

Development and Standardization of Mathematics Achievement Test for Unified Senior Secondary School Class 2 Promotion Examination in Ondo State, Nigeria

Joseph Oluwatayo Osakuade (Ph.D)^{1*}

¹Department of Guidance and Counselling, Faculty of Education, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria

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*Corresponding author: Joseph Oluwatayo Osakuade

Department of Guidance and Counselling, Faculty of Education, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria

Abstract

Advancement in science and technology is what can bring about rapid transformation of any country. Mathematics is a veritable tool in the understanding of science and technology. Despite the importance, the trend of secondary school students' performance in Mathematics in external examinations is worrisome. Perhaps, non-availability of standardized achievement test for formative assessment or for promoting the students to the certificate class could be the cause. The purpose of this study was to develop and standardize Mathematics Achievement Test (MAT) for unified senior secondary school class 2 promotion examination in Ondo State. Seventy five SSS2 students randomly selected from Akoko metropolis of the state constituted the sample. MAT for SSS2 was the instrument for this study. The instrument was developed and standardized following various stages of test development and standardization processes. Out of the initial 75 items drafted, 50 items formed the final MAT. The final MAT was valid and reliable. The reliability coefficients were (0.97 and 0.89) using test retest and Kuder-Richardson-20 methods of reliability respectively. From the results obtained, the following conclusions were drawn: The MAT was developed by the researcher, the validated test items were in line with the mathematics curriculum for senior secondary school class 2 students in Ondo State, the developed and validated MAT exhibited good measure of difficulty and discrimination indices. Based on the findings and the conclusion of this study, it was recommended among others that the developed MAT should be used by mathematics teachers teaching senior secondary school class two students in Ondo State and the examination unit of the Ondo State Ministry of Education should make use of this MAT to improve on the quality of their examinations.

Keywords: Development, standardization, mathematics achievement test, unified promotion examination, senior secondary school class 2.

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INTRODUCTION

Technological advancement is very essential for every country at present for global competitiveness. Advancement in science and technology is what can bring about rapid transformation of any country. The objectives of education in Nigeria includes the training of the mind in the understanding of the world around and the acquisition of appropriate skills, values and competence both mental and physical as equipment for the individual to live and contribute meaningfully to the development of the society (FRN, 2004). In her quest for the attainment of these goals of education and production of future scientists for national development, science education was introduced into the curriculum of senior secondary schools in Nigeria.

Mathematics is a veritable tool in the understanding of science and technology. Mathematics is the subject needed in all the facet of life. It is being used in the study of science and humanity. It is the nucleus of all sciences. It has been asserted that without mathematics there cannot be any modern developed Society (Ukeje, 2005). This accounts for the reason why Mathematics is made a compulsory subject at the Primary and Secondary School levels in Nigeria (Federal Republic of Nigeria, 2008). Mathematics is also a pre-requisite subject for gaining admission into any tertiary institution in Nigeria. Thus, mathematics is expected to help in accelerating social, economic and technological progress of any Society.

Despite the fact that Mathematics is a veritable tool in the understanding of science and technology, there has been a repeated low level of achievement or poor performance of secondary school students in the subject in Ondo State (Akinwumi, 2023). The trend of secondary school students' performance in WASSCE (May/June) between 2010 and 2018 in Mathematics in Ondo State according to Akinwumi (2023) are: 17.7%, 11.1%, 9.5%, 16.7%, 28.3%, 23.2%, 38.7% and 29.7% respectively. For these periods of nine years in Ondo State, secondary school students performed below average in WASSCE Mathematics.

As an intervention strategy to checkmate the poor performance in the subject, the Ondo State Government introduced Unified promotion examination for all Senior Secondary School class two (SSS2) students in 2005. The sole purpose of the examination was to promote credible candidates into the certificate class that would subsequently perform excellently well in WASSCE (Akinwumi, 2023). Despite this giant stride on the part of government, the poor performance of students from Ondo State in Mathematics still continues unabated.

On what could have been responsible for this poor performance, in a separate study conducted by Oloda (2021) and Akinwumi (2023), it was observed that the psychometric properties of Mathematics items used for this Ondo State unified promotion examination needed to be improved upon. Besides, some of the mathematics items used for the examination were biased as they differentiate among students in terms of gender, age, school location and types of schools. Apart from this, the teachers preparing students for this Unified promotion examination too have no standardised formative achievements to be using in assessing their students at SSS2 classes.

Statement of the Problem

Quality assessment tools are needed in the course of instruction in the school system to guide effective teaching, learning and assess the level of mastery of students. The researcher observed that based on the findings of several researchers that the Ondo State Unified promotion mathematics examination used to promote students into certificate class, is not yielding the expected results because many students certified competent and promoted to SSS3 are not doing well in SSCE. Besides, research evidences have also shown that most teachers do not know to construct and validate assessment tools (Ugwu, 2012; Chime, 2012; Obilor,

2019). The teachers made tests lack basic psychometric qualities and are not appropriate for the assessment of students' learning. It was against this background that the researcher envisioned that there should be a need to develop and standardize achievement test in Mathematics to be used by teachers as formative test to assess SSS2 students and also improve the quality of Unified promotion mathematics examination already in place in Ondo State, hence the gap to be filled in this study.

Purpose of the Study

The main purpose of this study was to construct and standardize Mathematics achievement test for Unified SSS2 promotion examination in Ondo State. Specifically, the study sought to:

- i. Construct mathematics achievement test for unified SSS2 promotion examination in Ondo State
- ii. Validate the developed test,
- iii. Carry out item analysis, and
- iv. Standardize the test.

Methods of Construction and Standardization of Mathematics Achievement Test

This test was constructed on the basis of secondary level objectives and curriculum for SSI and SSII mathematics. The test items were prepared from the prescribed text book of SSI and SSII mathematics. The achievement test was designed to measure students' knowledge, comprehension, application, analysis and synthesis in mathematics. The achievement test was prepared through adopted five basic steps namely: test conceptualization, test construction, item scoring and analysis, reliability and validity and test standardization. The achievement test construction process was adopted following steps as shown below:

Preparation Test of Blueprint

A blueprint is a detail plan of any action or outline. It provides the researcher a bird's eye view of the entire test and also provides the users with basic instruction on the rationale for the process in creating test blue print. A test blueprint ensures appropriate item representation of content with weighting. In blueprint, we can see the content area, unit wise topics, item wise weighting of contents by objectives, number of items and distribution of scores (marks) and their mutual relationships. It is the basis for test construction. The details of test after the first try out (Draft preparation) are given in the form of blueprint. The test blueprint is given in table 1 below:

Table 1: Table of Specification (Draft)

Content	Weighting %	Knowledge	Comprehension	Application	Analysis	Synthesis	Total
		15%	16%	60%	5%	4%	100%
Number and Numeration	39%	2	5	19	1	2	29
Algebraic Processes	16%	3	2	6	1	0	12
Measurement	11%	2	0	6	0	0	8
Plane Geometry	11%	2	3	3	0	0	8

Content		Knowledge	Comprehension	Application	Analysis	Synthesis	Total
	Weighting %	15%	16%	60%	5%	4%	100%
Trigonometry	9%	1	1	4	0	1	7
Statistics and Probability	15%	1	1	7	2	0	11
TOTAL	100%	11	12	45	4	3	75

The items on the table of specification is shown in Table 2

Table 2: Items on the Table of Specification (Draft)

Content	Weighting %	Knowledge	Comprehension	Application	Analysis	Synthesis	Total
		15%	16%	60%	5%	4%	100%
Number and Numeration	39%	24, 48	5, 11, 17, 44, 56	1, 2, 8, 19, 25, 26, 28, 31, 34, 35, 38, 41, 50, 51, 52, 53, 54, 55, 58.	18	3, 27	29
Algebraic Processes	16%	61, 62, 63	36, 40	6, 29, 32, 42, 57, 64	7		12
Measurement	11%	67, 68		20, 23, 43, 49, 65, 66			8
Plane Geometry	11%	4, 47	30, 37, 39	10, 69, 70			8
Trigonometry	9%	74	33	45, 71, 72, 73		22	7
Statistics and Probability	15%	75	12	9, 13, 14, 15, 46, 59, 60	16, 21	0	11
TOTAL	100%	11	12	45	4	3	75

Preparation of Preliminary Draft

The preliminary draft of achievement test was prepared by the researcher after finalizing the blueprint. The draft was given to other colleagues in test and measurement. After receiving their opinions, some items were modified in terms of item difficulty and language. On this basis, 5 items were eliminated from the draft. In each question 1 mark was given for correct response and 0 for wrong response.

Pilot Testing

The pilot testing was done on a sample of 75 SSS3 students (presently in first term of the SSS3 who have completed SSS1 and SSS2 curriculum) selected from three (3) Government Senior Secondary Schools of Akoko South West Local Government Area of Ondo State.

Item Analysis

Item analysis is the item-wise analysis which helps to detect the strength and weakness of each test

item. The process of item analysis was carried out by using two contracting test groups composed from the upper and lower 27% of the examinees. The performance of students in upper and lower 27% were compared using the following formulae to calculate Difficulty Level and Discriminating Power.

$$P = \frac{R_U + R_L}{N_U + N_L}$$

$$D.P = \frac{R_U - R_L}{\frac{1}{2}(N_U + N_L)}$$

P = Power of difficulty level

$D.P$ = Discriminating Power

R_U = Correct response given by upper group

R_L = Correct response given by lower group

N_U = Total number of students in upper group

N_L = Total number of students in lower group

The result of Difficulty Level is as shown in Table 3

Table 3: Difficulty Level (P-Level)

Item	Number of Items	Difficulty Index Range	Quality	Interpretation
-	0	0.75 – 1.00	Easy/Poor	Discard/Review
13,31,67,15, 49, 3, 22, 27,47, 14, 17, 18, 38, 8, 26, 42, 44, 29, 37, 61, 69, 2, 5, 10, 70, 1, 39,48, 57,72, 53, 63, 64.	33	0.26 – 0.74	Moderate	Retain
11, 20, 23, 32, 33, 34, 35, 50, 51, 55, 4, 6,21, 60, 36, 56, 62, 40, 41, 46, 71,75.	22	0.21 – 0.25	Fair	Retain
54. 66, 25, 65, 7, 19, 30, 74, 12, 59, 73, 28, 43, 58, 16, 24, 52, 9, 45, 68	20	0.00 – 0.20	Difficult	Discard

From Table 3, the item difficulty values are interpreted according to Joshua (2005), Thompson

(2009) and Rana (2014). If the value of difficulty index is greater than 0.75 then it is considered as easy and

discarded, between 0.26- 0.74 is considered as moderate and retained, between 0.21-0.25 is considered to be fair and retained, but below 0.20 is considered difficult and they were discarded.

The result of item discrimination is also shown in Table 4.

Table 4: Item Discrimination Index (D. P)

Item	Number of Items	Discrimination Power Index Range	Quality of the items	Interpretation
42, 47, 1, 22, 31, 67, 14, 15, 51, 17, 48.	11	0.40 -1.00	very good	Retained
2, 5, 26, 32, 35, 49, 70, 13, 27, 37, 39, 61, 69.	13	0.30 – 0.39	Reasonably good	Retained
8, 10, 23, 38, 3, 20, 40, 56, 57, 60, 18, 33, 36, 4, 64, 6, 21, 34, 41, 44, 46, 50, 55, 71, 72, 75.	26	0.20 -0.29	Marginal and need revision	Revised and Retained
58, 52, 9, 28, 30, 43, 45, 12, 16, 59, 66, 73, 7, 19, 29, 54, 62, 68, 74, 24, 53, 65, 11, 25, 63.	25	Below 0.20	Poor items	Eliminated

In Table 4, the discrimination Power values were interpreted according to Kolawole (2006) Rules of Thumb, if the value of discriminating index is greater than 0.39 then it is considered as best, between 0.30- 0.39 is considered as reasonably good, between 0.20-0.29 is considered to be marginal which was improved on, but below 0.20 is considered poor items and they were discarded.

Preparation of Final Test

After the first try out, the mathematics achievement test was given and administered in another group of 75 students of current SSS3 students who had completed the syllabus. Same process of first try out was followed for finding difficulty value and discriminating index. The number of questions after calculating P-Level and D- Level are given in Table Table5. The items lying in ‘Very good’, ‘good’ and marginal (which have been revised) levels were selected for the final draft.

Table 5: Final Decision

Item	Difficult Level	Accepted/ Rejected	Discrimination Power	Accepted or Rejected	Remark
1	0.31	A	0.62	A	Accepted
2	0.33	A	0.38	A	Accepted
3	0.50	A	0.24	A	Accepted
4	0.22	A	0.21	A	Accepted
5	0.33	A	0.38	A	Accepted
6	0.22	A	0.20	A	Accepted
7	0.12	R	-0.05	R	Rejected
8	0.38	A	0.29	A	Accepted
9	0.02	R	0.05	R	Rejected
10	0.33	A	0.29	A	Accepted
11	0.24	A	-0.19	R	Rejected
12	0.10	R	0.00	R	Rejected
13	0.64	A	0.33	A	Accepted
14	0.48	A	0.48	A	Accepted
15	0.57	A	0.48	A	Accepted
16	0.05	R	0.00	R	Rejected
17	0.40	A	0.43	A	Accepted
18	0.40	A	0.23	A	Accepted
19	0.12	R	-0.05	R	Rejected
20	0.24	R	0.24	A	Accepted
21	0.22	A	0.20	A	Accepted
22	0.50	A	0.52	A	Accepted
23	0.24	A	0.29	A	Accepted
24	0.05	R	-0.10	R	Rejected
25	0.14	R	-0.19	R	Rejected
26	0.38	A	0.38	A	Accepted
27	0.50	A	0.33	A	Accepted
28	0.07	R	0.05	R	Rejected
29	0.36	A	-0.05	R	Rejected

Item	Difficult Level	Accepted/ Rejected	Discrimination Power	Accepted or Rejected	Remark
30	0.12	R	0.05	R	Rejected
31	0.60	A	0.52	A	Accepted
32	0.24	A	0.38	A	Accepted
33	0.24	A	0.22	A	Accepted
34	0.24	A	0.20	A	Accepted
35	0.24	A	0.38	A	Accepted
36	0.21	A	0.22	A	Accepted
37	0.36	A	0.33	A	Accepted
38	0.40	A	0.25	A	Accepted
39	0.31	A	0.33	A	Accepted
40	0.21	A	0.24	A	Accepted
41	0.21	A	0.20	A	Accepted
42	0.38	A	0.76	A	Accepted
43	0.07	R	0.05	R	Rejected
44	0.38	A	0.20	A	Accepted
45	0.02	R	0.05	R	Rejected
46	0.21	A	0.20	A	Accepted
47	0.50	A	0.71	A	Accepted
48	0.31	A	0.43	A	Accepted
49	0.57	A	0.38	A	Accepted
50	0.24	A	0.20	R	Accepted
51	0.24	A	0.48	A	Accepted
52	0.05	R	0.10	R	Rejected
53	0.29	A	-0.10	R	Rejected
54	0.19	R	-0.05	R	Rejected
55	0.24	A	0.20	A	Accepted
56	0.21	A	0.24	A	Accepted
57	0.31	A	0.24	A	Accepted
58	0.07	R	0.14	R	Rejected
59	0.10	R	0.00	R	Rejected
60	0.22	A	0.24	A	Accepted
61	0.36	A	0.33	A	Accepted
62	0.21	A	-0.05	R	Rejected
63	0.29	A	-0.29	R	Rejected
64	0.29	A	0.21	A	Accepted
65	0.14	R	-0.10	R	Rejected
66	0.19	R	0.00	R	Rejected
67	0.60	A	0.52	A	Accepted
68	0.02	R	-0.05	R	Rejected
69	0.36	A	0.33	A	Accepted
70	0.33	A	0.38	A	Accepted
71	0.21	A	0.20	A	Accepted
72	0.31	A	0.20	A	Accepted
73	0.10	R	0.00	R	Rejected
74	0.12	R	-0.05	R	Rejected
75	0.21	A	0.20	A	Accepted

Note: 'A' denotes Accepted while 'R' denotes Rejected

Reliability of the Test

According to Anastasi and Ubrina (1982), reliability refers to the consistency of scores obtained by the same persons when they are re-examined with the same test on different occasions, or with different sets of equivalent items, or under other variable examining conditions. The reliability of the test was estimated by test-retest method. The test was administered and repeated after 20 days. The reliability coefficient was

calculated between the first and the second set of scores and it was found to be 0.97. Kuder-Richardson-20 formulae was also used to further ascertain the reliability of the test, a reliability coefficient of 0.89 was obtained. Alonge (2004) suggests the absolute value of r for standardised test usually have high reliability coefficient between +0.80 and +0.90 but reliability coefficient of 0.50 to 0.70 are suitable for classroom tests,

Validity of the Test

The validity coefficient is sometimes said to show how precisely it measures what it ought to measure. According to Anastasi (2007), the validity of a test concerns with what the test measures and how well it does so. In most achievement test, validity is primarily a matter of content or face validity. Content validity of the test, which requires the determination of the adequacy of each item, was ensured through careful planning of the test, satisfying the adequacy of sampling of test items models of the construct to be measured and the meticulous analysis of the test items of experts. The statistical validity of the test items included in the test was compared with the objectives of the topics taught. It was found that there was positive correlation between the items and objectives. So it can be claimed that test has

got content validity. The validity coefficient reported here show that the achievement test used in the study is reasonably valid.

Norms

A standardized test must have norms which should be the average performance of a group or groups that the examiner has taken for the administration of the final form. Norms are measure of achievement which represents the typical performance of a group or groups. Norms are used for interpreting the scores of the individual or a class. Norms are empirically established by determining what persons in a representative group actually do on a test. This achievement test follows the age norms. The four categories of four groups of age and their average performance are stated below:

Table 6: Table of Norm

Age Group in Years	Frequency	Minimum Score	Maximum Score	Average Performance in Percentage (%)
11-13	4	28	52	41.5
14-16	38	10	50	25.7
17-19	32	14	62	34.6
20 and above	1	26	26	26.0
Overall (16 Years)	75	10	62	30.3

The Final copy of the Test is in Appendix 1

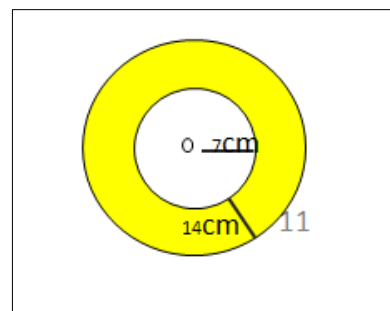
Appendix 1: Final Copy

STANDARDIZED MATHEMATICS ACHIEVEMENT TEST FOR UNIFIED SSS II PROMOTION EXAMINATION

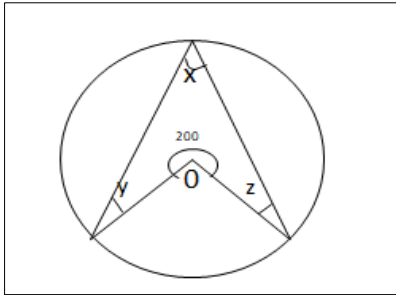
- Simplify $\left\{\frac{1}{2} + \frac{3}{4}\right\} \div 1\frac{1}{4}$. A. $1\frac{4}{5}$ B. 1 C. $\frac{25}{4}$ D. $6\frac{1}{4}$ E. $\frac{5}{4}$
- The 3rd term of a Geometric Progression is 8 and the 6th term is 1. Find the 4th term of the Progression. A. 32 B. 16 C. 2 D. 4 E. $\frac{1}{2}$
- I think of a natural number. If 6 is added to the number, the answer is equal to the square of the number. Find the number. A. 3 B. -3 C. -2 D. 2 E. 0
- How many sides has a regular polygon in which its interior angle is 120^o greater than its exterior angle? A. 30 B. 6 C. 10 D. 11 E. 12
- Correct 4564.257 to two significant figures. A. 4564.26 B. 4500 C. 4600 D. 4500.257 E. 4600.257
- Find the value of 'C' in the relation $y = x^2 + 2x + C$ if passes through the point
 - (2, 3). A. 7 B. 8 C. -7 D. 10 E. -10
- Evaluate $\frac{2^{2n-1} \times 16^{n-1}}{64^n}$ A. 32 B. $\frac{1}{32}$ C. -32 D. $\frac{-1}{32}$ E. 2^{6n-5}
- Calculate the gradient of the line ST, if a straight line passes through the point X (2,5) and Y(5,9). A. $\frac{3}{4}$ B. $\frac{2}{5}$ C. $\frac{5}{9}$ D. $\frac{5}{2}$ E. $\frac{4}{3}$
- Use the following information to answer questions 12 to 14.

Height (m)	1.3	1.4	1.5	1.6	1.7
Frequency	2	4	8	4	2

- The table above, which shows the height of students in SS2A of a particular school can be graphically represented using the following except_____ A. Simple Bar Chart B. Pie Chart C. Multiple Bar Chart D. Line Graph E. Histogram
- How many students are in the SS2A of the School? A. 7.4 B. 8 C. 1.5 D. 20 E. 6
 - Find the average height of the students. A. 1.48 B. 8 C. 1.5 D. 20 E. 6
 - Find the Median Height of the Students A. 1.48 B. 8 C. 20 D. 6 E. 1.5
 - Simplify $(h^4)^{-3/2}$ A. h^6 B. $\frac{1}{h^6}$ C. $h^{\frac{5}{2}}$ D. $h^{-\frac{11}{2}}$ E. $\frac{5}{2}$
 - A two-digit number is such that the sum of its digits is equal to the difference between the number and when the digits are interchanged, which is equal to 9. Find the number when the first digit of the number is greater than the second digit A.54 B. 45 C. 56 D. 65 E. none.
 - Find the area of the shaded portion of the figure below. Taken $\pi = \frac{22}{7}$. A. 462cm^2 B. 154cm^2 C. 232cm^2 D. 616cm^2 E. 98cm^2 .



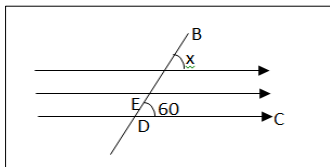
15. The numbers of beans in ten (10) cocoa pods randomly selected are 20, 24, 15, 42, 38, 35, 32, 25, 22 and 27. Calculate the different between the median and mean number of beans per cocoa pod (a) 3 (b) 1 (c) 10 (d) 2 (e) 0.
16. If $\sin \Phi = \frac{3}{5}$, evaluate $\tan \Phi$ A. $\frac{4}{5}$ B. $\frac{3}{4}$ C. $\frac{4}{3}$ D. $\frac{5}{3}$ E. $\frac{5}{4}$
17. Calculate the value of x in the figure below:



- i. A 80° B. 100° C. 160° D. 200° E. 20° .
18. If two positive numbers differ by 3. If their product is 10, find the larger number A. 5 B. 2 C. $\frac{1}{2}$ D. 20 E. 15.
19. Express 12 in Denary to Binary. (a) 0011 (b) 3 (c) 1100 (d) 12 (e) 10.
20. If x is inversely proportional to y and where $x = 6$, $y = 2$. Find y when $x = 4$. A. 24 B. 8 C. $\frac{4}{3}$ D. 6 E. 3.
21. The angle of depression of a chick from the top of a tower is 48° . What is the angle of elevation of the top of the Tower from the chick? A. 132° B. 42° C. 48° D. 312° E. 90° .
22. Evaluate $\frac{0.00081}{0.009}$ and express your answer in standard form. A. 9.0×10^1 B. 0.9×10^1 C. 9.0×10^2 D. 9.0×10^{-2} E. 0.9×10^{-1} .

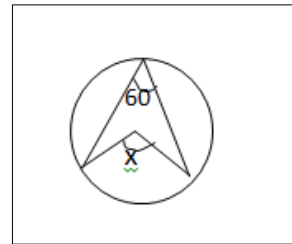
x	1	2	3
1	1	2	3
2	2	0	2
3	3	2	1

23. What is the module of the table below
A. 2 B. 5 C. 6 D. 3E. 4
24. Which of this expression satisfy the condition of $x < y$ and $y \leq z$. A. $x = z$ B. $z < x$ C. $x < z$ D. $x > z$ E. $x \leq z$
25. What is the value of x in the diagram below.



- i. 120° B. 60° C. 80 D. 300° E. 30° .
26. If the nth term of a sequence if $T_n = 3 + (1-n)^2$, then find the value of $T_5^2 - T_3^2$. A. 312 B. 13 C. -312 D. -13 E. 91

27. The Sum of interior Angle of n-sided polygon is given by ---- A. $(n-2) \times 90$ B. $(n-2) \times 360$ C. $(n-2) \times 180$ D. $(n+1) \times 90$ E. $(n+2) \times 180$
28. Find the Lowest Common Multiple (LCM) of $3y$, $6xy$ and $12yz$. A. $12xyz$ B. $3y$ C. $6yz$ D. $24xyz$ E. $18xy$
29. Convert 2134 to binary. A. 39 B. 3111 C. 111001 D. 100111E. 1110101
30. Expand $(y-3)(y+3)$. A. y^2+6y-9 B. y^2-6y-9 C. y^2-6y+9 D. y^2+6y+9 E. y^2-9 .
31. Express 0.025 as a percentage. A. 25% B. 2.5 % C. 250% D. 0.025% E. 0.25%
32. The probability that three students will fail in their tests are $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{4}{7}$ respectively. What is the probability that they will all succeed. A. $\frac{1}{21}$ B. $\frac{3}{21}$ C. $\frac{6}{21}$ D. $\frac{5}{14}$
33. A triangle with only two sides equal is called ----- triangle. A. Isosceles B. Equilateral C. Scalene D. Acute Angled E. quadrilateral
34. The Roman numeral CXCIV represents _____ A. 204 B. 94 C. 194 D. 214 E. 104
35. What is the value of x in this diagram? A. 60° B. 120° C. 150° D. 360° E. 180°



36. Find the value of x, if $9^{\frac{x-1}{2}} = 27$. A. 3 B. 4 C. 5 D. 6 E. $\frac{1}{2}$
37. Simplify $32^{\frac{-3}{5}} \times 16^{-\frac{1}{2}} \div 64^{-\frac{5}{6}}$ A. 0 B. 2 C. $\frac{1}{2^{10}}$ D. -5 E. 1
38. Find x, if $2x3_4 = 10011_2$ A. 3 B. 4 C. 0 D. 2 E. 1
39. If x are natural number, list the values of x that satisfying this inequality $x < 4$. A. -1, 0 1, 2, 3 B. 1, 2, 3, C. 0, 1, 2, 3 D. 1, 2, 3, 4 E. 0, 1, 2, 3, 4
40. Solve for the range of x in $3(x-2) > 4(2x+3)$ A. $x > 3.6$ B. $x < -3.6$ C. $x > 18$ D. $x < 18$ E. $x < 3$
41. The probability that Tope, Tola and Temi will hit a target is $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$ respectively. Find the probability that only Tola will hit the target? A. $\frac{1}{2}$ B. $\frac{1}{8}$ C. $\frac{1}{4}$ D. $\frac{1}{24}$ E. $\frac{1}{12}$
42. If p is varies inversely as q, when p is 4, $q = \frac{1}{4}$. What is the value of p when $q = 5$? A. 4 B. $\frac{5}{4}$ C. $\frac{1}{5}$ D. 5 E. $\frac{4}{5}$
43. Make x, the subject of the relation $T = \frac{h\sqrt{x^2-4ac}}{2a}$ A. $x = \frac{\sqrt{4a^2T^2}}{h^2} - 4ac$ B. $x = \frac{\sqrt{4a^2T^2}}{h^2} + 4ac$ C. $x = \frac{\sqrt{4a^2T^2}}{h^2} - 4ac$ D. $x = \frac{\sqrt{4a^2T^2}}{h^2} + 4ac$ E. $x = \frac{h\sqrt{T^2-4ac}}{2a}$

45. A polygon with 5 sides is called ____ A. Nonagon B. Hexagon C. Decagon D. Pentagon E. Heptagon.
46. Find the length of a chord which subtends an angle of 60° at the center of a circle whose radius is 3cm. A. 3cm B. 9cm C. 18cm D. 6cm E. 36cm
47. Angle 45° can be constructed with the aid of ruler and compass through the following except ____ A. By bisecting angle 90° B. By bisecting the angle between 30° and 60° C. By bisecting angle between 32° and 58° D. by bisecting angle 60° twice and add the angles together E. By bisecting angle 180° twice.
48. A man walks 12km due east from a point A to point B, he then walks 5 km due south to a point C. Find the bearing of A from C to the nearest whole number. A. 023° B. 113° C. 067° C. 157° D. 024° E. 065°
49. The bearing of point N from point T is 125° . What is the bearing of point T from point N? A. 55° B. 035° C. 305° D. 125° E. 235°
50. What is the probability of picking letter 'T' from the word 'ATTIRE'? A. $\frac{1}{6}$ B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. $\frac{2}{5}$ E. $\frac{1}{3}$

CONCLUSION

From the results obtained, the following conclusions were drawn:

1. The Mathematics Achievement Test (MAT) was developed by the researcher
2. The validated test items were in tandem with the mathematics curriculum for senior secondary school class 2 students in Ondo State.
3. The developed and validated MAT exhibited good measure of difficulty and discrimination indices.
4. The test was valid and has high reliability coefficients of (0.97 and 0.89) using test retest and Kuder-Richardson-20 methods respectively.

Recommendations

Based on the findings and the conclusion of this study, the following recommendations were made:

1. The developed MAT should be used by mathematics teachers teaching senior secondary school class two students
2. The items of MAT developed should serve as template for the development of other achievement tests in Mathematics and other subjects for SSS2 students.
3. The examination unit of the Ondo State Ministry of Education should make use of this MAT to improve on the quality of their question items.

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