**INTRODUCTION TO DIFFERENTIAL EQUATIONS**

A differential equation is one which contains a function and its derivative in the same equation.

It could be said to be an equation with at least one derivative

A differential equation is a relationship between an independent variable x, a dependent variable y and at least one derivative of y.

NB:

**1.1 TYPES OF DIFFERENTIAL EQUATIONS**

1. Ordinary Differential Equations: This is one in which the unknown function (y) depends only on one independent variable (x).

2. Partial Differential Equations. This is one in which the unknown functions depends on at least two independent variables.

**1.2 FORMATION OF A DIFFERENTIAL EQUATION**

A differential equation is formed when arbitrary constants are eliminated from a given function. Omo me seff no unders

**1.3 ORDER AND DEGREE OF A DIFFERENTIAL EQUATION**

The order of a DE is the highest derivative appearing in the equation. It is also called **differential coefficient**.

The degree of a DE is the power of the highest order is the degree

a. . This will have an order of 2 and a degreee of 1.

The order of a differential equation indicates how many initial conditions are needed to find a unique solution.

**1.4 INITIAL VALUE PROBLEM AND BOUNDARY VALUE PROBLEM**

In initial value problem (IVP), we are given the value of the function and its derivative at the same point (initial point)

and . For initial value problem, we are given a differential equation and an initial condition. For a first order equation, you will need one initial condition. For a second order equation, you will need two separate initial conditions.

Boundary Value Problems: Here we are given the value of function at two different points i.e. ,

**1.5 VERIFYING SOLUTIONS**

Verify that is a solution of . Find and such that , .

Answer: Therefore, is a solution of the differential equation

**1.6 LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS**

A linear differential equation is one where the degree is 1.

**1.7 CONDITIONS FOR LINEAR DIFFERENTIAL EQUATION**

1. In front of y and its derivatives must only be pure functions of x and never of y or other variables.

2. The powers of y and its derivatives must be 1. (Degree of 1)

3. g(x) must also be a function of x and neither y or its derivative should be there.

AUTONOMOUS DIFFERENTIAL EQUATIONS

A differential equation is called autonomous if it does not depend on the independent variable. For example,

, you’ll see that in the expression, there is no expression of t

NOTE: It does not change as time (independent variable) changes

Critical points: These are points where the derivative is equal to zero.

If at , is called a critical point

After that, we may check whether the critical points are stable or not:

Example, find the critical points and classify them as stable, half stable or unstable.

For critical point,

PROMPTS

1. Hi, I want you to answer like a [Millionaires name]. Use all the knowledge of [their name] and any and every available information about how [name] thinks. My challenge is: []. now provide me a detailed 500-word answer with 3 action points

2.