

Chapter 9

MATHEMATICAL LITERACY

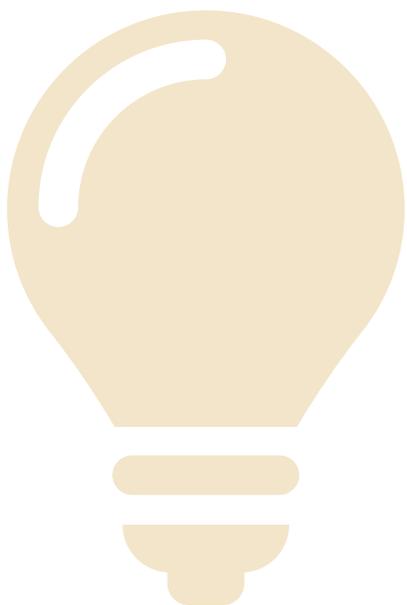
The following report should be read in conjunction with the Mathematical Literacy question papers of the November 2019 Examinations.

9.1 PERFORMANCE TRENDS (2015–2019)

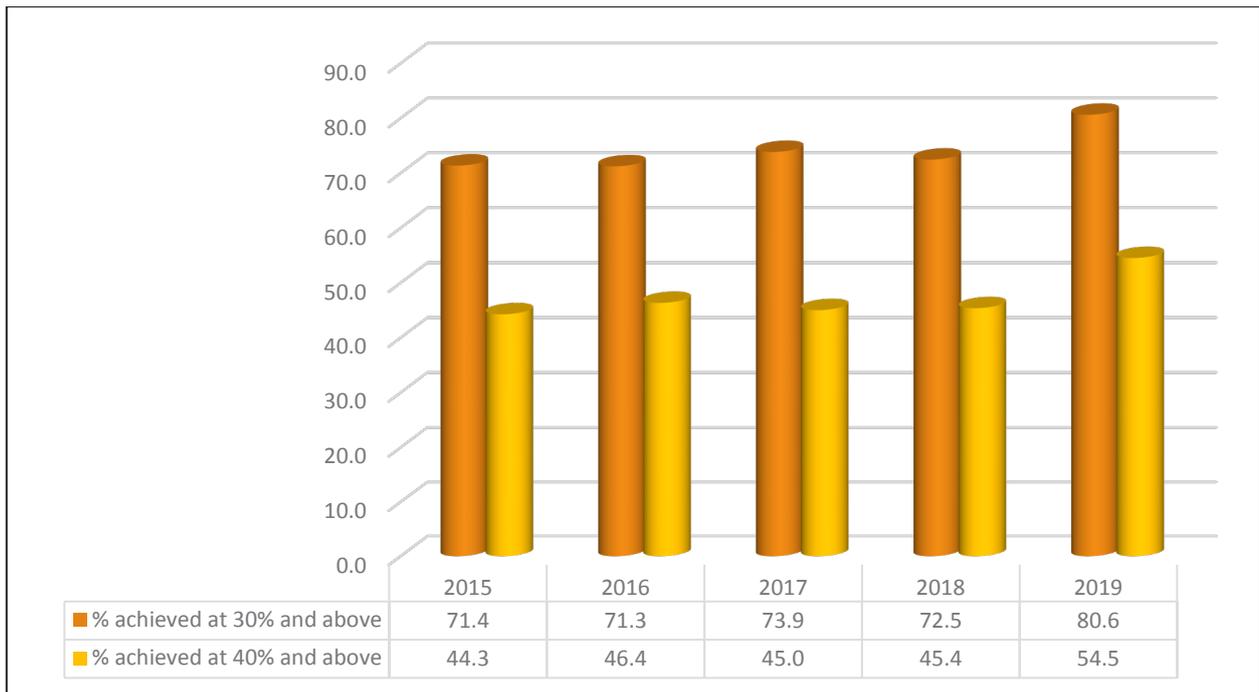
The number of candidates who wrote the Mathematical Literacy examinations in 2019 increased by 4 403. The performance of candidates in the 2019 examinations was very impressive. Achievement at 30% and above increased substantially from 72,5% in 2018 to 80,6% and achievement at 40% and above was an impressive 54,5%, in comparison to 45,4% in 2018. Performance in 2019 is by far the best since 2015.

Table 9.1.1 Overall Achievement Rates in Mathematical Literacy

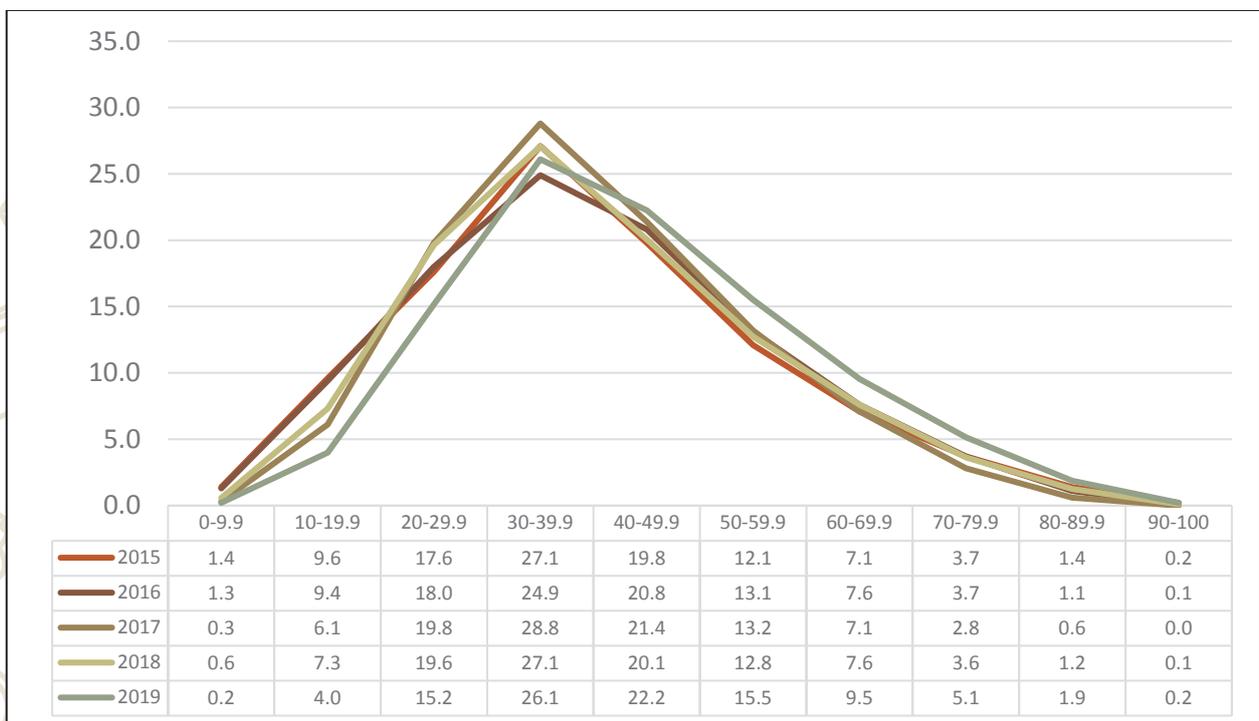
Year	No. Wrote	No. achieved at 30% and above	% achieved at 30% and above	No. achieved at 40% and above	% achieved at 40% and above
2015	388 845	277 593	71,4	172 214	44,3
2016	361 948	257 926	71,3	167 811	46,4
2017	313 030	231 230	73,9	140 991	45,0
2018	294 204	213 225	72,5	133 568	45,4
2019	298 607	240 816	80,6	162 877	54,5



Graph 9.1.1. Overall Achievement Rates in Mathematical Literacy (Percentage)



Graph 9.1.2 Performance Distribution Curves in Mathematical Literacy (Percentage)



9.2 GENERAL COMMENTS ON PAPER 1 AND PAPER 2

- (a) **Terminology:** Learners should be taught the definitions of commonly used terms in Mathematical Literacy such as ‘volume’ and ‘perimeter’. Learners should compile a topic-wise glossary of terms at the back of their notebooks with a brief but clear definition next to each term. A separate notebook may also be kept for this purpose. By the end of the year, all learners should have a comprehensive glossary of all the relevant terms.
- (b) **Enhance learners’ skills in accurately interpreting specific questions and using information that is relevant:** Teachers are advised to read through and interpret the requirements of each question with learners. Learners should also be guided on how to extract relevant information from the context and to identify the information that is relevant to each subquestion. Tables are often used to reduce written text.
- (c) **Use past NSC papers:** Firstly, it must be noted that past examination question papers serve as one of many teaching and learning resources. It must be used for revision purposes only. Past papers cannot replace the *CAPS* document and *Examination Guidelines*. Teachers can adapt certain questions for use in class, especially those that include working with large numbers. Secondly, teachers should ensure that learners revise questions that define mathematical terms, especially in a given context.
- (d) **The importance of formative testing:** Short, informal formative tests must be used to build the confidence of learners in all topics. If learners do their own corrections, it provides them with immediate feedback and an understanding of the mark allocation. The less challenging sections in each of the questions in the NSC Mathematical Literacy papers can be used as ‘confidence-boosters’. Formative tests can be used to great effect to introduce new subtopics in the *CAPS*, such as *personal income tax* and *box-and-whisker plots*.
- (e) **Previous recommendations:** Teachers should consult past Diagnostic Reports to establish if there are topics or concepts that are repeatedly indicated as problematic to most learners. For example, it has been noted over time that learners’ basic mathematical knowledge is problematic; this includes learners’ inability to work with big numbers.

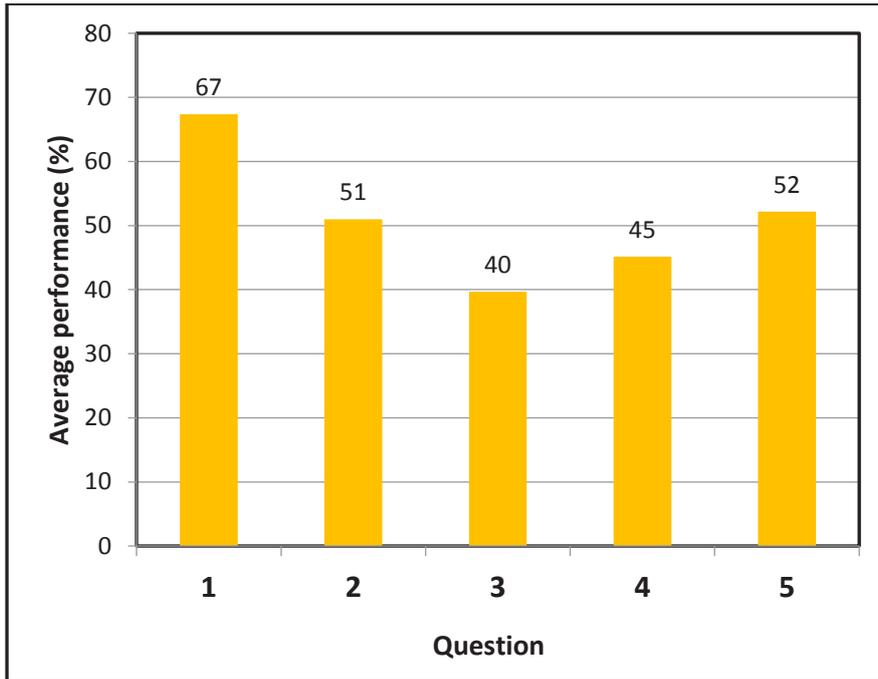
9.3 OVERVIEW OF LEARNER PERFORMANCE IN PAPER 1

General Comments

- (a) The 2019 question paper was set according to the new guideline document. Consequently, Q1 was based entirely on short contexts, with all questions pitched at level 1.
- (b) Teachers are advised to use the Mathematical Literacy Paper 1 from June 2017 to date to prepare for the 2020 examination.

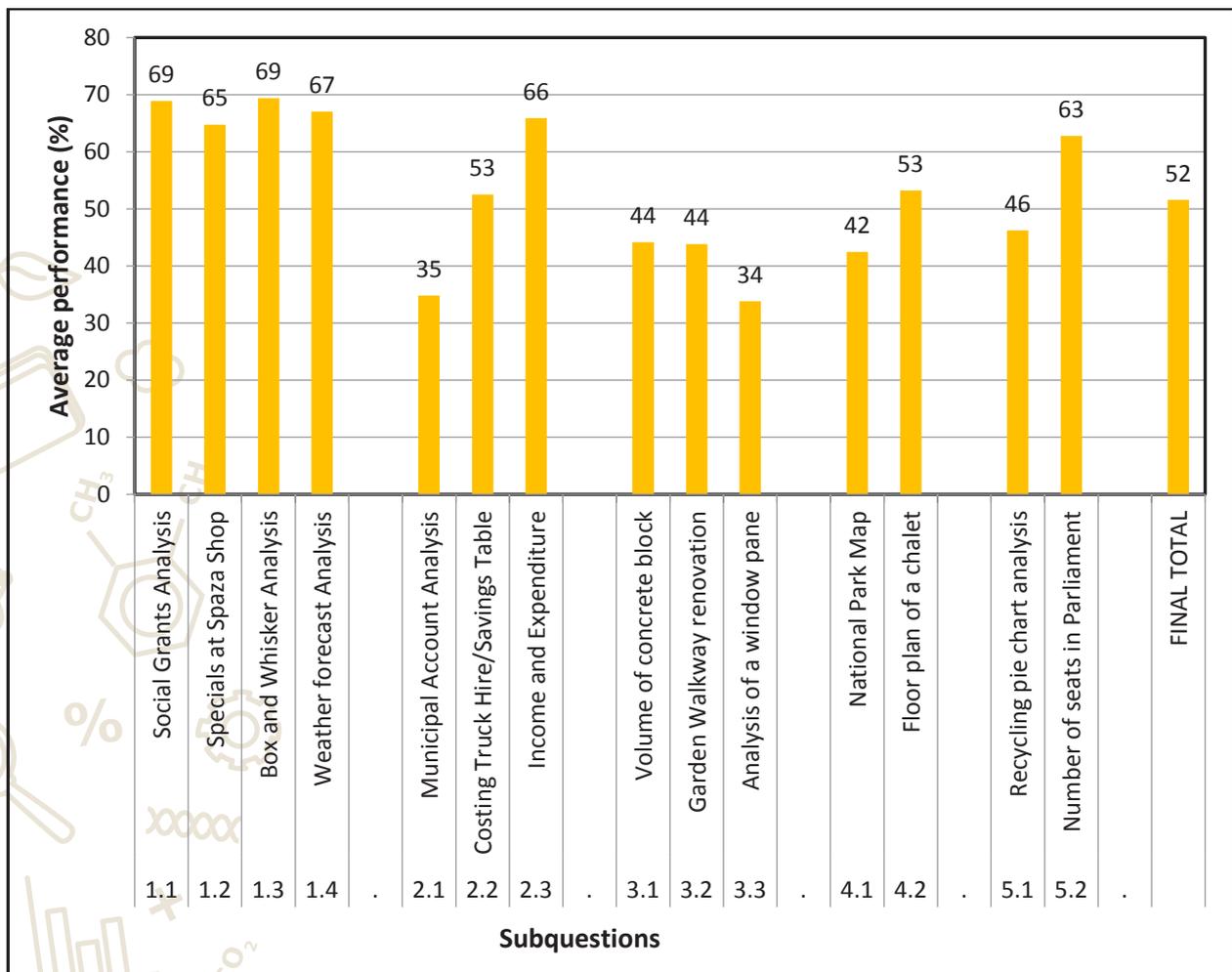
The following graph is based on data from a random sample of candidates. While this graph may not accurately reflect national averages, it is useful in assessing the relative degree of challenge of each question as experienced by candidates.

Graph 9.3.1 Average Percentage Performance per Question for Paper 1



Q	Content
Q1	Short contexts
Q2	Finance
Q3	Measurement
Q4	Maps and Plans
Q5	Data Handling

Graph 9.3.1 Average Percentage Performance per Question for Paper 1



9.4 ANALYSIS OF LEARNER PERFORMANCE IN INDIVIDUAL QUESTIONS IN PAPER 1

The change in the sequence of questions still benefits candidates, with Q1 based on short, level 1 contextual questions. This contributed to the improvement in the overall results in Mathematical Literacy in 2019.

QUESTION 1: SHORT CONTEXTS (INTEGRATED LEVEL 1 QUESTIONS ONLY)

Candidates performed well in this question except for Q1.1.1 which most learners misunderstood.

Common Errors and Misconceptions

- (a) Most candidates incorrectly chose 'categorical data' as an answer in Q1.1.1.
- (b) In Q1.1.3 some candidates used the wrong table to answer the question while others wrote the information in ascending order instead of descending order. These candidates lost one mark.
- (c) In Q1.1.4 some candidates could identify the two values but failed to find the difference between them. Hence, candidates were unable to determine the increase in disability allowances.
- (d) In Q1.1.5 some candidates listed more than two types of allowances and they were penalised for adding one or more extra incorrect allowances.
- (e) Many candidates had difficulty in converting grams to kilograms in Q1.2.1.
- (f) In Q1.2.2 some candidates wrongly added cash price to the selling price instead of subtracting the cash price from the selling price. This indicated that candidates have a lack of understanding of the term 'profit'.
- (g) The difference between analogue and digital formats of writing time was a challenge to many candidates in Q1.4.1.
- (h) In Q1.4.2 probability remains a challenge as many candidates could not write down the required answer of 20%.

Suggestions for Improvement

- (a) Teachers should incorporate more shopping leaflets from stores when selecting material to teach the topic of *personal finance*. This will enable learners to extract relevant information from leaflets with ease.

- (b) Teachers are advised to include questions on the definition of terms in their daily lessons and SBA tasks to ensure that learners are familiar with Mathematical Literacy terminology in all application topics.
- (c) Teachers should not assume that learners have mastered the skill of converting units of measurement in the lower grades. Converting units of measurement within the metric system should be practised by learners on a regular basis during contact time.
- (d) Learners should be taught how to express time values in different time formats. Time measurement and the difference between formats should be thoroughly revised in Grade 12. Teachers should use an analogue watch and a digital watch to demonstrate time formats.
- (e) Mathematical terms like *ascending* and *descending* should be displayed on wall charts in the classroom. Informal assessment tasks must include the testing of elementary mathematical terms.

QUESTION 2: FINANCE

The performance of candidates in this question was satisfactory and showed an improvement on the 2018 results.

Common Errors and Misconceptions

- (a) In Q2.1 most candidates rounded off their answers incorrectly. Candidates could not calculate the water tariff using the stepped/block tariff system.
- (b) Most candidates wrote kl instead of litre as the unit of measure in Q2.1.3.
- (c) In Q2.1.5 candidates just added the rates: $R8,28 + R8,79 + R15 = R32,07$ from the table instead of multiplying the units used in each step with the rate of that step. This showed a lack of knowledge on how to calculate charges using step tariffs.
- (d) Many candidates could not identify the graph as an inverse proportion graph in Q2.2.
- (e) In Q2.2.4(c) many candidates multiplied the rate by months, e.g. $17000 \times 36 \times 8,3/100 = R50\ 796$. Some candidates did not round off their answers as instructed. Others did not know that our currency has two decimal digits. Some candidates multiplied incorrect accumulated amounts with the correct interest rate. Some candidates calculated correctly but failed to round off to the nearest R100. Some candidates used a compounding method or compound interest formula which is not CAPS aligned.
- (f) In Q2.2.4(d) some candidates used other incorrect values in the table, e.g. $9,00\% - 8,08\% = 0,92\%$.
- (g) In Q2.3.1 candidates were unable to use millions/billions correctly and wrote R2 427 as a final answer instead of R242 700 million.

Suggestions for Improvement

- (a) Teachers should focus on concepts related to VAT calculations, i.e. calculating the amount of VAT charged, on prices excluding VAT and on prices including VAT. They should also focus on rounding within the context.
- (b) Learners should be exposed to tariff systems of different municipalities and/or authentic contexts in which cost calculations are done, e.g. sewerage cost, electricity cost and water cost. These are real-life contexts and are used currently. Many textbooks only expose learners to linear systems and this is misleading.
- (c) Learners should clearly understand the difference between the interest rate values and interest values.
- (d) Teachers should enhance learners' skills of interpreting and filtering the information given in the question so that they will be able to select the information to be used in calculations.
- (e) Learners should be exposed to all the financial documents that are listed in the CAPS document.

QUESTION 3: MEASUREMENT (VOLUME; AREA; PERIMETER; CONVERSIONS)

There was a decline in the performance of the candidates in this topic in the 2019 examination.

Common Errors and Misconceptions

- (a) In Q3.1.1 candidates with a language barrier struggled to express the definition of *volume* in their own words.
- (b) In Q3.2 the conversion of units was problematic. Many candidates did not realise that all the dimensions must be in the same units before substitution into the formulae. Some candidates used the area of the walkway instead of the area of the blocks. Some candidates could not associate the diagram in the question paper with diagrams in ANNEXURE B.
- (c) In Q3.2.3 candidates did not know when to multiply or when to divide. Some candidates swapped the numerator and denominator. Some candidates wrote the correct fraction but then multiplied it by twenty. Most candidates did not contextualize the answer by rounding up their answers.
- (d) In Q3.3.3 some candidates struggled to determine the diameter. Furthermore, some candidates used the radius instead of the diameter. Some candidates used the dimensions of the large window and divided by the radius instead of the diameter.
- (e) In Q3.3.4 many candidates did not double the width of the window pane and they did not multiply by the inverse of the given ratio. Candidates only multiplied 37 by the width of one large window. Some candidates multiplied the radius by 2 and did not carry on. Some candidates used any values in the picture. Candidates could not multiply by the inverse of $\frac{3}{4}$.

Suggestions for Improvement

- (a) Teachers must provide learners with conversion tables or methods like 'King Henry Died A Miserable Death Called Measles' (KHDAMDCM) when doing conversions from one unit of measurement to another.
- (b) Mathematical terms such as *radius* and *diameter* must be reinforced on a regular basis. Learners must be taught how to differentiate between the radius and the diameter and which one (radius or diameter) to apply in the calculation for a particular context.
- (c) Teachers must expose learners to the glossary of terminology, especially at the introduction of the lessons.
- (d) Learners should be taught that rounding values will be determined by the context in which the rounding occurs.

QUESTION 4: MAPS AND PLANS

Candidates' performance in this question was satisfactory. This reflected an improvement in comparison to previous years' performances.

Common Errors and Misconceptions

- (a) Most candidates did not read Q4.1.1 correctly. The question asked for the activities represented by the symbols given on the map. The candidates named the symbols on the map and not the activities.
- (b) In Q4.1.5 candidates did not measure the bar graph to obtain the correct scale factor in order to calculate the actual distance.
- (c) Many candidates only used the distance one-way and not the return distance in Q4.1.6. Some candidates divided by 60 instead of multiplying by 60 to convert hours to minutes.
- (d) In Q4.2.2 some candidates failed to read the floor plan with understanding and as a result failed to interpret the compass directions in the context of the given plan.
- (e) Some candidates used all the rooms on the plan in Q4.2.3. Some candidates wrote the answer as a ratio. Most candidates could not recall that probability is expressed using a scale that ranges from 0 (impossible events) to 1 (events that are certain to take place).

Suggestions for Improvement

- (a) Learners need more practice in questions involving general directions and questions on a given set of directions. The interpretation of compass directions in the context of appropriate maps and plans must be taught in Grade 12.

- (b) Teachers should note that when a scale is given there is every chance that some actual measurement will be required. Therefore, learners should be afforded the opportunity to use their rulers in class on a regular basis to measure classroom items such as books, pens and pencils. Scale should be taught well to enable learners to interpret and make sense of maps and plans.
- (c) Teaching should also enhance the understanding of symbols and notations used on plans.
- (d) Time conversions must be given special attention in class or in intervention programmes. Learners should be able to convert units of measurement of time from memory, e.g. 12 months = 1 year.

QUESTION 5: DATA HANDLING

This question required candidates to interpret data in tables with large numbers.

Common Errors and Misconceptions

- (a) In Q5.1.3 candidates did not subtract from 11,2%, instead they subtracted from 100%.
- (b) Many candidates left out the word 'millions' or did not put in the corresponding number of zeros in Q5.1.4.
- (c) In Q5.1.7 candidates struggled to determine the probability.

Suggestions for Improvement

- (a) Teachers must place emphasis on the theory of data handling.
- (b) Teachers should teach learners to read, select and analyse data presented in different types of graphs in order to answer questions relating to the data. Emphasis should be placed on exposing learners to exercises of one pie chart drawn from a sector of another pie chart.
- (c) Learners should be exposed to writing out big numbers (hundred thousands, millions and billions) and doing calculations with percentages.
- (d) Emphasis should be on:
 - The order of the ratio based on the question
 - The difference between simplified form and unit form
 - Simplification of a ratio proportionally
- (e) Teachers should emphasise the difference between a *histrogram* and a *bar graph* and plotting points correctly on the graph.

9.5 OVERVIEW OF LEARNER PERFORMANCE IN PAPER 2

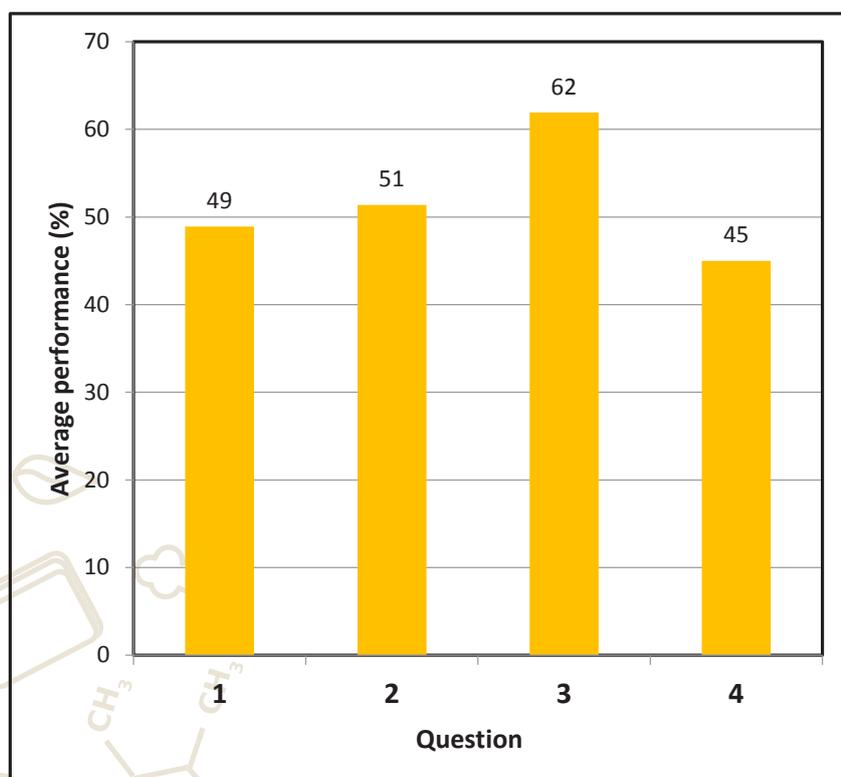
General Comment

The performances of candidates were similar to those recorded in the past.

9.6 ANALYSIS OF LEARNERS' PERFORMANCE IN INDIVIDUAL QUESTIONS IN PAPER 2

The following graph is based on data from a random sample of candidates. While this graph may not accurately reflect national averages, it is useful in assessing the relative degree of challenge of each question as experienced by candidates.

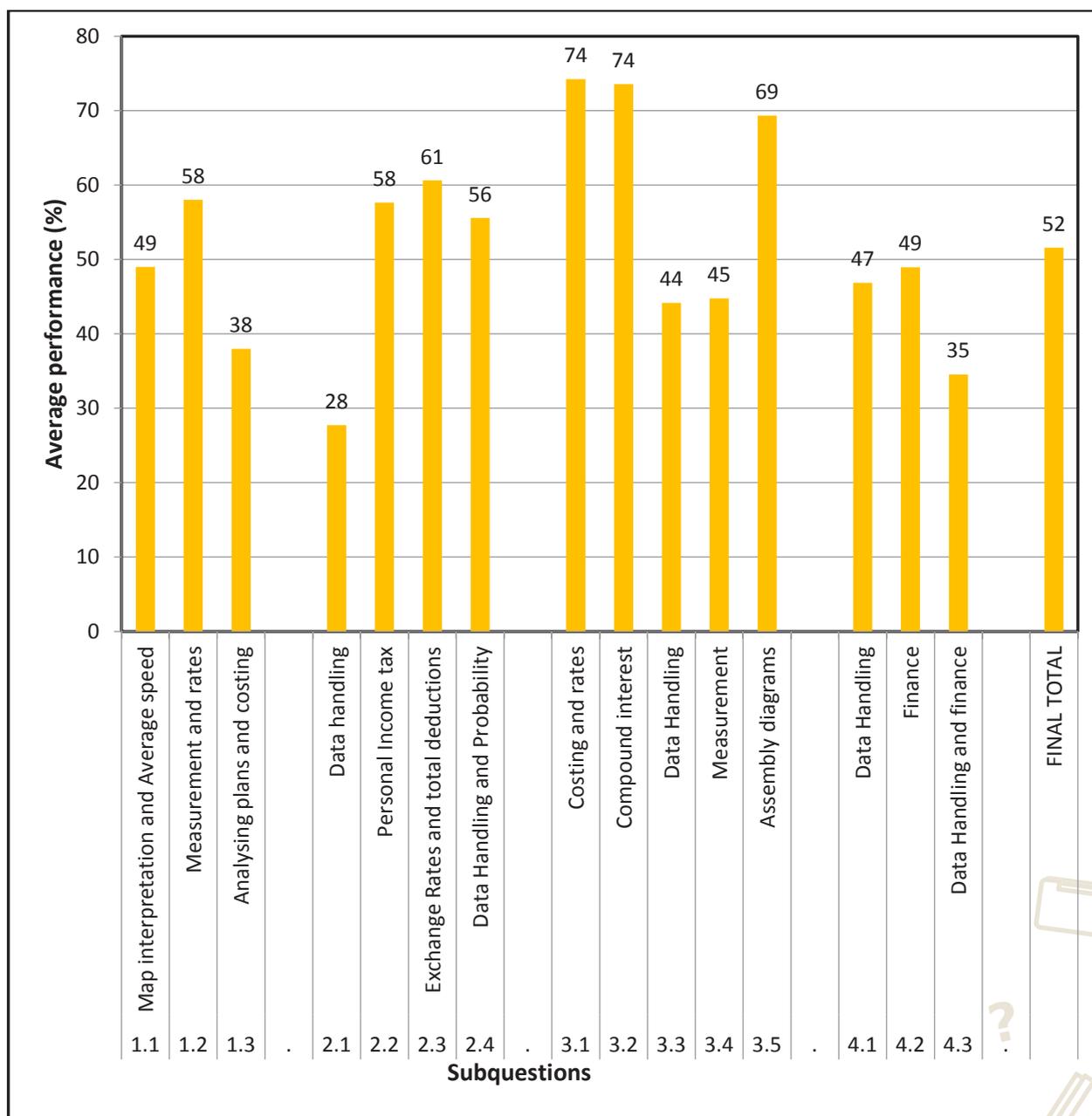
Graph 9.6.1 Average Percentage Performance per Question for Paper 2



Q	Content
Q1	Maps Scale, Measurement and Finance
Q2	Data Handling and Finance
Q3	Finance, Data Handling and Assembly diagrams
Q4	Data Handling, Probability and Finance



Graph 9.6.2 Average Percentage Performance per Subquestion for Paper 2



9.7 ANALYSIS OF LEARNER PERFORMANCE IN INDIVIDUAL QUESTIONS IN PAPER 2

QUESTION 1: MAPS AND PLANS; MEASUREMENT

Common Errors and Misconceptions

- (a) In Q1.1.1 some candidates used perception rather than the actual distance to identify the two towns closest to Nampo Park. On the map, Viljoenskroon looks further from Nampo Park than Klerksdorp. However, Viljoenskroon is 45 km from Nampo Park, and is closer than Klerksdorp.

- (b) In Q1.1.2 most candidates could only give one of the correct directions. Many candidates did not understand the concept of compass direction and instead explained the route from OR Tambo Airport to Bultfontein.
- (c) Many candidates, in Q1.1.3, did not take note of the key to the map. Instead, they incorrectly used their own routes to arrive at an answer.
- (d) In Q1.1.4 most candidates struggled to write 8 pm in digital format and hence could not calculate the elapsed time. Some candidates were not aware that the time used in the formula represents time in hours only. Most candidates struggled to make time the subject of the formula. Many candidates could not convert a fraction of an hour into minutes.
- (e) In Q1.2.1 many candidates did not convert the given measurements to the same unit. Other candidates calculated the volume of the trough but did not go on to subtract the capacity of the water.
- (f) In Q1.2.3 many candidates did not understand the concept of 'half empty' and hence, they did not divide by two.
- (g) Most candidates did not recognise that the dimensions of the small block were 1 m in Q1.3 and hence could not use the plan correctly.
- (h) In Q1.3.2 many candidates did not determine the distance from stand 10 to 17 on the given floor plan. Some candidates only measured the distance on paper and did not relate it to the actual measurement of 36,5 m. Many of them could not convert the scale into a ratio.
- (i) Most candidates did not use the correct dimensions for stand 26 in Q1.3.3 and did not divide by 16 to find the cost of 1 square metre.

Suggestions for Improvement

- (a) Learners should be exposed to various types of maps, plans and other representations.
- (b) Directions should be taught using practical examples and learners should be taught how to read different directions when travelling between two places.
- (c) Learners should be taught that before calculating perimeter, area, volume or surface area, the units of the dimensions should be the same. If the dimensions are given in different units then they must first be converted to the same units.
- (d) Learners should be taught how to convert parts of an hour to minutes and vice versa.
- (e) Learners should be exposed to scenarios in which they work with time. They should be able to add and subtract time, using hours and minutes and a combination of both.
- (f) Teachers should refrain from using the compound interest formula as the compound interest formula is not listed in the Mathematical Literacy CAPS document.

QUESTION 2: DATA ANALYSIS AND FINANCE

Common Errors and Misconceptions

- (a) In Q2.1.1 many candidates struggled to differentiate between numbers and money. Many of them failed to convert the R287,24 billion into a full monetary value. The calculation of the mean was a further challenge for many, particularly when the mean is given and either the numerator or denominator needs to be calculated. Many candidates used the information that the millionaires earn between

R1 and R2 million a year, instead of using the formula:
$$\frac{\text{Total income}}{\text{Number of millionaires}}$$

- (b) In Q2.1.2 some candidates failed to see that R148 266 was 1005.0065% of the previous year, instead they used it as 100%. As a result, most of them calculated 5% of R148 266 and thereafter subtracted this amount from R148 266 as if the question was about percentage decrease.
- (c) Some candidates misunderstood or disregarded the fact that the medical aid amount in Q2.2.1 was given as monthly and therefore should be converted to annually.
- (d) In Q2.2.2 many candidates disregarded the age of the person and only subtracted one rebate. In a few cases, candidates used the wrong tax bracket and were penalised. In other cases it was obvious that candidates could not answer the tax rebate question.
- (e) Most learners struggled with conversions of currencies in Q2.3.1. As such, they could not make the correct decision. Conversion from Danish Kr to ZAR was done incorrectly. Early rounding resulted in candidates being penalized.
- (f) In Q2.3.2 most candidates did not calculate the total deductions but only used the employment deduction to calculate the percentage of annual deductions.
- (g) In Q2.4.2 some candidates assumed that G20 consists of 20 countries instead of 23 as shown in the table. The rounding to three decimal places was also a problem.
- (h) Some candidates did not understand the concept of quartiles in Q2.4.3(b) and some interchanged the 1st and 3rd quartile.

Suggestions for Improvement

- (a) Teachers should give learners practice on how to write down large numbers, like billions, fully.
- (b) Learners should be exposed to questions involving two or more formulae.
- (c) Teachers should reinforce that the concept of using VAT inclusive to find the VAT exclusive price can translate to other problems where a previous value is required.
- (d) Teachers should stay informed about the latest developments in terms of individual taxes and rectify information in textbooks that are outdated.

- (e) Learners should be taught the different concepts of measures of spread and measures of central tendencies.
- (f) Teachers should find a way to motivate learners to read the question again after answering the question in order to make sure that the correct rounding or verification was done.

QUESTION 3: MAP ANALYSIS; MEASUREMENT; LAYOUT ANALYSIS

Common Errors and Misconceptions

- (a) Some candidates only determined the hourly rate in Q3.1.1 and did not go on to determine the rate per minute to answer the question.
- (b) In Q3.1.2 some candidates could not determine whether the amount given was full or as a rate. Hence for 18 hours solo flying at a cost of R31 050, candidates multiplied these values which was not needed. They also multiplied the 700 by 2 which was also not needed. For the cost of the theory lessons they multiplied by 3 instead of 5. Other candidates were confused by two durations attached to one rate, for example, 15 hours of theory lessons costing R1 242 per 3-hour lesson.
- (c) Many candidates still used the compound interest formula in Q3.2. Some candidates were able to find the balance at the end of the first year but used the original value (principal amount) in the calculations for the second year.
- (d) In Q3.3.1 some candidates could not provide a reason as to why more candidates passed at the second attempt.
- (e) Most candidates struggled with Q3.3.2 because the row and columns in TABLE 2 were switched in TABLE 3. Many candidates could not work with proportions involving percentages. Some candidates correctly calculated the missing values A, B C and D but then failed to calculate the total number of students who passed the test.
- (f) In Q3.4 many candidates could not convert hours into weeks, days and hours. Some candidates divided 154 weeks by 7 days instead of multiplying by 7 days.
- (g) In Q3.5.1 some candidates only considered the benches parts (4) as the correct answer.

Suggestions for Improvement

- (a) Learners should be given guidance on how to analyse given information.
- (b) Teachers should not teach the compound interest formula, but rather the step by step solution.
- (c) Teachers should include Level 4 questions during their lessons and have assessments that include Level 4 questions. This will give learners confidence in approaching similar Level 4 questions in an examination.

- (d) Teachers should emphasise the use of proportions as a skill in solving problems in various contexts. Teachers should reinforce time calculations and conversions of time into days, hours and minutes. The emphasis should also be on working out a part of a time period.
- (e) Assembly of structures as prescribed in CAPS should be emphasised as an integral part of Maps, Plans and Other Representations.

QUESTION 4: DATA ANALYSIS AND FINANCE

Common Errors and Misconceptions

- (a) In Q4.1.1 some candidates substituted the incorrect denominator, writing $\frac{14,5 \text{ million} - 10,8 \text{ million}}{14,5 \text{ million}} \times 100$ instead of $\frac{14,5 \text{ million} - 10,8 \text{ million}}{10,8 \text{ million}} \times 100$. Other candidates did not write the final answer as a percentage.
- (b) Some candidates selected the incorrect data in Q4.1.3, or they did not understand what was expected in the question.
- (c) In Q4.1.4 many candidates did not recognise that the effect of rounding could result in percentages not adding up to 100%, especially when dealing with large denominators.
- (d) Many candidates used the number of household sizes as the total outcomes in Q4.1.5 and incorrectly concluded that the probability was instead of summing the given probabilities. Many candidates used the wrong column from the given data.
- (e) Most candidates scored 1 mark only in Q4.2.1 because they did not write the range of the class. They only wrote R20 instead of R20 – R79.
- (f) In Q4.2.2 some candidates wrote the total without the word million or in an expanded form. These candidates lost one mark.
- (g) Most candidates could not find the correct household size in Q4.2.3 because they did not read the NOTE given in the key information (they rounded the household size to 4 instead of using 3,5). Many candidates did not know how many days there are in one year.
- (h) In Q4.2.4 many candidates only found 4% of 280 and multiplied by the number of months in a year instead of the number of days in a year.
- (i) In Q4.3.1 most candidates who gave a wrong answer (incorrect name), did not state that the name they gave as their answer was correct (in terms of the question), implying that the candidates did not check their calculations.
- (j) In Q4.3.2 most candidates calculated incorrectly $85\% \text{ of } R125 + 73\% \text{ of } R98$ instead of $(12,2 \text{ million} \times R125) + (10,6 \text{ million} \times R98)$. Other candidates did not multiply by 12 to arrive at the annual amount spent.

- (k) Many candidates referred to the percentages that differ in Q4.3.3, instead of referring to the scale used on the vertical axis as the reason why the graphs appeared different.

Suggestions for Improvement

- (a) Teachers should encourage learners to first make sense of the information before attempting the questions.
- (b) Learners must be made aware that not all formulae will be given, and therefore they should know the formula for percentage change.
- (c) Teachers should emphasise that in all verification questions, learners must provide calculations to justify their answers.
- (d) Teachers should explain the concept of rounding (off versus down or up) and the effects of rounding.
- (e) Teachers should inform candidates that if the data is given in percentages, then it immediately represents probability.
- (f) Learners should be taught how scales have an impact on the appearance of graphs, i.e. that the graphs of the same data will appear to be different when different scales are used.

