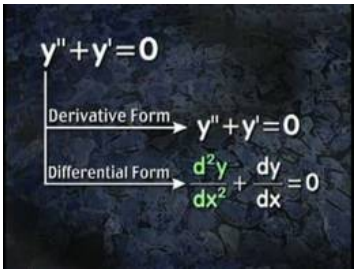
DIFFERENTIAL EQUATIONS

Created: Wednesday, 09 November 2011 07:44 | Published: Wednesday, 09 November 2011 07:44 | Written by Super User | Print

Introduction



Equations involving derivatives are known as differential equations.

Examples: $(dy/dx)+ 3y=5$

$(d^2y/dx^2)+3(dy/dx)+5x=0$

Order of a differential equation

Order of a differential equation is defined as the order of the highest order derivative of the dependent variable with respect to the independent variable involved in the given differential equation.

Consider the following equations:

$(dy/dx)+3y=0$ …… (1)

$(d^2y/dx^2)+3(dy/dx)+4y=7$ …… (2)

$(d^3y/dx^3)2+(d^2y/dx^2)5-3(dy/dx)=1$ …… (3)

Order of (1) = 1

Order of (2) = 2

Order of (3) = 3

Degree of a differential equation

The degree of a differential equation is the power of highest order derivative.

Degree of (1) above =1

Degree of (2) above = 1

Degree of (3) above = 2

1) Find the order and degree of the following:

a) $(d^2y/dx^2)3+(dy/dx)2+\sin(dy/dx)+1=0$

Order = 2

Degree = not defined [since sin (dy/dx) is not defined]

b) $2x^2(d^2y/dx^2)-3(dy/dx)+y=0$

Order = 2

Degree=1

General and Particular solutions of a differential equation

Here an equation and a differential equation will be given; we have to verify whether the given equation is a solution of the given differential equation.
Example: Verify that the function $y=x^2+2x+C$ is a solution of the differential equation $y'-2x-2=0$
$y=x^2+2x+C$
$y'=2x+2$
$y'-2x-2=0$
Hence the given equation is a solution of the differential equation

Formation of a differential equation whose general solution is given

Given the equation of a family of curves having arbitrary constants, we have to differentiate and eliminate the constants (arbitrary). If there is one constant differentiate once, if two constants are there then differentiate two times and eliminate the arbitrary constants to form the differential equation.
Example: Form the differential equation of the family of parabolas having vertex at origin and axis along positive y-axis.
Let P denote the family of above said parabolas and let (0,a) be the focus, where 'a' is arbitrary constant. Hence the equation of P is $x^2=4ay$ ……. (1)
Differentiating both sides, $2x=4ay'$
$a=x/[2y']$
Hence (1) becomes $x^2=4[x/(2y')]$
$xy'-2y=0$
Therefore the differential equation is $xy'-2y=0$.

Methods of solving first order, first degree differential equations

Differential equations with variables separable

A first order-first degree differential equation is of the form $(dy/dx)= F(x,y)$.
If $F(x,y)$ can be expressed as a product $g(x)\,h(y)$ where $g(x)$ is a function of 'x' and $h(y)$ is a function of 'y' then it is said to be variable separable type.
After separating, the next step is to integrate to obtain the solution of the differential equation.
Example: Solve $(dy/dx) + y=1$ (y?1)
$(dy/dx)=1-y$
$dy/(1-y) = dx$
?$dy/(1-y) =$?dx
$-\log(1-y)=x+c$
$x+\log(1-y)+c=0$, which is the required solution.

Now try it yourself! Should you still need any help,click here to schedule live online session with e Tutor!

About eAge Tutoring :

eAgeTutor.com is the premium online tutoring provider. Using materials developed by highly qualified educators and leading content developers, a team of top-notch software experts, and a group of passionate educators, eAgeTutor works to ensure the success and satisfaction of all of its students.

Contact us today to learn more about our tutoring programs and discuss how we can help make the dreams of the student in your life come true!

Reference Links :

- http://en.wikipedia.org/wiki/Equation

- http://en.wikipedia.org/wiki/Derivative
- http://en.wikipedia.org/wiki/Differential_equation
- http://en.wikipedia.org/wiki/Variable_(mathematics)
- http://www.efunda.com/math/ode/generalterms.cfm

Category:ROOT