Province of the
EASTERN CAPE
EDUCATION

EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE

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REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

2023 NSC CHIEF MARKER'S REPORT

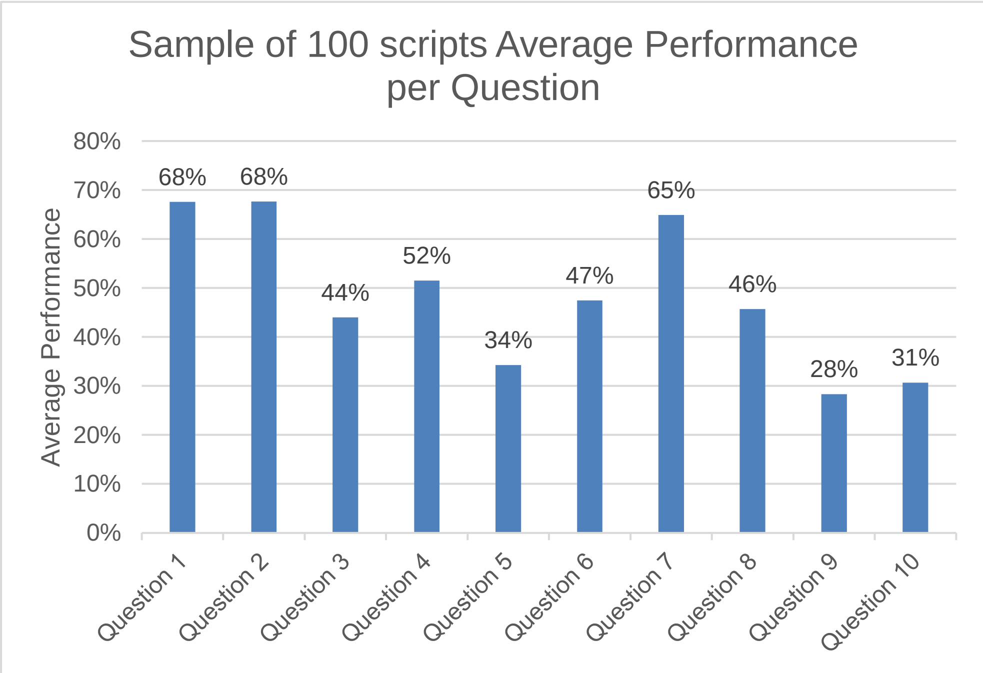
SUBJECT	**MATHEMATICS**		
QUESTION PAPER	1		
DURATION OF QUESTION PAPER	**3 hr**		
PROVINCE	**EASTERN CAPE**		
DATES OF MARKING	**4 – 19 DECEMBER 2023**		

SECTION 1: (General overview of Learners Performance in the queston paper as a whole)

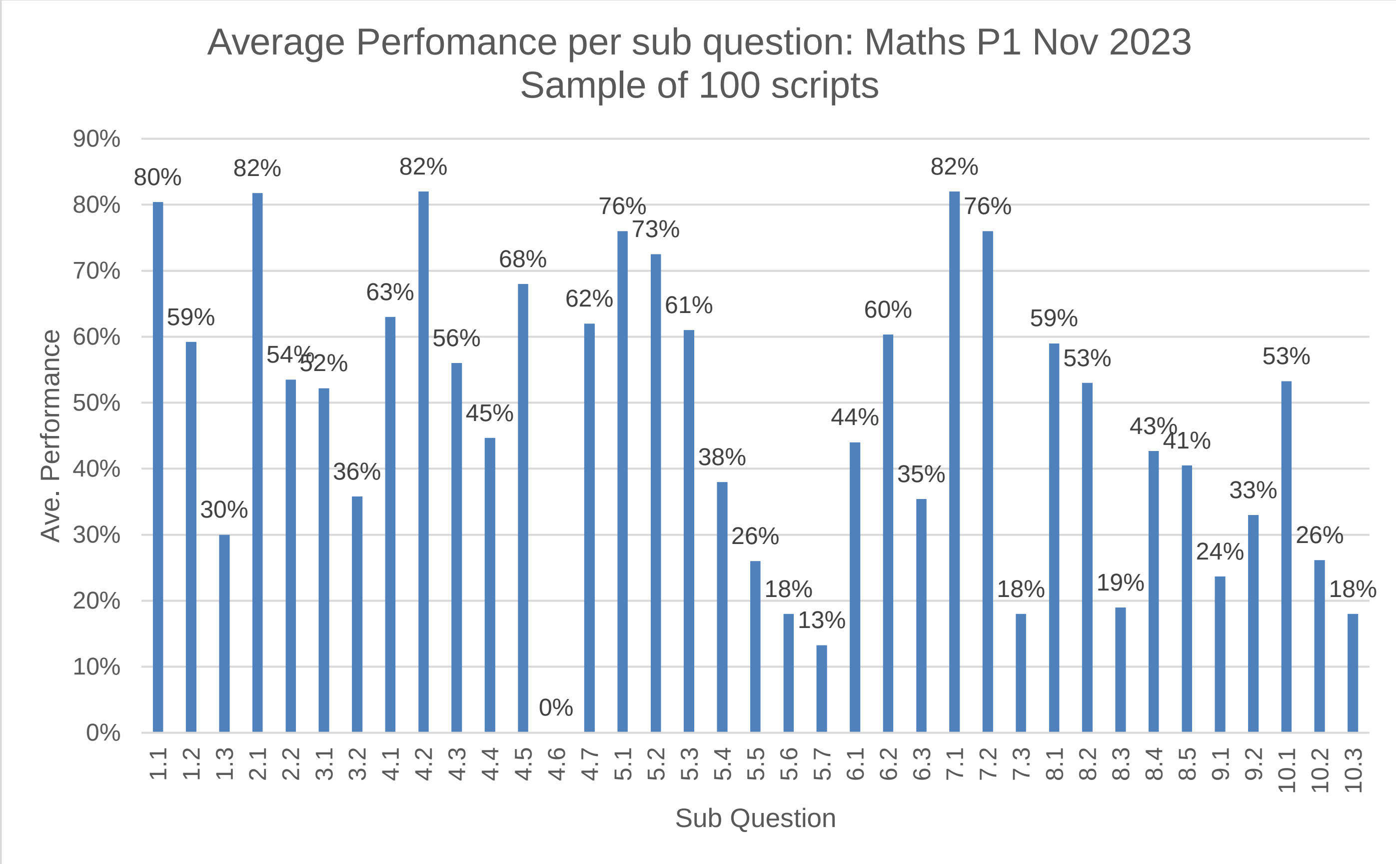
Based on the Rasch analysis, 53 of the 100 learners that were sampled managed to meet the pass requirements of at least 30%. The average for the sample is 53% with a sample standard deviation of 28.12 which implies that the sample data is widely spread. The sample was drawn randomly from the scripts that were written by the 2023 matric students from our province. The most well answered questions were QUESTIONS 1, 2 and 7 which averaged 68%, 68% and 65% respectively. This is probably due to the more accessible nature of the question paper and familiarity of most of the sub questions in these sections. This was a good performance compared with a sample average of 53% for the whole paper. Also common in these questions is the routine nature of questioning exhibited in all the well answered questions.

Generally, one can say that the paper was very accessible to most candidates, even those candidates that did not get good assistance in Grade 12. QUESTION 9 still remains the poorest answered question although this year's question was not that difficult. While it still remains a higher order question, it was of a nature that would have been covered in a classroom situation. Owing to the usually challenging questions in this topic, candidates might have failed to answer the question because they did not cover topic in class. It is common practice in some schools that difficult topics are scantly and sometimes never covered.

The most poorly answered question in the whole question paper was QUESTION 4.6 followed closely by QUESTION 10.3.2. QUESTION 4.6 is not a familiar question although it is part of the syllabus. As Level 4 question, it is normal practice that a totally new question is asked in this manner. As for QUESTION 10.3.2, like questions have been asked before albeit from a different angle. Not one candidate scored a single mark from QUESTION 4.6 in the whole sample of 100. All learners in the sample dropped the 2 marks. One can confidently say the contents of the question paper are generally part of the expectations of the CAPS document. There is no question in the question paper that can be classified as not meeting the CAPS requirements. Just that for higher order questions, a learner was supposed to have prepared thoroughly. It is common that many of our learners write tests and exams without adequate preparation. It is important for candidates to practice past exam papers so that they are familiar with how questions are asked. Candidates who would have practised past exams questions would increase their chances of answering questions with relative ease and efficacy.



If we delve deeper into sub questions analysis, we can see the impact of higher order questions on such questions like, QUESTIONS 3, 4, 5, 9 and 10. Such questions like 1.3, 3.2, 4,6, 5.6 and 5.7 are some of the questions where candidates struggled to get marks. An analysis of each sub-question is going to be under taken. Suggestions, where necessary, would be given to help both educators and learners try to improve on the subject.



SECTION 2: Comment on candidates' performance in individual questions

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

QUESTION 1

1.1 Solve for x:

1.1.1 $x^2 + x - 12 = 0$ (3)

1.1.2 $3x^2 - 2x = 6$ (answers correct to TWO decimal places) (4)

1.1.3 $\sqrt{2x+1} = x - 1$ (4)

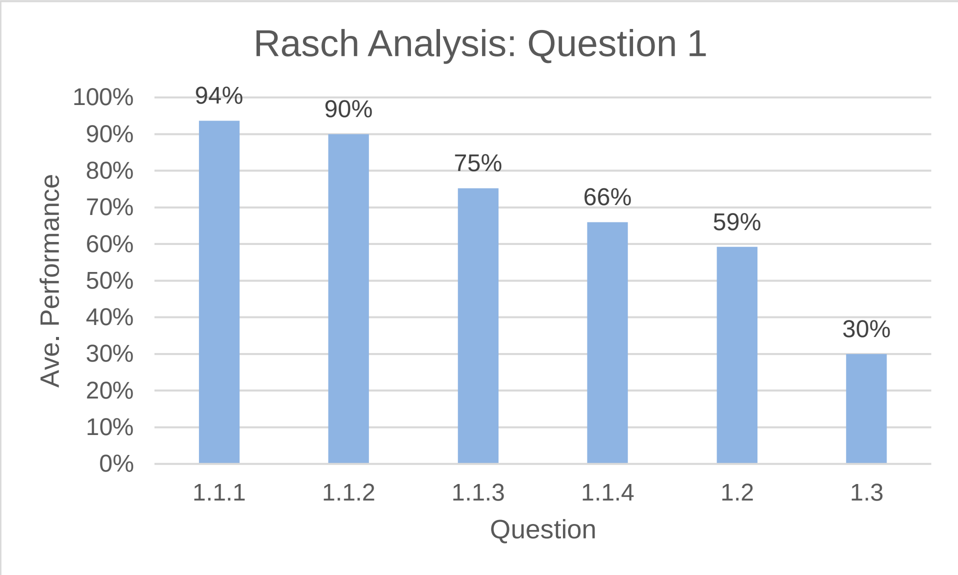
1.1.4 $x^2 - 3 > 2x$

1.2 Solve for x and y simultaneously:

$x + 2 = 2y$ and $\frac{1}{x} + \frac{1}{y} = 1$ (5)

1.3 Given: $2^{m+1} + 2^m = 3^{n+2} - 3^n$ where m and n are integers.

Determine the value of $m + n$.	(4) **[24]**



QUESTION 1 is generally expected to boost the candidates' chances of getting high marks. Besides, some of the content tested in this section dates back to Grade 10 content. As such, this question paper was no exception, most questions were accessible to the majority of the candidates. According to the above graph, it is clear that learners tend to do well in this topic although we still have challenges with learners who cannot do basic factorisation of trinomials and solve simple quadratic equations and inequalities. In as much as the simultaneous equations were not difficult, there was a challenge with the fractional part, most learners managed to collect only the first two marks and nothing else.

(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 1.1.1

- Generally, well done, with an average score of 94% in the 100 sampled scripts. It is common that this question is accessible to all learners.
- Very few learners could not correctly factorise the trinomial, some got $(x+3)(x-4)=0$ instead of $(x-3)(x+4)=0$.
- In the inequality, we still have a lot of learners who solve them the same way that they solve equations without paying attention to the inequality signs.
- Learners should avoid relying on the calculator to just get answers without conceptual understanding.

QUESTION 1.1.2

- Equally, an easy question for the majority of learners although there were some learners who could not rewrite the equation in standard form, thereby losing all the 4 marks.
- While substituting into the formula is not a challenge, there is carelessness in making careless

mistakes. There is a feeling that one has that some leaners are even taught to ignore the signs since they will not change the answer, e.g. $x=\frac{-(-2)\pm\sqrt{(-2)^2-4(3)(-6)}}{2(3)}$ and $x=\frac{2\pm\sqrt{(2)^2-4(3)(-6)}}{2(3)}$ would give you the same result. As teachers we should always be careful to always teach for conceptual understanding rather than just passing the exam.

- One other common error was for learners to use wrong quadratic formula yet the formula is given in the formula sheet. Learners should always be encouraged to copy the formula from the formula sheet to avoid unnecessary loss of marks.

QUESTION 1.1.3

- This a common question that is available in past examination question papers.
- As such, the majority of learners were able to garner some marks with an average of 75% in the sampled scripts.
- Squaring method to some candidates is still a challenge, as some learners squared the right hand side separately.
- $\left(\sqrt{2x-1}\right)^2=(x)^2-(1)^2$.
- Moving forward, some of the candidates divided by x when they were supposed to use zero factor method to reduce the quadratic equation into a linear equation $x-4=0$. Again, this resulted in loss of marks.
- In the final step, most candidates did not check the validity of the answer.

QUESTION 1.1.4

- Most candidates did not have a problem with acquiring the first 2 marks, the problem came when interpreting their answers. The majority of the learners could not get the final 2 marks because they could not interpret the answer.
- Understanding the method of solving inequalities is still a challenge as they treat the inequality signs the same as the equal sign in equations.
- Getting incorrect solution to the equation made most candidates loosing 2 marks as the last mark was a combo mark.
- Most candidates seem not to have a conceptual understanding of the inequality signs, they write meaningless inequalities like $-1>x>3$ or $x\in(-1;-\infty)$
- Writing the answer in graphical solution has no mark, it is regarded as a method and the solution must be given as an inequality or interval notation.
- Number line, tables, parabola are various methods that can be used in solving inequalities. It would

help candidates to understand the solution to an inequality if the problem is unpacked and demonstrated by using various values within the interval.

QUESTION 1.2

- This was supposed to be a very easy set of simultaneous equations but many candidates did not get it right mainly because some candidates could not go beyond the stage of substitution.
- Our learners tend to be confused by algebraic fractions, particularly if the unknown is in the denominator. In this case, if the equation was written as $y+x=xy,$ it could have been more accessible to candidates.
- Fractions in general are always a problem, learners should be made aware of their importance in the lower grades.

QUESTION 1.3

- The question proved to be challenging to most learners although the correct values of *m* and *n* without working could have given the candidates full marks. They could have used trial and error method and got the marks since the values are that small.
- Most candidates were not able to apply the rules of exponents in this question. While most could get to $2^m(3)=3^n(8),$ most learners did not know what to do beyond that. Many tried to force for a common base for 3 and 8 which did not work.
- For some who managed to take it further, they left their answers at $m=3$ and $n=1.$ They forgot to add the two together.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Educators can refer to Mind the Gap study guide compiled by the Department of Basic Education for inequalities. Educators should take more time in grade 10 and put more emphasis in teaching learners on how to represent inequalities
  e.g. $-1<x<3; x<-1 \text{ or } x>2.$
- Difference between **AND ; OR** must be explained thoroughly so that learners do not to confuse the two terms
- Most of the content in Question 1 is completed in grade 11, therefore Grade 11 work should be revised and whenever learners are to write controlled test try to include Question 1 content.
- As learners struggle with factorization, educators must encourage those learners to use the quadratic formula as an alternative.
- Learners must be reminded about rounding off, they should know that incorrect rounding off results in loss of marks.
- Usage of quadratic formula should not only be confined to the variable x as the unknown, but also use other variables.
- Learners must be reminded that when squaring surds, both sides of the equations must be considered.

- Expansion of quadratic expressions of the form $(x+a)^2$ should be practised thoroughly to maximize of marks per question.

QUESTION 2

2.1 Given the arithmetic series: 7 + 12 + 17 + …

2.1.1 Determine the value of T_{91} (3)

2.1.2 Calculate S_{91} (2)

2.1.3 Calculate the value of n for which $T_n = 517$ (3)

2.2 The following information is given about a quadratic number pattern:

$T_1 = 3$, $T_2 - T_1 = 9$ and $T_3 - T_2 = 21$

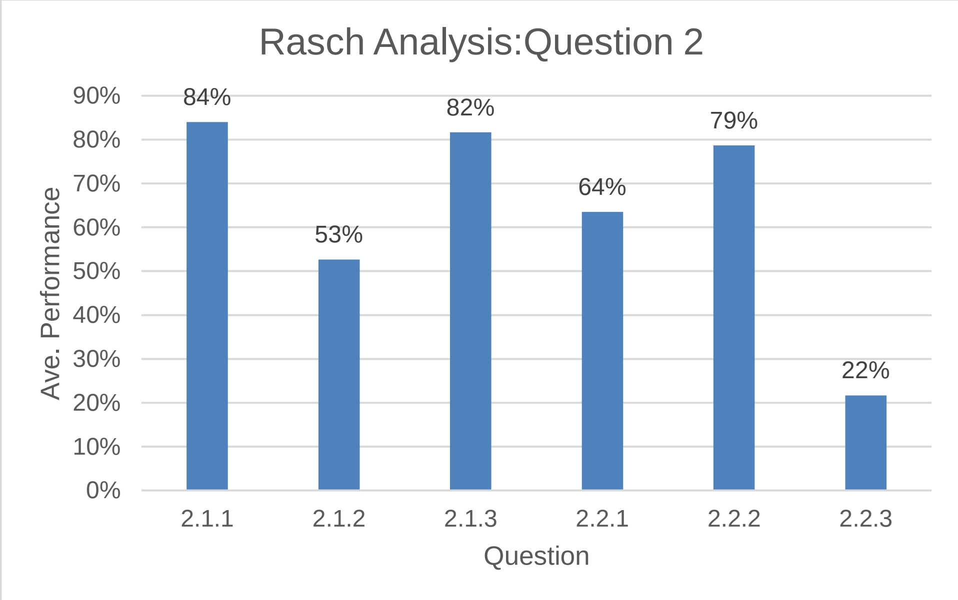
2.2.1 Show that $T_5 = 111$ (2)

2.2.2 Show that the general term of the quadratic pattern is $T_n = 6n^2 - 9n + 6$ (3)

2.2.3 Show that the pattern is increasing for all $n \in N$. (3)

[16]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



The question was generally well answered, particularly Question 2.1, 2.1.3 and 2.2.2. The major reason this could have happened could be that the question was largely covering Grade 10 & 11 content. With 68% average for the question, it was reasonably well done. While the first part of the question concentrated on arithmetic number patterns, quite a big percentage of learners struggled to get it right.

(b) wWhy were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 2.1.1

- This question was well answered although quite a number of candidates made some regrettable errors e.g. T_{19} instead of T_{91}. This was a very common error across board.
- The majority of the learners were able to identify that the series is linear although they could not correctly substitute.

QUESTION 2.1.2

- Not badly done but generally learners struggle with any S_n formula, even though the formulas are available in the formula sheet. They are not sure which S_n formula to use when between linear and geometric series.
- Some of those that used $n = 19$ instead of $n = 91$ corrected the value in this question.

- A number of them used the S_∞ formula instead of the expected sum of a geometric series formula.

QUESTION 2.1.3

- One of the best answered questions, although there were some candidates who could not identify the right formula to use.
- Most candidates found it easy to correctly substitute into the T_n formula of a linear number pattern.
- For most of those who did not score high, it was because of using the wrong formula.

QUESTION 2.2.1

- This was an easy question but the provision of the formula in Question 2.2.2 made many candidates use the given formula to answer this question, resulting in them losing marks.
- Otherwise for those that showed that $T_5 = 111$without using the formula got it right.
- Probably it would have been better for the two questions 2.2.1 and 2.2.2 to be swapped around. This would have given access to more candidates.
- Candidates tried to be creative in their answering showing that $T_5 = 111.$
- It is very important to indicate the common difference when working with quadratic sequence. The basic diagram was sufficient in answering the question.

i.e. 3 12 33 66 111

9 21 33 45

12 12 12

QUESTION 2.2.2

- Well answered with a few computational errors.
- The few that failed were not accurate in their successive substitution of the values of *a*, *b* and *c*.

QUESTION 2.2.3

- Most candidates used the given statement to answer the question without showing any calculation.
- When the verb ‘Show’ or ‘Prove’ is used in the question, candidates are reminded to use calculations, and end with what was asked in the question.
- Most candidates could not get the last mark because they did not conclude.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- If candidates answer similar questions to 2.1.1 by means of expansion, it must be emphasized that the full expansion must be shown.
- Educators, when teaching number patterns, must deal with each type separately, so as to make learners be able to understand when mixed questions of arithmetic and geometric sequences /series are tested
- Learners must be reminded that *n* in number patterns is always a natural number.
- Expose learners more, to questions that require them to apply the words 'Show', 'Prove', so as to make them understand that they are not allowed to use the given formula.
- Educators must teach or show learners how the formula for quadratic number pattern is derived i.e.

  using
  $$T_1 = a + b + c$$
  $$T_2 = 2a + 4b + c$$
  $$T_3 = 3a + 9b + c$$

- This could help the learner to be flexible when proving quadratic number patterns.

QUESTION 3

3.1 Given the geometric series: $3+6+12+\ldots$ to n terms.

3.1.1 Write down the general term of this series. (1)

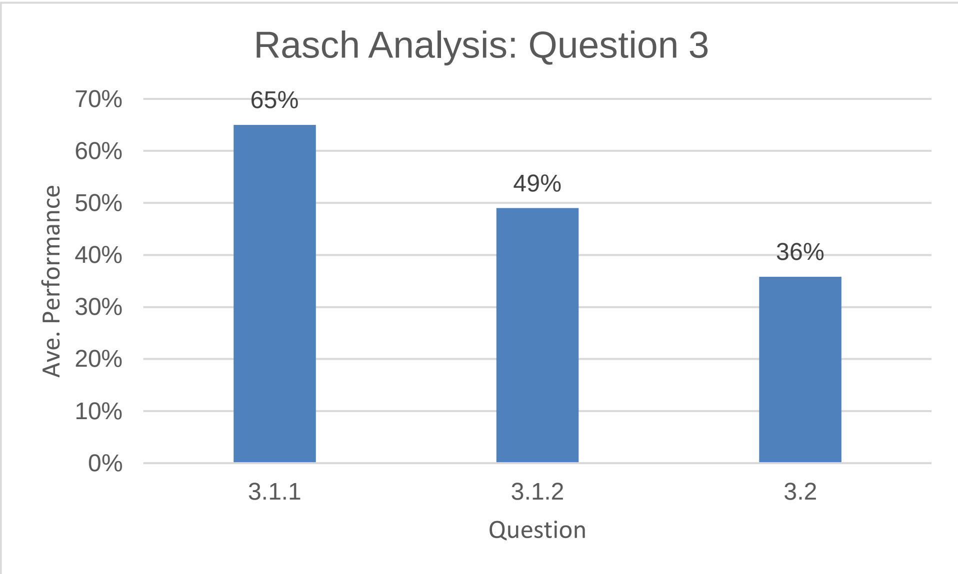
3.1.2 Calculate the value of k such that: $\sum_{p=1}^{k}\frac{3}{2}(2)^{p}=98\,301$ (4)

3.2 A geometric sequence and an arithmetic sequence have the same first term.

- The common ratio of the geometric sequence is $\frac{1}{3}$
- The common difference of the arithmetic sequence is 3
- The sum of 22 terms of the arithmetic sequence is 734 more than the sum to infinity of the geometric sequence.

Calculate the value of the first term. (5)

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



This was a well answered question particularly QUESTION 3.1.1. Although this was worth 1 mark, the majority of the candidates got it right. Most candidates went on to use the T_n that they found in QUESTION 3.1.1 to solve the series problem in 3.2.2. Many learners have a problem with interpreting the meaning of the sigma notation and writing down the terms that are added in the series. The performance in the final question was not good, as this was a higher order question. Most learners managed to pick up a few marks for substitution although some could not identify the right formula to use in each case.

(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 3.1.1

- The biggest challenge in this question was candidates not picking the right formula. In the case of this question, most candidates got the mark.
- The few who didn't get any mark, they just used any number pattern formula.

QUESTION 3.1.2

- Most of the candidates struggled with this question. This is mostly because of the sigma notation that learners do not understand.
- Mostly, if a candidate failed to expand the series, they could not get more than 1 mark for $n = k$.

QUESTION 3.2

- Formulas were a big issue in this question. Even then, the meaningful interpretation of the question was lacking with most of the candidates.
- Instead of S_{22}, they used T_{22} and also many were confused on how we 734 was to be accommodated.
- Instead of the S_∞ formula, some used the S_n formula for a geometric series.

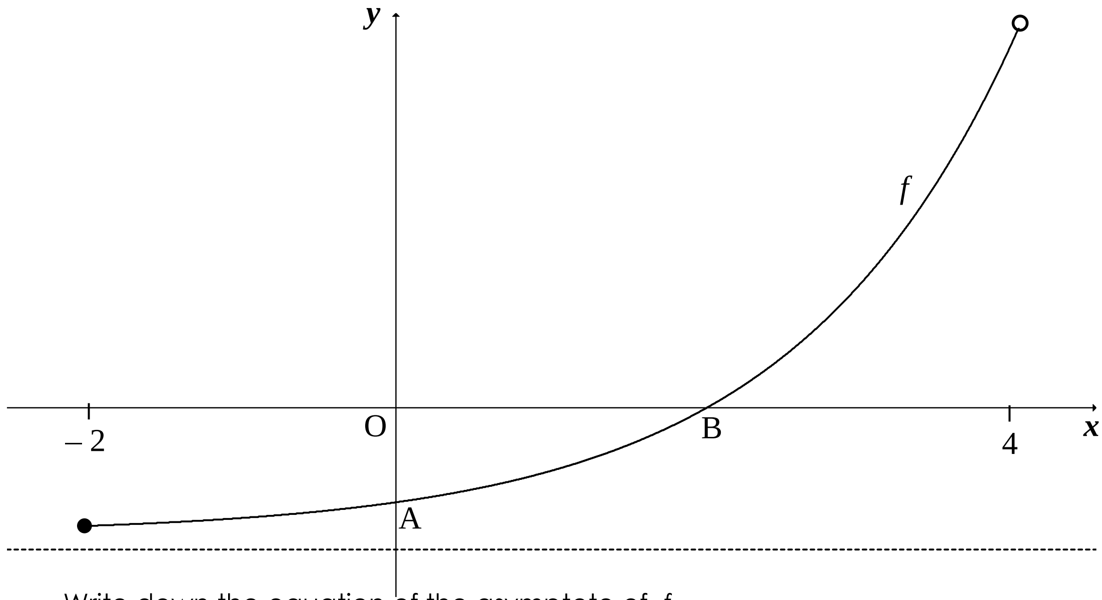
(c) Provide suggestions for improvement in relation to Teaching and Learning

- Educators are encouraged to emphasize on the differences between the term, sum and infinity formulas.
- Answering past exam papers related to the topic would also go a long way in trying to help the learners understand.
- Educators should always alert the learners of the different formulas that they can get on the formula sheet.

QUESTION 4

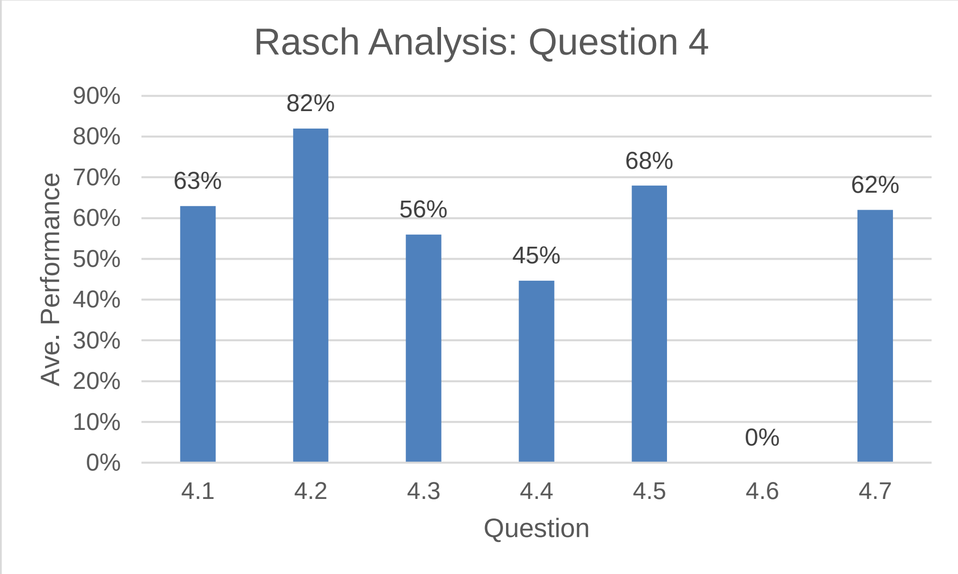
Sketched below is the graph of $f(x) = 2^x - 4$ for $x \in [-2\,;\,4)$.

A and B are respectively the *y*- and x-intercepts of *f*.



4.1	Write down the equation of the asymptote of *f* .	(1)
4.2	Determine the coordinates of B.	(2)
4.3	Determine the equation of *k*, a straight line passing through A and B in the form *k*(*x*) = …	(3)
4.4	Calculate the vertical distance between *k* and *f* at x = 1	(3)
4.5	Write down the equation of *g* if it is given that $g(x) = f(x) + 4$	(1)
4.6	Write down the domain of g^{-1}.	(2)
4.7	Write down the equation of g^{-1} in the form *y* = …	(2)
		[14]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The question was generally well answered, particularly Question 4.1. Learners are generally comfortable with writing the equation of asymptote. The restriction in the domain could have confused a number of learners since in the recent past exams there have not ha that kind of asking.



(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 4.1

- This was the best answered sub question in this question.
- Some of the few candidates who got it wrong wrote $q=-4$ as their answer.

QUESTION 4.2

- The question was fairly well answered.
- Most candidates could easily write down the x-coordinate of B as the point lies on the x-axis.

QUESTION 4.3

- This was supposed to be an easy question for most of the learners but it was not as well done as one would have expected.
- Most candidates followed the route of using $y=mx+c$, and substituted one of the coordinates of A or B. Sadly, a number of candidates could find the coordinates of A but in the final equation of *k*, they used a positive *y*-intercept.
- Equally, some candidates could not realise that the gradient of *k* was positive, as such it was impossible for them to find a negative gradient of the line.

QUESTION 4.4

- Most candidate do understand the concept of the higher value of *y* subtracting the lower value of *y*. Unfortunately many did not substitute into $\frac{3}{2}x-3-(2^x-4)$ for them to get full marks. Even then, they did not get any mark because the first mark was for the numerical values after substitution.
- A few learners did subtract $k(1)$ from $f(1)$ thereby getting a negative $\frac{1}{2}$ and did not change to positive since it's a distance.

QUESTION 4.5

- This was certainly not a problem at all, most candidates got it right. It was interesting though to note that quite a number of candidates left their final answer as $y = 2^x - 4 + 4$. This was possible because the candidates were not confident with determining the equation of an exponential function.

QUESTION 4.6

- This was the most difficult question in the whole question paper.
- In as much as in class, we talk a lot about the relationship between the coordinates of a function and its inverse, we seldom explain on what happens between the coordinates of the range and domain of an inverse.
- One of the major reasons is that the question is not familiar such that when the candidates were revising, they could not have come across such a way of questioning.
- What could have complicated the situation is that the domain was restricted, again not a familiar way of questioning. In real terms, this was supposed to guide the candidates in relating the coordinates of the domain of a function to coordinates of the range of its inverse.
- Based on the Rasch analysis, no candidate managed to score any marks in this question.

QUESTION 4.7

- For those candidates who were able to find the correct $g(x)$, finding it's inverse was not a problem at all.
- We believe that if $g(x)$ was given somewhere in the question, it was going to be more accessible to more candidates. Most that could not get it right, not because they could not find the inverse of an exponential function, but because they did not get the correct $g(x)$ in Question 4.5. If it was given to them, they probably would have gotten it right.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Expose learners to more higher order questions.
- Explain the concept of finding a vertical distance between function using visual applications like Geogebra, Graph, Sketchpad etc.
- The concepts of domain and range should be explained even in the context of inverses.
- In relation to functions, teachers should clearly explain when to use $y = q$ or $x = p$. Learners tend to use *p* and *q* in place of *x* and *y* respectively.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

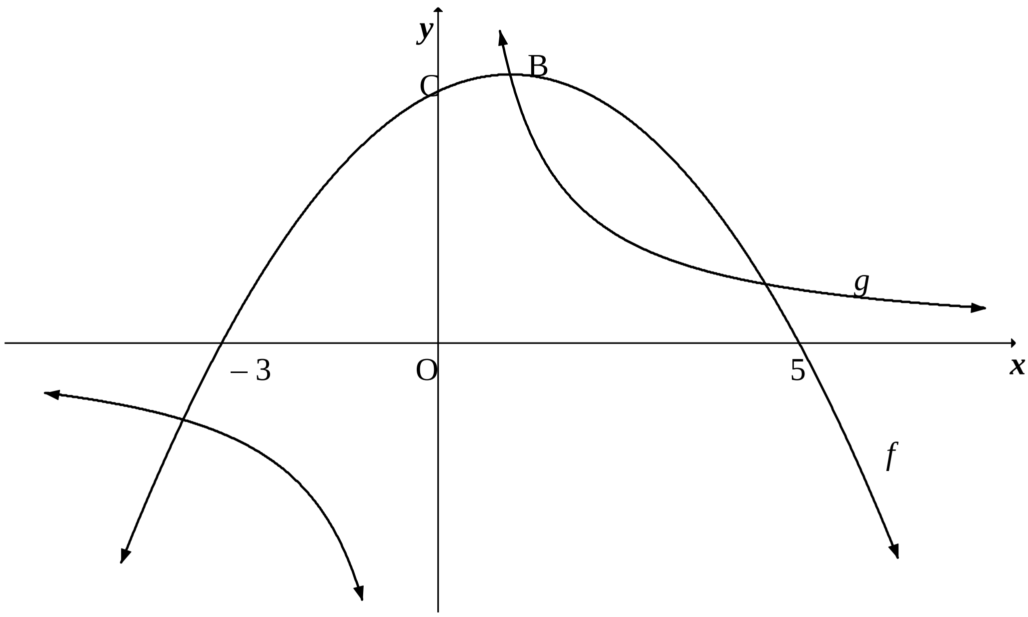
- Educators must train learners on how to interpret graphs. In most case mathematics software like graph system or GeoGebra can be used for illustration and visualization purposes.
- Learners should be thoroughly trained in logarithm functions, exponential functions and inverses

function.

- Educators to more emphasize on the concept of solving logarithm equations and how it relates with the exponential functions.
- Graph interpretation and how to interpret inequalities from graphs should form part educators' lesson planning when teaching functions.

QUESTION 5

The graphs of $f(x) = -\frac{1}{2}(x-1)^2 + 8$ and $g(x) = \frac{d}{x}$ are drawn below. A point of intersection of *f* and *g* is B, the turning point of *f*. The graph *f* has x-intercepts at $(-3\,;0)$ and $(5\,;0)$ and a *y*-intercept at C.

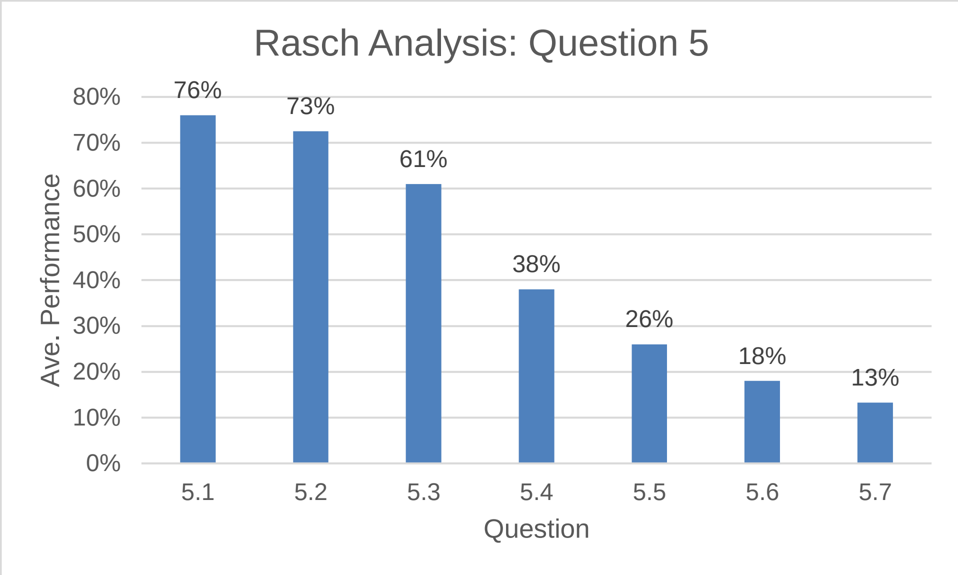


5.1	Write down the coordinates of the turning point of *f*.	(2)
5.2	Calculate the coordinates of C.	(2)
5.3	Calculate the value of *d*.	(1)
5.4	Write down the range of *g*.	(1)
5.5	For which values of x will $f(x).g(x) \le 0$?	(3)
5.6	Calculate the values of *k* so that *h(x)* = – 2x + *k* will not intersect the graph of *g*.	(5)
5.7	*h* is a tangent to *g* at R, a point in the first quadrant. Calculate *t* such that $y = f(x) + t$ intersects *g* at R.	(4)
		[18]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

The question was fairly well answered probably because the format in which the equations of f and g were given was what the candidates are familiar with. The first 3 sub questions were routine questions that are generally covered in class, hence they were accessible to most learners. Only QUESTIONS 5.6 and 5.7 were of a higher order.

They were quite challenging and only above average performers managed to get some marks.



(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 5.1

- Generally, candidates did not have a problem with this question, it was well answered. A few learners though wrote the x coordinate as $x = -1$. This later complicated their answering of QUESTION 5.3.

QUESTION 5.2

- Equally this question was well answered, only a few learners gave a negative *y* coordinate.
- It was only in a very few cases that candidates could not identify the x-coordinate as 0.

QUESTION 5.3

- A supposedly easy question that was answered fairly well.
- Most learners who could not get the correct value of *d* used the $x = -1$ that they used in Question 5.1. Even if they got the CA answer correct, this was supposed to alert them that their answer is not correct since a negative *d* would imply that the graph of *g* exists in the second and fourth quadrant.

QUESTION 5.4

- Candidates generally do not have problems with finding a range of a function but somehow they struggle if the line of asymptote lies on the axes.
- Quite a few candidates just only wrote $y \in \mathbb{R}$. They could not locate the line of asymptote for the function.

QUESTION 5.5

- This question was poorly answered, it was quite a challenge. Possibly the wording was also not familiar for the candidates.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Revisit transformations from grade 8 and 9 when teaching functions.
- Teach the interpretation of graphs from grade 10.
- Integrate topics from grade 10.
- The concept of plotting points on cartesian plane must be revised. This will remind learners on how to write solutions in coordinate form.
- Educators can make use of GeoGebra (free download) to illustrate the concept of parallel, perpendicular and tangents to learners and make the connection between algebraic calculations and graphs. For instance, when teaching the concept of tangents and parabola, GeoGebra can be utilised to illustrate as shown in the diagram below:
- Interpretation of functions and the correct notations (inequalities) should be stressed when revising. Putting more emphasis on grade 10 and 12 functions.

Revision of basics algebra when teaching functions because functions need algebraic skills like factorization, solving of equations etc.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- There are too many learners taking Mathematics who lack the basic skills.
- Candidates do not read the instructions/questions and do not motivate/explain an answer if asked for a motivation or explanation. They must give an equation if an equation is asked and not stop too soon. Give coordinates if coordinates are asked for.
- The language barrier remains a problem for many candidates.
- Motivate learners to write neatly and answer the questions in numerical order.
- Point out the instruction that states that an answer only will not necessarily be awarded full marks.
- When x-intercepts, stationary points or inflection points are calculated, equating to 0 is important and carries a mark.
- If a sub-question is answered out of place from the rest of the question it is always good to write a note regarding the page on which it is redone.
- Tell learners to always consult their diagrams (Functions) and to critically analyse their responses to questions – example if the $y - intercept$ is below the $x - axis$ then it has to be negative. If they get a positive answer, they must realise that somewhere along the line they made a mistake and need to trace back to find their mistake.

QUESTION 6

6.1 Patrick deposited an amount of R18 500 into an account earning *r*% interest p.a., compounded monthly. After 6 months, his balance was R19 319,48.

6.1.1 Calculate the value of r. (3)

6.1.2 Calculate the effective interest rate. (2)

6.2 Kuda bought a laptop for R10 000 on 31 January 2019. He will replace it with a new one in 5 years' time on 31 January 2024.

6.2.1 The value of the old laptop depreciates annually at a rate of 20% p.a. according to the straight-line method. After how many years will the laptop have a value of R0? (2)

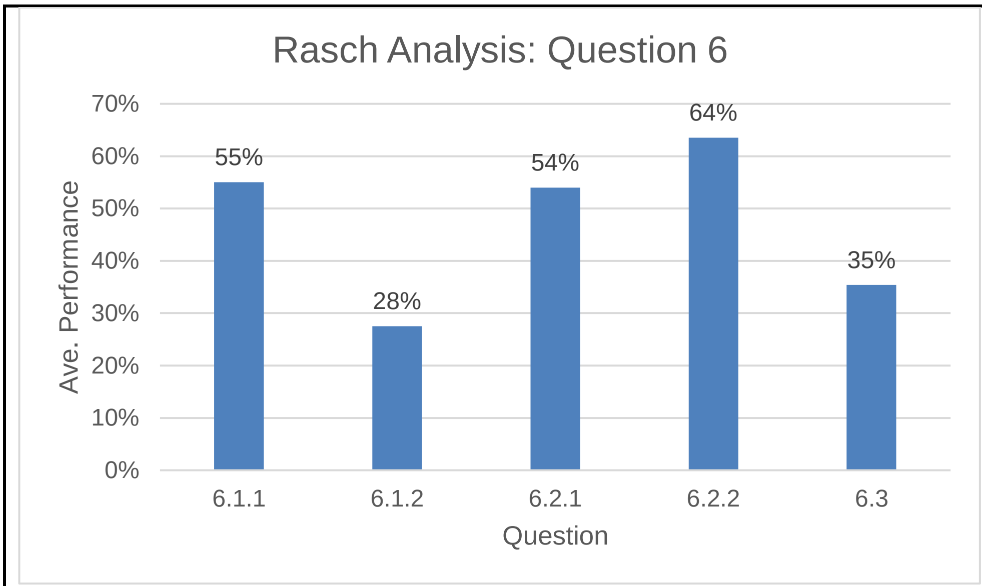
6.2.2 Kuda will buy a laptop that costs R20 000. In order to cover the cost price, he made his first monthly deposit into a savings account on 28 February 2019. He will make his 60^{th} monthly deposit on 31 January 2024. The savings account pays interest at 8,7% p.a., compounded monthly. Calculate Kuda's monthly deposit into this account. (4)

6.3 Tino wins a jackpot of R1 600 000. He invests all of his winnings in a fund that earns interest of 11,2% p.a., compounded monthly. He withdraws R20 000 from the fund at the end of each month. His first withdrawal is exactly 1 month after his initial investment. How many withdrawals of R20 000 will Tino be able to make from this fund?

(5)

[16]

(a)	**General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?**



Question 6 was generally fairly answered, especially 6.1.1, 6.2.1 and 6.2.2. The only challenge was that candidates were mixing formulas.

(b)Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 6.1.1

- This was a Grade 11 concept that does not give problems to the matrics.
- Many of the learners that did not get it right could have failed due to the value of $n = 6.$ Generally learners find it difficult to deal with months if they are not a multiple of 12. Some used $\frac{1}{2}$ while many used 72 months.

QUESTION 6.1.2

- While this is a straight forward Grade 11 concept, the candidates were probably put off their line of thinking by the 6 months.
- In the marking guideline, if $n \neq 12,$ it was a breakdown, which probably explains why the average was this low.

QUESTION 6.2.1

- A fairly well answered question although R0 could have offset some of the candidates.
- A number of candidates were confused at which formula to use between simple or compound interest or between appreciation and depreciation.
- This question was generally well answered.
- This was due to the marking guideline which was very kind. Answer only was worth 2 marks yet some

of the learners got $n = 5$ from subtracting 2019 from 2024.

QUESTION 6.2.2

- This was a straight forward future value question, hence the good average in the question.
- It was also good that marks were independently awarded for the correct values of *i* and *n*.

QUESTION 6.3

- The question was not as well answered as one would have expected. With an average of 35%, it becomes one of the least performed question.
- Most learners could not realise that the present value formula was the one expected to be used.
- The other issue was that for one to get full marks in the question, he/she had to round his answer downwards, and not upwards. which is what learners are used to. So many learners could not get that lat mark as they rounded off their answer to 148 instead of 147.
- The other big factor in financial mathematics is the issue of language. If a question is long and wordy, the learners tend to lose the meaning of the question.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- When teaching this topic, educators should train their learners to look for key words in the given information. This would in turn help them to understand the questions better.
- Always encourage learners to copy the formulas from the formula sheet as there are too many cases of incorrect formulas.
- Educators must use correct terminology and ensure that learners have a clear understanding of all the financial terminologies.
- The timeline sets the scene for mathematical thinking and there will be no need to repeatedly read the question.
- It is recommended that learners practise the i and n value independently from the formulae. Once a learner understands the impact of different compounding periods they can thereafter focus on interpretation and substitution using the correct formulae.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

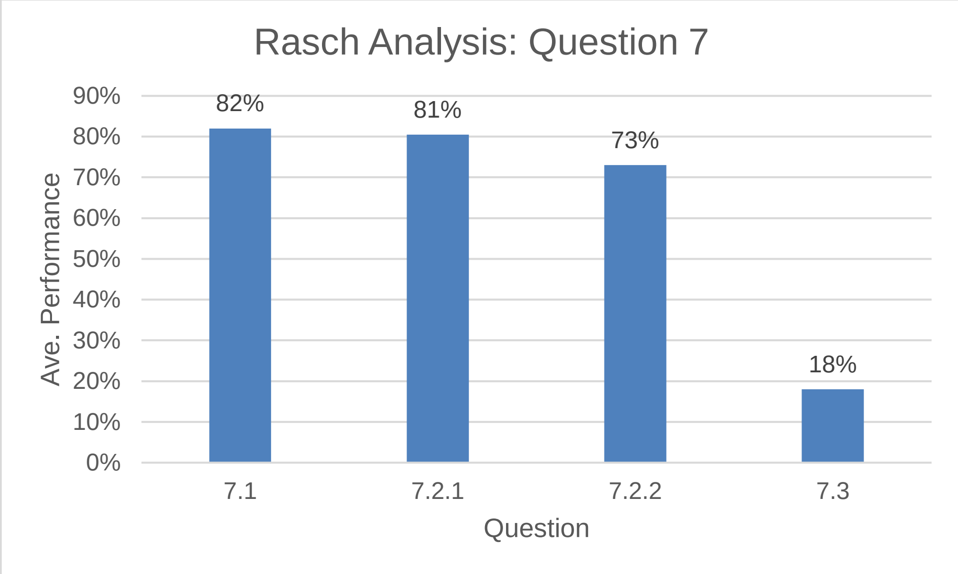
- It is recommended that special attention be given to this topic and that workshops be organised in various districts as to enrich the educators so that they can be empowered and hopefully give learners a better understanding of the topic.
- Learners should also be exposed to the various scenarios giving guidelines as to the selection of the best formula.

- Reading skills and calculator skills play a crucial role in the answering of financial maths and these skills must be practised.
- Teachers must use correct mathematical language when teaching finance.
- make sure that learners know when to use which formula when doing finance

QUESTION 7

7.1	Determine $f^{/}(x)$ from first principles if $f(x) = -4x^2$		(5)
7.2	Determine:		
	7.2.1	$f^{/}$(x) if $f(x) = 2x^3 - 3x$	(2)
	7.2.2	$D_x\left(7.\sqrt[3]{x^2} + 2x^{-5}\right)$	(3)
7.3	For which values of x will the tangent to $f(x) = -2x^3 + 8x$ have a positive gradient?		(3) **[13]**

(a)	**General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?**



This is one of the best answered questions in the whole questions in the whole question paper. Candidates seem to have been comfortable with differentiating from first principles. The questions were ordinary and similar to those that leaners do in class which made them more accessible to learners. Notation has improved over time, candidates used lose a mark each for not using the correct notation.

(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 7.1

- The question was generally well answered.
- There were a few candidates who lost a mark each due to incorrect notation but the fact that notation was only for the limit, it means that some learners managed to get good marks.

QUESTION 7.2.1

- Another well answered question owing to its simplicity and straight forwardness.
- If the candidates were ready for the exam, they were not supposed to have a problem at all.

QUESTION 7.2.2

- Generally a well answered by most of the learners.

QUESTION 7.3

This question was poorly answered.

- For the low to middle performers, this was a very challenging question. Most tried to answer but they did not score any marks.
- Although the concept of a gradient is clear to most learners, the way the question was asked could have caused the candidates not to understand the meaning of the question.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Knowledge of simplifying algebraic expressions and exponents and surds is therefore required.

- Educators should try and keep calculus simple and structured and teach the basic principles as not to confuse learners. Higher level questions can thereafter be introduced to brighter learners.
- The use of GeoGebra is once again advised.
- Educators must emphasise the importance of writing down the complete formula and taking care to use the correct notation throughout the solution.
- Educators MUST know that the following are regarded as notation errors and candidates are penalised once commtted:
  1. If $f'(x)$ was not shown as part of the formula.
  2. If the lim is omitted too soon.
  3. If an equal sign was written between the $\lim$ and the fraction part.
- Teachers must focus more on the types of questions that include root signs, brackets and denominators, when dealing with derivatives.
- Assess learners on how to get expressions in a form appropriate for differentiation purposes: for instance, if the questions involves square roots and fractions.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Basic foundation skills from Grade 8 and 9.
- Educators must teach the syllabus and ensure that credibility in terms of assessments is observed.
- Unseen questions to be given to the top performing learners.

QUESTION 8

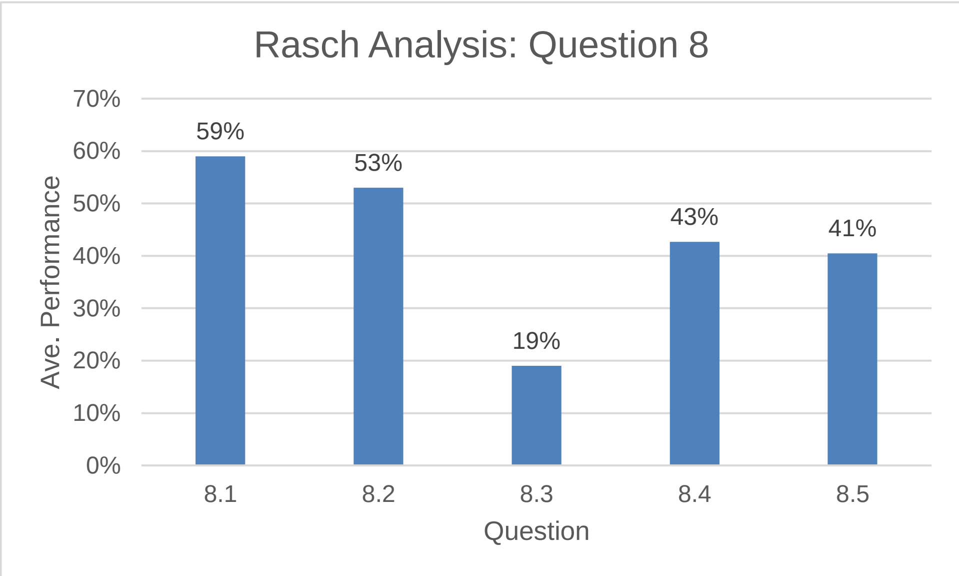
Given: $f(x) = -x^3 + 6x^2 - 9x + 4 = (x-1)^2(-x+4)$

8.1 Determine the coordinates of the turning points of f. (4)

8.2 Draw a sketch graph of f. Clearly label all the intercepts with the axes and any turning points. (4)

8.3	Use the graph to determine the value(s) of k for which $-x^3+6x^2-9x+4=k$ will have three real and unequal roots.	(2)
8.4	The line $g(x)=ax+b$ is the tangent to f at the point of inflection of f. Determine the equation of g.	(6)
8.5	Calculate the value of θ, the acute angle formed between g and the x-axis in the first quadrant.	(2) **[18]**

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



The question was generally not difficult but candidates did not do very well. QUESTION 8.1 seemed easy for the majority of the candidates and QUESTION 8.3 was the most difficult of the lot.

(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 8.1

- The manner in which the question was asked made it possible for most learners to answer correctly.
- The two format of the cubic function also gave candidates options as which one they cane use to ancer the question.
- Most candidates know that determining coordinates of the turning points of a cubic function would require one to find the first derivative of the function but they always do not write $f'(x)=0$ yet it's always allocated a mark.

- Determination of turning points is generally easier if the equation of the cubic function is given, like in this case.

QUESTION 8.2

- This was fairly done.
- Most learners have no problem with sketching of a cubic function. They got good marks on the sketching.
- There were some learners that lost marks because they did not label their sketch, they did not indicate the turning points yet, in most cases, all the relevant information is worked out on the same page.
- Educators should teach learners to always label their sketches fully and label fully, show turning points, and intercepts.

QUESTION 8.3

- Not well answered.
- Nature of roots is not too much of a problem to most learners but somehow, they struggle to link this to roots of quadratic or cubic function.

QUESTION 8.4

- As a 6 mark question, it was fairly done.

QUESTION 8.5

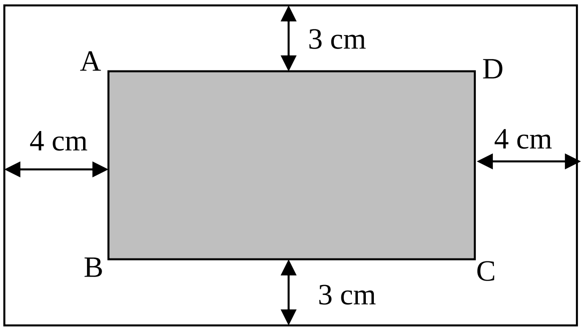
- Fairly answered.
- Most candidates were aware that the gradient of a straight line is equal to the tangent of the angle of inclination of the same line with the x-axis. They could not however

(c) Provide suggestions for improvement in relation to Teaching and Learning

- The concept of plotting points on Cartesian plane must be revised. This will remind learners on how to write solutions in coordinate form.
- Interpretation of functions and the correct notations should be stressed when revising. Putting more emphasis on grade 10 and 12 functions and also basics of algebra because functions need algebraic skills like factorization and solving equations.

QUESTION 9

The diagram below represents a printed poster. Rectangle ABCD is the part on which the text is printed. This shaded area ABCD is 432 cm^2 and AD = x cm. ABCD is 4 cm from the left and right edges of the page and 3 cm from the top and bottom of the page.



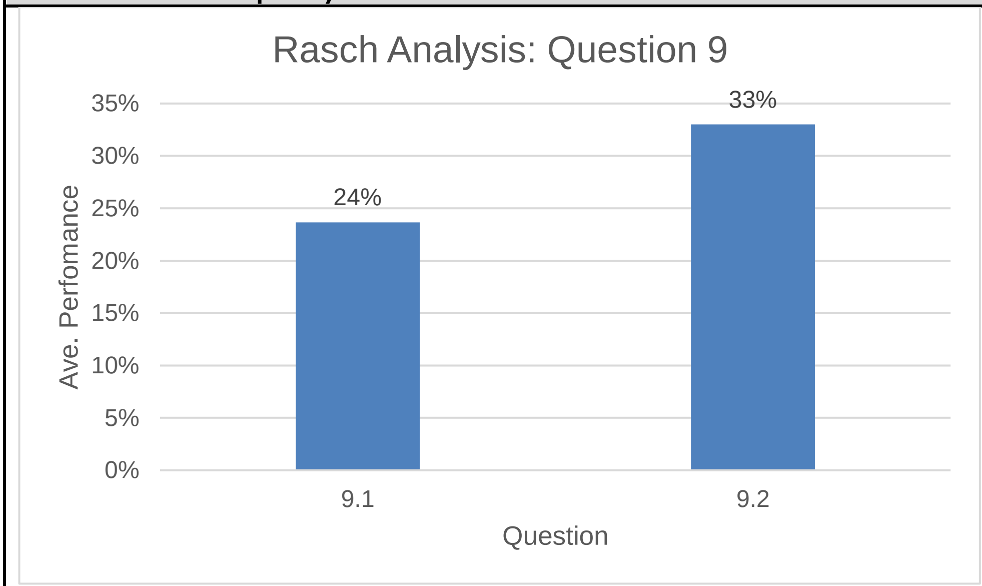
9.1 Show that the total area of the page is given by:

$$A(x) = \frac{3\,456}{x} + 6x + 480$$ (3)

9.2 Determine the value of x such that the total area of the page is a minimum. (3)

[6]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



The question was poorly answered by most candidates although it was clear that the question was easy this time around.

(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 9.1

- The question was poorly answered.
- Learners are generally not comfortable with areas of shapes, more so with an unknown value of x.
- Most candidates could not conceptualize the diagram and hence were not able to find the area of

the of the page.

- Most of the candidates lost more marks in this part Question 9 than in the second one.
- While this is a very straight forward

QUESTION 9.2

- Candidates performed a little better on this question compared to the first part of Question 9.
- Many learners used the given A(x) to find its derivative and then determine the value of x.
- A lot of candidates left their answer as – 24 instead of a positive distance.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Teachers are encouraged to teach all sections of the syllabus regardless of their feelings towards the topic.
- Even if the topic is generally difficult, learners are encouraged to revise the past exam papers on this topic so that if the questions are easy, like this, they are able to answer.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Calculus probably need to done earlier in term 1 so that they answer the questions in different test sessions for more practice.

There is need to consider introducing integration to help learners understand calculus in general.

QUESTION 10

10.1 A and B are independent events. P(A) = $\frac{1}{3}$ and P(B) = $\frac{3}{4}$

Determine:

10.1.1 P(A and B) (2)

10.1.2 P(at least ONE event occurs) (2)

10.2 The probability that it will snow on the Drakensberg Mountains in June is 5%.

- When it snows on the mountains, the probability that the minimum temperature in Central South Africa will drop below 0 °C is 72%.
- If it does not snow on the mountains, the probability that the minimum temperature in Central South Africa will drop below 0 °C is 35%.

10.2.1 Represent the given information on a tree diagram. Clearly indicate the probabilities associated with EACH branch. (3)

10.2.2 Calculate the probability that the temperature in Central South Africa will NOT drop below 0 °C in June 2024. (3)

10.3 Ten learners stand randomly in a line, one behind the other.

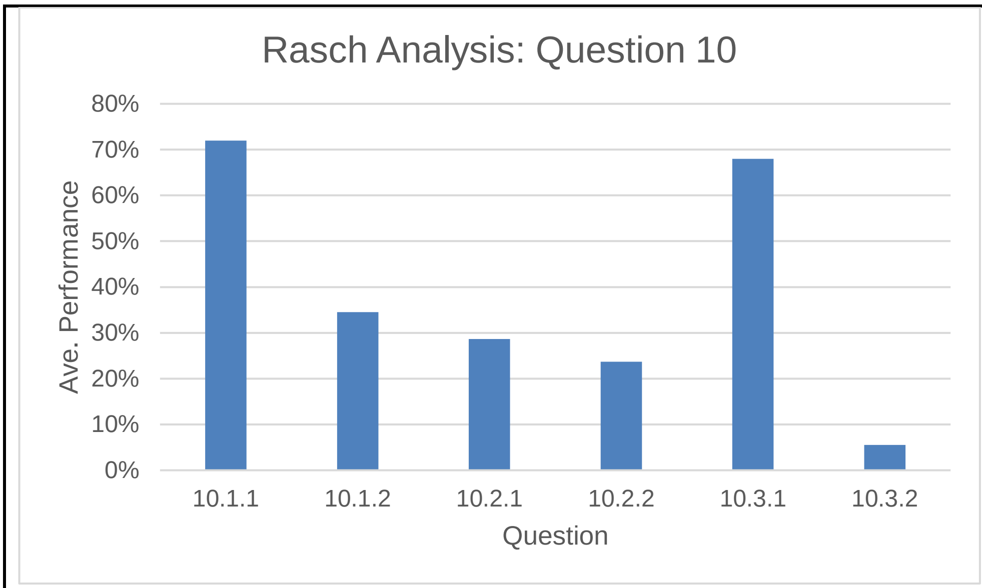
10.3.1 In how many different ways can the ten learners stand in the line? (1)

10.3.2 Calculate the probability that there will be 5 learners between the 2 youngest learners in the line. (4)

[15]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

The question was generally well answered, particularly Question 2.1. The major reason this could have happened could be that the question was largely covering Grade 10 content.



(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

QUESTION 10.1.1

- Most candidates answered this question very well.
- Independent events are generally not a challenge to most learners and this question was no exception. Most candidates were able to work out the required probability.

QUESTION 10.1.2

- This was not a difficult question but it was not well answered most probably because candidates were confused by the use of 'at least one event'.
- They could have done better if the question was asked directly as P(A or B).

QUESTION 10.2.1

- One question that was not well at all.
- Most candidates could not represent the information on a tree diagram.

QUESTION 10.2.2

- Most candidates could not make sense of the question since they did not draw a correct tree diagram in Question 10.2.1. It was badly answered.
- If the tree diagram was correctly drawn, the questions was not difficult. Just that most learners are not very good with conditional probability.

QUESTION 10.3.1

- This was one of the most well answered questions.
- Most candidates find this question accessible especially because it is a common kind of question in the past exam papers.
-

QUESTION 10.3.2

- This was Level 4 question which was one of the most poorly answered questions.
- This was not surprising because most candidates struggle with the counting principle, especially those with different options of arrangements like in this case.
- The accuracy marks awarded to the answers made it even more difficult for a learner to get part marks. In this type of question, a mark is usually awarded to the possibility space but it was not the case this time around.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- This is a very difficult topic for learners but if the Grade 11 component is covered effectively, then teaching the counting principle component becomes lighter.
- Learners are encouraged to revise the Grade 11 probability thoroughly before they start on the counting principle.
- For easier conceptualization, teachers should try to be as practical as they possible be in teaching probability and only use formulas later on, once the ground work is done.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- There is need for conceptual development to be prioritized through projects and investigations. Material needs to be developed that will help build foundations for probability and counting principle.
- As a generally challenging topic, counting principle should not only be taught once towards the end, it should probably be taught early enough for learners to have enough practice before exams.
- It is possibly worth exploring to arrange our ATPs in such a way that easier topics can be done later during the year and give a chance to difficult topics to be tested more.