Introduction to Differentiation

1. Find the derivative for each of the following:

a. x^7 b. x^{10} c. x^6 d. $x^{6.5}$ e. $x^{6.8}$

f. $3x^7$ g. $4x^3$ h. $6x^2$ i. $5x^{3.2}$ j. $6x^{4.6}$

2. Find the derivative for each of the following:

a. $x^{\frac{1}{2}}$ b. $x^{\frac{1}{3}}$ c. $x^{\frac{2}{3}}$ d. $x^{\frac{3}{4}}$ e. $x^{\frac{5}{3}}$

f. $8x^{\frac{1}{2}}$ g. $4x^{\frac{3}{2}}$ h. $6x^{\frac{2}{3}}$ i. $4x^{\frac{5}{3}}$ j. $8x^{\frac{5}{3}}$

3. Find an expression for $f'(x)$ where:

a. $f(x) = 5x^2$ b. $f(x) = 8x^2 + 5x$ c. $f(x) = 8x^2 + 3$ d. $f(x) = 8x^{\frac{1}{2}} - 5x$ e. $f(x) = 5x^{4.3}$

f. $f(x) = 3x^7 + 3x^{-1}$ g. $f(x) = 5x^3 - 5x^2 + 3$ h. $f(x) = x^2 + 8x^{-3}$ i. $f(x) = 4x^3 - 5x^{-2}$

4. Find an expression for $\frac{dy}{dx}$ where:

a. $y = \sqrt[3]{x^4}$ b. $y = 5x^2 + \frac{8}{x^2}$ c. $y = 6x^3 - \frac{7}{x^2}$ d. $y = \left(\sqrt{x}\right)^5 - 3x^5$

e. $y = 5x^3 - 5x^{-4}$ f. $y = 6x^3 - 3x^2 + \frac{5}{x^3}$ g. $y = 7x^3 - 5x^{3.8} + \frac{8}{x^3}$ h. $y = 8x^2 + \frac{3}{x^2} + 5x^6$

5. Find $f(t)$ and hence calculate the speed where

a. $f(t) = 3t^2$ at $t = 2$ b. $f(t) = t^4$ at $t = 10$ c. $f(t) = 2t^3$ at $t = 3$

d. $f(t) = \sqrt{t^5}$ at $t = 9$ e. $f(t) = \sqrt[4]{x^3}$ at $t = 128$ f. $f(t) = 4t^{\frac{5}{3}}$ at $t = 27$

6. Find $f(x)$ and hence calculate the rate of change where

a. $f(x) = x^4$ at $x = 2$ b. $f(x) = x^5$ at $x = 10$ c. $f(x) = 2x^4$ at $x = 3$

d. $f(x) = \sqrt{x^3}$ at x= 9 e. $f(x) = \sqrt[4]{x}$ at $x = 81$ f. $f(t) = 4x^{\frac{2}{3}}$ at $x = 8$

7. Find the derivative of each of the following

a. $(2x + 1)(x + 3$ b. $(x + 1)(2x + 1)(3x + 1)$ c. $\frac{4}{x}\left(\frac{3}{x} + 2\right)$

d. $\frac{x^3+2x^2+7}{x}$ e. $\left(\frac{1}{x^2} - x^2\right)^2$ f. $\frac{7x^5+3x+5}{4x^2}$

8. Find the equation of the tangent to the curve

a. $y = x^3$ at $(2, 8)$ b. $y = x^2 + 3x$ at $(1, 4)$ c. $y = 5\sqrt{x}$ at $(4, 10)$

d. $y = \frac{x^2-1}{3}$ at $x = 5$ e. $y = x^2(x + 4)$ at $x = 3$ f. $y = x^3 - 2x^2 + 7$ at $x = 2$