{2}}}$

5. and 6.

(a) $-2(x^2 + 2)^{-8}(x + 7)^9(2x^2 + 49x - 10) = \frac{-2(x+7)^9[2x^2+49x-10]}{(x^2+2)^8}$

(b) $\frac{4-3t^2}{2\sqrt{t}(t^2+4)^2}$

(c) $\frac{3(7+10u-3u^2)}{(3u^2+7)^2}$

7. (a) $10(2ax + b)^4(5x^2 - ab)^5[17ax^2 + 6bx - a^2b]$

(b) $\frac{-2x^2(abx^2+b^2x+ac)}{(bx^3-cx)^2}$