DATE: -   16TH January, 2024
CLASS: -   SS 2$^{A\&B}$
TIME: -   8:00-9.20pm   PERIOD: -   1ST & 2ND
DURATION: -   80 Minutes
SUBJECT: -   Further Mathematics
THEME: -   Calculus
UNIT TOPIC: -   Differentiation
LESSON TOPIC: -   Rules of differentiation
SPECIFIC OBJECTIVES: - At the end of the lesson, the students should be able to;

i. recall differentiation from the first principle and differentiation of polynomials
ii. explore the standard formulas for the rules of differentiation
iii. discuss differentiation using product rule
iv. apply the differentiation using the quotient rule
v. respond to questions differentiation involving; function of functions, product and quotient rule.

INSTRUCTIONAL RESOURCES: - Illustrative chart.

PRESENTATION

STEP 1: Identification of prior ideas

MODE: - Whole

Teachers Activities: The teacher drills the student on the formula for differentiation of polynomial and differentiation from the first principle.

Students Activities: - The students respond by relaying their prior knowledge on differentiation from the first principle and differentiation of polynomials.

1.   If $y = x^3$

$y + \delta y = (x + \delta x)^3$

$y + \delta y = x^3 + 3x^2 \delta x + 3x \delta x^2 + \delta x^3$

$\delta y = x^3 + 3x^2 \delta x + 3x \delta x^2 + \delta x^3 - x^3$

$= 3x^2 \delta x + 3x \delta x^2 + \delta x^3$

$\frac{\delta y}{\delta x} = 3x^2 + 3x \delta x + \delta x^2$

$\lim_{\delta x \to 0} \frac{\delta y}{\delta x} = 3x^2$

2.   If $y = x^3$

From the formula; $y = x^n$ then $\frac{\delta y}{\delta x} = nx^{n-1}$

$\frac{\delta y}{\delta x} = 3x^2$

STEP 2: - Exploration

MODE: - Whole

Teachers Activities: - The writes the standard formulas for the rules of differentiation and explains using a chart.

Students Activities: - The class listens and copied the standard formulas for the rules of differentiation into their notebooks

1. $\frac{\delta y}{\delta x} = \frac{dy}{du} x \frac{du}{dx}$

2. $\frac{d(u.v)}{dx} = u\frac{\delta v}{\delta x} + v\frac{\delta u}{\delta x}$

3. $\quad \dfrac{d\left(\frac{u}{v}\right)}{dx} = \dfrac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

Function of Functions

1.   If $y=(x^2+3)^4$

$$\dfrac{\delta y}{\delta x} = \dfrac{dy}{du} \times \dfrac{du}{dx}$$

$Y=u^4$ and $\dfrac{dy}{du} = 4u^3$

$U=x^2+3$ then $\dfrac{du}{dx} = 2x$

Since, $\dfrac{\delta y}{\delta x} = \dfrac{dy}{du} \times \dfrac{du}{dx}$

$\qquad\qquad \dfrac{\delta y}{\delta x} = 4u^3 \times 2x$

$\qquad\qquad\qquad = 8x(x^2+3)^3$

STEP 3: - Discussion

MODE: - Whole

Teachers Activities: - The teacher drills the students on the definition of the product rule.

Students Activities: - The students identify and discus the products rule using a chart.

Product rule $\rightarrow \quad \dfrac{d(u.v)}{dx} = u\dfrac{\delta v}{\delta x} + v\dfrac{\delta u}{\delta x}$

1.   If $\quad y=(x^2+1)(x^3+3)$

$\qquad\qquad y = u.v$

$\qquad \dfrac{d(u.v)}{dx} = u\dfrac{\delta v}{\delta x} + v\dfrac{\delta u}{\delta x}$

$\qquad U=(x^2+1), \quad \dfrac{\delta u}{\delta x} = 2x$

$\qquad V=(x^3+3), \quad \dfrac{\delta v}{\delta x} = 3x^2$

$\qquad \dfrac{dy}{dx} = u\dfrac{\delta v}{\delta x} + v\dfrac{\delta u}{\delta x}$

$\qquad\qquad = (x^2+1)(3x^2)+(x^3+3)2x$

$\qquad\qquad = 3x^4+3x^2+2x^4+6x$

$\qquad\qquad = 5x^4+3x^2+6x$

STEP 4: - Application

MODE: - Whole

Teachers Activities: - The teacher drills the students on the definition of the quotient rule.

Students Activities: - The students defined and apply the quotient rule

Quotient rule $\rightarrow \quad \dfrac{d\left(\frac{u}{v}\right)}{dx} = \dfrac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

2.   If $y = \dfrac{X^2+1}{X^2-1}$

$\qquad$ If $y = \dfrac{X^2+1}{X^2-1} = \dfrac{u}{v}$

$\qquad\qquad U = X^2+1, \quad \dfrac{\delta u}{\delta x} = 2x$

$\qquad\qquad V = X^2-1, \quad \dfrac{dv}{dx} = 2x$

$\qquad \dfrac{dy}{dx} = \dfrac{(x^2-1).2x-(x^2+1).2x}{(x^2-1)^2}$

$$=\frac{-4x}{(x^2-1)^2}$$

STEP 5: - Evaluation

MODE: - Whole

Teachers Activities: - The teacher drill the students on questions related to the lesson.

1. List the standard formulas for the rules of differentiation
2. Differentiate $Y=(2x^3-3x^2+6x)^{-5}$
3. Differentiate $y= \sqrt{x}(x^4+3)$

4. Differentiate $Y=\frac{(x-1)^2}{x^2}$

Students Activities: - The entire class responds to the class exercise.

CONCLUSION: - The teacher marks the class exercise and writes correction on the chalkboard.

ASSIGNMENT: - Exercise 4a,nos 3-6,Further Mathematics for senior secondary schools.

.REFEREENCE BOOK: - 1. Engineering Mathematics by K Strod.

2. Pure Mathematics by Backhouse   .