

Ph1105 Problem Sheet C

1. Differentiate the following functions with respect to x

(i) $y = \sin^2\left(\frac{x^2}{x^2 + 1}\right)$

(ii) $y = x^3\left(\cos x + \sin(3x)\right)^{\frac{1}{3}}$

(iii) $y = \frac{x \tan x}{x + \tan x}.$

2. Evaluate each of the following integrals

(i) $\int \frac{x^2 - 2x^3}{x^5} dx$

(ii) $\int \frac{3x^2 + 6x - 5}{(x^3 + 3x^2 - 5x + 1)^5} dx$

(iii) $\int x(2 - x^2)^3 dx$

(iv) $\int \frac{x}{\sqrt{4 - 5x^2}} dx.$

3. Evaluate the following integrals

(i) $\int \frac{\sec^2 \sqrt{x}}{\sqrt{x}} dx$

(ii) $\int x \sec^2(x^2) dx.$

(i) $\int_0^{\frac{\pi}{4}} \sec^2 x \tan x dx$

(ii) $\int_0^2 x \cos(3x^2) dx$