

**DIFFERENTIATION & APPLICATIONS (Q 6 & 7, PAPER 1)**

**LESSON NO. 1: ALGEBRAIC DIFFERENTIATION**

**2006**

6 (a) Differentiate  $\sqrt{x}(x+2)$  with respect to  $x$

**SOLUTION**

$$y = \sqrt{x}(x+2) = x^{\frac{3}{2}} + 2x^{\frac{1}{2}}$$

$$\Rightarrow \frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + x^{-\frac{1}{2}} = \frac{3}{2}\sqrt{x} + \frac{1}{\sqrt{x}}$$

$$y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1} \dots\dots \textcircled{1}$$

**2005**

6 (a) Differentiate with respect to  $x$

(i)  $(1+7x)^3$

**SOLUTION**

$$y = [f(x)]^n \Rightarrow \frac{dy}{dx} = n[f(x)]^{n-1} \times f'(x) \dots\dots \textcircled{1}$$

$$y = (1+7x)^3 \Rightarrow \frac{dy}{dx} = 3(1+7x)^2(7) = 21(1+7x)^2$$

**2004**

6 (a) Differentiate  $\frac{1}{2+5x}$  with respect to  $x$ .

**SOLUTION**

$$y = [f(x)]^n \Rightarrow \frac{dy}{dx} = n[f(x)]^{n-1} \times f'(x) \dots\dots \textcircled{1}$$

$$y = \frac{1}{2+5x} = (2+5x)^{-1} \Rightarrow \frac{dy}{dx} = -1(2+5x)^{-2}(5) = -\frac{5}{(2+5x)^2}$$

**2003**

6 (a) Differentiate  $\sqrt{1+4x}$  with respect to  $x$ .

**SOLUTION**

$$y = [f(x)]^n \Rightarrow \frac{dy}{dx} = n[f(x)]^{n-1} \times f'(x) \dots\dots \textcircled{1}$$

$$y = \sqrt{1+4x} = (1+4x)^{\frac{1}{2}} \Rightarrow \frac{dy}{dx} = \frac{1}{2}(1+4x)^{-\frac{1}{2}}(4) = \frac{2}{\sqrt{1+4x}}$$

**2002**

6 (a) Differentiate  $(x^4 + 1)^5$  with respect to  $x$ .

**SOLUTION**

$$y = [f(x)]^n \Rightarrow \frac{dy}{dx} = n[f(x)]^{n-1} \times f'(x) \dots\dots \textcircled{1}$$

$$y = (x^4 + 1)^5 \Rightarrow \frac{dy}{dx} = 5(x^4 + 1)^4 \times 4x^3 = 20x^3(x^4 + 1)^4$$

**2001**

6 (a) Differentiate  $\frac{x}{1+x^2}$  with respect to  $x$ .

(b) (i) Given that  $y = \sqrt{x}$ , what is  $\frac{dy}{dx}$ ?

**SOLUTION**

**6 (a)**

**THE QUOTIENT RULE:** If  $y = \frac{u}{v}$  then:  $\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2} \dots\dots \textcircled{4}$

$$y = \frac{x}{1+x^2} \Rightarrow \frac{dy}{dx} = \frac{(1+x^2)(1) - x(2x)}{(1+x^2)^2} = \frac{1+x^2 - 2x^2}{(1+x^2)^2} = \frac{1-x^2}{(1+x^2)^2}$$

**6 (b) (i)**

$$y = \sqrt{x} = x^{\frac{1}{2}} \Rightarrow \frac{dy}{dx} = \frac{1}{2} x^{-\frac{1}{2}} = \frac{1}{2\sqrt{x}} \quad y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1} \dots\dots \textcircled{1}$$