

1. Differentiate the following functions with respect to  $x$ .

(a) Use the quotient rule to differentiate

$$y = \frac{2x^4 - 3x}{4x - 1}$$

(b) Use the Chain rule to differentiate

$$y = 6 \cos(x^3 + 3)$$

(c) Select an appropriate rule to differentiate

$$y = (4x^2 - e^{2x}) \sin 3x$$

4. Find the following integrals.

(a)  $\int \left( 5x^2 + \sqrt{x} - \frac{4}{x^2} \right) dx$

(b)  $\int \left[ \cos\left(\frac{x}{2}\right) - \sin\left(\frac{3x}{2}\right) \right] dx$

(c)  $\int_1^5 \frac{s}{\sqrt{s^2 + 4}} ds$

5. (a) Find the area bounded by the curve  $y = \frac{1}{x}$  between  $x = 2$  and  $x = 6$ .  
(Give your answer to 3 decimal places.)

(b) Sketch the curve for  $y = \sin(x)$  between  $x = 0$  and  $x = 2\pi$ , then find the total area enclosed by the curve  $y = \sin x$  and the X axis between  $x = 0$  and  $x = 1.7\pi$ .

6. If the instantaneous rate of change of a population is

$$50t^2 - 100t^{\frac{3}{2}}$$

(measured in individuals per year) and the initial population is 25000 then

(a) What is the population after  $t$  years?

(b) What is the population after 25 years?

7. Use integration by parts to solve the following integral

$$\int 5x \cos(4x) dx$$