DATE: - 23RD January, 2024
CLASS: - SS 2A
TIME: - 8:00-9.20pm PERIOD: - 7th & 8th
DURATION: - 80 Minutes
SUBJECT: - Further Mathematics
THEME: - Calculus
UNIT TOPIC: - Differentiation
LESSON TOPIC: - Differentiation of Transcendental functions
SPECIFIC OBJECTIVES: - At the end of the lesson, the students should be able to;

i. recall and manipulate trigonometrical ratios
ii. prove the differentiation of given trigonometrical ratios
iii. discuss the standard table of the differentiation of given trigonometric functions
iv. apply the formulas from the standard table on the differentiation of circular function
v. respond to questions on the differentiation of transcendental function s

INSTRUCTIONAL RESOURCES: - Illustrative chart.

PRESENTATION

STEP 1: Identification of prior ideas
MODE: - Whole
Teachers Activities: The teacher drills the student on SOH/CAH/TOA and its manipulation.
Students Activities: - The students respond and listen to the contribution of the teacher.

Sin=$\frac{opp.}{hyp.}$, Cos=$\frac{adj}{hyp.}$, Tan=$\frac{opp.}{adj.}$, Cosec=$\frac{1}{sin}$, Sec=$\frac{1}{cos}$, Cot=$\frac{1}{tan}$

The derivatives of other circular functions can be obtained from the derivatives of the functions of sin x, cos x and tan x. It is important to note that it is assumed that x is measured in radian (180˚ being equal to$2\pi\ radian$). It is also important to observe that when θ is small,

So that $\theta < \frac{\pi}{18}$, then sin $\theta = \theta,\ cos\theta = 1\ ,\ tan\theta = \theta$

Thus, as $\delta x \to 0, sin\delta x \to \delta x,\ cos\delta x \to 1\ and\ tan\delta x \to \delta x.$

STEP 2: - Exploration
MODE: - Whole
Teachers Activities: - The teacher illustrates differentiation of trigonometric functions to the class using a chart.
Students Activities: - The class listens, ask relevant questions and copied their notes.

1. If y=f(x) = sin x

$\frac{\delta y}{\delta x} = \frac{f(x+\delta x)-f(x)}{dx}$

$=\frac{\sin(x+\delta x)- sinx}{\delta x}$

$=\frac{sinxcos\delta x+cosxsin\delta x -sinx}{\delta x}$

(Note: sin (A+B) = sin A cos B + cos A sinB)

As $\delta x \rightarrow 0$

$$=\frac{\delta y}{\delta x} \rightarrow \frac{sinx.1+cosx.\delta x - sinx}{\delta x} = \frac{\delta x \cos x}{\delta x}$$

$$=\lim_{\delta x \to 0} \frac{\partial y}{\delta x} = \cos x$$

Therefore we say that the derivative of sin x is obtained from the first principle.

STEP 3: - Discussion

MODE: - Whole

Teachers Activities: - The teacher completes the standard table of the differentiation of given trigonometric functions

Students Activities: - The students identify and discus the differentiation of the given trigonometric functions from the standard table.

The teacher presents a chart on the standard table for the differentiation of circular functions.

y	$\frac{\delta y}{\delta x}$
K (constant)	0
Sin x	Cos x
Cos x	-Sin x
tan x	$\sec^2 x$
Sec x	Sec x tan x
Cosec x	Cosec x cot x
Cot x	$-\text{cosec}^2\ x$

STEP 4: - Application

MODE: - Whole

Teachers Activities: - The teacher solves examples using the standard formula table.

Students Activities: - The students listen as the teacher applies the differentiation of circular function

The teacher solves examples using the formula.

1. If y= sin 3x

$$Y = \sin u \ , \frac{\delta y}{\delta u} = \cos u$$

$$U = 3x \ , \frac{\delta u}{\delta x} = 3$$

$$\frac{\delta y}{\delta x} = \frac{\delta y}{\delta u} x \frac{\delta u}{\delta x}$$

$$\frac{\delta y}{\delta x} = \cos u.3 = 3\cos 3x \quad \text{e.t.c.}$$

$2sinxcosx$

2. Differentiate the following with respect to x.
   a. $3xcosx$ b. $x^2/sinx$ c. $secxtanx$

Solution:

a. $\frac{d}{dx}(3xcosx) = 3x\frac{d}{dx}cosx + cosx\frac{d}{dx}3x = -3xsinx + 3cosx = 3cosx - 3xsinx = 3(cosx - xsinx).$

b. $x^2/sinx = \frac{d}{dx}(x^2/sinx) = [sinx\frac{d}{dx}(x^2) - x^2\, x^2\frac{d}{dx}sinx] \div sinx^2.$

c. $secxtanx \;\Rightarrow secx\frac{d}{dx}tanx + tanx\frac{d}{dx}secx = secx(sec^2 x + tanx(secxtanx)$

$\therefore \frac{dx}{dy} = secx(sec^2x + tan^2x)$

STEP 5: - Evaluation

MODE: - Whole

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

1. Briefly discuss the basics of circular function?
2. Differentiate cos x and tan x.
3. Draw the standard table for the differentiation of circular functions.
4. Solve for $y=x^2 + 3\sin x$

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 4b,nos 4&5,Further Mathematics for senior secondary schools.

.REFEREENCE BOOK: - 1. Engineering Mathematics by K Strod.
2. Pure Mathematics by Backhouse .