Second term Mathematics E-Lesson Note

SUBJECT: MATHEMATICS **CLASS: SS 3**

SCHEME OF WORK

WEEK	TOPIC
1.	Calculation on interest on bonds and debentures using logarithm table and problems on taxes and value added tax.
2.	Coordinate Geometry of straight line: Cartesian coordinate graphs, distance between two points, midpoint of the line joining two points.
3.	Coordinate Geometry of straight lines: Gradient and Intercepts of a line, angle between two intersecting straight lines and application.
4.	Differentiation of algebraic functions: meaning of differentiation, differentiation from first principle and standard derivatives of some basic functions.
5.	Differentiation of algebraic functions: Basic rules of differentiation such as sum and difference, product rule, quotient rule and maximal and minimum application.
6.	Integration and evaluation of simple algebraic functions: Definition, method of integration: substitution, partial fraction and integration by parts, area under the curve and use of Simpson's rule.
7– 12.	Revision and mock examination.

REFERENCE TEXT

- **New General Mathematics for SS book 3 by J.B Channon**
- **Essential Mathematics for SS book 3**
- **Mathematics Exam Focus**
- **Waec and Jamb past Questions**

WEEK ONE

- Calculation on interest on bonds and debentures using logarithm table

- Problems on taxes and value added tax.

WEEK TWO

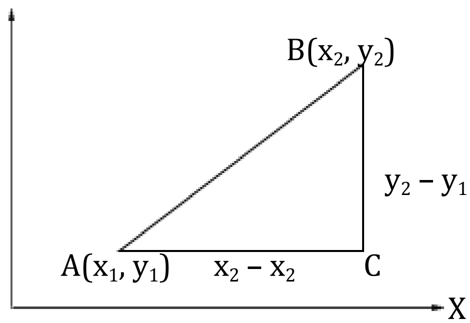
- Coordinate Geometry of straight line: Cartesian coordinate graphs
- distance between two points
- midpoint of the line joining two points
- Coordinate Geometry of Straight line:
- Cartesian coordinate graph:

Distance between two lines:

In the figure below, the coordinates of the points A and B are (x_1, y_1) and (x_2, y_2), respectively. Let the length of AB be l.

y

l



Using Pythagoras theorem:

$AB^2 = AC^2 + BC^2$

$l^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

$$\mathbf{l = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$$

Example:

Find the distance between the each pair of points: a. (3, 4) and (1, 2)   b. (3, - 3) and (- 2, 5)

Solution:

Using $l = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

a. $l = \sqrt{(3 - 1)^2 + (4 - 2)^2}$

$l = \sqrt{2^2 + 2^2}$

$l = \sqrt{8} = 2\sqrt{2}$ units

b. $l = \sqrt{(3 - (-2)^2 + (-3 - 5)^2}$

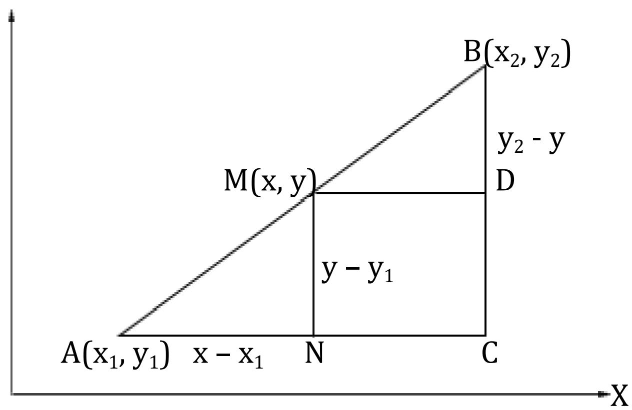
$= \sqrt{5^2 + (-8)^2}$

$= \sqrt{25 + 64} = \sqrt{89} = 9.43$ units

Evaluation: Find the distance between the points in each of the following pairs leaving your answers in surd form: 1. (-2, - 5) and (3, - 6)   2. (- 3, 4) and (- 1, 2)

Mid-point of a line:

The mid-point of the line joining two points:



Triangle MAN and BMD are congruent, so AM = MD and BD = MN

$x - x_1 = x_2 - x$ $\qquad$ $y - y_1 = y_2 - y$

$x + x = x_2 + x_1$ $\qquad$ $y + y = y_2 + y_1$

$2x = x_2 + x_1$ $\qquad$ $2y = y_2 + y_1$

$$x = \frac{x_2 + x_1}{2} \qquad y = \frac{y_2 + y_1}{2}$$

Hence, the **mid-point** of a straight line joining two is $\left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}\right)$

Example: Find the coordinates of the mid-point of the line joining the following pairs of points.

a. (3, 4) and (1, 2) $\qquad$ b. (2, 5) and (- 3, 6)

Solution:

Mid-point = $\left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}\right)$

a. Mid-point = $\left(\frac{1 + 3}{2}, \frac{4 + 2}{2}\right)$ = (2, 3)

b. Mid-point = $\left(\frac{-3 + 2}{2}, \frac{6 + 5}{2}\right)$ = $\left(\frac{-1}{2}, \frac{11}{2}\right)$

Evaluation: Find the coordinates of the mid-point of the line joining the following pairs of points.

a. (- 2 , - 5) and (3, - 6) $\qquad$ b. (3, 4) and (- 1, - 2)

General Evaluation

1. Find the distance between the points in each of the following pairs leaving your answers in surd form: 1. (7, 2) and (1, 6)
2. What is the value of r if the distance between the points (4, 2) and (1, r) is 3 units?
3. Find the coordinates of the mid-point (-3, -2) and (-7, - 4)

Reading Assignment: NGM for SS 3 Chapter 9 page 77 – 78,

Weekend Assignment:

1. Find the value of $\alpha^2 + \beta^2$ if $\alpha + \beta = 2$ and the distance between the points $(1, \alpha)$ and $(\beta, 1)$ is 3 units.
2. The vertices of the triangle ABC are A (7, 7), B (- 4, 3) and C (2, - 5). Calculate the length of the longest side of triangle ABC.
3. Using the information in '2' above, calculate the line AM, where M is the mid-point of the side opposite A.

WEEK THREE

- Coordinate Geometry of straight lines:
- Gradient and Intercepts of a line
- Angle between two intersecting straight lines and application

Gradient and Intercepts of a line

Gradient of a line of the form $y = mx + c$, is the coefficient of x, which is represented by m and c is the intercept on the y axis.

Example

1. Find the equation of the line with gradient 4 and y-intercept -7.

Solution

$m = 4$, $c = - 7$,

Hence, the equation is; $y = 4x - 7$.

Evaluation:

1.What is the gradient and y intercept of the line equation $3x - 5y + 10 = 0$?

2. Find the equation of the line with gradient - 9 and y-intercept 4.

Gradient and One Point Form

The equation of the line can be calculated given one point (x, y) and gradient (m) by using the formula; $y - y1 = m(x - x1)$

Example

Find the equation of the line with gradient -8 and point(3, 7).

Solution

$m = - 8$, $(x1, y1) = (3,7)$

Equation: $y - 7 = - 8(x - 3)$

$y = -8x + 24 + 7$

$y = -8x + 31$

Evaluation:

1. Find the equation of the line with gradient 5 and point(-2, -7).
2. Find the equation of the line with gradient -12and point (3, -5).

Two Point Form:

Given two points (x1, y1) and (x2, y2), the equation can be obtained using the formula:

y2 - y1 = y - y1
x2 - x1   x - x1

Example: Find the equation of the line passing through (2,-5) and (3,6).

Solution

6 - (-5)/3 - 2 = y - (-5)/x - 2
11 = y + 5/x - 2
11(x - 2) = y + 5
11x - 22 = y + 5
y - 11x + 27 = 0

Evaluation:

1.Find the equation of the line passing through (3, 4) and (-1, -2).
2.Find the equation of the line passing through (-8, 5) and (-6, 2).

Angles between Lines

Parallel lines:

The angle between parallel lines is 0^0 because they have the same gradient

Perpendicular Lines:

Angle between two perpendicular lines is 90^0 and the product of their gradients is – 1. Hence, $m_1m_2 = -1$

Examples:

1. Show that the lines y = -3x + 2 and y + 3x = 7 are parallel.

solution:

Equation 1: y = -3x + 2, $m_1 = -3$
Equation 2: y + 3x = 7,
y = -3x + 7, $m_2 = -3$

since; $m_1 = m_2 = -3$, then the lines are parallel

2. Given the line equations x = 3y + 5 and y + 3x = 2, show that the lines are perpendicular.

solutions:

Equation 1:   x = 3y + 5,   make y the subject of the equation.

$3y = x + 5$

$y = x/3 + 5/3$

$m_1 = 1/3$

Equation 2: $y + 3x = 2$,

$y = -3x + 2$, $m_2 = -3$

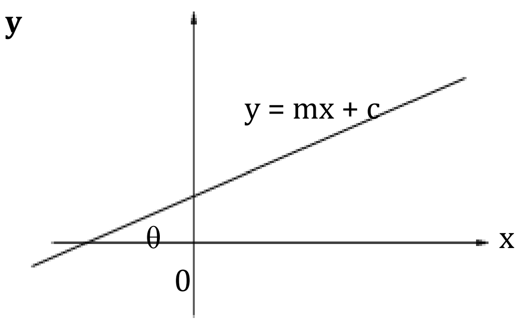
hence: $m_1 \times m_2 = 1/3 \times -3 = -1$

since: $m_1m_2 = -1$, then the lines are perpendicular.

Evaluation: State which of the following pairs of lines are: (i) perpendicular (ii) parallel

(1) $y = x + 5$ and $y = -x + 5$ (2). $2y - 6 = 5x$ and $3 - 5y = 2x$ (3) $y = 2x - 1$ and $2y - 4x = 8$

Angles between Intersecting Lines:



The gradient of y = mx + c is tan θ. Hence **m = tan θ** can be used to calculate angles between two intersecting lines. Generally the angle between two lines can be obtained using: tan 0 = m2 -m1
1 + m1m2

Example: Calculate the acute angle between the lines y=4x -7 and y = x/2 + 0.5.

Solution:

Y=4x -7, m1= 4, y=x/2+0.2, m2 =1/2.

Tan O= 0.5 - 4. = -3.5/3
1 + (0.5*4)

Tan O =- 1.1667

O=tan-1(-1.1667) = 49.4

Evaluation: Calculate the acute angle between the lines y=3x -4 and x - 4y +8 = 0.

General Evaluation:

1.Calculate the acute angle between the lines y=2x -1 and 2y + x = 2.

2.If the lines 3y=4x -1 and qy= x + 3 are parallel to each other, find the value of q.

3.Find the equation of the line passing through (2,-1) and gradient 3.

Reading Assignment: NGM for SS 3 Chapter 9 page 75 – 81

Weekend Assignment

1.Find the equation of the line passing through (5,0) and gradient 3.

2.Find the equation of the line passing through (2,-1) and (1, -2).

3. Two lines y=3x - 4 and x - 4y + 8=0 are drawn on the same axes.

(a) Find the gradients and intercepts on the axes of each line.

(b) Find the equation parallel to x -4y + 8=0 at the point (3, -5)

WEEK FOUR

- Differentiation of algebraic functions: meaning of differentiation

- Differentiation from first principle
- Standard derivatives of some basic functions.

Consider the curve whose equation is given by $y = f(x)$ Recall that $m = \frac{y_2 - y_1}{x_2 - x_1 x} = f(x+x)-f(x)$

As point B moves close to A, dx becomes smaller and tends to zero.
The limiting value is written on Lim $\frac{f(x+x) - f(x)}{dx}$ and is denoted by as $x \rightarrow 0$

$f^1(x)$ is called the **derivative of f(x)** and the **gradient function of the curve**

The process of finding the derivative of f(x) is called differentiation. The rotations which are commonly used for the derivative of a function are $f^1(x)$ read as f – prime of x, df/dx read as dee x of f
df/dx read dee - f dee- x, dy/dx read dee - y dee- x

If $y = f(x)$, this $dy/dx = f^1(x)$ (it is called the differential coefficient of y with respect to x.

Differentiation from first principle: The process of finding the derivative of a function from the consideration of the limiting value is called differentiation from first principle.

Example 1
Find from first principle, the derivative of $y = x^2$
Solution

$y = x^2$
$y + y = (x + x)^2$
$y + y = x^2 + 2xx + (x)^2$
$y = x^2 + 2xx + (x)^2 - y$
$y = x^2 + 2xx + (x)^2 - x^2$
$y = 2xx + (x)^2$
$y = (2x + x)x$
$\frac{y}{x} = 2x + x$
Lim $x = 0$
$\frac{dy}{dx} = 2x$

Example 2:
Find from first principle, the derivative of 1/x
Solution
Let $y = \frac{1}{x}$
$y + y = \frac{1}{x + x}$

$y = \frac{1}{x + x} - y$

$y = \frac{1}{x + x} - \frac{1}{x}$

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

$y = x - \frac{x - x}{x^2 + xx}$

$dy = \frac{-x}{x^2 + x}$

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

Lim x = 0

$\frac{dy}{dx} = \frac{-1}{x^2}$

Evaluation: Find from first principle, the derivatives of y with respect to x:

1. $Y = 3x^3$ 2. $Y = 7x^2$ 3. $Y = 3x^2 - 5x$

Rules of Differentiation: Let $y = x^n$

$y + dy = (x + dx)^n$

$= x^n + nx^{n-1}dx + n(n-1) \frac{x^{n-2}(dx)^2 + \ldots (dx)^n}{2!}$

$= x^n + n x^{n-1}dx + \frac{n(n-1) x^{n-2} (dx)^2}{2!} + \text{---} + (dx)^n - x^n$

$= nx^{n-1}dx + \frac{n (n - 1) x^{n-1} (dx)^2}{2!}$

$dy/dx = n^{xn-1} + n (n - 1) x^{n-1} dx$

$\text{Lim } dy/dx = nx^{n-1}$

$dx = 0$

Hence; $\mathbf{dy/dx = nx^{n-1}}$ **if** $\mathbf{y = x^n}$

Example 3:

Find the derivative of the following with respect to x: (a) x^7 (b) $x^{½}$ (c) $5x^2 - 3x$ (d) $- 3x^2$ (e) $y = 2x^3 - 3x + 8$

Solution

a. Let $y = x^7$

$dy/dx = 7 x^{7-1} = 7x^6$

b. Let $y = x^{½}$

$dy/dx = ½ x^{½ -1} = ½ x^{-½} = \frac{1}{2\sqrt{x}}$

c. Let $y = 5x^2 - 3x$

$dy/dx = 10x - 3$

d. Let $y = - 3x^2$

$dy/dx = 2 \times - 3x^{2-1} = - 6x$

e. Let $y = 2x^3 - 3x + 8$

$dy/dx = 3 \times 2x^{3-1} - 3 + 0$

$= 6x^2 - 3$

Evaluation:

1. If $y=5x^4$,find dy/dx 2.Given that $y= 4x^{-1}$ find y^1

General Evaluation

1. Find, from first principles, the derivative of $4x^2 - 2$ with respect to x.
2. Find the derivative of the following a.$3x^3 - 7x^2 - 9x + 4$ b. $2x^3$ c. 3/x
3. Using idea of difference of two square; simplify $243x^2 - 48y^2$
4. Expand (2x -5)(3x-4)
5. If the gradient of $y=2x^2-5$ is -12 find the value of y.

Reading Assignment: NGM for SS 3 Chapter 10 page 82 -88,

Weekend Assignment

Objective

1. Find the derivative of $5x^3$(a) $10x^2$ (b) $15x^2$ (c) 10x (d) $15x^3$
2. Find dy/dx, if $y = 1/x^3$(a) $-3/x^4$ (b) $3/x^4$ (c) $4/x^3$ (e) $-4/x^3$
3. Find $f^1(x)$, if $f(x) = x^3$ (a) 3x (b) $3x^2$ (c) ½ x^3 (d) $2x^3$
4. Find the derivative of 1/x(a) $1/x^2$ (b) $-1/x^2$ (c) – x (d) $-x^2$
5. If $y = - 2/3\, x^3$. Find dy/dx (a) 4/3 x^2 (b) $2x^2$ (c) $- 2x^2$ (d) –2x

Theory

1. Find from first principle, the derivative of y = x + 1/x
2. Find the derivative of $2x^2 - 2/x^3$

WEEK FIVE

- Differentiation of algebraic functions:
- Basic rules of differentiation such as sum and difference, product rule, quotient rule
- Maximal and minimum application.

Derivative of algebraic functions

Let f, u, v be functions such that

$f(x) = u(x) + v(x)$

$f(x + x) = u(x + x) + v(x + x)$

$f(x + x) - f(x) = \{u(x+ x) + v(x+ x) - v(x + x) - u(x) - v(x)\}$

$= u(x + x) - u(x) + v(x + x) - v(x)$

$\underline{f(x + x) - f(x)} = \underline{u(x + x)-u(x)} + \underline{v(x + x) - v(x)}$

Lim $f(x + x) - f(x) = U^1(x) + V^1(x)$

if y = u + v and u and v are functions of x, then **dy/dx = du/dx + dv/dx**

<u>**Examples**</u>: Find the derivative of the following

1) $2x^3 - 5x^2 + 2$ 2)$3x^2 + 1/x$ 3)$2x^3 + 2x^2 +1$

Solution

1. Let $y = 2x^3 - 5x^2 + 2$
   $dy/dx = 6x^2 - 10x$

2. Let $y = 3x^2 + 1/x = 3x^2 + x^{-1}$
   $dy/dx = 6x - x^{-2} = 6x - \frac{1}{x^2}$

3. Let $y = 2x^3 + 2x^2 + 1$
   $dy/dx = 6x^2 + 4x$

Evaluation: 1. If $y = 3x^4 - 2x^3 - 7x + 5$. Find dy/dx
2.Find $\frac{d}{Dx}(8x^3 - 5x^2 + 6)$

Function of a function (chain rule)
Suppose that we know that y is a function of u and that u is a function of x, how do we find the derivative of y with respect to x?
Given that $y = f(x)$ and $u = h(x)$, what is dy/dx?
$dy/dx =$, this is called the chain rule

Examples
Find the derivative of the following.(a)$y = (3x^2 - 2)^3$ (b) $y = (1 - 2x^3)$ (c) $5/(6-x^2)^3$
Solution
1. $y = (3x^2 - 2)^3$
   Let $u = 3x^2 - 2$
   $y = (3x^2 - 2)^3 \Rightarrow y = u^3$
   $y = u^3$
   $dy/du = 3u^2$
   $du/dx = 6x$

   $dy/dx = = 3u^2 \times 6x$
   $= 18xu^2 = 18x(3x^2 - 2)^2$

2. $y = (1 - 2x^3)^{1/2} \Rightarrow (1 - 2x^3)^{1/2}$
   Let $u = 1 - 2x^3$, hence $y = u^{1/2}$
   $dy/dx = = ½ u^{-1/2} \times (-6x^2)$
   $= -3x^2 u^{-½} = \frac{-3x^2}{u^{1/2}}$

   $\frac{-3x^2}{\sqrt{u}} = \frac{-3x^2}{\sqrt{(1 - 2x^3)}}$

3. $y = \frac{5}{(6 - x^2)^3} = 5(6 - x^2)^{-3}$
   Let $u = 6 - x^2$
   $y = 5(u)^{-3}$
   $dy/du = -15u^{-4}$
   $du/dx = -2x$
   $dy/dx = dy/du \times du/dx = -15u^{-4} \times (-2x) = 30x\, u^{-4} = 30x\,(6 - x^2)^{-4}$
   $=$ 30x

$(6 - x^2)^4$

Evaluation:

1. Given that $y = \frac{1}{(2x + 3)^4}$ find dy/dx
2. If $y = (3x^2 + 1)^3$, Find dy/dx

Product Rule

We shall consider the derivative of y = uv where u and v are function of x.

Let y = uv

Then y + y = (u +u)(v + v)

= uv + uv + vu +uv

y = uv + uv + vu+ uv – uv

y= uv + vu + uv

$y = u\frac{v}{x} + v\frac{u}{x} + uv$

As x =>0 ,u=> 0 , v=> 0

$\lim_{x \to 0} \frac{y}{x} = \lim_{x \to 0} \frac{uv}{x} + \lim_{x \to 0} \frac{vu}{x} + \lim_{x \to 0} \frac{uv}{x}$

Hence **dy/dx= U dv + Vdu**
dxdx

Examples
Find the derivatives of the following.
(a) $y = (3 + 2x)(1 - x)$ (b) $y = (1 - 2x + 3x^2)(4 - 5x^2)$

Solution
1. $y = (3 + 2x)(1 - x)$
Let $u = 3 + 2x$ and $v = (1 - x)$
$du/dx = 2$ and $dv/dx = -1$

$dv/dx = u\frac{dv}{dx} + v\frac{du}{dx}$
$= (1 - x)2 + (3 + 2x)(-1) = 2 - 2x - 3 - 2x$
$dy/dx = -1 - 4x$

2. $y = (1 - 2x + 3x^2)(4 - 5x^2)$
Let $u = (1 - 2x + 3x^2)$ and $v = (4 - 5x^2)$
$du/dx = -2 + 6x$ and $dv/dx = -10x$

$dy/dx = u\frac{dv}{dx} + v\frac{du}{dx}$
$= (1 - 2x + 3x^2)(-10x) + (4 - 5x^2)(-2 + 6x)$
$= -10x + 20x^2 - 30x^3 + (-8 + 10x^2 + 24x - 30x^3)$
$= -10x + 20x^2 - 30x^3 - 8 + 10x^2 + 24x - 30x^3$
$= 14x + 30x^2 - 60x^3 - 8$

Evaluation
Given that (i) $y = (5+3x)(2-x)$ (ii) $y = (1+x)(x+2)^{3/2}$,find dy/dx

Quotient Rule:
If $y = \frac{u}{v}$
then; $\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

Examples:
Differentiate the following with respect to x. (a) $\frac{x^2 + 1}{1 - x^2}$ (b) $\frac{(x - 1)^2}{\sqrt{x}}$

Solution:
1. $y = \frac{x^2 + 1}{1 - x^2}$
Let $u = x^2 + 1$ $du/dx = 2x$
$v = 1 - x^2$ $dv/dx = -2x$

$\frac{dy}{} = v\frac{du}{} - u\frac{dv}{}$

dxdxdx

$$\frac{\;}{v^2}$$

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

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

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

2. $y = \frac{(x-1)^2}{\sqrt{x}}$

Let $u = (x-1)^2$ $du/dx = 2(x-1)$

$v = \sqrt{x}$ $dv/dx = 1/2\sqrt{x}$

$dy/dx = \frac{\sqrt{x}\, 2(x-1) - (x-1)^2\, 1/2\sqrt{x}}{(\sqrt{x})^2}$

$dy/dx = \frac{\sqrt{x}\, 2(x-1) - (x-1)^2\, 1/2\sqrt{x}}{x}$

Evaluation: Differentiate with respect to x: (1) $\frac{(2x+3)^3}{(x^3-4)^2}$ (2) $\frac{\sqrt{x}}{\sqrt{(x+1)}}$

Applications of differentiation:

There are many applications of differential calculus.

Examples:

1. Find the gradient of the curve $y = x^3 - 5x^2 + 6x - 3$ at the point where $x = 3$.

   Solution:

   $Y = x^3 - 5x^2 + 6x - 3$

   $dy/dx = 3x^2 - 10x + 6$

   where $x = 3$; $dy/dx = 3(3^2) - 10(3) + 6$

   $= 27 - 30 + 6$

   $= 3.$

2. Find the coordinates of the point on the graph of $y = 5x^2 + 8x - 1$ at which the gradient is -2

   Solution:

   $Y = 5x^2 + 8x - 1$

   $dy/dx = 10x + 8$

replace; dy/dx by -2

$10x + 8 = -2$

$10x = -2 - 8$

$x = -10/10 = -1$

3. Find the point at which the tangent to the curve $y = x^2 - 4x + 1$ at the point (2, -3)

   Solution:

   $Y = x^2 - 4x + 1$

$dy/dx = 2x - 4$

at point (2, -3): $dy/dx = 2(2) - 4$

$dy/dx = 0$

tangent to the curve: $y - y1 = dy/dx(x - x1)$

$y - (-3) = 0\ (x - 2)$
$y + 3 = 0$

Evaluation:
1. Find the coordinates of the point on the graph of $y = x^2 + 2x - 10$ at which the gradient is 8.
2. Find the point on the curve $y = x^3 + 3x^2 - 9x + 3$ at which the gradient is 15.

Velocity and Acceleration

Velocity: The velocity after t seconds is the rate of change of displacement with respect to time.
Suppose; s = distance and t = time,
Then; ***Velocity = ds/dt***

Acceleration: This is the rate of change of velocity compared with time.
Acceleration = dv/dt
Example:
A moving body goes s metres in t seconds, where $s = 4t^2 - 3t + 5$. Find its velocity after 4 seconds. Show that the acceleration is constant and find its value.
Solution:
$S = 4t^2 - 3t + 5$
$ds/dt = 8t - 3$
velocity $= ds/dt = 8(4) - 3$
$= 32 - 3$
$= 29$
Acceleration: $dv/dt = 8$.

Maxima and Minimal
1. Find the maximum and minimum value of y on the curve $6x - x^2$.
Solution:
$y = 6x - x^2$
$dy/dx = 6 - 2x$
equate $dy/dx = 0$
$6 - 2x = 0$
$6 = 2x$
$X = 3$
The turning point is (3, 9)

2. Find the maximum and minimum of the function $x^3 - 12x + 2$.
Solution:
$Y = x^3 - 12x + 2$
$dy/dx = 3x^2 - 12$
$3x^2 - 12 = 0$
$3x^2 = 12$
$x^2 = 12/3$
$x^2 = 4$ $\quad x = \pm 2$
minimum point occur when $d^2y/dx^2 > 0$
maximum point occurs when $d^2y/dx^2 < 0$
$d^2y/dx^2 = 6x$

substitute $x = 2$; $d^2y/dx^2 = 6 \times 2 = 12$
therefore: the function is minimum at point $x = 2$ and $y = -14$
substitute $x = -2$; $d^2y/dx^2 = 6(-2) = -12$
therefore: the function is maximum at point $x = -2$ and $y = 18$

Evaluation:
1. A particle moves in such a way that after t seconds it has gone s metres, where $s = 5t + 15t^2 - t^3$
2. Find the maximum and minimum value of y on the curve $4 - 12x - 3x^2$.

General Evaluation
Use product rule to find the derivative of
1. $y = x^2 (1 + x)^{½}$
2. $y = \sqrt{x}(x^2 + 3x - 2)^2$
3. Find the derivative of $y = (7x^2 - 5)^3$
4. Using completing the square method find t if $s = ut + \frac{1}{2}at^2$
5. If 3 is a root of the equation $x^2 - kx + 42 = 0$ find the value of k and the other root of the equation

READING ASSIGNMENT: NGM for SS 3 Chapter 10 page 90 -101,

WEEKEND ASSIGNMENT
OBJECTIVE
1.Differentiate the function $4x^4 + x^3 - 5$ (a)$4x^3 + 3x^2$ (b)$16x^2 + 3x^2$ (c)$16x^3 + 3x^2$ (d)$16x^4 + 3x^2$
2.Find d^2y/dx^2 of the function $y = 3x^5$ wrt x. (a) $15x^3$ (b) $45x^4$ (c) $60x^3$ (d) $3x^5$ (e) $12x^3$
3.If $f(x) = 3x^2 + 2/x$ find $f^1(x)$ (a) $6x + 2$ (b) $6x + 2/x^2$ (c) $6x - 2/x^2$ (d)$6x - 2$
4.Find the derivative of $2x^3 - 6x^2$ (a) $6x^2 - 12x$ (b) $6x^2 - 12x$ (c) $2x^2 - 6x$ (d) $8x^2 - 3x$
5.Find the derivative of $x^3 - 7x^2 + 15x$ (a) $x^2 - 7x + 15$ (b) $3x^2 - 14x + 15$ (c) $3x^2 + 7x + 15$ (d) $3x^2 - 7x + 15$

THEORY
1. Differentiate with respect to x. $y^2 + x^2 - 3xy = 4$
2. Find the derivative of $3x^3(x^2 + 4)^2$