***Differential Equation:***

* A differential equation is an equation that involve one or more derivatives.
* The order of differential equation is determined by the highest order derivative occur in the equation.

***First-Order Differential Equation***

* A first-order differential equation is an equation of the form:

1. ***Separable Differential Equations***

A first-order differential equation can be solved by integration if it is possible to collect all terms with and all terms with. That is if it is possible to write the equation in the form:

Then by integrating both sides of this equation

After completing the integrations, a general solution is obtain that define as a function of.

Example: Solve the differential equation:

Solution:

(Where represents the combined constants of integration)

Example: Solve the differential equation:

Solution:

Replace and

Homework: Solve the following differential equations:

1. ***Homogeneous Differential Equations***

A first-order differential equation of the form:

is called homogeneous.

Homogeneous equations can be transformed into an equation whose variables are separable by defining the new variable . Then, and

Substitution into the original differential equation and collecting terms with like variables then gives the separable equation:

After solving this separable equation, the solution of the original equation is obtained when replace by .

Example: Solve the homogeneous differential equation:

Solution:

Sub

and,

Then by integrating:

Replace by :

* This result can be further simplified as follow:

Let, then

Or

Homework: Solve the homogeneous differential equations:

1. ***Exact Differential Equations***

An exact differential equation is an equation that can be written in the form:

and have the property that:

Where are constant.

Example: Solve the differential equation (exact):

Solution:

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Homework: Solve the differential equation (exact):

1. ***Linear Differential Equations***

A first-order linear differential equation is one that can be written in the standard form:

The general solution:

Where is the integrating factor:

Example: Solve the linear differential equation:

Solution:

,

The integrating factor

Or

Homework: Solve the linear differential equation: