Indefinite Integration and Applications

1. Compute the indefinite integrals below.

a. $\int 3x^3 - 4x^2 + 3x + 2\,dx =$

b. $\int 4\sqrt{t} + \frac{2}{\sqrt[3]{t}}\,dt =$

c. $\int \frac{3x^2 + 2x - 1}{4x^3}\,dx =$

d. $\int \frac{3x\,dx}{\sqrt[3]{x^2+1}} =$

e. $\int (x^2 + 2x)(x^3 + 3x^2 - 1)^3\,dx =$

f. $\int (x^2 + 1)(x + 3)^2\,dx =$

g. $\int 1000e^{-0.05t}\,dt =$

h. $\int \frac{t^2 + 5}{3t + 1}\,dt$

2. Find the function $y = f(x)$, given that $y' = x - \frac{1}{x}$, and $f(1) = 3$.

3. Find the function $y = g(x)$, given that $y'' = x^2 - 1$, $g'(1) = 2$ and $g(1) = 2$.

4. The marginal revenue function for a firm is

$$\frac{dr}{dq} = 200 - q^{2/3}.$$

Find the firm's demand function.

5. A firm's fixed cost is \$12000, and their marginal cost function is

$$\frac{dc}{dq} = (q + 1000)^{1/3} + 50.$$

Find the firm's cost function.

6. A firm's marginal revenue and marginal cost functions are

$$\frac{dr}{dq} = 100 - \sqrt{3q + 10} \quad \text{and} \quad \frac{dc}{dq} = 0.2q + 65,$$

respectively. How will the firm's **profit** change if output is increased from $q = 30$ to $q = 53$?

7. The marginal propensity to consume of a small nation is given by

$$\frac{dC}{dY} = \frac{9Y + 10}{10Y + 1},$$

where consumption C and national income Y are both measured in billions of dollars. Find the total change in national consumption and saving, if income increases from \$10 billion to \$15 billion.