

2023

Diagnostic Report

Book 1



Together we rise!



CHAPTER 9

MATHEMATICAL LITERACY

The following report should be read in conjunction with the Mathematical Literacy question papers of the November 2023 Examinations.

2.1 PERFORMANCE TRENDS (2019–2023)

The number of candidates who wrote the Mathematical Literacy examination in 2023 decreased by 28 170 compared to that of 2022. There was a decline in the pass rate this year.

Candidates who passed at the 30% level declined from 85,7% in 2022 to 82,3% in 2023. There was a corresponding change in the pass rate at the 40% level from 60,4% to 56,7% over the past two years.

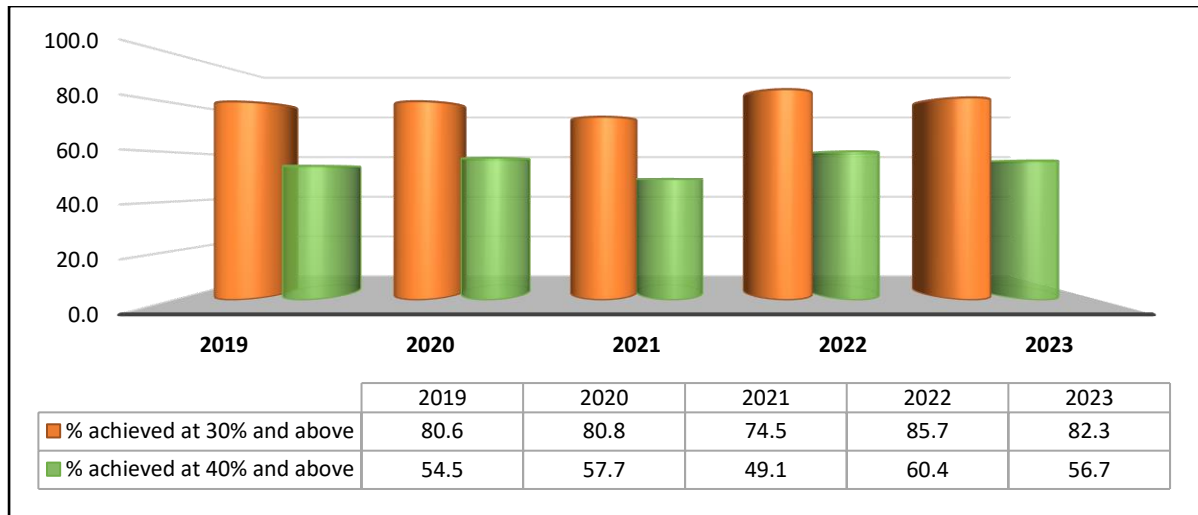
There was a slight improvement in the percentage of distinctions over 80%, which increased from 1,7% in 2022 to 2,1% in 2023. Given the decrease in the size of the 2023 cohort, this converts into an increase in the total number of distinctions from 7 650 to 8 859.

The various intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2023. The resourcefulness and diligence of the above-average candidates contributed to the overall results in the subject.

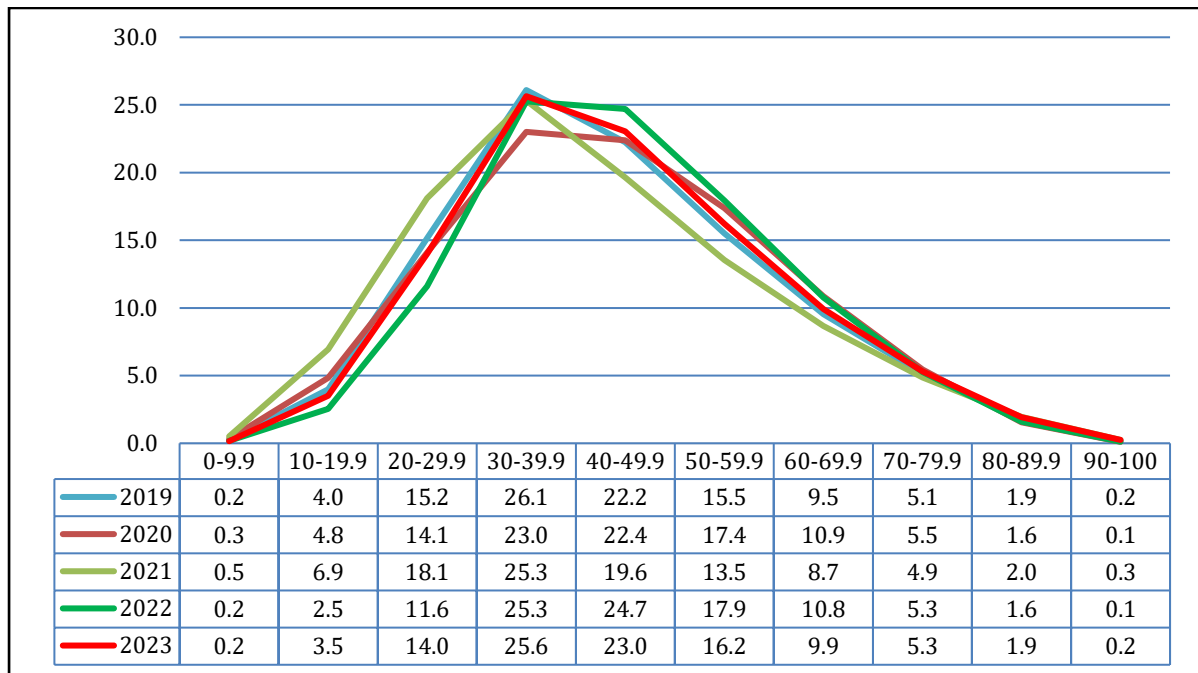
Table 9.1.1 Overall achievement rates in Mathematical Literacy

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
2019	298 607	240 816	80,6	162 877	54,5
2020	341 363	275 684	80,8	197 131	57,7
2021	441 067	328 382	74,5	216 692	49,1
2022	450 005	385 515	85,7	271 830	60,4
2023	421 835	347 227	82,3	239 045	56,7

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

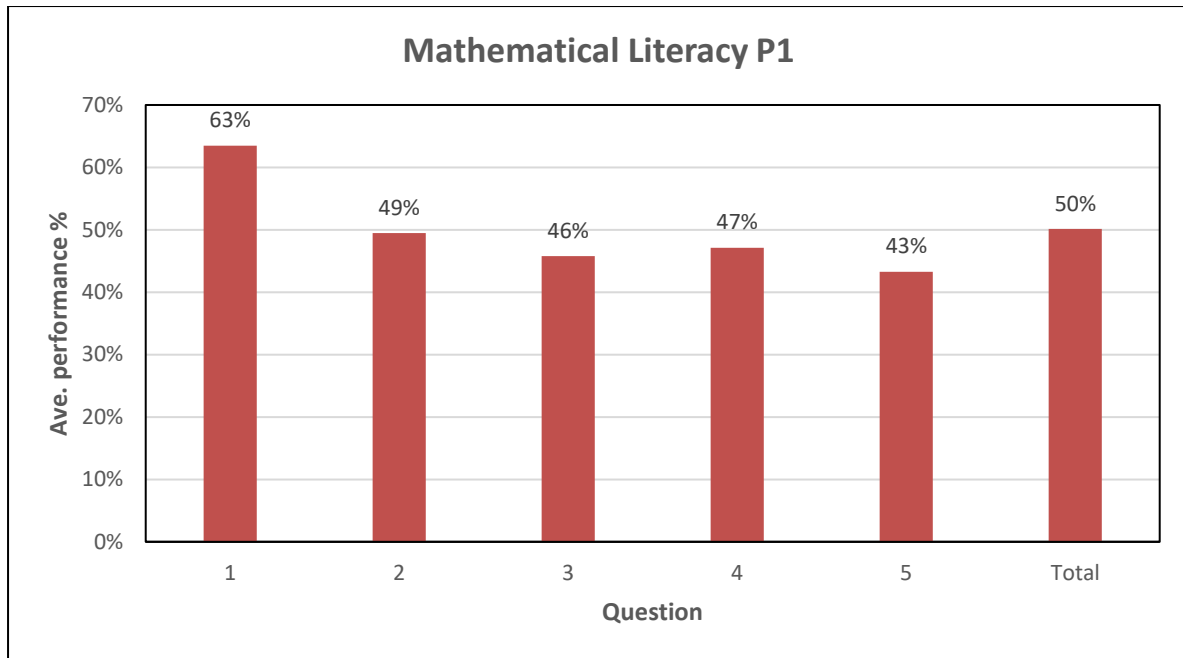
- (a) **Terminology:** Candidates still struggle with the definitions of commonly used terms in Mathematical Literacy such as *radius* and *median*. Learners should compile a topic-wise glossary of terms at the back of their notebooks with a brief but clear definition next to each term. A separate notebook 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) **Level 4 questions were once again poorly answered.** Teachers are advised to scaffold these questions by reading through and interpreting the requirements of each question with learners.
- (c) **Use of past NSC papers:** Firstly, it must be noted that past examination question papers should not be used to teach new content. They must be used for revision purposes only. Past papers cannot replace the *CAPS* document and *Examination Guidelines*. Teachers can, however, adapt certain questions for use in class. Secondly, teachers should ensure that learners revise questions that define mathematical terms, especially in each 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 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, particularly Question 1, can be used as confidence boosters.
- (e) **Previous recommendations: Candidates seem to have not taken heed of previous recommendation.** Teachers should consult past *Diagnostic Reports* to establish if some topics or concepts are repeatedly indicated as problematic to most learners. For example, it has been noted over time that learners' basic mathematical knowledge is problematic, and this includes learners' inability to work with large numbers or understand the concept of time.
- (f) Candidates once again lacked the skill of reading information from a graph, table, etc. These should be practised and integrated into classroom and homework activities throughout the FET phase.

9.3 OVERVIEW OF CANDIDATES' PERFORMANCE IN PAPER 1

General comments

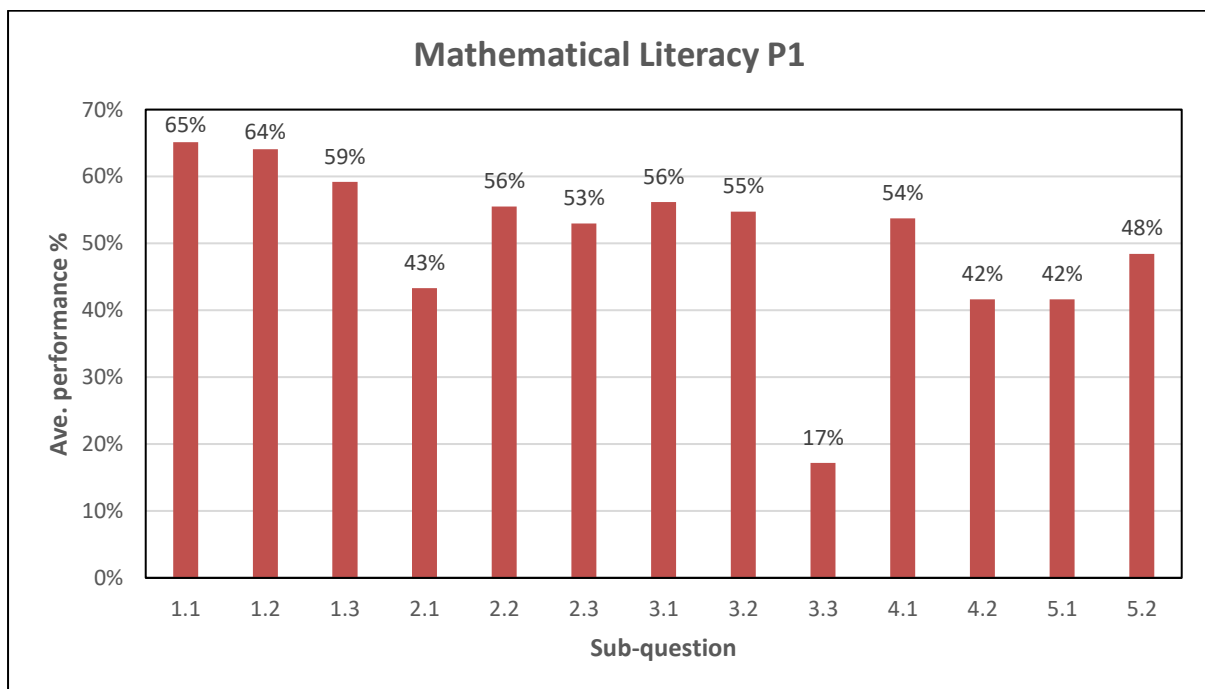
- (a) The 2023 question paper was set according to the *2021 Examination Guidelines* document. The Application Topics tested in Paper 1 are: Finance, Data Handling and Probability. Question 1 was based entirely on short contexts with all questions pitched at level 1.

Graph 9.3.1 Average performance per question in Paper 1 2023



Q	Topic
1	Finance & Data Handling
2	Finance & Probability
3	Data Handling
4	Finance, Data Handling & Probability
5	Finance, Data Handling & Probability

Graph 9.3.2 Average performance per subquestion in Paper 1 2023



Sub-Q	Topic	Sub-Q	Topic
1.1	Data Handling	3.2	Data Handling
1.2	Finance	3.3	Data Handling
1.3	Finance	4.1	Data Handling & Probability
2.1	Finance	4.2	Finance
2.2	Finance	5.1	Data Handling & Probability
2.3	Finance	5.2	Finance
3.1	Data Handling & Probability		

9.4 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 1

The three Application Topics and the sequence of questions, where Q1 was based on short, contextual questions, benefitted candidates. Q1 was the best answered question.

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

Common errors and misconceptions

- (a) In Q.1.1.1 candidates could not identify the data in the given table as an example of discrete data.
- (b) In Q.1.1.2 candidates still find it difficult to write large numbers in words.
- (c) Most candidates managed to write the ratio in the correct order in Q1.1.5 but could not simplify the ratio.
- (d) In Q1.2.2 many candidates did not add the 0,11 to calculate the total amount for one music CD.
- (e) Many candidates could identify the two values from the given table in Q.1.2.3 but could not calculate the amount as a percentage.
- (f) Some candidates did not multiply the R8,33 by 210 000. Instead they used the amount of R99 in Q.1.2.4. Several candidates used the correct values but divided these two correct values instead of multiplying them.
- (g) In Q1.2.5 candidates could identify the correct values and multiply these values instead of dividing them.
- (h) In Q1.3.3 candidates could explain the term *Gross Monthly Income*; they tended to confuse this term with *Net Income*.

Suggestions for improvement

- (a) Teachers should give learners enough practice in defining Mathematical Literacy definitions in context. As per CAPS, Mathematical Literacy must be taught and tested in a real-life authentic context.
- (b) Reading information from tables and graphs in Mathematical Literacy forms part of the Basic Skills Topics and this concept is taught at the Grade 10 level. Teachers are encouraged to integrate these Basic Skills Topics within the Application Topics.

- (c) The Glossary of Terminology provided by the DBE and provincial education departments should be utilised during teaching and learning activities at the beginning of a new section.
- (d) Pie charts will not always have perfect, neat, and tidy representations. The data used is set in real-life authentic contexts, therefore, the charts will not have perfectly balanced sectors where the names/labels of these sectors will fit perfectly in these sectors. Teachers are encouraged to illustrate examples of these pie charts that do not have perfectly balanced sectors where the labels will fit on the sectors of the pie charts.

QUESTION 2: FINANCE

Common errors and misconceptions

- (a) In Q.2.1.4 candidates are still making a well-documented error by not being able to note the difference between a *VAT Included* and a *VAT Excluded* calculation.
- (b) Most candidates in Q2.2.2 identified the correct *Tax Bracket* and could calculate the income tax payable before rebates are subtracted. Candidates found it difficult to interpret the negative answer. The concept of the tax threshold is poorly understood.
- (c) In Q2.3.3 candidates could not extract from the given context that the number in brackets represents a deficit or a negative number.
- (d) In Q.2.3.4 most candidates just subtracted the smaller number from the bigger number, ignoring the fact that they must subtract from the expected income, regardless of which is the most.

Suggestions for improvement

- (a) Teachers should focus on the different calculations for VAT inclusive and VAT exclusive calculations. The Basic Skills Topics covers the mathematical calculation of working with percentages in detail.
- (b) Teachers should make use of a variety of financial documents in past DBE examination question papers. Subject advisors should encourage teachers to design authentic tasks by making use of real-life authentic financial documents.
- (c) Teachers must continue to teach learners how to interpret tax rebates and explain how age relates to the number of rebates an individual will receive. Regular practice is required for working on calculations of rebates and tax per month by using tables.
- (d) Teachers and subject advisors are encouraged to design updated material on the subtopic *Budgets*. The progression of this topic with regard to content and context should be clear for the different grades in the FET band. For example, the progression from budgets with small number (households) to budgets with very large numbers (national budgets) must be evident in the learning and teaching material for learners.

QUESTION 3: DATA HANDLING

Common errors and misconceptions

- (a) Most candidates were unable to comment after they made the correct comparison for Q.3.1.3, while others were calculating the difference between urban and rural age groups.
- (b) In Q3.1.4 most candidates were able to identify the percentage of children who are overweight or obese, but they were unable to calculate children who are NOT overweight or obese using the number of learners in a rural school. Most candidates did not round off their answer.
- (c) Most candidates identified the 11,1 but did not subtract it from 100 in Q.1.1.5. Candidates still struggle with probability questions which are phrased as 'NOT'.
- (d) In Q3.2.2 most candidates read the months from the graph incorrectly. Secondly, candidates wrote only one month and lastly they wrote all the months given in the question paper.
- (e) Candidates could not comment on whether the selection of the sample in Q.3.3.3. was biased, skew or unfair. They merely stated that there were more children with normal nutritional status than malnourished. This suggests that candidates find it difficult to comment on a data sample using the following Mathematical terms, i.e. *skew*, *biased* or *unfair*.

Suggestions for improvement

- (a) Teachers should start the Application Topic Data Handling by revising the Data Cycle. Learners must be exposed to questions in the data cycle on whether the data sampling was biased and what makes a data sample biased.
- (b) The topic Probability should be taught by following the CAPS policy document, and the classroom and homework activities should include questions that are phrased as follows: 'Determine the probability of random selecting an item that is NOT ...' Consolidation of this type of phrasing can be selected from past DBE examination question papers.
- (c) Learners should be exposed to all types of growth charts, i.e. males and females, babies, including time in months and years, head circumference and weight.

QUESTION 4: FINANCE, DATA HANDLING AND PROBABILITY

Common errors and misconceptions

- (a) Candidates could identify the mode in Q.4.1.1 but struggled to write their answer as 'no mode'. Most candidates write 0 as no mode.
- (b) In Q4.1.2 most candidates wrote the items instead of writing the number of items.
- (c) Candidates only subtracted the one-way trip of R15, not realising that R30 for a return trip had to be subtracted in Q4.1.3.

- (d) In Q4.1.4 candidates could understand the concept of *median*, however, determining the median is still a challenge for most candidates. Some candidates are still making the error by not arranging the data in order before identifying the middle value(s).
- (e) In Q4.1.5 candidates are still writing a as a *ratio*. It is noted that this error has been made by candidates for years.
- (f) In Q4.2.4 many candidates lack the understanding of how an increase in the selling price impacts the break-even point: whether the break-even point will be lower or higher than the previous break-even point.

Suggestions for improvement

- (a) Measures of central tendencies (*mode*, *mean* and *median*) should be practised with very large and very small numbers. After learners have been tested on these concepts on a regular basis, teachers should give learners written feedback on the misconceptions.
- (b) The break-even point should not only be identified by learners, but they should also have a good understanding of what the break-even point means and how this point is influenced by an increase/decrease of the selling price/cost price.
- (c) Learners must engage in activities of how to present a probability answer as stated in the *CAPS* policy document. Probability activities must be set in real-life authentic contexts. Where learners make the error of writing *probability* as a *ratio*, a written comment next to the learner's incorrect answer must be made on why it is incorrect to represent a probability as a ratio.
- (d) Learners must be exposed to exam-type questions and contexts where the learner can practise the skill of extracting the mathematics from the given information before any calculations are done.

QUESTION 5: DATA HANDLING AND FINANCE

Common errors and misconceptions

- (a) In Q5.1.2 many candidates struggled with percentage increase and decrease calculations and formula. Values were swopped around to get a positive answer.
- (b) In Q.5.1.3 candidates demonstrated an understanding of the *range* concept, however, they could not work with negative numbers, resulting in failure to identify the maximum and minimum values.
- (c) In Q.5.1.4 many candidates still struggled with the *reverse mean calculation*, however, they were able to change the subject of the formula. They managed to change the subject of the formula but could not identify that there were 10 values in the data set.
- (d) In Q5.2.1 some candidates were not able to determine which currency is stronger or weaker than the other currency.
- (e) In Q.5.2.2 some candidates could identify the different exchange rates in the given

table, however, they did not know whether they had to multiply or divide by the exchange rate.

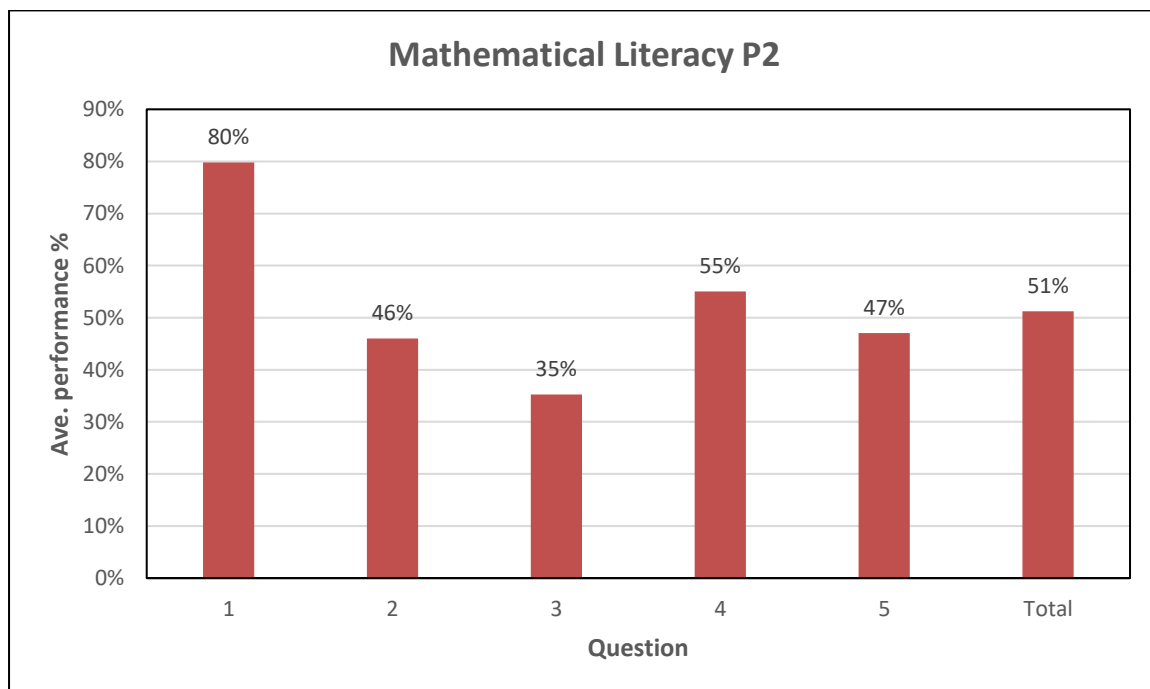
Suggestions for improvement

- (a) The focus on exchange rates should be on developing an understanding of the value of a currency in relation to other currencies and on the value of a particular currency in relation to the cost of living/business venture in a country, rather than on repetitive calculation using mathematical content and procedures.
- (b) The basic mathematical procedure on how to convert from one currency to another should be taught. The DBE booklet should be utilised as it explains how ratio can be used to convert from one currency to another. This method pre-empts confusion about when to divide when dealing with currency conversions.
- (c) The basic skills topic which deals with basic percentage calculations must be revised on a weekly basis. The percentage calculations are integrated and tested within ALL Application Topics in Mathematical Literacy.

9.5 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 2

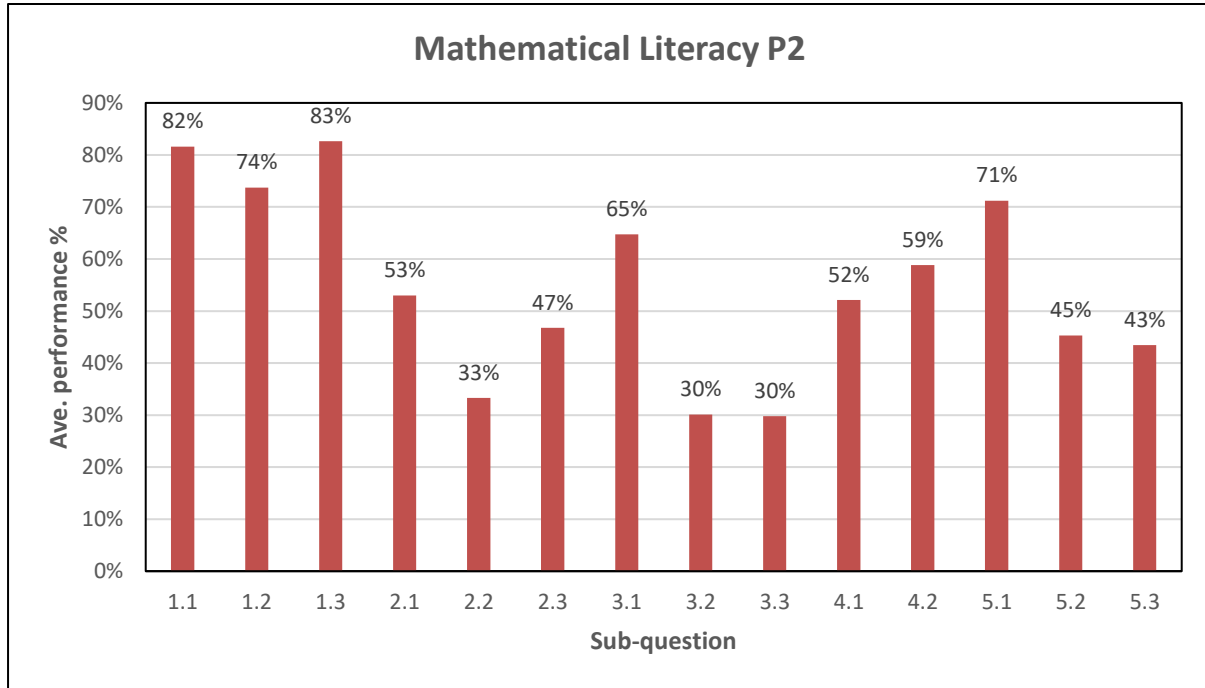
The following graph is based on data from a random sample of candidates. While this graph may not accurately reflect national averages, it is useful in assessing the relative degree of challenge of each question as experienced by candidates.

Figure 9.5.1 Average performance per question in Paper 2 2023



Q	Topic
1	Measurement, maps, plans and other
2	Probability, maps, plans and other
3	Measurement
4	Measurement, probability, maps, plans and other
5	Measurement, maps, plans and other

Figure 9.5.2 Average performance per subquestion in Paper 2 2023



Sub-Q	Topic	Sub-Q	Topic
1.1	Measurement, maps, plans and other	3.2	Measurement
1.2	Maps, plans and other	3.3	Measurement
1.3	Maps, plans and other	4.1	Measurement, maps, plans and other
2.1	Maps, plans and other	4.2	Measurement and probability
2.2	Maps, plans and other	5.1	Measurement
2.3	Probability, maps, plans and other	5.2	Measurement
3.1	Measurement	5.3	Measurement, maps, plans and other

9.6 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 2

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

Common errors and misconceptions

- (a) Q1.1 was well answered by most candidates but some of them did not follow instructions and instead of writing down the letter, they wrote the definition.

- (b) In Q 1.1.2 many candidates incorrectly chose G, showing that they could not differentiate between *area* and *volume*.
- (c) Some candidates in Q1.2.1 wrote down the names of the streets, instead of giving the number of streets.
- (d) In Q1.2.3 candidates were given an unfamiliar strip chart, and many were not able to correctly interpret it. The last distance of 1 100 m was mostly interpreted as the total distance and not the distance between the last two markers.
- (e) Many candidates answered Q1.3 well. A few candidates could not interpret the steps to assemble the chair, therefore they were unable to identify the number of screws in step 4.
- (f) In Q1.3.4 some candidates did not recognise the word 'pair'. Hence, they failed to identify the correct component.

Suggestions for improvement

- (a) Learners need to be exposed to different types of maps with different orientations. Learners must be made aware that they can rotate the question paper to ensure that the map is in the position with which they are more familiar.
- (b) Basic definitions should be taught in a clear and succinct manner. Learners should be encouraged to write the basic definition at the back of their notebooks.
- (c) Teachers are encouraged to use the definition booklets from DBE. Speed tests may be administered on the match questions developed from these terminologies and definitions.
- (d) Educators are encouraged to expose learners to various types of assembly diagrams, showing components and instructions.

QUESTION 2: MAPS AND PLANS AND PROBABILITY

Common errors and misconceptions

- (a) In Q 2.1.1 many candidates had a problem with the definition of a *layout plan* and confused the definition with that of a *floor plan*.
- (b) The performance in Q2.1.2 was good.
- (c) In Q2.1.3 many candidates chose A instead of C in the options provided because they were unable to recognise that north is facing downwards.
- (d) Q2.1.4 was poorly answered. Candidates had trouble to express their opinions due to language barriers. Candidates failed to explain why the plants were not placed on the northern table. Most candidates incorrectly wrote 'because of the sunlight'.
- (e) In Q2.1.5(a) some candidates could not accurately measure using a ruler or did not have a ruler in the examination room to measure. Some candidates were able to get the correct numerical value but wrote the wrong unit (m) and lost a mark.

- (f) In Q2.1.5(b) many candidates did not know how to calculate the scale. This shows that conversion, ratio, and simplification of a ratio which are basic mathematical literacy concepts is still a challenge. Some candidates still have a challenge to convert from cm to metres or vice versa.
- (g) Many candidates used area for the packaging problem in Q2.2 and arrived at the incorrect answer. A few candidates did not use half the table, instead they calculated the number of packs of water that could fit on the whole table, when the question stated that the packs would occupy half the table. Those who understood the packaging problem only calculated that 6 packs would fit on half of the table, not realising that one more pack could fit if you turn the pack so that the breadth can fit onto the length of the table.
- (h) In Q2.3.1 some candidates still confused general direction with giving directions from one place to another. Some candidates did not look at the point of reference of the north(N) to state the general direction, as the north on the map was not in the most familiar position.
- (i) In Q2.3.3 candidates did not read the whole map to see the label for the Pretoria Hotel. Many Pretoria-based candidates used their own knowledge and not the given map as the location of the hotel.
- (j) Many candidates in Q2.3.5. identified roads instead of presenting a reason. There was a lack of interpretation of the arrows. Not realising that all the roads on the map lead to the Pretoria Hotel and could be used by the conference attendees to get to the hotel.
- (k) Although many candidates answered Q2.3.6 well, there are still candidates who are struggling with addition of time.

Suggestions for improvement

- (a) Learners should be taught to explain terms using the given context.
- (b) Teachers should spend sufficient time on teaching scales and conversion into scale.
- (c) Learners must practise measuring accurately using a ruler.
- (d) Teachers should demonstrate packaging practically in the classroom to explain why volume calculations cannot be used in packaging problems.
- (e) Teachers should expose learners to questions that require them to determine the probability as a percentage.
- (f) Learners must be exposed to reasoning and opinion questions.
- (g) Learners must be taught to use the given resource and not to rely on their general knowledge to answer questions.
- (h) Teachers should afford learners the opportunity to critique the structure or plan during the lessons so that they get used to reasoning in context.
- (i) Teachers should expose learners to plans and maps with the position of north not facing upwards.

QUESTION 3: MEASUREMENT

Common errors and misconceptions

- (a) In Q3.1.1 some candidates added the six zeroes but did not remove the comma, arriving at an incorrect answer of 2,7000000.
- (b) Some candidates in Q3.1.2 added mixed units or could not correctly convert grams to kilograms.
- (c) In Q3.2.1 many candidates did not know that a square is a special type of rectangle with the length equal to the width, hence they were unable to calculate volume of the square hole.
- (d) Q3.2.2 was poorly answered. Candidates could not interpret the question that the post would occupy some of the volume of the hole.
- (e) In Q3.2.3 many candidates could not apply the ratio concept and lost valuable marks. Most candidates did not divide 5,5 bags of cement by 0,75 to determine the number of bags required to make 1 m³ of concrete. Early rounding off was also a problem.
- (f) Q3.3.1 was misinterpreted by many candidates. Candidates did not read the whole extract and only worked with the drawn diagrams. Most candidates used the dimensions of the post cap rather than the posts. This might be because only the post cap was visible in the context.
- (g) In Q3.3.2 candidates failed to link the question from previous and related subquestions. Some candidates added the areas of the triangle and the rectangle but did not multiply by 4 and 12 to get the total area of the caps that needed to be painted. Some candidates confused the height (2,5 cm) of the post cap with the perpendicular height (7,86 cm).
- (h) In Q3.3.3 conversion from cm² to m² was done incorrectly. Many candidates divided the spray rate instead of multiplying.

Suggestions for improvement

- (a) Writing large numbers in words or as numerals should be regularly assessed.
- (b) Teachers are advised to encourage learners to read questions carefully, i.e. find out whether a question should be rounded off to one or two decimal places.
- (c) Learners should be taught that all dimensions should be in the same unit before substituting into a formula.
- (d) Learners need to practise writing answers with the correct units and should be taught how to convert from one unit to another.
- (e) Teachers and learners should bring 3D items to class that can be analysed and interpreted.
- (f) Teachers should afford learners time to critique the scenarios during lessons with the intention of teaching them to be relevant when they give opinions, reasons, suggestions or views.

- (g) Teachers should vary the format of the spread rate of paint, e.g. 12,46 litres/m² or 0,08 m²/litres so that learners know when to divide and when to multiply by the spread rate.

QUESTION 4: MAPS AND PLANS, MEASUREMENT AND FINANCE

Common errors and misconceptions

- (a) In Q4.1.1 some candidates used the length of the floor runway which was 54 instead of the given width of (4 feet) which was in the context.
- (b) Q4.1.2 was well answered because the conversion factor was given. However, some candidates multiplied instead of dividing.
- (c) In Q4.1.3 many candidates could not reason why seats were not arranged behind each other since they are not exposed to seating arrangements at fashion shows. Some candidates also had problems expressing their reason because of a language barrier.
- (d) Q4.1.4(a) and (b) were poorly answered. Most candidates substituted the diameter instead of the radius into the given formula, and some did not square the radius to calculate the area of the triangle.
- (e) In Q 4.2.3 most candidates substituted correctly to a BMI formula, however, they did not square the denominator.
- (f) In Q4.2.4 and 4.2.5 candidates could not read the body chart correctly and hence could not answer the probability questions.
- (g) In Q4.2.5, because the Probability was given, learners manipulated their answers to correspond with the given probability of 0,833.

Suggestions for improvement

- (a) Learners should be taught to distinguish between *diameter* and *radius*.
- (b) Simple exercises need to be given to learners to practise writing ratios in the correct order and simplified form.
- (c) Teachers should expose learners to questions and unfamiliar contexts that require them to determine the probability as percentage and decimal.
- (d) Calculator operation should be emphasised when working with formulas. Teachers should explain the difference between the square (multiply a number by itself twice) and multiplying by 2 (adding a number twice).
- (e) Teachers should emphasise that the circumference of the circle is the perimeter of that circle, which means it is the total length or distance around the circle.

QUESTION 5: MAPS AND PLANS AND MEASUREMENT

Common errors and misconceptions

- (a) In Q5.1 most candidates substituted correctly into the formula; however, they did not square the length when calculating the surface area and omitted the unit.
- (b) In Q5.2.1 most candidates did not divide the mass by 0,001 tons to convert it to kilograms and multiply by 2 since the block of ice weighed 2 tons.
- (c) Most candidates in Q5.2.2 were unable to change the subject of the formula to calculate the volume of ice. Some candidates substituted the volume of water as the volume of ice.
- (d) Q5.3.1 was well answered.
- (e) In Q5.3.2 most candidates divided the distance in miles by 1,151 instead of multiplying by 1,151. Candidates were supposed to convert first to miles, then to km. Some candidates tried to convert straight from nautical miles to km.
- (f) Q5.3.3(a) was challenging as most candidates could not convert 10 days 4 hours to 244 hours and change the subject of the formulae to calculate speed. Many candidates did not round off the speed to two decimal places.
- (g) In Q5.3.3(b) most candidates did not divide 313,67 by 24 hours to determine the number of days and hours to find the arrival date and time.

Suggestions for improvement

- (a) Learners should be taught to substitute values exactly where they are expected to be according to the given formula.
- (b) Teachers should bring along calendars to class when they teach time in months, weeks, days and hours.
- (c) Teachers should expose learners to various formulae where the unknown is not necessarily the subject of the formula, example calculating the speed using the formula $\text{Distance} = \text{speed} \times \text{time}$.
- (d) Relevant terminology such as *find the total (add)* and *find the difference* should be used also in class activities for learners not to only experience them when writing examinations.
- (e) Teachers should expose learners to problems involving conversion of units using two factors.
- (f) Teachers should expose learners to a variety of transport timetables. Learners should be encouraged to work with the column or row that has all the necessary information for calculating the average speed unless they are restricted to work with a specific route.