DECLARATION

"This research project is my original work and has not been presented for a degree in any other University."

OGOMA, SHADRACK OCHIENG

"This research project paper has been submitted for examination with my approval as the University Supervisor."

PROF. G. S. ESHIWANI
DIRECTOR OF BUREAU OF EDUCATIONAL RESEARCH
KENYATTA UNIVERSITY
DEDICATION

For Mical, Faith, Judy and Tim
and their happiness.
ACKNOWLEDGEMENT

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ABSTRACT

"A STUDY OF THE RELATIONSHIP BETWEEN ACHIEVEMENT AND ATTITUDES TOWARDS MATHEMATICS AMONG STD. 7 PUPILS IN NAIROBI PRIMARY SCHOOLS."

This study of the relationship between achievement and attitudes towards mathematics among Std. 7 pupils attempted to establish the importance of attitudes towards mathematics in achievement in the subject. It also tried to measure the effect of other variables which are closely associated with performance in mathematics. These variables were the sex of the child, ability of the child in mathematics and socio-economic status of the child.

The sample of the study consisted of children from standard 7 in Nairobi city primary schools. Four schools were drawn randomly from the schools run by the City Commission. These schools were selected to reduce the diversity in availability of learning facilities. Then stratified random sampling was carried out to select 10 pupils from each of four schools. Each category, above average, average and below average in mathematics was selected from. Thus, 40 pupils made the sample size of the study.
The data was collected by the use of the following instruments: An achievement test which took the form of K.C.P.E. examination format, an ability test, and an attitude test. The ability test answer sheets contained items inquiring about the sex and socio-economic status of the respondent.

The instruments were scored manually, awarding points for correct responses and no point for incorrect responses in the case of ability and achievement tests. For attitude test, points were awarded depending on the type of feeling manifested. For example, positive feelings were awarded more points than negative feelings.

The scores were then analysed by use of some statistical techniques namely: the correlation coefficient, t-test, the percentages and mean. These helped in arriving at some conclusions from the study.

The correlation coefficient revealed that attitudes towards mathematics and achievement in mathematics were positively correlated. However the magnitude of the correlation was found to be statistically insignificant. The same statistic revealed a significant positive correlation between ability and achievement in mathematics.
The correlation between attitudes and achievement for girls was found to be higher than for boys. Lastly, socio-economic status was found to have insignificant influence on the performance on ability and achievement tests.

From the above findings the researcher concluded that the positive correlation that exists indicate that attitudes have some influence on achievement. Furthermore this influence is higher for girls than boys. Therefore, pupils should be encouraged in mathematics so that they develop positive feelings; more so in the case of girls. The correlation between ability and achievement was significant whereas that between attitude and achievement was insignificant. Ability was more important in achievement than attitude was. Conceptual approach to teaching mathematics should be adopted so that pupils develop the ability in mathematics. This calls for adequate teaching facilities.
1.0. INTRODUCTION

Performance in mathematics in Kenyan primary schools has not been satisfactory. Kenya National Examination Council, C.P.E. Newsletter, 1984 on its average performance report gives empirical evidence on this. The report compares the rural and Nairobi urban-low-cost schools.

Table 1: Performance in Mathematics

<table>
<thead>
<tr>
<th>Year</th>
<th>Rural Schools</th>
<th>Nairobi schools (High cost/private excluded)</th>
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<tr>
<td>1983</td>
<td>49.6%</td>
<td>47.6%</td>
</tr>
<tr>
<td>1982</td>
<td>48.1%</td>
<td>46.8%</td>
</tr>
<tr>
<td>1981</td>
<td>40.9%</td>
<td>41.8%</td>
</tr>
<tr>
<td>1980</td>
<td>45.5%</td>
<td>44.2%</td>
</tr>
<tr>
<td>1979</td>
<td>43.7%</td>
<td>42.8%</td>
</tr>
<tr>
<td>1978</td>
<td>51.3%</td>
<td>51.7%</td>
</tr>
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This report manifests two points clearly. First generally, the rural schools have consistently performed better than Nairobi low-cost schools over the years under consideration. Secondly, on the average, the candidates who take the mathematics examination find over half of the test items difficult. This is indicated by the performance of below 50%. This, in turn implies that on the average children achieve below the expectation during their mathematics lessons.

We are in an era of science and technology and no country would like to be left behind. The role of mathematics in science and technology cannot be overemphasized. Mathematical knowledge is part and parcel of subjects like physics, chemistry and others which lead to scientific fields. In view of this fact it is no wonder that many factors thought to affect performance in mathematics have been studied. Among these variables, attitudes towards mathematics have been shown to have an influence on mathematics performance.

Research on attitudes towards mathematics show that this variable is closely related to performance in mathematics. Aiken (1970), in his review of studies on attitudes towards mathematics clearly brings out the following:
First, much work has been done on grade distribution and stability of attitudes. These studies have tried to establish when attitudes towards mathematics start forming and when they stabilize.

Secondly, the manner in which attitudes relate to achievement in mathematics has been considered by quite a number of scholars. These studies have attempted to show the manner in which the attitude formed towards mathematics affects how much the pupil gains from a mathematics class.

Lastly, sex of the pupil and its influence on the attitudes which in turn implicates sex as a factor which influences achievement in mathematics has been studied.

Because of the evidence on grade distribution and stability of attitudes formed, standard seven pupils have been chosen for this study. It is the writer's opinion that the standard seven pupils have stable feelings towards mathematics.
Finally, the evidence on Kenyan pupils' performance in mathematics show that mathematics achievement is below expectation. Furthermore, the rural child is consistently superior than his urban counterpart. Therefore, the present study seeks to find out whether the attitudes these children form towards mathematics hinder their achievement in the subject.

1.1.0. The Background of the Problem

Generally, good achievers in mathematics have something good to tell about mathematics. It is the opposite with poor achievers. The latter group always have a negative feeling towards the subject.

Could the feeling towards mathematics be responsible for the level of achievement and ability in mathematics? The investigation of this matter was required to find out whether the feeling towards mathematics as a subject, becomes more positive, as the level of ability and
achievement in it increases.

1.1.1. Statement of Problem

The problem selected for this study was to investigate how achievement in mathematics relates with attitudes towards mathematics among standard 7 pupils in Nairobi.

1.1.2. Purpose of the Study

The main purpose of the study was to investigate the relationship between pupils' attitudes towards mathematics and achievement in mathematics and establish whether pupils achieve as per their abilities.

1.2. Research Questions

During the study, the researcher answered the following questions from the research findings:

(a) How is attitude towards mathematics related to ability and achievement in mathematics for:
(i) the whole group

(ii) boys

(iii) girls?

(b) How does correlation between attitudes and achievement compare with that one between achievement and ability.

(c) Does socio-economic status influence:

(i) attitude formation?

(ii) ability in mathematics?

1.3. **Hypotheses in Null Form**

In order to answer the research questions and find out whether the findings with regards to these questions were significant or not, the following hypotheses were tested. A table of critical values of correlation coefficient (r), giving sample sizes was used to either accept or reject the hypotheses at \( p < 0.05 \).
There is no correlation between attitudes of pupils towards mathematics and their achievement in mathematics.

There is no correlation between boys' attitudes towards mathematics and their achievement in mathematics.

There is no correlation between girls' attitudes towards mathematics and their achievement in mathematics.

There is no correlation between attitudes of pupils towards mathematics and ability in mathematics.

There is no correlation between boys' attitudes towards mathematics and their ability in mathematics.

There is no correlation between girls' attitudes towards mathematics and their ability in mathematics.
1.4. THE VARIABLES CONSIDERED

1) The dependent variables in this study were the mathematical abilities and mathematical achievements as revealed by the scores on the research instruments.

2) The independent variables in this study were:

(a) Sex of the child:
    equal number of boys and girls were selected.

(b) Attitudes of pupils towards mathematics first as a group and secondly according to the different sexes.

(c) Socio-economic status:
    The following were used as indicators of the socio-economic status of the pupils:
    (i) educational level of the parents.
(ii) occupation of the parents.

3) Intervening variables: There were some uncontrollable variables that may have had a significant influence upon the dependent variables:

a) the health and emotional state of the pupil at the time of taking the tests.

b) reading and comprehension abilities of the pupils.

The influence of these variables were assumed constant.

1.5. Limitations of the Study

(i) Response - set.

A respondent could have shown a positive attitude towards mathematics in an effort to give an impressive picture of himself or herself when this was not the case. In such a situation, the wrong response
could have led the researcher to assume a positive attitude erroneously.

(ii) English proficiency: The pupils who were not able to comprehend the items written in English language could not give a true account of themselves.

(iii) Anxiety: This is a variable which could have had an adverse influence on the responses. A very anxious pupil may not have understood an item or items well, which in turn might have affected his/her response.

(iv) The statistics: The interpretation of correlation coefficient, $V$ the statistics used to test the hypotheses is purely mathematical devoid of implications. The researcher could not therefore say attitudes cause performance.

(v) Sample size: Due to the limitations imposed by time and finance, only four schools out
of all Nairobi primary schools were used in the study sample. Ten pupils were chosen from each school making a sample size of forty pupils. This sample size made the generalization of result impracticable.

(vi) Urban set up: The sample was drawn from an urban set-up therefore, the findings could not be extended to portray the picture in the rural set-up.

1.6. Definition of Terms

In this section terms are defined as they were used in the study.

1. Positive attitudes were expressions of feelings which were more or less favourable. Any pupil who agreed with statements such as "Mathematics is interesting" was said to have a positive or favourable attitude towards the subject.
2. Negative attitudes were expressions of feelings contrary to favourable ones. On the evidence of negative responses have one was said to an unfavourable attitude towards mathematics.
CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter is devoted to reviews of literature relevant to the present study. It deals with empirical evidence on sex versus attitudes, attitudes versus performance and ability in mathematics versus performance in it.

The research findings to be reviewed will include both Kenyan and foreign situations.

2.1. On Sex/Attitudes

Literature exists on work which has been done to compare the kind of attitudes male and female learners have towards mathematics in particular and general life-outlook some of which reflect on the sex differences in participation and performance in mathematics.

According to Lynn and Derek, (1984) a 1982 survey of fifteen year olds shows general aspects of sex differences in attitudes. The findings of this survey show that boys have superior feelings about themselves than girls do with regards to mathematics. Boys express
greater expectation of success in mathematics while
girls express greater uncertainty. Boys over-rate
their performance and they do not do well as they
expect while girls under-rate themselves and do
better than they expect. Girls tend to make more
moderate assessments when asked to rate statements
and indicate perceived difficulty and usefulness of
mathematics.

The survey suggests reasons which would explain
the attitude differences existing between male and
female students. There is difference in tolerance,
particularly in problem solving. Boys seem to have
an advantage over girls because of the cultural
activities they involve in which differ from those
involved in by girls. The differences in activities
are due to cultural expectations of the sexes. Because
of diminished participation in mathematics, particularly
at higher level, not many females are in mathematics
classes teaching mathematics. There is therefore lack
of models for girls to copy in these classes. Male
teachers seem to pay more attention to boys than girls,
presumably because of the attitudes male teachers have
towards girls in mathematics. Amelia, (1983) seems to confirm this proposition with the finding that many teachers believe that there is a difference in performance between sexes.

Other reasons the survey of 1982 advances are culture based. The role expectation of a female is to be a housewife, a role which does not need maths which is useful in engineering, banking and so on, which the culture stipulates as male fields. In this connection boys tend to have more ambition in life which motivates them to work harder in the subject which requires this quality and tolerance. The role-stereotyping further inculcates unfavourable attitudes towards mathematics in the girls more than it does in boys. Maduesi, (1977) in her study of the interests and concerns of children confirms the effect of cultural influence on female and male children. She reports that boys significantly express more wishes about vocations and future careers than girls who significantly express home cores as favourite activity.
Survey of Herman (1963), in Aiken (1970), seems to differ with the general trend of differences in attitudes towards mathematics. In his study of the subjects least preferred by a group of 4th, 5 and 6th grades, he reports that arithmetic is typically in the middle when subjects are ranked from least to most preferred by both boys and girls. This finding, implicitly shows that there is room for improvement on the girls' attitudes at this level irrespective of the socialization which has already taken place in the society outside school. The role of the mathematics teacher is paramount in this case.

Eshiwani, (1975) reports a superior positive attitudes towards mathematics in favour of boys but points out that this difference is not significant. His study was on a group of Form II secondary school students.

Aiken and Dreger (1961), in Aiken (1970), throws light on the importance of attitudes as a confounding factor in mathematics performance for females. They
report mathematics attitude scale as a predictor of final mathematics grades of 67 college women. However, the scale is not a significant predictor for the 60 college men. Rease, (1961) in Aiken (1970), in line with Aiken and Dreger, concludes that attitudes and anxiety may be better predictors of achievement for females than for males. This implies a greater cultural reinforcement of interests and pursuit of mathematics in males at the higher grade levels.

In general then, it is evident that attitudes towards mathematics plays a greater role in influencing performance in mathematics. The attribute is more likely to be responsible for the sex differences in performance than the biological attribute-sex.

2.2. On Attitudes and Performance

Attitudes affect performance in some way or another. The relationship between the two (attitudes and performance) is reciprocal. Attitudes affect achievement and achievement affects attitudes. Neale, (1969) in Aiken (1970), refers to this relationship as a dynamic interaction between feelings and the behaviour as observed in the performance.
Gernstein (1964), in Aiken (1979) says, experienced feelings lead to particular self-image on the part of the pupil. The self-image will influence his expectation of future performance and affect his actual performance. Kempler, (1962) in Aiken (1970) in line with Gernstein suggests that lack of confidence in one's mathematical ability is associated with rigidity in mathematical tasks. McDenmott (1956), in Aiken (1970) gives behaviours indicative of the rigidity Kempler talks of as including such ones as the learner resorting to rote memory, inefficient methods and relying on other people and dishonest means in order to pass.

Shapiro (1962), in Aiken (1970) relates attitudes towards mathematics with perseverance towards solutions to arithmetic problems. His findings show that elementary school children who have a liking for mathematics have a higher perseverance than those who dislike mathematics. This is an indication that attitudes influence perseverance, a quality which is essential for mathematicians whose subject is such a challenging one.
Alpert et al. (1963) in Aiken (1970) analyze the relationship among attitude, expectation and performance. They come up with a view that level of expectation and performance is a kind of self-perpetuating cycle affecting child's self-concept, a concept related to attitudes and anxiety. Clerk, (1961) in Aiken (1970), has findings which are in line with the idea of self-perpetuating cycle linking expectation and performance. He reports that the difference between the poorest and the best pupils becomes progressively greater as they ascend the academic ladder.

Brown and Abell (1965) in Aiken (1970) in their study of correlation between attitude towards a subject and achievement in that subject find that this correlation is higher for arithmetic than for spelling, reading or language. Neale (1969) in Aiken (1970) in a seemingly slight shift from the emphasis on attitude, contends that, patience, compliance and obedience are more important than attitudes as determinants of achievement in mathematics. In close scrutiny of Neale's finding it is interesting to note that it ties with Shapiro's (1962) findings that attitudes influence perseverance which
Neale seems to have described in the three words: patience, compliance and obedience.

In his review by grade, Aiken (1970) reports findings of many researchers. We now look at the reports of a few of these researchers by grade. Lindgren et al. (1964), in their study of Brazilian elementary school children report significant positive correlation between problem solving, attitudes and scores on an arithmetic achievement test. Their further finding indicates a positive but not significant correlation between attitudes and marks in arithmetic. Shapiro (1962) says attitudes are significantly related to grade placement on the Wide Range Achievement Test to all parts of the arithmetic section of California Achievement Test and to school marks in arithmetic.

At the Junior High School level, Alpert et al. (1983) find a significant correlation between performance in mathematics and measures of attitudes towards mathematics. Degna (1967), Stephens (1960) and Werdelin (1966), all agree with Alpert and company. Stephens (1960) even concludes that attitude score might be used with achievement scores for placement on special classes.
At high school level, Anttonen (1968) reports moderate correlations of mathematics attitude scores with mathematics grade point averages. He points out that achievement is greater for students whose attitudes have remained favourable or have become favourable since elementary school. The moderate correlation this researcher gets may be explained by the fact that as students ascend the academic ladder, they are sorted into areas of specialization so that those who opt for mathematics are the ones whose attitudes do not vary so much. The group thus is a near homogenous one.

At college level, Harrington (1960), as would be expected, finds statistically significant relationship between attitude and performance in college mathematics course. To throw more light as to the reason for the above finding, he establishes that the selection of mathematics courses versus no mathematics courses is significantly related to attitude. This means the group which chooses mathematics courses are homogenous or near to this with regards to their attitudes towards the subject.
The problem of attitudes towards mathematics and how it influences performance is more critical at the elementary level. At this level no specialization has taken place. The aim of the teacher should be to make most (if not all) of his pupils have favourable attitudes towards mathematics to guarantee many future mathematicians as well as to accord them the utility of the subject. Whereas the researches reviewed do not consider the influence the teacher has as concerns formation of attitudes towards mathematics, the author is greatly convinced that teachers may be responsible for the formation of the attitudes discussed so far. The author assumes that the child comes to school with an ambition to learn, but this is turned off by the teachers approach.
SUMMARY

Attitudes are behaviours which are learnt. The environment of the child plays a big role in this.

These feelings have been shown to have alot of influence on pupils' performance and participation in mathematics. The social as well as physical environment should be so tailored as to minimize the formation of negative attitudes which would negatively influence performance and achievement in mathematics.
3.0. **Introduction**

This chapter is divided into four sections. The first section describes the research instruments which were used to measure the variables which were studied.

The second section describes the sample used in the study and how it was selected. Reasons why a particular method was used is given in this section.

The third section describes the methods and procedure for test administration. The way in which the testees were handled, as regards instructions of the tests, is discussed here.

The last section describes the way the different tests were scored. In particular, the scores on the attitude test are interpreted to reflect the feeling of the testee towards mathematics.
3.1. Research Instrument

The research instruments were designed to measure all the variables under study except those which were assumed constant.

To determine the level of achievement of a pupil, an achievement test was designed to measure how much the pupil has gained from the mathematics lessons. The test took the format of the Kenya Certificate of Primary Education Examination, except the items were fewer. This format was chosen because it was in line with what the pupils were being prepared for at the end of their primary level education. The test had 18 multiple choice questions and 7 questions which required that all the working be shown to indicate how the answer was arrived at.

The test items of the achievement test were set from standard six and standard seven (first term) work in mathematics. These sections of primary mathematics course were chosen because the testees were to be tested in the middle of second term of standard seven work. The researcher was convinced that by this time, first term work of standard seven would have been covered. This
being the case, the scores from the achievement test then gave a true picture of how much the pupil achieved because the items tested what the pupils had learnt not what they had not.

The study did not assume ability of the pupil in mathematics as a constant. Therefore, it was a variable which had to be measured. To measure ability of the child, a series of ability tests were given. These tests were adapted from School Mathematics Study Group, NLSMA Reports No.1 Part A X-Population Test Batteries. For example, an item in the report which read "A bank clerk reports that the number of $100-bills in a vault is 10,000. How much money is this?" was modified by replacing the $ sign by the Sh. sign. This was done for all similar items which had terms or signs unfamiliar to the testees. The aim of doing this was to eliminate the stumbling blocks which could be created by the unfamiliar situations.

Due to the limitation of time, only five areas of ability in mathematics were tested. These were arithmetic reasoning, computation, whole number comprehension, problem solving and five dots. We now
look at what each of these instruments were testing.

Arithmetic reasoning test had 15 items. Time allowed was 15 minutes. The items required that the pupil tell how the answer could be found. The pupil was thus not required to give the answer to any of the items. Taking into consideration the time allowed, this was a speed test where the pupil was required to read, understand and figure out the method very fast. Only those with ability in this area would be expected to attempt many items correctly.

The computation test had 15 items to be done within 15 minutes. This test did not require the pupil to read, comprehend and code in mathematical symbols to compute the answer. Rather, it required the pupil to do the latter. It was testing the ability of the child to operate on numbers, both whole and fractional, using the four basic operations, addition, subtraction, multiplication and division.

The whole number comprehension test had 12 items to be answered in 20 minutes. This test was intended
to measure the competency of the pupil on large and small numbers as well as the place value.

For example:–

(1) "The closest the earth comes to the sun is 91,000,000. How should this number be said?"

(2) "Which of the following shows the correct meaning of 407?

(A) (4 x ten) + (7 x one)
(B) (4 x one) + (7 x ten)
(C) (4 + 0 + 7) x (one hundreds)
(D) (4 x one + (0 x ten) + (7 x one)
(E) (4 x ten x ten) + (0 x ten) + ( 7 x one)."

The problem solving test had 10 items to be answered in 20 minutes. These items required that the pupil translate the word problems into symbolic form then compute the answer. The ability to read and comprehend an item then translate into mathematical symbols to be able to compute the answer was tested by the items.
Furthermore, the pupil was tested on how much he was competent in figuring three dimensional objects represented on a two-dimensional plane.

The last test battery on the ability instrument was the five dots test. The questions in this section were based on five dots in a row with 1 cm between each dot. The test measured the spatial ability of the pupil. He required to consider each dot in relation to the others. For example an expression like, $S = Q_2$, meant the dot named $S$ was 2 cm to the right of dot named $Q$.

To determine the sex variable, the answer sheets were so designed as to allow the respondent to indicate whether she was a girl or he was a boy.

To establish the feelings of the pupil towards mathematics, attitude test was given whose items required the pupil to say something about mathematics. The test had 20 items; 10 items had statements saying something in favour of mathematics. The other 10 items did the opposite. The opposite items did not necessarily alternate, neither did similar items follow each other consecutively.
This is to say that there was no definite order of opposite or similar items.

The pupil was expected to respond in the affirmative or disagreement to the item. The degree of the response was determined by a qualifying adjective. For example, the pupil could strongly agree or agree with the item statement. "Strongly agree" indicated a degree of agreement higher than "agree". This will become clearer when we discuss how the responses were scored in section 3.4 of this chapter.

The items had an in-built check for consistency in a testee's responses. For example, if a testee responded to an item "mathematics is interesting" by "Strongly agree" then he/she was expected to respond to the item "Mathematics is boring" by "strongly disagree". Again, as the method of scoring in section 3.4 will show, the degree of consistency showed whether respondents' attitude was definitely positive or negative or neither of the two.

Finally, a pupil was required to respond to items asking the occupation and educational status of the parents. The occupation and educational status of the
parents were used as the indices of socio-economic status of the pupils' parents hence of the pupil. For example, university level of education would be assumed to imply the parent(s) were of higher social status than those of primary level education. The occupation of the parent would of course, confirm this assumption or not.

3.2. Research sample and its selection

The objective of the study was to find out the relationship between attitudes and achievement in mathematics. In other words the underlying question was 'do poor achievers' attitudes towards mathematics differ from that of good achievers in mathematics?" 

Thus, the sampling had to be a stratified one. The progress reports were used to categorize pupils into above average, average and below average in mathematics.

First, four schools to form the sample schools for the study were randomly chosen from the City Commission Primary Schools in Nairobi. The schools run by the City Education Department were selected for the study in order
that the diversity among the schools in terms of facilities be reduced. The schools to form the population from which the sample school were to be chosen had to meet the following two condition: be a mixed school and be up to, at least, standard seven level.

Next, ten pupils were chosen from standard seven group in each of the four sample schools. The following is the procedure which was used to select the ten pupils.

The researcher was provided with progress reports of standard seven in each school. Separate lists of boys and girls were made from the reports. Each list was stratified into above average, average and below average groups. From the list of boys, five boys were selected. Similarly, five girls were selected. The five selected pupils represented each category mentioned earlier. The random selection for boys was done as shown in the table below.
<table>
<thead>
<tr>
<th>Category</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above average</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Average</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Below Average</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

**KEY:** S1 Signifies School 1

S2, School, 2, etc.

The order of selection from the categories alternated from school to school. The researcher believed this would not affect the results because the schools were not a variable in consideration.

The researcher intentionally made the number of pupils selected from above and below average the same and more than that of average pupils because these two categories have more influence on the averages than the middle group.
Girls were similarly chosen to procure the sample of twenty girls. This, together with the boys made forty pupils, the study sample.

3.3. Method and procedure for test administration

The research instruments were all administered by the researcher in individual schools. This means that the instruments were administered on different days and under different conditions as offered by the individual school environment.

The testing period was scheduled for the whole school day. Each day, the testing in the respective school, started at 9.00 a.m. with the attitude test. The attitude test was started with so that the other tests; ability and achievement would have no influence on the pupils' attitudes. For example, if say, the testing day started with achievement test and it happened to be difficult to the pupil, there was danger the pupil would form an opinion about mathematics which was not there.
Another reason for choice of attitude test to be administered first was the relaxing effect the researcher thought it would have on the pupils. As usual in a testing situation, pupils would come in very anxious. Attitude test items being general and in fact the respondent simply supplying an opinion, it was expected that the testees would relax considerably as the testing day picked up.

The attitude test had twenty items which were to be responded to within twenty minutes. Before the start of the test, the instructions were clearly explained for everyone to understand what he/she was expected to do. This was not a test trying to find out whether pupils follow instructions or not. Clear and comprehensive instructions were vital if a true feeling of the respondent to mathematics was expected to be effectively measured by the instrument. Therefore the researcher was convinced that explaining what the pupils were expected to do did not unduly influence the response of the pupil. The difference between terms like "strongly agree" and "agree" was explained so that the pupil knew when to choose either of the two.
Ability tests followed the attitude test. Instructions were again clearly explained before the start of each test. In all, there were five ability tests.

Finally, the achievement test was administered. The schedule for test administration is given below. This schedule was not strictly adhered to because at times explanation of instructions would take more than the scheduled time.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00 - 9.20</td>
<td>Attitude test</td>
</tr>
<tr>
<td>9.30 - 9.45</td>
<td>Arithmetic reasoning</td>
</tr>
<tr>
<td>9.55 - 10.10</td>
<td>Computation</td>
</tr>
<tr>
<td>10.20 - 10.40</td>
<td>Whole number comprehension</td>
</tr>
<tr>
<td>10.40 - 11.00</td>
<td>Break</td>
</tr>
<tr>
<td>11.05 - 11.25</td>
<td>Problem solving</td>
</tr>
<tr>
<td>11.35 - 11.50</td>
<td>Five dots</td>
</tr>
<tr>
<td>12.00 - 2.00</td>
<td>Lunch break</td>
</tr>
<tr>
<td>2.10 - 3.00</td>
<td>Achievement test.</td>
</tr>
</tbody>
</table>
3.4. **Test Scoring**

All the tests were scored manually. All the test scores were expressed as percentages. The discussion that follows gives full details of how each individual test was scored.

The attitude test consisted of 20 items. Each item was scored according to the feeling it portrayed. The items were a series of statements to which the subjects were supposed to respond by making a choice from five possibilities provided. These possibilities were:

a) strongly agree  
b) agree  
c) don't know  
d) disagree  
e) strongly disagree.

For statements portraying positive feelings towards mathematics points were awarded thus:

a) strongly agree...........5 points  
b) agree.....................4 points  
c) don't know..............3 points  
d) disagree................2 points  
e) strongly disagree........1 point.
For statements portraying negative feelings towards mathematics the scoring was reversed thus:

a) strongly agree............ 1 point
b) agree..................... 2 points
c) don't know............... 3 points
d) disagree.................. 4 points
e) strongly disagree........ 5 points.

Therefore, the maximum points that could be scored were 100 and the minimum 20 points. A score of 20 points was interpreted to mean extreme or perfect negative feeling towards mathematics. A score of 100 points meant perfect positive feeling.

To determine whether the feeling of a respondent was negative or positive, his/her score was divided by 20 (number of test items) to get the average. An average score below 3 indicated negative feeling and that above 3 a positive feeling. An average score of 3 meant a neutral feeling, neither positive nor negative.
The ability test consisted of 71 items all together. Each correct response was 1 point. Total points scored in the test was expressed as fraction of 71 and converted into percentage corrected to 2 decimal places. Incorrect responses scored 0 (no point).

The achievement test had 25 items. Each correct response scored 4 points. Incorrect responses scored 0 (no point). The sum of all the points scored gave the percentage score of the respondent in the test.
CHAPTER FOUR

ANALYSIS OF THE FINDINGS

4.0. Introduction

This chapter discusses the research findings as measured by the research instruments described in chapter 3.

The main aim of the research was to investigate the relationship between attitudes towards mathematics and achievement in mathematics. Since ability in mathematics was a variable considered important in achievement, the relationship between attitudes and ability was also considered.

Pairs of variables were taken one at a time. Correlation coefficient was computed. Hoel, (1971) says correlation is a measure of relationship between a pair of variables. It is a useful measure of the strength of relationship between two variables except that the variables have to be linearly related. Thus as the correlation approaches +1 or -1, the degree of linear relationship increases. A correlation of 0 magnitude may therefore mean two things; either an
existence of a close relationship but not linear or no relationship at all between the pair of variables.

4.1. Attitudes, achievement and ability

Table 3 below gives the distribution of the scores on the achievement, attitudes and ability instruments. The respondents were coded 1, 2, 3,...40 in a descending order in accordance with their scores on the achievement instrument.
Table 3: Achievement, Attitude and Ability Score Distribution for the whole Group

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Sex</th>
<th>Achievement</th>
<th>Attitude</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>92</td>
<td>87</td>
<td>89</td>
</tr>
<tr>
<td>2</td>
<td>G</td>
<td>88</td>
<td>78</td>
<td>83</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
<td>78</td>
<td>42</td>
<td>82</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>74</td>
<td>74</td>
<td>62</td>
</tr>
<tr>
<td>5</td>
<td>G</td>
<td>70</td>
<td>49</td>
<td>69</td>
</tr>
<tr>
<td>6</td>
<td>B</td>
<td>66</td>
<td>87</td>
<td>72</td>
</tr>
<tr>
<td>7</td>
<td>B</td>
<td>62</td>
<td>91</td>
<td>76</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>60</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>60</td>
<td>55</td>
<td>73</td>
</tr>
<tr>
<td>10</td>
<td>G</td>
<td>60</td>
<td>58</td>
<td>68</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
<td>56</td>
<td>76</td>
<td>79</td>
</tr>
<tr>
<td>12</td>
<td>G</td>
<td>54</td>
<td>80</td>
<td>58</td>
</tr>
<tr>
<td>13</td>
<td>B</td>
<td>52</td>
<td>68</td>
<td>72</td>
</tr>
<tr>
<td>14</td>
<td>G</td>
<td>52</td>
<td>90</td>
<td>55</td>
</tr>
<tr>
<td>15</td>
<td>G</td>
<td>50</td>
<td>81</td>
<td>80</td>
</tr>
<tr>
<td>16</td>
<td>G</td>
<td>48</td>
<td>76</td>
<td>69</td>
</tr>
<tr>
<td>17</td>
<td>G</td>
<td>46</td>
<td>58</td>
<td>59</td>
</tr>
<tr>
<td>18</td>
<td>B</td>
<td>42</td>
<td>59</td>
<td>54</td>
</tr>
<tr>
<td>19</td>
<td>B</td>
<td>42</td>
<td>85</td>
<td>48</td>
</tr>
<tr>
<td>20</td>
<td>B</td>
<td>42</td>
<td>86</td>
<td>70</td>
</tr>
<tr>
<td>21</td>
<td>B</td>
<td>40</td>
<td>81</td>
<td>51</td>
</tr>
<tr>
<td>22</td>
<td>B</td>
<td>40</td>
<td>55</td>
<td>61</td>
</tr>
<tr>
<td>23</td>
<td>G</td>
<td>40</td>
<td>82</td>
<td>49</td>
</tr>
<tr>
<td>24</td>
<td>G</td>
<td>38</td>
<td>83</td>
<td>58</td>
</tr>
<tr>
<td>25</td>
<td>B</td>
<td>38</td>
<td>79</td>
<td>56</td>
</tr>
<tr>
<td>26</td>
<td>G</td>
<td>36</td>
<td>51</td>
<td>62</td>
</tr>
<tr>
<td>27</td>
<td>B</td>
<td>34</td>
<td>51</td>
<td>51</td>
</tr>
<tr>
<td>28</td>
<td>B</td>
<td>32</td>
<td>62</td>
<td>46</td>
</tr>
<tr>
<td>29</td>
<td>G</td>
<td>32</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>30</td>
<td>B</td>
<td>30</td>
<td>78</td>
<td>46</td>
</tr>
<tr>
<td>31</td>
<td>G</td>
<td>30</td>
<td>75</td>
<td>51</td>
</tr>
<tr>
<td>32</td>
<td>G</td>
<td>28</td>
<td>61</td>
<td>41</td>
</tr>
<tr>
<td>33</td>
<td>B</td>
<td>28</td>
<td>41</td>
<td>66</td>
</tr>
<tr>
<td>34</td>
<td>G</td>
<td>28</td>
<td>56</td>
<td>44</td>
</tr>
<tr>
<td>35</td>
<td>B</td>
<td>26</td>
<td>65</td>
<td>20</td>
</tr>
<tr>
<td>36</td>
<td>G</td>
<td>24</td>
<td>52</td>
<td>46</td>
</tr>
<tr>
<td>37</td>
<td>G</td>
<td>24</td>
<td>59</td>
<td>39</td>
</tr>
<tr>
<td>38</td>
<td>G</td>
<td>24</td>
<td>75</td>
<td>35</td>
</tr>
<tr>
<td>39</td>
<td>G</td>
<td>22</td>
<td>54</td>
<td>25</td>
</tr>
<tr>
<td>40</td>
<td>G</td>
<td>14</td>
<td>72</td>
<td>27</td>
</tr>
</tbody>
</table>

The correlation coefficients were computed for the whole group, group of boys and group of girls separately.
RESULTS

Table 4: Correlation Coefficients for Attitudes versus Achievement and Attitudes versus Ability

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sample Size</th>
<th>Attitude/ Achievement</th>
<th>Attitude/ Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole</td>
<td>40</td>
<td>0.240</td>
<td>0.194</td>
</tr>
<tr>
<td>Boys</td>
<td>20</td>
<td>0.213</td>
<td>0.098</td>
</tr>
<tr>
<td>Girls</td>
<td>20</td>
<td>0.227</td>
<td>0.238</td>
</tr>
</tbody>
</table>

The results of the computed coefficients displayed on Table 4 were used to test the six hypotheses of the research namely,

- $H_{o1}$: There is no correlation between attitudes of pupils towards mathematics and their achievement in mathematics.
- $H_{o2}$: There is no correlation between boys' attitudes towards mathematics and their achievement in mathematics.
- $H_{o3}$: There is no correlation between girls' attitudes towards mathematics and their achievement in mathematics.
There is no correlation between attitudes of pupils towards mathematics and their ability in mathematics.

There is no correlation between attitudes of boys towards mathematics and their ability in mathematics.

There is no correlation between attitudes of girls towards mathematics and their ability in mathematics.

4.2. Comparison

To answer the research question: "How does the correlation between attitudes and achievement compare with that one between achievement and ability?", two correlation coefficients were computed, the correlation coefficient for attitude versus achievement and achievement versus ability.
RESULTS

Table 5: Correlation Coefficients for Attitudes versus Achievement and Ability versus Achievement.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Correlation $(\sqrt{\cdot})$</th>
<th>$1 - \sqrt{\cdot}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes/Achievement</td>
<td>0.240</td>
<td>0.942</td>
</tr>
<tr>
<td>Ability/Achievement</td>
<td>0.827</td>
<td>0.316</td>
</tr>
</tbody>
</table>

4.3 Socio-Economic Status

Does Socio-economic status influence attitude formation? To answer this question, the number of respondents in each of the two categories, low and high status, was first established. Then, the number in each category with negative, neutral and positive attitudes was determined. This number was expressed as a fraction of the total in the category. The fraction was then expressed as a percentage.
Table 6: Socio-Economic-Status versus Attitudes
(Sample sizes)

<table>
<thead>
<tr>
<th>Status</th>
<th>Negative</th>
<th>Neutral</th>
<th>Positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>11</td>
<td>1</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>High</td>
<td>4</td>
<td>0</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>1</td>
<td>23</td>
<td>39</td>
</tr>
</tbody>
</table>

NB: One respondent's information was discarded because it was incomplete.

Table 7: Socio-Economic Status versus Attitudes
(Percentages)

<table>
<thead>
<tr>
<th>Status</th>
<th>Negative</th>
<th>Neutral</th>
<th>Positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>44%</td>
<td>4%</td>
<td>52%</td>
<td>100%</td>
</tr>
<tr>
<td>High</td>
<td>29%</td>
<td>0%</td>
<td>71%</td>
<td>100%</td>
</tr>
</tbody>
</table>
4.4. Socio-Economic Status, Ability and Achievement

Does Socio-Economic status influence ability in mathematics and achievement in mathematics? To answer this question, the mean scores for achievement and ability were computed for each of the two status; low and high socio-economic status.

RESULTS

Table 8: Status' Mean Achievement and Mean Ability Scores

<table>
<thead>
<tr>
<th>Status</th>
<th>Respondents</th>
<th>Mean Achievement</th>
<th>Mean Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>25</td>
<td>45.12</td>
<td>58.56</td>
</tr>
<tr>
<td>High</td>
<td>14</td>
<td>45.43</td>
<td>55.36</td>
</tr>
</tbody>
</table>

To find out whether the mean score difference were significant:
Table 9: Total Mean Scores and t-Values

<table>
<thead>
<tr>
<th>Status</th>
<th>Low</th>
<th>High</th>
<th>t-Value</th>
<th>d.f.</th>
<th>c.v.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>25</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Achievement</td>
<td>45.12</td>
<td>45.43</td>
<td>0.049</td>
<td>37</td>
<td>1.684</td>
</tr>
<tr>
<td>Mean Ability</td>
<td>58.56</td>
<td>55.36</td>
<td>0.574</td>
<td>37</td>
<td>1.684</td>
</tr>
</tbody>
</table>
CHAPTER FIVE

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

5.0. Introduction

In this chapter, the researcher summarizes the research study. The Summary gives the purpose of the study, the reviewed literature as well as a brief description of the sample of the study.

Conclusions based on the analysis in chapter 4 are also drawn in this chapter. They are drawn considering each research question and hypothesis at a time.

The conclusions drawn from the research findings then lead to the implications of the study results. The implications are discussed as they relate to attitude formation and achievement in mathematics.

Finally, recommendations for further research are given.

5.1. Summary

The purpose of this study was to investigate how attitudes formed by standard seven pupils towards mathematics related with achievement in mathematics.
The study sought to answer these questions. How is attitude towards mathematics related to ability and achievement in mathematics for the whole group, boys and girls separately? How does correlation between attitudes and achievement compare with that one between achievement and ability? And, lastly, does socio-economic status influence (i) attitude formation? (ii) ability in mathematics? (iii) achievement in mathematics?

It was hoped that the study would be of great interest to teachers and parents because it would give the relative importance between attitudes towards mathematics and ability in mathematics with respect to how they influence achievement in mathematics.

A review of literature related to attitudes and achievement in mathematics showed that boys have superior attitudes towards mathematics than girls. But the researchers were not all of the same opinion that the differences in the feelings were significant.
On the attitude formation and performance in mathematics, generally the study findings reviewed had reports of positive correlation. This meant that as attitudes increase performance likewise increases and vice versa. It should be noted that not all the findings were found by these researchers to be significant correlations.

The subjects selected consisted of standard seven pupils of Nairobi Primary Schools. Four schools were randomly selected from the Nairobi City Primary Schools.

The following statistics were used to help answer the research questions: the mean, the correlation coefficient and percentages.

5.2. Conclusions

The conclusions to be found in this chapter were derived from the analysis of data in chapter four. The results of the analysis were summarized in tables which are given in chapter four in Table 2 through 8.
The conclusions are divided into three categories. The main purpose of the study was to answer three main questions. Therefore, each section will answer each main question.

5.2.1. Conclusions based on Attitudes, Ability and Achievement.

1. (a) There was a positive correlation between attitudes towards mathematics and achievement in mathematics for:
   i. the whole group studied
   ii. the boys and
   iii. the girls.

   All the correlations were however not significant at $\rho < 0.05$ level of significance.

   The correlation between attitudes towards mathematics and achievement in mathematics for girls was higher than for boys.

   Thus, the null hypotheses, of no correlation between attitudes towards mathematics and achievement in mathematics for:
i. whole group
ii. boys
iii. girls.
were accepted at $p < 0.05$ level of significance.

(b) There was a positive correlation between attitudes towards mathematics and ability in mathematics for:
   i. the whole group
   ii. boys
   iii. girls.

All the correlations were however not significant at $p < 0.05$ level of significance. The correlation between attitudes towards mathematics and ability in mathematics for girls was much higher than that one for boys. In fact it was approximately two and half times the correlation for boys.

2. The correlation between attitudes and achievement was much lower than that one between ability in mathematics
and achievement in mathematics. The latter was approximately three and a half times the former.

When the coefficient for attitudes versus achievement was squared and the square subtracted from one to find the residual factors, it was found that other factors, apart from attitude, were responsible for 94.2% of the points scored in achievement test.

When the same was done for ability versus achievement, it was found that other factors, apart from ability were responsible for only 31.6% of the points scored in the achievement test.

3. Out of 25 respondents from the low socio-economic status 44% were of negative attitudes, towards mathematics, 4% were neutral and 52% of positive attitudes towards mathematics. Out of the 14 respondents from the high socio-economic status 29% had negative feelings and 71% had positive feelings towards mathematics.
This indicates statistically that out of 100 pupils from low socio-economic status, 52 would have positive feelings towards mathematics while the same number taken from the high class status group, 71 would have positive feelings.

4. The influence of socio-economic status on ability and achievement in mathematics was found to be insignificant when the t-test was used to test the mean difference of the low and high class mean scores in ability and achievement.

5.2.2. General Conclusions

Three general conclusions can be made from this study. First, all cases where attitudes were compared with other variables (ability and achievement), a positive correlation was found. However, the correlations were not large enough for the hypotheses to be statistically rejected.
Secondly, pupils realize the importance of mathematics therefore, generally have positive feelings. However, they lack the ability in the subject to enable them achieve optimally. This was indicated by the higher correlation between ability and achievement. This clearly showed that low achievers have low ability and high achievers have high ability.

Thirdly, socio-economic status did not have undue influence on the performance on achievement and ability tests.

5.3. Implications of the Study

1. The positive correlations found between attitudes towards mathematics and achievement as well as ability in mathematics imply that both boys and girls must be helped to develop positive feelings towards mathematics.

2. Comparison of the correlations between the pairs of variables, attitudes and achievement, ability and achievement indicates that the pupils are not performing to their expectation because of lack
of the ability in the subject. Facilities and proper approaches to teaching mathematics should be adopted so that pupils develop concepts in mathematics to enhance their abilities in the subject.

3. The correlations for the sample of girls between the two pairs (attitudes versus achievement and attitudes versus ability in mathematics) revealed that the correlations for girls were consistently higher than those of boys. This implies that attitudes as a variable is more important as a factor influencing achievement in mathematics for girls than for boys. This means that even though both boys/girls need encouragement to form healthy feelings, girls need this kind of treatment more than boys do.

5.4. Recommendations for Further Research

1. There is need to replicate the study using a bigger sample. The sample size of 40 pupils used in the study was chosen due to the limitations of time and finance. This size cannot be conclusively said to be a proper
representation of the Nairobi primary school children of standard seven population.

2. The study should be replicated by taking care of the reading and comprehension abilities of the respondents. These variables were assumed constant, an assumption which was not necessarily true.

3. There is need for more research on other factors which influence achievement in mathematics apart from the attitudes. The residual factors were found to be responsible for the points scored in achievement test more than the attitude as a factor. In particular, research should be done on ability and its relation to achievement. This variable was found to be more important in relation to achievement than attitudes.
ATTITUDE TEST.

You will have 20 min.

(i) This is not a test. There are no right or wrong answers to any of the questions. Just answer them as truthfully as you can.

(ii) The questions ask you to tell how you feel about mathematics. Your answer to each question should tell how you feel about it.

(iii) To answer a question mark with an X one the answer sheet the letter which corresponds the answer which seems best to you.

(iv) Please work carefully and quickly. Do not spend a long time on any one question. Just mark the answer that seems best to you at the moment. Please answer all statements and give only one answer to each.

V) If you have any questions while you are working, just raise your hand.

Sample question

It is more fun in English lesson than maths lesson.

A strongly agree
B agree
C don't know
D disagree
E strongly disagree

which one of the five ways tells best how you feel about the statement. A, or B or C or D or E? Mark the letter in front of the answer you choose with an X on the answer sheet.
1. I like story books more than arithmetic books
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree

2. I like doing arithmetic more than doing anything else.
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree

3. The subject I hate most is arithmetic.
   A) strongly agree
   B) agree
   C) don't know
   D) Disagree
   E) strongly disagree

4. Arithmetic is enjoyable.
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree

5. Arithmetic is not enjoyable.
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree.
6. Arithmetic is a subject which is more difficult to understand than any other subject.

A) strongly agree  
B) agree  
C) don't know  
D) disagree  
E) strongly disagree

7. No matter how hard I try I cannot understand arithmetic.

A) strongly agree  
B) agree  
C) don't know  
D) disagree  
E) strongly disagree

8. Arithmetic is useful in life.

A) strongly agree  
B) agree  
C) don't know  
D) disagree  
E) strongly disagree

9. Arithmetic is easier for me than other subjects.

A) strongly agree  
B) agree  
C) don't know  
D) disagree  
E) strongly disagree
10. I can get along perfectly well in everyday life without arithmetic.

A) strongly agree
B) agree
C) don't know
D) disagree
E) strongly disagree.

11. I cannot understand how some pupils think arithmetic is enjoyable.

A) strongly agree
B) agree
C) don't know
D) disagree
E) strongly disagree.

12. I wish I could do better in arithmetic.

A) strongly agree
B) agree
C) don't know
D) disagree
E) strongly disagree.

13. I try to do the very best work in arithmetic that I can.

A) strongly agree
B) agree
C) don't know
D) disagree
E) strongly disagree.
14. I am very proud of my arithmetic school work
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree

15. Pupils really enjoy arithmetic lessons.
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree

16. Arithmetic lessons should be reduced to be less than what they are.
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree.

17. Arithmetic is more of a game than it is hard work.
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree.

18. My parents think arithmetic is my most important subject.
   A) strongly agree
   B) agree
   C) don't know
   D) disagree
   E) strongly disagree.
19. There is so much hard work in arithmetic that it takes the fun out of it.

A) strongly agree
B) agree
C) don't know
D) disagree
E) strongly disagree.

20. I would not like to do arithmetic after standard eight.

A) strongly agree
B) agree
C) don't know
D) disagree
E) strongly disagree.
APPENDIX B

ARITHMETIC REASONING

INSTRUCTIONS

This section consists of problems in arithmetic. However, you do not have to find the answer to each problem. You only have to tell how the answer could be found.

EXAMPLE 0

Jane's father was 26 years old when she was born. Jane is 8 years old. How old is her father now?

(A) Subtract
(B) Divide
(C) Add
(D) Multiply.

Jane's father is now 34 years old. But, you are asked to find this. You are asked how to find this. Since his age is found by adding 26 and 8, choice (C) should be marked with an X.

EXAMPLE 00

Desks are priced at sh 40/- each. If bought in groups of 4, the total price is reduced by sh. 20/-. How much would 4 desks cost?

(A) Divide and add
(B) Multiply and multiply
(C) Subtract and divide
(D) Multiply and subtract.

One way to solve the problem would be to multiply sh. 40/- by 4 and subtract 20 from the product. So you should mark choice (D) with an X.

Although some problems may be worked in more than one way, only one of the ways will be given among the answer choices.

You should only guess if you can rule out some of the choices. Do NOT guess wildly.
You will have 15 minutes for this section. If you finish before time is called, check your work.

For each question choose the correct answer from those given and mark the correct answer on the answer sheet with an X. DO NOT WRITE ON THIS QUESTION PAPER.

1. There are 4 quarts in a gallon and 4 cups in a quart. How many cups are there in a gallon?

A) Add
B) Subtract
C) Multiply
D) Divide.

2. An electric planer is set to remove \( \frac{1}{4} \) of a centimetre each time a piece of wood is passed through it. If a board is put through 7 times, how much wood will have been removed?

A) Multiply
B) Subtract
C) Divide
D) Add

3. There are 54 children in a class. If there are 33 boys in the class, how many are girls?

A) Add
B) Multiply
C) Subtract
D) Divide

4. A man wants to plant grass around his new house. His plot is 120 metres by 90 metre (10,800 sq metre). His house is centred on the plot and occupies 2,785 square metre. How many square metre of ground may be planted with grass?

A) Add
B) Divide
C) Multiply
D) Subtract.
5. A wholesale fruit dealer sells oranges at sh. 7 per kilo and lemons at 3 sh per kilo. One day he sold 79 kilos of each type of fruit. How much money was taken in?

A) Add and divide  
B) Add and multiply  
C) Multiply and subtract  
D) Divide and divide.

6. A cyclist in an international bicycle race has covered an average of 9 kilometres every 20 minutes. If he can maintain the same average speed, how long will it take him to cycle the remaining 84 kilometres of the race?

A) Divide and multiply  
B) Subtract and divide  
C) Add and subtract  
D) Divide and add.

7. A grocer sells oranges for sh 6 a dozen. The oranges cost him sh. 3 a dozen. How much profit is there on each orange?

A) Subtract and multiply  
B) Divide and subtract  
C) Add and divide  
D) Subtract and divide.

8. A boy works in a shop after school for a total of 10 hours a week. He also works 8 hours on Saturdays. How much is he paid per hour, if he makes 20/70 per week?

A) Multiply and subtract  
B) Add and divide  
C) Add and divide  
D) Add and multiply.
9. Wangare took a job which pays sh 65/00 per week. After paying taxes she is left with 76% of her salary, and each week she spends a total of sh 55.00 on lunches and bus fares. How much does her job increase the family income?

A) Divide and subtract
B) Subtract and multiply
C) Add and divide
D) Multiply and subtract.

10. A rectangular tank is 15 metres deep and contains 2,000,000 litres of water, when it is full. The short rains filled the tank but, a drought in January caused the water level to drop 8 metres. Approximately how many litres of water were consumed during the drought?

A) Subtract and divide
B) Add and subtract
C) Divide and multiply
D) Subtract and multiply.

11. A certain part of beef costs sh 7/50 per kilogramme. How much beef could a mother serve to each of 5 children, if she could only afford to spend sh.20/- for the beef?

A) Divide and divide
(B) Multiply and add
(C) Subtract and multiply
D) Divide and multiply.

12. A coat marked sh 40/- was sold for sh 29/95 during a sale. What was the per cent reduction?

A) Divide and add
B) Subtract and divide
C) Multiply
D) Add and divide.
13. Tom wants to buy a ball costing 5/25. He has saved 4/50. How much money does he need to save?

A) Subtract
B) Divide
C) Add
D) Multiply.

14. There are 60 chairs in a room, placed in 5 equal groups. How many chairs are in each group?

A) divide
B) Add
C) Subtract
D) Multiply.

15. A certain mother generally squeezes 1/2 oranges for a glass of orange juice. The average cost of the oranges she bought during one year was 40 per orange. Approximately how much did it cost the family for the 827 glasses of juice that they drank during the year?

A) Multiply and subtract
B) Add and divide
C) Multiply and multiply
D) Divide and multiply.

IF YOU FINISH BEFORE TIME IS CALLED STD, CHECK YOUR WORK.
COMPUTATION.

This scale is intended to measure ability to add, subtract, multiply and divide whole numbers and to add or subtract fractions.

INSTRUCTIONS.

There are 15 questions in this section. Write the answer to each of the questions on the answer sheet. DO NOT WRITE ON THE QUESTION SHEET. ROUGH PAPER FOR WORKING IS PROVIDED.

You will have 15 minutes for this section.
Please do not write on this paper.

1. 13-8 =
2. 7 x 4 =
3. 9 + 5+8=
4. 24-6=
5. 103
   +7
6. 96
   +85
7. 378
   -63
8. 56
   x3
9. 32
   x12
10. 72
    -65
11. 834
    -49
12. 600
    -123
13. 2\frac{1}{2} + \frac{1}{4} =
14. \frac{1}{2} + 2/4 =
15. 1-1/3
WHOLE NUMBER COMPREHENSION

INSTRUCTIONS

In this part there are 12 questions on numbers and how we write them. Here is an example to show you how you should mark your answer sheet.

Example 0

Subtraction 807 from 1,725

(A) 819  Ans Ex.0
(B) 918
(C) 928  A X  C D E
(D)1,018
(E)1,622

The answer is B. See how the choice has been marked with X for Ex.0.

For these problems you will mark all of your answers on the answer sheet. Be careful that you mark the correct answer for each question. You are to work as many questions as you can. Do not spend too much time on any one question. You should only guess if you can rule out some of the choices. DO NOT guess wildly.
You will have 20 minutes for this section

1. The closest the earth comes to the sun is 91,000,000 miles. How should this number be said.

(A) ninety-one million.
(B) nine million one hundred thousand.
(C) ninety-one thousand.
(D) ninety-one hundred thousands.

2. Which of the following shows 407?

(A) \(4 \times \text{ten} + (7 + \text{one})\)
(B) \(4 \times \text{one} + (7 \times \text{ten})\)
(C) \((4 + 0 + 7) \times \text{(one hundred)}\)
(D) \(4 \times \text{one} + (0 \times \text{ten}) + (7 \times \text{one})\)
(E) \(4 \times \text{ten} \times \text{ten} + (0 \times \text{ten}) + (7 \times \text{one})\)

3. 

\[
\begin{array}{c}
400 \\
- 199 \\
\hline
201
\end{array}
\]

In this subtraction problem, we must borrow or regroup. Which statement below shows how to do it for this problem.

(A) \(400 = (3 \text{ hundreds}) + (9 \text{ tens}) + (9 \text{ ones}).\)
(B) \(400 = (3 \text{ hundreds}) + (9 \text{ tens}) + (10 \text{ ones}).\)
4. On the blackboard Joe read the warning.
   
   A MISPLACED DECIMAL POINT MEANS A LARGE MISTAKE.
   How does a misplaced decimal point change a number?

   (A) One place too far to the right makes the number 10 times too large.

   (B) One place too far to the right subtracts 1 from the number.

   (C) One place too far to the left subtracts 1 from the number.

   (D) One place too far to the left makes the number one-half as large.

   (E) One place too far to the left makes the number 10 times too large.

5. A bank clerk reports that he has 10,000 one hundred shillings notes. How much money does he have?

   (a) Shs.1,000

   (b) Shs.10,000

   (c) Shs.100,000

   (d) Shs.1,000,000

   (e) Shs.10,000,000.
6. In circleland, people write:

When they mean 58, and they write:

When they mean 83\(\frac{4}{4}\). What number do they mean when they write the following?

(A) 2359
(B) 3529
(C) 5239
(D) 9325
(E) 5329

7. What is the answer to this addition problem?

\[
\begin{array}{c}
\text{6} \\
\text{1} \\
\text{5} \\
\end{array}
\quad + 
\begin{array}{c}
\text{7} \\
\text{4} \\
\end{array}
\]
B. On planet X - 200 the following symbols were used for numbers.

\[ \triangle = 1, \quad \bowtie = 10, \quad \boxtimes = 100 \]

For example

\[ b = \triangle \triangle \triangle, \quad 15 = \bowtie \triangle \triangle \triangle, \quad 123 = \boxtimes \bowtie \bowtie \triangle \triangle \triangle \]

How would 324 be written?

(A) \( \boxtimes \boxtimes \boxtimes \bowtie \bowtie \triangle \triangle \triangle \)

(B) \( \boxtimes \boxtimes \bowtie \bowtie \triangle \triangle \triangle \)

(C) \( \boxtimes \boxtimes \boxtimes \bowtie \triangle \triangle \triangle \)

(D) \( \boxtimes \boxtimes \boxtimes \bowtie \bowtie \triangle \triangle \triangle \)

(E) None of the above.

9. Which of the following is equal to 37 tens?

(A) \( \frac{37}{100} \)

(B) \( \frac{37}{1000} \)

(C) 37

(D) 370

(E) 3700

10. Which arrow points to the tenths' place?
11. If a new system of number notation used the following symbols

- △ stands for zero
- □ stands for five
- ♦ stands for eight
- ○ stands for two

Which is the correct answer to the following?

- □ △ ○ ○
- ○ ○ △ ○
- ♦ ○ ○ ○
- ○ ○ ♦ ○
- ○ ○ ○
12. If the two middle digits of 6348 were interchanged, the number would be

(A) 100 less
(B) 90 less
(C) Unchanged
(D) 90 more
(E) 100 more.
PROBLEM SOLVING.

INSTRUCTIONS.

In this section there are 10 problems about several types of mathematics. For each question choose the correct answer from those given and mark the correct letter on the answer sheet with an "X". DO NOT WRITE ON THIS QUESTION PAPER.

You will have 20 minutes for this section.

1. Tom's mother cooked 48 potatoes. She also cooked 64 bananas. She cooked how many fewer potatoes than bananas?

A 112
B 48
C 26
D 14
E 16

2. Ann has sh 30 to spend for books. Each book costs sh. 5. How many books can Ann buy?

A \( n = 30 - 5 \)
B \( n = \frac{30}{5} \)
C \( n = 5 \times 30 \)
D \( n = 30 + 5 \)

3. Daniel bought a bag of 20 new marbles. He now has 75 marbles. How many marbles did Daniel have before he bought the new ones?

A \( 20 + 75 = n \)
B \( 75 = 20 + n \)
C \( n + 20 = 75 \)
D \( 75 - 20 = n = 75 - 20 \)
4. Suppose you have a marble game.
   You drop a marble at A. It goes to B.
   How many ways can it go?
   A 2
   B 4
   C 5
   D 6
   E The number of ways is not given.

5. Look at the chart below.
   Some numbers are needed to complete it.
   What would you write instead of the question mark (?) in the ring?
<table>
<thead>
<tr>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOHN</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>MARY</td>
<td>4</td>
<td>8</td>
<td>?</td>
</tr>
<tr>
<td>TOM</td>
<td>1</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>10</td>
<td>18</td>
<td>?</td>
</tr>
</tbody>
</table>
   A 3
   B 4
   C 10
   D 13
   E My answer is not given.

6. If $R - S = T$, then which of the following is(are) true?
   (I) $R + T = S$
   (II) $R - T = S$
   (III) $S + T = R$
   A) I only
   B) III only
   C) I and II
   D) I and III
   E) II and III
7. The following diagrams are pictures of loops of rope. Which one cannot be pulled or twisted (without cutting) to form a circular loop without a knot?

A) I  
B) II  
C) III  
D) IV  
E) V

The picture to the left shows the number 3425. What number is shown by the picture on the right?

A) 999  
B) 9730  
C) 8269  
D) 973  
E) 269
The picture below shows that something happened to a large group. How was the group at the left changed to become the group at the right?

A) 4 was added to it
B) 4 was subtracted from it
C) it was multiplied by \( \frac{1}{4} \)
D) It was divided by \( \frac{1}{4} \)
E) It was not changed

In the figure above the line ST is drawn to the scale: 1 cm to 100 metres. What is the distance represented by ST?

A) 200 metres
B) 173 metres
C) 150 metres
D) 125 metres
E) 100 metres

STOP
IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THESE PROBLEMS.
The questions in this section are based on five dots in a row. There is one cm between each dot. Each dot is named with a capital letter as shown below:

P Q R S T

We agree to give each dot many names. Since dot S is 2 cm to the right of dot Q. We will say another name for dot S is Q\(2\). The 2 is written to the right of Q. Another name for dot S is R\(1\) because dot S is 1 cm to the right of dot Q.

When we write an equal sign between names, we say we have two names for the same dot. S = Q\(2\) or Q\(2\) = S are true statements because Q\(2\) and S are names of the same dot. P\(3\) = Q is a false statement because P\(3\) and Q are not names of the same dot.

Another way of naming dot S is 1T. Here the 1 is written to the left of T as dot S is to the left of dot T. We would write S = 1T. Two more names for dot S are OS and SO (the O is a zero) because the dot which is zero cm from dot S is dot S itself.

There are seven names for dot S. They are S, OS, SO, R\(1\), Q\(2\), P\(3\) and 1T. See if you can think of seven names for dot R.

S\(2\) looks like a dot name but it is not because there is no dot 2 cm to the right of dot S.

All the questions in this section are about names. You may read the explanation at any time during the test.

Here are some practice examples.

Ex. 0
Q\(2\) =

(A) P
(B) Q
(C) R
(D) S
(E) T
The correct answer is S, which is choice (D). See how D has been marked with an X.

Try the next two examples.

Ex.0 A B C D E
Q_____ = D

(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

Ex.000 A B C D E
Q_____ = P

(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

For this section, you will mark all of your answers on the answer sheet.

Work as quickly and as accurately as you can. You should guess only if you can rule some of the choices. Do not guess wildly.

You will have 15 minutes for this section.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>P3 = (A) P (B) Q (C) R (D) S (E) T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2R = (A) P (B) Q (C) R (D) S (E) T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3OT = (A) P (B) Q (C) R (D) S (E) T</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. \( R = \underline{---} \) T

\begin{align*}
(A) & \quad 0 \\
(B) & \quad 1 \\
(C) & \quad 2 \\
(D) & \quad 3 \\
(E) & \quad 4 \\
\end{align*}

5. \( \underline{---} = Q \)

\begin{align*}
(A) & \quad 0 \\
(B) & \quad 1 \\
(C) & \quad 2 \\
(D) & \quad 3 \\
(E) & \quad 4 \\
\end{align*}

6. \( \underline{---} = P \)

\begin{align*}
(A) & \quad P \\
(B) & \quad Q \\
(C) & \quad R \\
(D) & \quad S \\
(E) & \quad T \\
\end{align*}

7. \( \underline{---} = R \)

\begin{align*}
(A) & \quad P \\
(B) & \quad Q \\
(C) & \quad R \\
(D) & \quad S \\
(E) & \quad T \\
\end{align*}

In the following questions, \( X \) stands for one of \( P, Q, R, S, \text{ or } T \) and \( n \) stands for one of \( 0, 1, 2, 3, \text{ or } 4 \).

8. If \( T = x_4 \), then \( x = \quad \)

\begin{align*}
(A) & \quad P \\
(B) & \quad Q \\
(C) & \quad R \\
(D) & \quad S \\
(E) & \quad T \\
\end{align*}

9. If \( x_0 = Q \), then \( x = \quad \)

\begin{align*}
(A) & \quad P \\
(B) & \quad Q \\
(C) & \quad R \\
(D) & \quad S \\
(E) & \quad T \\
\end{align*}

10. If \( P_1 = S \), then \( n = \quad \)

\begin{align*}
(A) & \quad 0 \\
(B) & \quad 1 \\
(C) & \quad 2 \\
(D) & \quad 3 \\
(E) & \quad 4 \\
\end{align*}

11. If \( T = R_0 \), then \( n = \quad \)

\begin{align*}
(A) & \quad 0 \\
(B) & \quad 1 \\
(C) & \quad 2 \\
(D) & \quad 3 \\
(E) & \quad 4 \\
\end{align*}
12. If \( Qn \neq IT \), then \( n = \)

(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

13. If \( nS = Rl \), then \( n = \)

(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

By using the symbols ( ) more names can be given to a dot. For example, \((Pl)2\) names the dot which is 2 cm right of the dot \(Pl\). Dot \(Pl\) is \(Q\). Thus, \((Pl)2\) is another name for dot \(S\).

The name 3 \((Pl)2\) names a dot 3 cm left of \((Pl)2\). We have just shown that \((Pl)2 = S\), \(P\) is 3 cm to the left of \(S\). Thus, 3 \((Pl)2 = P\). Now answer the following questions.

14. \((2T)1 = \)

(A) \(P\)
(B) \(Q\)
(C) \(R\)
(D) \(S\)
(E) \(T\)

15. If \(2(Q3) = x\), then \(x = \)

(A) \(P\)
(B) \(Q\)
(C) \(R\)
(D) \(S\)
(E) \(T\)

16. \(((Pl)1)2 = \)

(A) \(P\)
(B) \(Q\)
(C) \(R\)
(D) \(S\)
(E) \(T\)

17. If \(T = (xl)2\), then \(x = \)

(A) \(P\)
(B) \(Q\)
(C) \(R\)
(D) \(S\)
(E) \(T\)
18. If \((2R)^n = R\), then \(n = \ldots\)
(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

19. If \((nS)^2 = S\) then \(n = \ldots\)
(A) 0
(B) 1
(C) 2
(D) 3
(E) 4
DO ALL THE QUESTIONS.

Read the following questions carefully then choose the correct answer to the problem. (Mark your answer with an X on the answer sheet.

1. \[99 \times 98 + 99 \times 102 = \text{equals}\]

A. 19,790 B. 19,900
C. 19,890 D. 19,900

2. \[125 \times 908 \times 6 = \text{equals}\]

A. 99800 B. 998000
C. 9980000 D. None of the above.

3. The expression \(5^*2\) will not represent a whole number if \(*\) is replaced by

A. + B. -
C. \(\div\) D. \(\times\)

4. If \(x = 4\), then \(2x - 3 = \text{equals}\)

A. 3 B. 5
C. 11 D. 21

5. Faith has \(sh\; x\). Judy has twice as much as Faith. If their total sum of money is \(sh. \;60\), how much does Faith have?

A. \(sh. \;30\) B. \(sh. \;60\)
C. \(sh. \;\{60 + x\}\) D. \(sh. \;20\)
6. If $X$ represents a whole number, then the replacement for $X$ which satisfies $3X-6+6=33$ is
   A. 3    B. 7    C. 11    D. 15

7. If $X = 1$ and $Y = 2$, then $2(2X+5Y)$ equals.
   A. 14    B. 18    C. 24    D. 148

8. If $X=2$, then $(3X)^2$ equals.
   A. 36    B. 9    C. 81    D. 12

9. Which of the following is a prime number?
   A. 1512    B. 71    C. 175    D. None of the above.

10. $25,012 - 9.08$ equals.
    A. 15,932    B. 16,004    C. 16,040    D. 16,932

11. Which one of the following represent the greatest number?
    A. 2.3466    B. 2.3447    C. 2.3395    D. 2.346

Find the circumference of a circle whose diameter is 63 cm (use $\pi = \frac{22}{7}$).

A. 106 cm.    B. 1916 cm.    C. 188 cm    D. 6804 cm.
13. The speed of a bicycle as a fraction of the speed of a motor cycle is 3/5. If motor cycle is travelling at 45km. per hour, then the speed of the bicycle in km per hour is.

A. 15     B. 27
C. 30     D. 35

14. Which one of the following products is equal to $\frac{7}{15} \times \frac{8}{13} \times \frac{2}{5}$?

A. $\frac{7}{15} \times \frac{13}{8} \times \frac{5}{2}$  B. $\frac{7}{15} \times \frac{8}{13} \times \frac{5}{2}$
C. $\frac{7}{15} \times \frac{8}{13} \times \frac{2}{5}$  D. $\frac{7}{15} \times \frac{13}{8} \times \frac{2}{5}$

15. $\frac{2}{3} \times \frac{4}{5} \times \frac{10}{18}$ =

A. $\frac{1}{3}$  B. $\frac{2}{3}$
C. $\frac{3}{2}$  D. $\frac{3}{1}$

16. In the above diagram, $X^\circ$ equals.

A. 40     B. 50
C. 100     D. 130

17. $6 + 4 + 5 =$

A. 7     B. 3
C. 3     D. 7

18. $2 \times 5 \times 4 =$

A. 40     B. 1
C. 3     D. 10
In the following seven questions, i.e. Nos. 19-25 work out the solution on the paper provided.

19. Susan is younger than Priscilla. Valeria is older than Priscilla. Raphael is younger than Susan. Who is second oldest?

20. If the diameter of a circle is 8, then 3 times the radius of the circle is?

21. Juma worked for 3 hours and 35 minutes in the morning and 1 hour and 55 minutes in the afternoon. How long did he work altogether?

22. A bus has 75 seats. There are five seats in each row. How many rows of seats are there in the bus?

23. A rectangular piece of paper measures 321 cm. by 25.3 cm.
A. What is the perimeter of the paper?
B. Write down the perimeter in millimetres.

24. 2/5 of pupils in a std. 7 class were girls. There were 27 boys in the class.
(a) How many pupils were there in the std. 7 class?
(b) How many girls were there?

25. What is the square root of
(a) 225?
(b) 1296?
BIBLIOGRAPHY


