Name # M. Sulaiman

ID # 7925

Section A

Assignment # 1st

Subject : Numerical Analysis

Ma'am Shumaila Mazhar

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1) Review of Integration concepts

- Substitution methods
- Integration by parts

3) Integration Rational function

and a table of common integral. A more through and complete treeatment these methods can be found in your text book (or generally calculas book)

1) Substitution: In some cases an integral can ~~can~~ be alter d into a manageable from by just changing variable.

If the integrand can be written in the ~~from~~ form $f(g(x))\,g'(x)$ then we may ~~take~~ make the substitution $u = g(x)$ which implies $du = g'(x)$ and

Integrates as follows

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

Example:

$$\int 12 \sin x \cos x \sqrt[4]{3\sin^2 x + e^8}\, dx$$

we may consider chosing

$$u = 3\sin^2 x + e^8$$

$$du = 6\sin(x)\cos x\, dx$$

Then

$$\int 12 \sin x \cos x \sqrt[4]{3\sin^2 x + e^8}\, dx$$

$$= \int 2\,(3\sin^2 x + e^8)^{\frac{1}{4}}\,(6\sin x \cos x\, dx)$$

$$= \int 2u^{\frac{1}{4}}\, du$$

$$= 2\left(\frac{4}{5}\right) u^{5/4} + C$$

$$\boxed{= \frac{8}{5}\left(3\sin^2 x + e^8\right)^{\frac{5}{4}} + C}$$

where C is constant of integration

3)

Integration by parts :-

Let $u(x$ an $v(x)$ ~~by~~ be two differentiable function. An easy way to get the formula for integration by parts is as follows

$$\int u(x)v(x))' = u'(x)(v)(x)$$

$$\Rightarrow \{\int u(x)v'(x)\}' - u'(x)v(x)$$

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

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

In case of definite integral we have

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

Integration by parts is useful in eliminating" a ~~part~~ of u

Integral that makes the integral difficult to do. The annoying part of the integral is often chosen to be $u(x)$

3) Integrating Rational function

A rational function is a function that can be expressed as the ratio of two polynomials. Consider integrating the rational function

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

The end

Application of trapezodial Rule in engineering

In numerical analysis the ~~trapezodial~~ traperoidal rule or methods is a technique for approximating the definite integral

$$\int_{x_0}^{x_n} f(x)\,dx$$

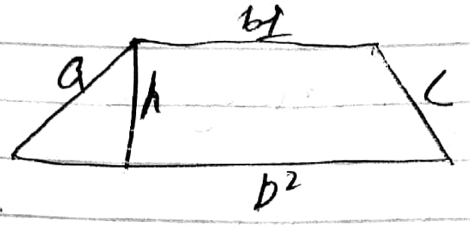
It also known as traperium rule

~~Trapezodial~~ trapezoidal Rule

$$= \frac{h}{2}\left[\{y_0 + y_n\} + 2(y_1 + y_2 + y_3 + \cdots y_{n-1})\right]$$

How it work

Trapezoid an on kind rectangle which has 4 sides and minimum two sides as parallel

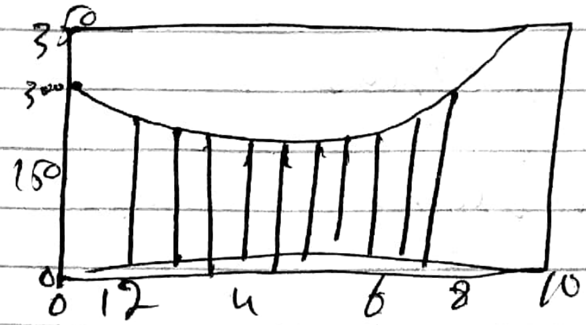


Area $A = \left(\frac{b_1 + b_2}{2}\right) h$

The trapezidal rule works by approximating the region under the graph of the ~~function~~ as a trapezoid and calculating its area in limit

$$\int_a^b f(x)\,dx = \frac{(b-a)}{2}\left[f(a) + f(b)\right]$$

The trapezoidal rule approximating improves with more strips from This figure we can clearlly see



Application of trapezoidal rules

=> The trapezoidal rule is one of the family member of numerical - integration formula.

=> The trapezoidal rule has faster convergence.

=> Moreover, the trapezoidal rule tends to become extremily accurate then periodic function.

=>

C code for trapezoidal method

problem and Algorithm

Advantages:-

There are many alternatives to the trapezoidal rule

but this method deserves attention because of

-> ~~it~~ ease of use

-> Power ful convergence properties

-> straight forward analysis.

Conclusion.

Trapezoidal rule can be applied accuratly for non-periodic function also in term of periodic integrals

The end.

Application of Simpson's rule:

Integration, or Anti-~~ang~~ differentiation, is a fascinating math idea. we have method and rule for integrating the work.

for most $f(x)$ function we encounter

-> There are some function, however that is difficult if not impossible to integrate using the usual technique.

one Application in the real world is calculating the moment of inertia of a Gaussian-shaped pad.

There is no closed-form solution for the integral of a Gaussian curve b/w two values (other than $-\infty$, to $+\infty$)

So what do wed?

we used Numerical methods,

Like simpsons, rule named

after the english mathematici

Th omas Simpson.s.

$$P(x) = a_0x^2 + a_1x + a_2$$