CHAPTER 9

MATHEMATICAL LITERACY

The following report should be read in conjunction with the Mathematical Literacy question papers of the November 2022 Examinations.

9.1   PERFORMANCE TRENDS (2018–2022)

The number of candidates who sat for the Mathematical Literacy examinations in 2022 increased by 8 938 compared to that of 2021.

The table below indicates an upward trend over the years 2018-2020 followed by a decline in 2021. However, a substantial improvement in results was evident this year.

Candidates who passed at 30% (Level 2) improved substantially from 74,5% in 2021 to 85,7% in 2022. There was also a corresponding improvement in the pass rate at 40% (Level 3) over the past two years from 49,1% to 60,4%.
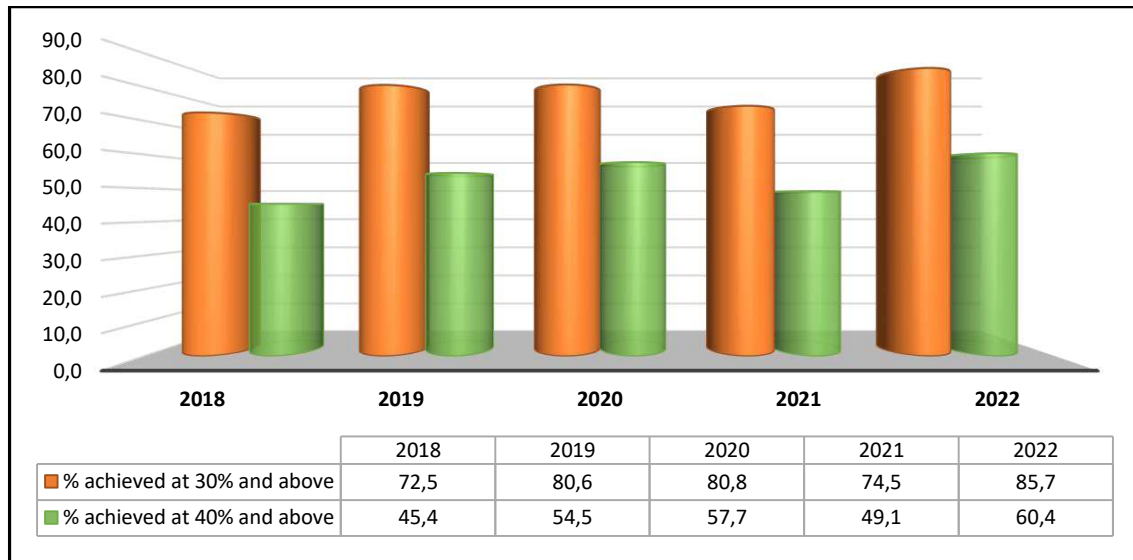
However, the percentage of distinctions over 80% (Level 7) declined from 2,3% to 1,7%. This converts into a decrease of 2 495 in the total number of distinctions.

In view of disruption to academic programmes in 2020 and 2021, and despite the factor distinction factor mentioned above, the results achieved by this cohort are particularly commendable. Strategic intervention programmes at all levels (National, Provincial, Districts and Schools) ensured that learners were adequately prepared. The diligence and perseverance of the above-average candidates also contributed to the overall performance.
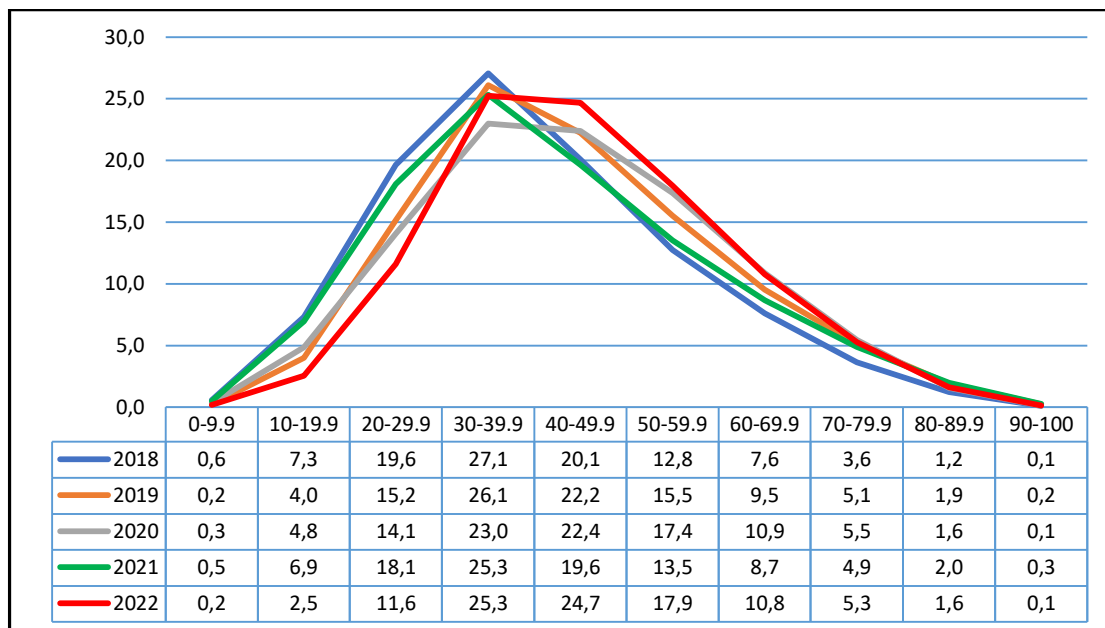
Table 9.1.1 Overall achievement rates in Mathematical Literacy

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
2018	294 204	213 225	72,5	133 568	45,4
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

Graph 9.1.1   Overall achievement rates in Mathematical Literacy (percentage)

	2018	2019	2020	2021	2022
% achieved at 30% and above	72,5	80,6	80,8	74,5	85,7
% achieved at 40% and above	45,4	54,5	57,7	49,1	60,4

Graph 9.1.2   Performance distribution curves in Mathematical Literacy (percentage)

	0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	70-79.9	80-89.9	90-100
2018	0,6	7,3	19,6	27,1	20,1	12,8	7,6	3,6	1,2	0,1
2019	0,2	4,0	15,2	26,1	22,2	15,5	9,5	5,1	1,9	0,2
2020	0,3	4,8	14,1	23,0	22,4	17,4	10,9	5,5	1,6	0,1
2021	0,5	6,9	18,1	25,3	19,6	13,5	8,7	4,9	2,0	0,3
2022	0,2	2,5	11,6	25,3	24,7	17,9	10,8	5,3	1,6	0,1

9.2   GENERAL COMMENTS ON PAPER 1 AND PAPER 2

(a)   **Terminology:** *English Across the Curriculum* should be emphasised. Learners should be taught 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)   **Enhance learners' skills in interpreting level 4 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 and how to identify the information that is relevant to each subquestion.

(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 *2021 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 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, particularly Questions 1, 2 and 3 can be used as confidence-boosters.

(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, and this includes learners' inability to work with large numbers or understand the concept of time.

## 9.3   OVERVIEW OF CANDIDATES' PERFORMANCE IN PAPER 1

General comments

(a) The 2022 question paper was set according to the current *2021 Examination Guideline*s. Application Topics tested in Paper 1 are Finance, Data Handling and Probability. Q1 was based entirely on short contexts with all questions pitched at level 1.

(b) Teachers are advised that the format of the examination paper will not change in 2023. Teachers are encouraged to use the exemplar papers of 2021, November 2021, May/June 2022 and the November 2022 papers as a guide.

(c) The *2021 Examination Guidelines* need to be studied by the teacher and be made available to Grade 12 learners at the beginning of the academic year.

Graph 9.3.1   Average performance per question in Paper 1 2022
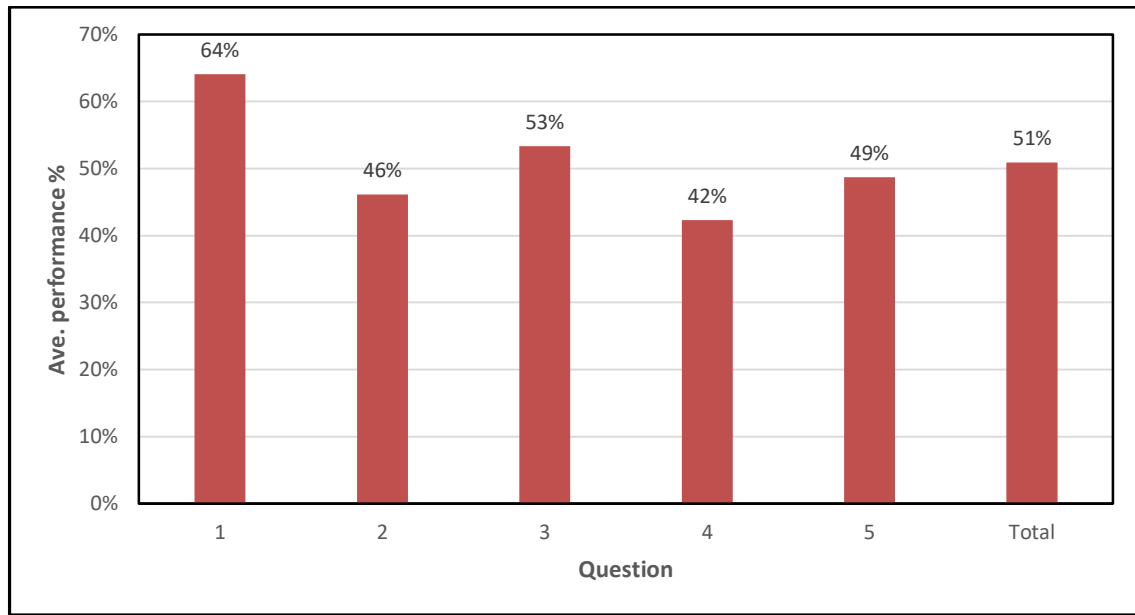
Q	Topic
1	Finance, Data Handling and Probability
2	Finance
3	Data Handling
4	Finance, Data Handling and Probability
5	Finance and Data Handling

Graph 9.3.2   Average performance per subquestion in Paper 1 2022
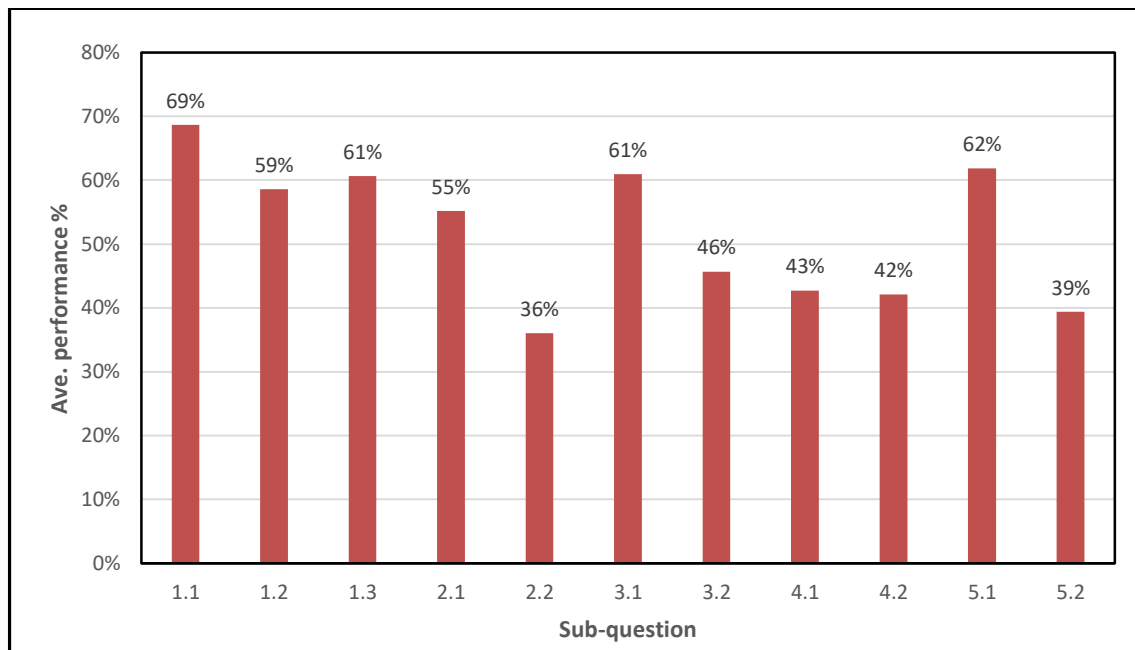
Sub-Q	Topic	Sub-Q	Topic
1.1	Finance, Data Handling and Probability	3.2	Data Handling
1.2	Finance	4.1	Finance and Probability
1.3	Data Handling and Finance	4.2	Data Handling, Finance and Probability
2.1	Finance	5.1	Data Handling and Finance
2.2	Finance	5.2	Finance
3.1	Data Handling		

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)   Candidates could not identify that the information given in the table was an example of Numeric or Categorical Data in Q1.1.1.

(b)   In Q1.1.6(a) candidates could not define the term *probability in context*; instead, they gave a *general definition of probability*.

(c)   Some candidates could not convert a decimal value to a percentage in Q1.1.6(b).

(d)   In Q1.2.1 candidates could not give the correct definition for the word *investment*.

(e)   Candidates calculated the interest of plan A and the interest of plan B in Q1.2.3 instead of calculating the difference of the values given in Plan B.

(f)   Some candidates did not understand the meaning of *difference* in Q1.2.4 in a mathematical sense, in that they did not subtract the values from each other, although they were able to identify the values.

(g)   In Q3.1.1 candidates could identify the graph as a bar graph, but struggled to name the specific type.

(h)   Candidates could not round the answer to the nearest 50 cents in Q1.3.3; most rounded to the nearest 10 cents.

Suggestions for improvement

(a)   The glossary on terminology provided by the DBE and Provincial Education Departments should be utilised during teaching and learning activities at the beginning of a new section.

(b)   Teachers should give learners enough practice in defining Mathematical Literacy definitions in context. As per *CAPS,* Mathematical Literacy must be taught and tested in an authentic context.

(c)   Mathematics is a component of Mathematical Literacy, therefore teachers are encouraged to integrate the Basic Skills topics within the Application Topics as part of learners' daily classwork and homework activities.

(d)   Rounding in Mathematical Literacy forms part of the Basic Skills topics and this concept is taught at Grade 10 level. The different types of rounding should be revised daily in all FET Grades when a calculator has been used to generate an answer.

QUESTION 2: FINANCE

Common errors and misconceptions

(a)   In Q2.1.3 most candidates did not know what to do with the discount. They added the discount instead of subtracting it.

(b)   Most candidates added the R7 000 excess to the quotation from the panel beaters in Q2.1.4, not realising that the quotation was inclusive of the excess amount.

(c)   In Q2.1.5 candidates calculated 15% VAT of the total monthly premium, not realising that the total monthly premium was 15% VAT inclusive.

(d)   Most candidates managed to identify the cost of sanitation in Johannesburg in Q2.2.1 if a property size was 175 m^2; however, they could not round off to the nearest 10 cents.

(e)   Many candidates multiplied R443,96 with the area, where they just had to add the 15% VAT to the tariff in Q2.2.3.

Suggestions for improvement

(a)   Teachers should make use of a variety of financial documents in different contexts beside the *CAPS* document throughout the FET phase. Subject Advisors should conduct workshops with teachers on how to design authentic tasks by making use of financial documents.

(b)   Teachers should focus on the different calculations for VAT inclusive and VAT exclusive calculations. Learners within a school should use one simple method to differentiate between the two basic calculations. When learners use multiple methods for these two basic calculations, they tend to easily confuse the two calculations.

(c)   Teachers and subject advisors are advised to integrate current tariff systems and not always use tariffs systems given in textbooks and study guides. Mathematical Literacy uses real-life contexts and tariff systems change over a period.

(d)   When learners calculate VAT for a tariff system, they do not take all information into consideration before they give the final answer. Teachers are encouraged to inculcate the skill of extracting all information from the given context before learners give their final solution.

QUESTION 3: DATA HANDLING

Common errors and misconceptions

(a)   Candidates were unable to give a reason why the table value would be different from the actual value in Q3.1.2. Candidates still struggle to interpret table values given in ten thousands.

(b)   In Q3.1.3 most candidates wrote 365,9 as indicated in the table and did not consider that the data from the table was given in ten thousands, i.e. 3 659 000.

(c)   Candidates miscalculated the mean in Q3.1.5. Many candidates still get confused with the difference between *mean* and *median*.

(d)   In Q3.2.2 candidates could not convert 7,6 million to 7 600 000 and added the 7,6 to the 183 000 without converting the number.

(e)   Candidates could not calculate the difference between the two percentages; they calculated the percentage increase and could not read off the value of Quarter 3 in Q3.2.3. This suggests that candidates find it difficult to read off values from the graph.

(f)   In Q3.2.4 candidates struggled to conclude that the employment and unemployment added up to 100% given the number of unemployed as 7,6 million. Most candidates calculated 34,4% of 7,6 million.

Suggestions for improvement

(a)   Teachers must provide learners with data tables where large numbers are expressed in ten thousands, millions, etc. Questions on why data is expressed in ten thousands, millions, etc. must be integrated in short tests and classwork activities. The difference of table values and actual values when dealing with large numbers should be regularly practised in class.

(b)   Measures of central tendencies (mode, mean and median) should be practised with large and very small numbers. After learners have been tested on these concepts on a regular basis, written feedback should be given to learners by the teacher where misconceptions occur.

(c)   The basic skill topic of percentages should be revised on a regular basis in a variety of contexts integrated throughout all the Application Topics at Grade 12 level. Teachers must integrate percentages into daily informal tasks and note learner misconceptions to design activities to assist learners.

QUESTION 4: FINANCE, DATA HANDLING AND PROBABILTY

Common errors and misconceptions

(a)   Candidates could substitute values correctly into the given formula but struggled with the order of operations (*BODMAS*) in Q4.1.1.

(b)   In Q4.1.2 many candidates could not interpret the monthly tax tables. Candidates calculated the monthly tax payable.

(c)   Candidates, struggled to write large numbers in words in Q4.2. Symbols and letters were mixed in their answers.

(d)   In Q4.2.2 candidates could identify the correct values, but could not write the ratio in the correct order.

(e)   Determining the median as required in Q4.2.3 is still a challenge for some candidates. Candidates did not arrange the data in order before trying to find the median.

(f)   In Q4.2.4 candidates identified and added the correct values but did not subtract it from the total number of vehicles sold.

(g)   Many candidates struggled to use a reverse calculation in Q4.2.5 to calculate Q3 and were unable to change the subject of the formula.

Suggestions for improvement

(a)   Order of operations (*BODMAS*) must be practised in class and learners should not be overly dependent on calculators that are programmed with *BODMAS*. Where basic mathematical calculations are done in any application topic, *BODMAS* must be emphasised.

(b)   When teaching personal income tax, teachers should incorporate all tax tables, i.e. monthly, weekly, and annual tax tables in the classroom activities. Material selection should not be limited to the tables used in past DBE question papers.

(c)   Writing large numbers in words is introduced in Grade 10. In Grade 11 and Grade 12 writing large numbers in words should be integrated into learners' daily activities and tested in short informal texts and SBA tasks where applicable.

(d)   Reverse calculations can be integrated into all topics where a formula is given. Regular exposure to this type of calculation will be beneficial for learners, when preparing for SBA tasks and examinations.

QUESTION 5: DATA HANDLING AND FINANCE

Common errors and misconceptions

(a)   In Q5.1.2 some candidates, struggled to write 8,3 billion as 8 300 000 000. Instead of calculating the total percentage for the agricultural sector which is 11%, they just multiplied by 4%.

(b)   In Q5.2.1 candidates could not identify the currency that was weakest against the rand. Some candidates gave an answer of British pound as the weakest currency against the rand instead of the Japanese yen.

(c)   Candidates did not understand the concept of exchange rate given in the table in Q5.2.2 and could not calculate the inverse of an exchange rate.

(d)   Most candidates did not know when to multiply or when to divide when converting from one currency to another currency (Q5.2.3). For example, some learners multiplied by R11,785 instead of dividing.

(e)   In Q5.2.5 some candidates were able to calculate the amount earned after two years but could not calculate the interest earned for the last 8 months.

Suggestions for improvement

(a)   The focus on exchange rates is 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 should be on how to convert from one currency to another. 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 and when to multiply when dealing with currency conversions.

(c)   The compound interest formula is not prescribed in the *Mathematical Literacy CAPS*. Learners must be able to do all mathematical calculations in Mathematical Literacy using a basic calculator. A manual calculation needs to be done when calculating interest (compound).

## 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 2022
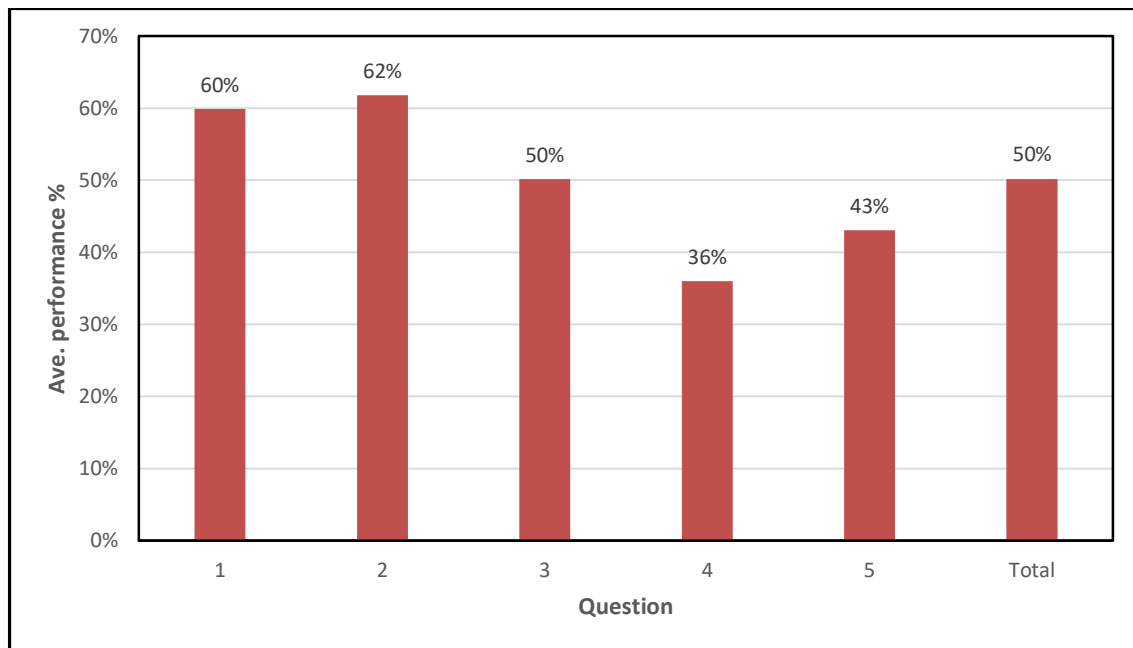
Q	Topic
1	Measurement, maps, plans and other
2	Probability, maps, plans and other
3	Measurement and probability
4	Measurement, maps, plans and other and finance
5	Measurement, maps, plans and other

Figure 9.5.2   Average performance per subquestion in Paper 2 2022
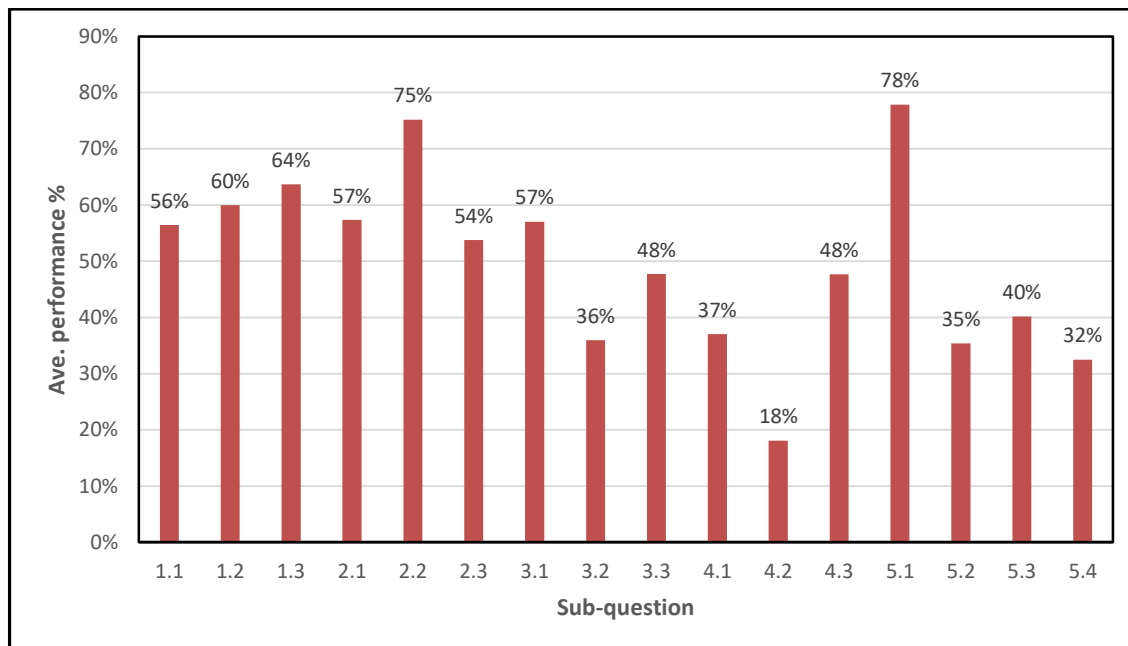
Sub-Q	Topic	Sub-Q	Topic
1.1	Measurement	3.3	Measurement
1.2	Maps, plans and other	4.1	Measurement, maps, plans and other
1.3	Maps, plans and other	4.2	Measurement
2.1	Maps, plans and other	4.3	Finance
2.2	Probability	5.1	Maps, plans and other
2.3	Maps, plans and other	5.2	Measurement
3.1	Measurement	5.3	Measurement
3.2	Measurement	5.4	Measurement

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)   Q1.1.1 was well answered by most candidates.

(b)   In Q1.1.2 some candidates referred to instruments of time and not time format.

(c)   Many candidates did not include that the time was in the afternoon and lost one mark in Q1.1.3. Alternatively, candidates could not differentiate between *to* and *past* in writing time in words.

(d)   In Q1.1.4 many candidates were unable to identify the total number of clocks that indicate the time in the afternoon.

(e) In Q1.1.5 some candidates divided by 60 instead of multiplying to convert hours to minutes.

(f) Many candidates could not interpret the assembly diagram correctly in Q1.2, hence did not know how many nuts were used or left over in each step.

(g) Most candidates answered Q1.3.1 and Q1.3.3 well, as it was direct reading from the map.

(h) In Q1.3.2 many candidates were unable to use the compass directions accurately and answered *Limpopo* instead of *Gauteng*.

(i) Most candidates wrote only one national road, the N14, and left out the N18 since they know that the road running through Vryburg and Mahikeng is the N18.

(j) In Q1.3.4 many candidates wrote down the names of the towns when the question asked for the number of towns.

(k) In Q1.3.5 many candidates could not measure the distance between two points on a map. This is a basic skill which is taught in Grade 10. Some wrote their answers in cm and lost a mark.

Suggestions for improvement

(a) The importance of laying a thorough foundation in Grade 10 cannot be emphasised enough. Teachers should spend the first week of the year simply addressing basic skills which will make it easier for learners to navigate the curriculum since these skills are found in different contexts throughout.

(b) Basic definitions should be taught in a clear and succinct manner.

(c) Question by question analysis should be encouraged after assessments so that challenges can be identified and addressed as early as possible.

(d) Teachers are encouraged to expose learners to various types of assembly diagrams so as to demystify this section.

(e) Time formats and conversions of time should be practised throughout the year.

(f) Teachers should cover all the units of time, namely seconds, minutes, hours, days, weeks, months, years, when teaching time conversion.

(g) Learners must be taught to use the given resource and not rely on their natural surroundings to answer questions.

QUESTION 2: MAPS AND PLANS AND PROBABILITY

Common errors and misconceptions

(a) In Q 2.1.1, 2.1.4 and 2.3.3(a) and (b) were poorly answered because of the language barriers, which was evident in the manner in which candidates expressed themselves.

(b) Some candidates misread the number of seats available in Q2.1.2 or rushed their answers and left out the seats at a particular table.

(c) In Q2.13 many candidates focused only on the chairs closer to the south wall and arrived at an answer of six instead of 13.

(d) In Q2.1.4 a few candidates gave answers that were not in context and lost valuable marks.

(e) In Q2.1.5 many candidates used left and right or up and down instead of the compass directions and lost three marks.

(f) Q2.2.1 was poorly answered. Far too many candidates could not give the correct answer, *tree diagram*. Wrong answers such as *spider diagram*, *probability diagram*, *step-and-leave diagram* or a *pedigree diagram* for hybridisation in Life Sciences.

(g) Q2.2.2. to Q2.2.4 were well answered.

(h) In Q2.3 many candidates still struggled with basic definitions like *route map*.

Suggestions for improvement

(a) Teachers should spend sufficient time on basic concepts like **maps, plans** and **scales**.

(b) Learners should be tested on definitions regularly.

(c) Teachers should write the name of the diagram on the chalkboard during the lesson. They should emphasize correct naming of the diagram during both formal and informal assessment.

(d) Teachers should expose learners to questions that require them to determine the probability as a percentage.

(e) Teachers should integrate Geography when teaching the topic of Maps and Plans.

(f) Teachers should highlight that left is west and right is east and should be read as 'WE' in the compass drawings. When north is not facing up, the learners should rotate the map or the plan for north to face up.

(g) Teachers should refer to the *CAPS* document and not just rely on past papers.

QUESTION 3: MEASUREMENT

Common errors and misconceptions

(a) In Q3.1.1 many candidates multiplied the sides instead of adding them to calculate perimeter. Some candidates omitted the bracket resulting in the common error: Perimeter = 2 x 239 + 89 mm instead of Perimeter = 2 x (239 + 89) mm**.** Some candidates gave the answer as a square unit.

(b) Many candidates worked with mixed units (mm and cm) in the same calculation in Q3.1.2.

(c) In Q3.1.3(a) some candidates still confused diameter and radius.

(d)   Q3.1.3 (b) was poorly answered. Candidates could not change the subject of the formula. Most candidates did not round the final answer to the nearest gram.

(e)   In Q3.2.1 many candidates did not know that February had 28 days. Most candidates only gave partial answers, either forgetting to multiply by 5 or 1,6.

(f)   Q3.2.2 was poorly answered. Candidates did not answer the question in context and gave general ways of saving water.

(g)   In Q3.3.1, many candidates could not differentiate between *cooking time* and *preparation time* when reading the recipe. Most candidates could not subtract time.

(h)   Most candidates answered Q3.3.2 well, but some candidates could not round off to the nearest ten.

(i)   In Q3.3.3 some candidates could not work with fractions or convert from millilitres to litres. Many multiplied instead of dividing.

Suggestions for improvement

(a)   Teachers are advised to encourage learners to read questions carefully, i.e. find out whether a question should be rounded to one or two decimal places.

(b)   Teachers should focus on and use past papers to help learners understand key words like: CONVERT, CALCULATE, SHOW, DETERMINE, DESCRIBE, STATE, EXPLAIN, GIVE, VERIFY.

(c)   Learners need to practise writing answers with the correct units and should be taught how to convert from one unit to another.

(d)   Teachers must emphasise that all dimensions must be in the same unit before calculating.

(e)   Teachers should explain to learners the difference between *show* and *verify* in the context of a question.

QUESTION 4: MAPS AND PLANS, MEASUREMENT AND FINANCE

Common errors and misconceptions

(a)   Q4.1.1 was a challenge. The worst performance in the entire paper was in this subquestion. Most of the learners could not spatially align themselves with the various aspects of the birdhouse and were unable to respond. Some candidates added a second 25 instead of a 23, resulting in the answer being 143 cm. Some candidates converted from cm to mm incorrectly.

(b)   In Q4.1.2 the request to verify was misinterpreted in the given context.

(c)   In Q 4.1.3 many candidates used *diameter* instead of *radius*. Some could not square the radius/diameter. Most of the candidates added the last part instead of subtracting. Candidates failed to use the formula.

(d)   Q4.2 was poorly answered. Instead of dividing by 10 and 14 most candidates multiplied. They failed to apply the **ratio** to calculate the number of litres required, given the spread rate. Most of the candidates do not know the meaning of the term *coat* with reference to painting.

(e)   Q 4.3.1: Most candidates thought that R287,40 was the cost of wooden boards for 1 bird house and not for 6, as given in the question. As a result, most did not divide the R287,40 by 6 before adding the costs.

(f)   Q4.3.2: Candidates could not explain *break even* using the given context. They gave partial answers using words like 'meet', 'intersect', 'join', 'merge'.

(g)   Q4.3.3: Some candidates failed to read from the table and took the value from Q4.3.1 to use it in Q4.3.3.

Suggestions for improvement

(a)   Teachers should give more attention to assembly diagrams and their interpretation.

(b)   Simple exercises can be done to increase learners' spatial awareness by allowing them to bring 3D items to class that can be analysed and interpreted.

(c)   Learners should be taught to distinguish between the units of area volume and perimeter.

(d)   Learners should be given multiple opportunities to practise calculator skills and *BODMAS*.

(e)   Teachers should expose learners to various formulae whereby the unknown is not necessarily the subject of the formula, e.g. finding the radius using the formula for calculating the volume of a cylinder.

QUESTION 5: MAPS AND PLANS AND MEASUREMENT

Common errors and misconceptions

(a)   Q5.1 was well answered, but some learners responded with the names of the elements and not the numbers.

(b)   In Q5.2.1 the concept of decade was not understood by most of candidates. Some candidates divided by 100 instead of ten. Other candidates just subtracted the years and wrote the answer as decades.

(c)   Most candidates answered Q5.2.2 correctly. A few candidates did not know how many days there are in November. Other candidates did not understand the concept 'elapsed' and included the starting day.

(d)   Q5.3.1 was well answered. Many candidates could not simplify the ratio or wrote the ratio as a fraction or wrote the ratio in reverse.

(e)   Q5.3.2 was either correct or wrong. Some candidates multiplied instead of dividing to convert from feet to metres.

(f)   Q5.3.3 was challenging as most candidates used the incorrect values to calculate the percentage discount. Some candidates used the incorrect denominator.

(g)   Candidates could not interpret Q5.4 well. They were unable to change the subject of the formula. They also struggled with calculating the actual time used for the journey.

Suggestions for improvement

(a)   Learners should be taught to read questions with due diligence. By simply glossing over questions, candidates are overlooking critical information contained in the questions.

(b)   More time should be spent on conversions and time as these aspects seem to have been neglected.

(c)   Teachers should bring along calendars to class when they teach time in months, weeks and days. Learners should perform calculations practically, using the calendars. The emphasis should be on the day from and days in between.

(d)   The first value mentioned in the question statement should appear first in the ratio, followed by the second value.

(e)   Teachers should give learners sufficient practice questions on the calculation of time elapsed and conversion thereof.