

UNKNOWN YET

BY

Ni Jeremiah Wisdom

17/56EB0

A PROJECT SUBMITTED TO THE DEPARTMENT OF
MATHEMATICS, FACULTY OF PHYSICAL SCIENCES, UNIVERSITY
OF ILORIN, ILORIN, KWARA STATE, NIGERIA.

IN PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE AWARD
OF BACHELOR OF SCIENCE (*B.Sc.*) DEGREE IN MATHEMATICS.

JANUARY, 2021

Certification

This is to certify that this project was carried out by **Wisdom** of Matriculation Number 17/56EB0, for the award of Bachelor of Science B.Sc (Hons) degree in the Department of Mathematics, Faculty of Physical sciences, University of Ilorin, Ilorin, Nigeria.

.....

name

(SUPERVISOR)

Date

.....

.....

PROF. K. RAUF

(HEAD OF DEPARTMENT)

.....

Date

.....

external

(EXTERNAL EXAMINER)

.....

Date

Acknowledgments

All thanks to God the Almighty, the one who is and will forever be, the one and only true God, for all He was done for me throughout the course of my academic journey in the University of Ilorin. May the name be praised forever.

ABSTRACT

This project work is concerned with

Table of Contents

Title Page	1
Certification	i
Acknowledgments	ii
ABSTRACT	iii
Table of Contents	iv
1 GENERAL INTRODUCTION	1
1.1 INTRODUCTION	1
1.2 STATEMENT OF THE PROBLEM	1
1.3 AIMS AND OBJECTIVES OF THE STUDY	1
1.4 SIGNIFICANCE OF STUDY	1
1.5 SCOPE OF THE STUDY	1
2 LITERATURE REVIEW	2
2.1 REVIEW OF RELATED LITERATURE	2

3	SOLVED EXAMPLES	3
3.1	Solved Examples on Rectangle Rule	3
3.1.1	Example 1	3
3.1.2	Example 2	4
3.1.3	Example 3	4
3.2	Solved Examples on Midpoint Rule	5
3.2.1	Example 1	5
3.2.2	Example 2	6
3.2.3	Example 3	7
3.3	Solved Examples on Trapezoidal Rule	8
3.3.1	Example 1	8
3.3.2	Example 2	9
3.3.3	Example 3	10
3.4	Solved Examples on Simpson's Rule	10
3.4.1	Example 1	10
3.4.2	Example 2	11
3.4.3	Example 3	12
3.5	Solved Examples on Corrected Trapezoidal Rule	13
3.5.1	Example 1	13
3.5.2	Example 2	14
3.5.3	Example 3	15
4	THE NEWTON-COTES FORMULAE	16
4.1	DISCUSSION OF RESULTS	16

5	SUMMARY, CONCLUSION AND RECOMMENDATION	17
5.1	SUMMARY	17
5.2	CONCLUSION	17
5.3	RECOMMENDATION	17
	REFERENCES	18

Chapter 1

GENERAL INTRODUCTION

1.1 INTRODUCTION

1.2 STATEMENT OF THE PROBLEM

1.3 AIMS AND OBJECTIVES OF THE STUDY

1.4 SIGNIFICANCE OF STUDY

1.5 SCOPE OF THE STUDY

Chapter 2

LITERATURE REVIEW

2.1 REVIEW OF RELATED LITERATURE

Chapter 3

SOLVED EXAMPLES

3.1 Solved Examples on Rectangle Rule

3.1.1 Example 1

Using Rectangle rule, solve

$$I = \int_1^3 (x^3 - 2x^2 + 7x - 5) dx$$

Solution

$$f(x) = x^3 - 2x^2 + 7x - 5$$

$$b = 3, \quad a = 1$$

$$\text{Rectangle rule} = b - af(a)$$

$$\begin{aligned}
&= (3-1)(1^3 - 2(1)^2 + 7(1) - 5) \\
&= (2)(1 - 2 + 7 - 5) \\
&= (2)(1) \\
&= 2
\end{aligned}$$

3.1.2 Example 2

Using Rectangle rule, solve

$$I = \int_0^1 (x^3 + 3x + 1) dx$$

Solution

$$f(x) = x^3 + 3x + 1$$

$$b = 1, \quad a = 0$$

$$\text{Rectangle rule} = b - af(a)$$

$$= (1 - 0)(0^3 + 3(0) + 1)$$

$$= (1)(1)$$

$$= 1$$

3.1.3 Example 3

Using Rectangle rule, solve

$$I = \int_2^5 (x^5 + 2x^4 + 3x^2 + 2) dx$$

Solution

$$f(x) = x^5 + 2x^4 + 3x^2 + 2$$

$$b = 5, \quad a = 2$$

$$\text{Rectangle rule} = b - af(a)$$

$$= (5 - 2)(2^5 + 2(2)^4 + 3(2)^2 + 2)$$

$$= (3)(32 + 32 + 12 + 2)$$

$$= (3)(78)$$

$$= 234$$

3.2 Solved Examples on Midpoint Rule

3.2.1 Example 1

Using Midpoint rule, solve

$$I = \int_1^3 (x^3 - 2x^2 + 7x - 5) dx$$

Solution

$$f(x) = x^3 - 2x^2 + 7x - 5$$

$$b = 3, \quad a = 1$$

$$\text{Midpoint rule} = b - af\left(\frac{a+b}{2}\right)$$

$$\begin{aligned}
&= (3-1)f\left(\frac{1+3}{2}\right) \\
&= (3-1)f\left(\frac{4}{2}\right) \\
&= (2)f(2) \\
&= (2)(2^3 + 2(2)^2 + 7(2) - 5) \\
&= (2)(9) \\
&= 18
\end{aligned}$$

3.2.2 Example 2

Using Midpoint rule, solve

$$I = \int_0^1 (x^3 + 3x + 1) dx$$

Solution

$$f(x) = x^3 + 3x + 1$$

$$b = 1, a = 0$$

$$\text{Midpoint rule} = b - af\left(\frac{a+b}{2}\right)$$

$$\begin{aligned}
&= (1-0)f\left(\frac{0+1}{2}\right) \\
&= (1)f\left(\frac{1}{2}\right) \\
&= (1)\left(\left(\frac{1}{2}\right)^2 + 3\left(\frac{1}{2}\right) + 1\right) \\
&= (1)\left(\frac{1}{4} + \frac{3}{2} + 1\right) \\
&= \frac{21}{4}
\end{aligned}$$

3.2.3 Example 3

Using Midpoint rule, solve

$$I = \int_2^5 (x^5 + 2x^4 + 3x^2 + 2) dx$$

Solution

$$f(x) = x^5 + 2x^4 + 3x^2 + 2$$

$$b = 5, a = 2$$

$$\text{Midpoint rule} = b - af\left(\frac{a+b}{2}\right)$$

$$\begin{aligned}
&= (5-2)f\left(\frac{2+5}{2}\right) \\
&= (3)f\left(\frac{7}{2}\right) \\
&= (3)\left(\left(\frac{7}{2}\right)^5 + 2\left(\frac{7}{2}\right) + 3\left(\frac{7}{2}\right)^2 + 2\right) \\
&= (3)\left(\frac{27651}{32}\right) \\
&\Rightarrow \frac{82953}{32}
\end{aligned}$$

3.3 Solved Examples on Trapezoidal Rule

3.3.1 Example 1

Using trapezoidal rule, solve

$$I = \int_1^3 (x^3 - 2x^2 + 7x - 5) dx$$

Solution

$$f(x) = x^3 - 2x^2 + 7x - 5$$

$$b = 3, \quad a = 1$$

$$\text{Trapezoidal rule} = \frac{1}{2}(b-a)[f(a) + f(b)]$$

$$\implies \frac{1}{2}(3-1) [(1^3 - 2(1)^2 + 7(1) - 5) + (3^3 - 2(3)^2) + 7(3) - 5]$$

$$\implies \frac{1}{2}(2) [(1 - 2 + 7 - 5) + (27 - 18 + 21 - 5)]$$

$$\implies [1 + 25]$$

$$\implies 26$$

3.3.2 Example 2

Using trapezoidal rule, solve

$$I = \int_0^1 (x^3 + 3x + 1) dx$$

Solution

$$f(x) = x^3 + 3x + 1$$

$$b = 1, \quad a = 0$$

$$\text{Trapezoidal rule} = \frac{1}{2}(b-a)[f(a) + f(b)]$$

$$\implies \frac{1}{2}(1-0)[(0^3 + 3(0) + 1) + (1^3 + 3(1) + 1)]$$

$$\implies \frac{1}{2}(1)[1 + 5]$$

$$\implies \frac{1}{2}[6]$$

$$\implies 3$$

3.3.3 Example 3

Using trapezoidal rule, solve

$$I = \int_2^5 (x^5 + 2x^4 + 3x^2 + 2) dx$$

Solution

$$f(x) = x^5 + 2x^4 + 3x^2 + 2$$

$$b = 2, \quad a = 5$$

$$\text{Trapezoidal rule} = \frac{1}{2}(b - a)[f(a) + f(b)]$$

$$\Rightarrow \frac{1}{2}(5 - 2)[(2^5 + 2(2)^4 + 3(2)^2 + 2) + (5^5 + 2(5)^4 + 3(5)^2 + 2)]$$

$$\Rightarrow \frac{1}{2}(3)[(32 + 32 + 12 + 2) + (3125 + 1250 + 75 + 2)]$$

$$\Rightarrow \frac{3}{2}[78 + 445]$$

$$\Rightarrow \frac{3}{2}[4530]$$

$$\Rightarrow \frac{13590}{2}$$

$$\Rightarrow 6795$$

3.4 Solved Examples on Simpson's Rule

3.4.1 Example 1

Using Simpson's rule, solve

$$I = \int_1^3 (x^3 - 2x^2 + 7x - 5) dx$$

Solution

$$f(x) = x^3 - 2x^2 + 7x - 5$$

$$b = 3, \quad a = 1$$

$$\text{Simpson's rule} = \frac{b-a}{6} \left[f(a) + 4f\left(\frac{a+b}{2}\right) + f(b) \right]$$

$$\Rightarrow \frac{3-1}{6} \left[(1^3 - 2(1)^2 + 7(1) - 5) + 4f\left(\frac{1+3}{2}\right) + (3^3 - 2(3)^2 + 7(3) - 5) \right]$$

$$\Rightarrow \frac{2}{6} [(1 - 2 + 7 - 5) + 4(2^3 - 2(2)^2 + 7(2) - 5) + (27 - 18 + 21 - 5)]$$

$$\Rightarrow \frac{1}{3} [1 + 36 + 25]$$

$$\Rightarrow \frac{62}{3}$$

3.4.2 Example 2

Using Simpson's rule, solve

$$I = \int_0^1 (x^3 + 3x + 1) dx$$

Solution

$$f(x) = x^3 + 3x + 1$$

$$b = 1, \quad a = 0$$

$$\text{Simpson's rule} = \frac{b-a}{6} \left[f(a) + 4f\left(\frac{a+b}{2}\right) + f(b) \right]$$

$$\begin{aligned}
&\Rightarrow \frac{1-0}{6} \left[(0^3 + 3(0) + 1) + 4\left(\frac{0+1}{2}\right) + (1^3 + 3(1) + 1) \right] \\
&\Rightarrow \frac{1}{6} \left[1 + 4\left(\frac{1}{2}\right) + 5 \right] \\
&\Rightarrow \frac{1}{6} \left[1 + 4\left(\frac{1}{8} + \frac{3}{2} + 1\right) + 5 \right] \\
&\Rightarrow \frac{1}{6} \left[\frac{33}{2} \right] \\
&\Rightarrow \frac{11}{4}
\end{aligned}$$

3.4.3 Example 3

Using Simpson's rule, solve

$$I = \int_2^5 (x^5 + 2x^4 + 3x^2 + 2) dx$$

Solution

$$\begin{aligned}
f(x) &= x^5 + 2x^4 + 3x^2 + 2 \\
b &= 5, \quad a = 2 \\
\text{Simpson's rule} &= \frac{b-a}{6} \left[f(a) + 4f\left(\frac{a+b}{2}\right) + f(b) \right] \\
&\Rightarrow \frac{5-2}{6} \left[(2^5 + 2(2)^4 + 3(2)^2 + 2) + 4f\left(\frac{7}{2}\right) + (3125 + 1250 + 75 + 2) \right] \\
&\Rightarrow \frac{3}{6} \left[78 + \frac{27651}{32} + 4452 \right] \\
&\Rightarrow \frac{1}{2} \left[\frac{172611}{32} \right] \\
&\Rightarrow \frac{172611}{64}
\end{aligned}$$

3.5 Solved Examples on Corrected Trapezoidal Rule

3.5.1 Example 1

Using corrected trapezoidal rule, solve

$$I = \int_1^3 (x^3 - 2x^2 + 7x - 5) dx$$

Solution

$$f(x) = x^3 - 2x^2 + 7x - 5$$

$$f'(x) = 3x^2 + 4x + 7$$

$$b = 3, \quad a = 1$$

$$\text{Corrected trapezoidal rule} = \frac{b-a}{2} [f(a) + f(b)] + \frac{(b-a)^2}{12} [f'(a) - f'(b)]$$

$$\begin{aligned} \Rightarrow & \frac{3-1}{2} [(1^3 - 2(1)^2 + 7(1) - 5) + (3^3 - 2(3)^2 + 7(3) - 5)] \\ & + \frac{(3-1)^2}{12} [(3(1)^2 + 4(1) + 7) - (3(3)^2 + 4(3) + 7)] \end{aligned}$$

$$\Rightarrow 1[(1 - 2 + 7 - 5) + (27 - 18 + 21 - 5)] + \frac{4}{12}[(3 - 4 + 7) - (27 - 12 + 7)]$$

$$\Rightarrow [1 + 25] + \frac{1}{3}[6 - 22]$$

$$\Rightarrow 26 + \left(-\frac{16}{3}\right)$$

$$\Rightarrow 26 - \frac{16}{3}$$

$$\Rightarrow \frac{62}{3}$$

3.5.2 Example 2

Using corrected trapezoidal rule, solve

$$I = \int_0^1 (x^3 + 3x + 1) dx$$

Solution

$$f(x) = x^3 + 3x + 1$$

$$f'(x) = 3x^2 + 3 \quad a = 0$$

$$\text{Corrected trapezoidal rule} = \frac{b-a}{2} [f(a) + f(b)] + \frac{(b-a)^2}{12} [f'(a) - f'(b)]$$

$$\begin{aligned} \Rightarrow & \frac{1-0}{2} [(0^3 + 3(0) + 1) + (1^3 + 3(1) + 1)] \\ & + \frac{(1-0)^2}{12} [(3(0)^2 + 3) - (3(1)^2 + 3)] \end{aligned}$$

$$\Rightarrow \frac{1}{2} [(1) + (5)] + \frac{1}{12} [3 - 6]$$

$$\Rightarrow \frac{1}{2} [6] + \frac{1}{12} [-3]$$

$$\Rightarrow 3 - \frac{3}{12}$$

$$\Rightarrow \frac{11}{4}$$

3.5.3 Example 3

Using corrected trapezoidal rule, solve

$$I = \int_2^5 (x^5 + 2x^4 + 3x^2 + 2) dx$$

Solution

$$f(x) = x^5 + 2x^4 + 3x^2 + 2$$

$$f'(x) = 5x^4 + 8x^3 + 6x$$

$$b = 5, \quad a = 2$$

$$\text{Corrected trapezoidal rule} = \frac{b-a}{2} [f(a) + f(b)] + \frac{(b-a)^2}{12} [f'(a) - f'(b)]$$

$$\begin{aligned} \Rightarrow & \frac{5-2}{2} [(2^5 + 2(2)^4 + 3(2)^2 + 2) + (5^5 + 2(5)^4 + 3(5)^2 + 2)] \\ & + \frac{(5-2)^2}{12} [(5(2)^4 + 8(2)^3 + 6(2)) + (5(5)^4 + 8(5)^3 + 6(5))] \end{aligned}$$

$$\begin{aligned} \Rightarrow & \frac{3}{2} [(32 + 32 + 12 + 2) + (3125 + 1250 + 75 + 2)] \\ & + \frac{3}{4} [(80 + 64412) - (3125 + 1000 + 30)] \end{aligned}$$

$$\Rightarrow \frac{3}{2} [78 + 4452] + \frac{3}{4} [156 - 4155]$$

$$\Rightarrow \frac{13590}{2} + \left(\frac{-11997}{4} \right)$$

$$\Rightarrow \frac{13590}{2} - \frac{11997}{4}$$

$$\Rightarrow \frac{15183}{4}$$

Chapter 4

THE NEWTON-COTES FORMULAE

4.1 DISCUSSION OF RESULTS

Chapter 5

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

5.2 CONCLUSION

In the course of this study,

5.3 RECOMMENDATION

Based on what we have considered in this study,

It is recommended that a formulae be done so that it value could be compare with the most accurate of the closed Newton-Cotes Formulae.

REFERENCES

A.