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ASSIGNMENT :- 01

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SUBMITTED TO :- MAM SHUMAILA

SUBJECT :- NUMERICAL ANALYSIS

DEPARTMENT :- CIVIL ENGINEERING

DATE :- 9 - 9 - 2020

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Question :- 01

Integration :-

Integration is the act of bringing together smaller components into a single system that function's as one.

It is a technique, of finding a function g(x) the derivative of which, Dg(x), is equal to a given function f(x). This is indicated by the integral signs "∫", as in ∫f(x), usually called the indefinite integral of function.

Review of Integration Concepts :-

It Contains some major Concept of Integration, including

① Substitution method.

② Integration by parts.

③ Integrating Rational function.

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(1) Substitution Method :-

① In the substitution method you or we solve for one variable, and then substitue this expression in to the other equation.

② Resubstitue the value into the original equation to find the corresponding variable.

$$\int f[g(x)]g'(x)\,dx = \int f(u)\,du$$

If the function $f(u)$ has an easily indentification anti-derivaties the it's okay, If not then another substitution may be needed.

(2) Integration by parts :-

It is a special method of Integration that is often useful when two functions are multiplied together, but is also helpful in other ways.

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$\Rightarrow [u(x)v(x)]' = u'(x)v(x) + u(x)v'(x)$

$\Rightarrow u(x)v'(x) = [u(x)v(x)]' - u'(x)v(x)$

$\Rightarrow \int u(x)v'(x)\,dx = u(x)v(x) - \int v'(x)u(x)\,dx$

$\Rightarrow \int u\,dv = uv - \int v\,du$

In case of definite integral,

$\int_a^b u(x)v'(x)\,dx = [u(x)v(x)]_{x=a}^{x=b} - \int_a^b u'(x)v(x)\,dx.$

③ "Integrating Rational function" :-

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

To integrate such function, we use the method of partial fraction to split, into easily integrable pieces.

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(4)

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

Now, $\int \frac{3x+2}{2x^2+x-3}\,dx = \frac{1}{2}\log(2x+3) + \log(x-1) + C$

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Question:- 02

Simpson's Rule :-

Simpson's rule is a numerical method for approximating the integral of a function between two limits, a and b. It's based on knowing the area under a parabola, or a plane curve.

Simpson's 1st Rule :-

$$\int_{x_0}^{x_n} f(x)\,dx = \frac{h}{3}\left[(y_0+y_n) + 2(y_2+y_4+\cdots) + 4(y_1+y_3+\cdots)\right]$$

Simpson's 2nd Rule :-

$$\int_{x_0}^{x_n} f(x)\,dx = \frac{3h}{8}\left[(y_0+y_n) + 3(y_1+y_2+y_3+y_4+y_5) + 2(y_3+y_6+y_9+\cdots)\right]$$

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Simpson's 1st Rule :-

(1) It is also known as Simpson's one-third (1/3) rule.

(2) It is applicable for even intervals.

(3) The error is of order h^4.

(4) In this rule, $y(x)$ is a polynomial of degree 2.

(5) It uses 3 data points.

Simpson's 3rd Rule :-

(1) It is also known as Simpson's $3/8^{th}$ rule.

(2) The error is of order h^5.

(3) In this rule, $y(x)$ is a polynomial of degree 3.

(4) It is applicable for the intervals which is multiple of 3.

(5) It uses four data points.

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Trapezoidal Rule :-

The Trapezoidal role also known as the trapezoid role or Trapezium Rule, is a technique for approximating the definite integral. The Trapezoidal rule works by approximating the region under the graph of the function as a trapezoid and calculating it's area.

Trapezoidal Rule :-

$$\int_{x_0}^{x_n} f(x)\,dx = \frac{h}{2}\left[(y_0+y_n) + 2(y_1+y_2+\cdots + y_{n-1})\right]$$

Trapezoidal Rule :-

1. It is applicable for equal intervals.
2. The error is of order h^2.
3. The accuracy can be improved by increasing the no. of intervals i.e. by decreasing the value of h.

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(4) In this rule, $y(x)$ is a linear function of x.

(5) In general, trapezoidal rule is less accurate when compared with Simpson's rule.

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Application of Simpson and Trapezoidal Rule in Engineering :-

1. It helps to find the area.
2. Locate the Centroid.
3. find the arc length of a graph.
4. Find the surface area of solid.
5. find the volume of solid figure.
6. Solve for the work done.
7. Solve the moment of Inertia.
8. It is also used to find, Sectional area.
9. waterplane area.
10. Submerged volume.
11. Logitudinal Centre of flotation.
12. Vertical Center of buoyancy.