EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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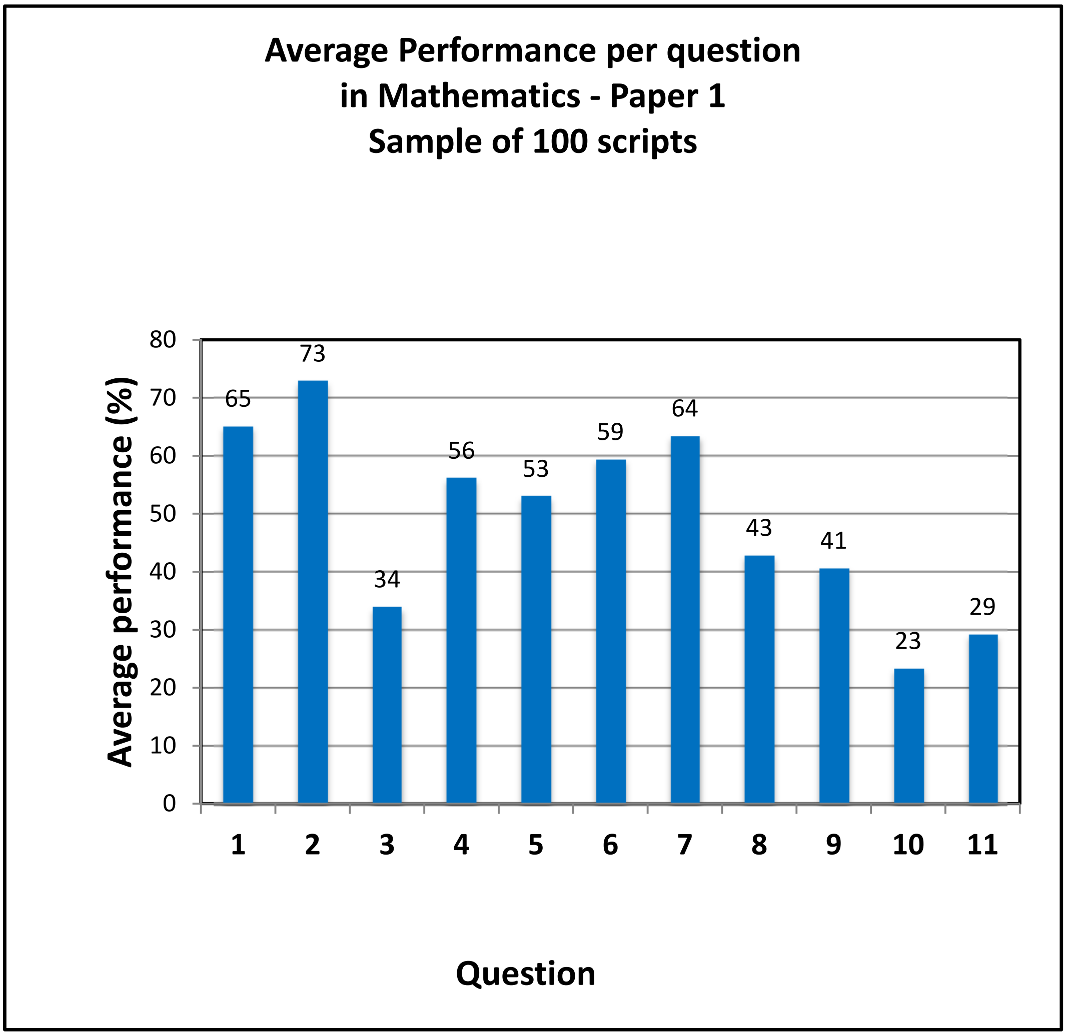
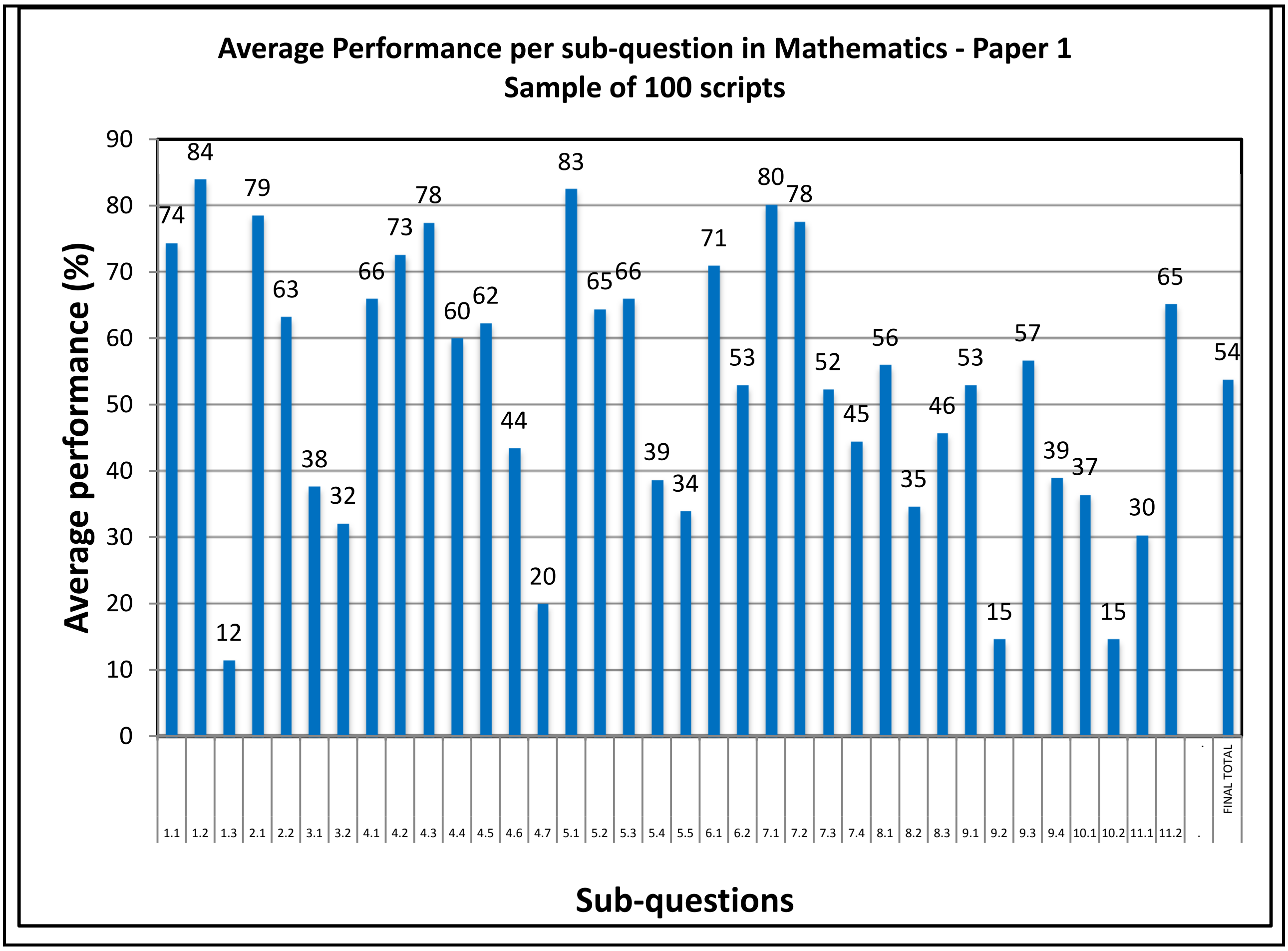
2019 NSC CHIEF MARKER'S REPORT

SUBJECT	**MATHEMATICS**
PAPER	**1**
DURATION OF PAPER	**3 HOURS**
DATES OF MARKING	**30 NOV 19 – 14 DEC 19**

SECTION 1: (General overview of Learner Performance in the question paper as a whole)

Candidate results covered the full spectrum from no marks to almost full marks. The graph below shows an analysis of the marks for 100 scripts drawn from good, average and weak candidates with an even distribution of marks from 0 to almost full marks. The graph indicates that these candidates performed best in routine questions (1, 2 and 7) and worst in questions requiring applications and higher order thinking (3, 10 and 11).
This paper tested whether maths is being taught in our classrooms and whether learners are not just coached to answer exam papers. It is time for learners to realise that one does not absorb Maths through being in the "presence" of Maths. It requires hard work, dedication and perseverance to achieve goals.




Average Performance per sub-question in Mathematics - Paper 1
Sample of 100 scripts
Average performance (%)
Sub-questions
0
10
20
30
40
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70
80
90
74
84
12
79
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7.4
8.1
8.2
8.3
9.1
9.2
9.3
9.4
10.1
10.2
11.1
11.2
FINAL TOTAL

SECTION 2: Comment on candidates' performance in individual questions

The bar graphs generated from the Rasch analysis are included for each question. Please note that this is drawn from 100 scripts ranging from 0 to almost full marks and does not give a true reflection of the <u>overall</u> achievement of <u>all</u> candidates but gives a good indication of how the results for the sub questions vary. The overall achievement of candidates was very poor as too many learners lack the basic knowledge and understanding of Mathematics.

Brief comments are made on common mistakes made and advice is given to educators to implement so that future candidates can achieve optimal results. Comments are also included to assist educators with internal marking as well as comments on the setting of internal papers. It is advised that educators read this report in conjunction with the official marking guideline.

Educators must remember that additional notes implemented at the marking venues only apply for the paper of 2019 and it cannot be perceived as policy or a way of teaching maths forward.

QUESTION 1

QUESTION 1

1.1 Solve for x:

1.1.1 $x^2 + 5x - 6 = 0$ (3)

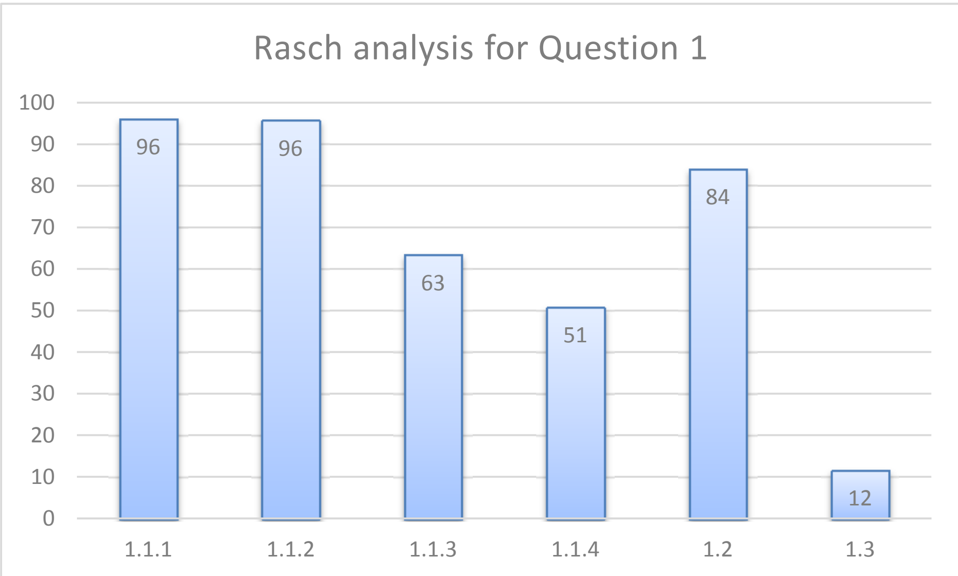
1.1.2 $4x^2 + 3x - 5 = 0$ (correct to TWO decimal places) (3)

1.1.3 $4x^2 - 1 < 0$ (3)

1.1.4 $\left(\sqrt{\sqrt{32}+x}\right)\left(\sqrt{\sqrt{32}-x}\right) = x$ (4)

1.2 Solve simultaneously for x and y:
$y + x = 12$ and $xy = 14 - 3x$ (5)

1.3 Consider the product $1 \times 2 \times 3 \times 4 \times \ldots \times 30$.
Determine the largest value of k such that 3^k is a factor of this product. (4)
[22]



It is expected that question 1 should be one of the best answered questions as it once again contains very routine questions.
1.1.1 Consistent accuracy was applied for wrong factors.
1.1.2 No marks are allocated if a wrong formula was used or if candidates factorized the quadratic expression. This is the question where one mark is lost for incorrect rounding.
1.1.3 Candidates are still faced with the challenge of understanding the concept of solving inequalities. There are various methods that can be used in the solving of inequalities, e.g. parabola, number line or tables. It would help learners to understand the solution to an inequality if the problem is unpacked and demonstrated by using various values within the intervals. Visualizing the question by means of the graph of the function can assist in the understanding of the method. Educators can refer to the method illustrated in the Mind the Gap study guide compiled by the Department of Basic Education.
1.1.4 Breakdown of marking was applied in this question when serious mathematical errors were made. Incorrect application of surd laws leads to many breakdowns. Candidates who applied the surd to both brackets had a better chance to avoid breakdowns. $\therefore \sqrt{(\sqrt{32}+x)(\sqrt{32}-x)} = x$ Many candidates who managed to complete the question neglected to discard the -4 as a solution.
1.2 Routine question that was fairly well answered.
1.3 This was a very challenging question for candidates and it was one of the most poorly answered questions. The powers of 3, namely $3, 9$ and 27, were used as the multiples of 3, instead of $3, 6, 9, 12, 15, 18, 21, 24, 27$ and 30.   Most candidates did not even attempt this question.
General comments   • Most of the content of question 1 is completed in grade 11. Learners must regularly revisit these sections from the start of grade 12.   • Learners who struggle to factorize solving quadratic equations can be motivated to use the formula.   • Ensure that learners know how to round off; don't assume that they know.   • Teach the use of the quadratic formula not only in terms of x but using other unknowns as well. This will prevent candidates from interchanging y and x when first solving y in simultaneous equations.

QUESTION 2

QUESTION 2

2.1 Given the quadratic sequence: 321 ; 290 ; 261 ; 234 ; ….

2.1.1 Write down the values of the next TWO terms of the sequence. (2)

2.1.2 Determine the general term of the sequence in the form $T_n = an^2 + bn + c$. (4)

2.1.3 Which term(s) of the sequence will have a value of 74? (4)

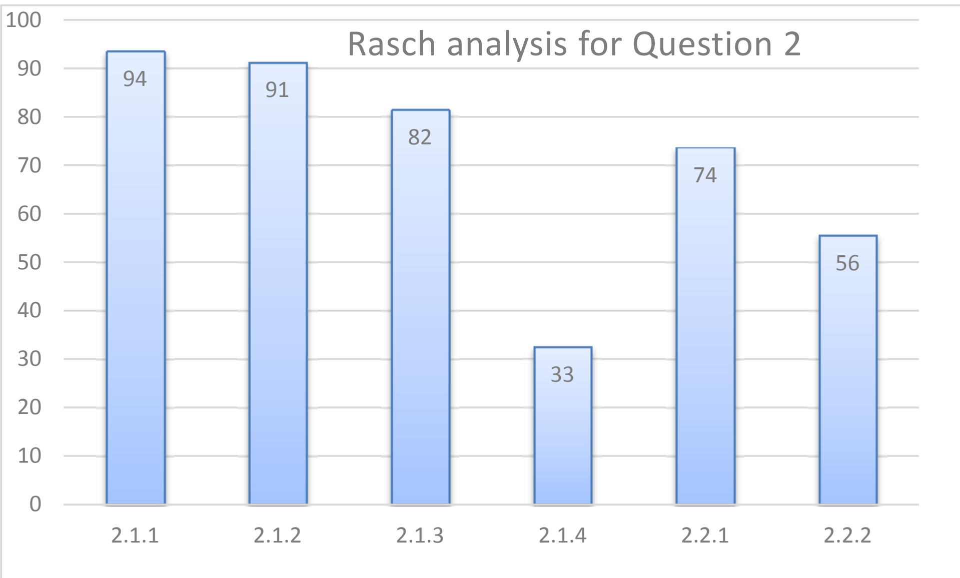
2.1.4 Which term in the sequence has the least value? (2)

2.2 Given the geometric series: $\frac{5}{8} + \frac{5}{16} + \frac{5}{32} + \ldots = \text{K}$

2.2.1 Determine the value of K if the series has 21 terms. (3)

2.2.2 Determine the largest value of n for which $T_n > \frac{5}{8192}$ (4)

[19]



This question had routine questions testing sequences and series and was one of the best answered question.

2.1.1 – 2.1.3 were very routine questions and candidates could score good marks in this section. A very common mistake was to identify the second difference as -2 instead of 2. Educators should give enough examples where the first and/or second differences are not all always positive.

Learners must be aware of the restriction to $n \in N$ when working with number patterns and the link between quadratic number patterns and the graph of the quadratic function should be made. Candidates who realized this connection accepted the two possible solutions to n in 2.1.3 and realized that the minimum term value for 2.1.4 would be at the turning point of the parabola. Some candidates rejected the $n = 20$. Constantly emphasise the difference between $T_n = 74$ and T_{74}.

2.2 The sum of n terms for a geometric sequence is a routine question and 2.2.1 was answered well with most candidates using the correct formula and using their calculators correctly.

Some candidates were able to set up the inequality for 2.2.2. Take note of the swopping of the inequality in the following step.

$\left(\frac{1}{2}\right)^{n-1} > \left(\frac{1}{2}\right)^{10}$
$\therefore n - 1 < 10$
$\therefore n < 11$

It is not very common to work with similar exponential inequalities and it is good to show learners the thinking behind the swopping, e.g. by including the following steps.

$\left(\frac{1}{2}\right)^{n-1} > \left(\frac{1}{2}\right)^{10}$
$\therefore (2^{-1})^{n-1} > (2^{-1})^{10}$
$\therefore 2^{-n+1} > 2^{-10}$
$\therefore -n + 1 > -10$
$\therefore -n > -11$
$n < 11$

General comments:

- Educators should teach learners the connection quadratic number patterns and functions and also the "partnership" between quadratic and linear number patterns.
- Use alternative words for $<, >, \leq, \geq$, at least, at most, smallest, biggest, minimum, maximum, etc.
- Familiarize learners with formulae on the information sheet.

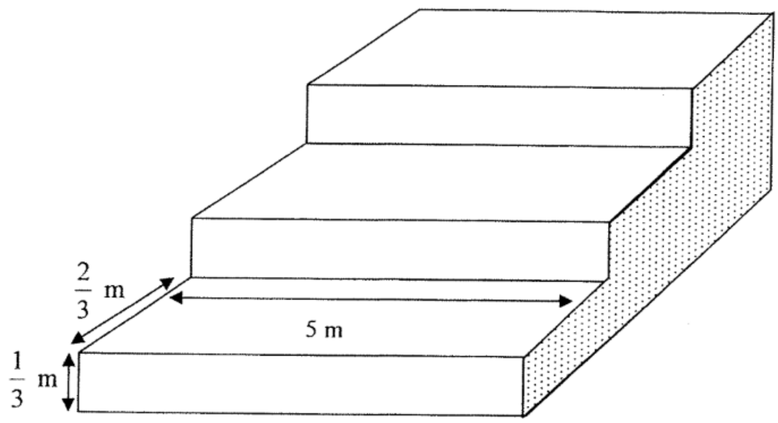
QUESTION 3

QUESTION 3

3.1 Without using a calculator, determine the value of: $\sum_{y=3}^{10}\frac{1}{y-2}-\sum_{y=3}^{10}\frac{1}{y-1}$ (3)

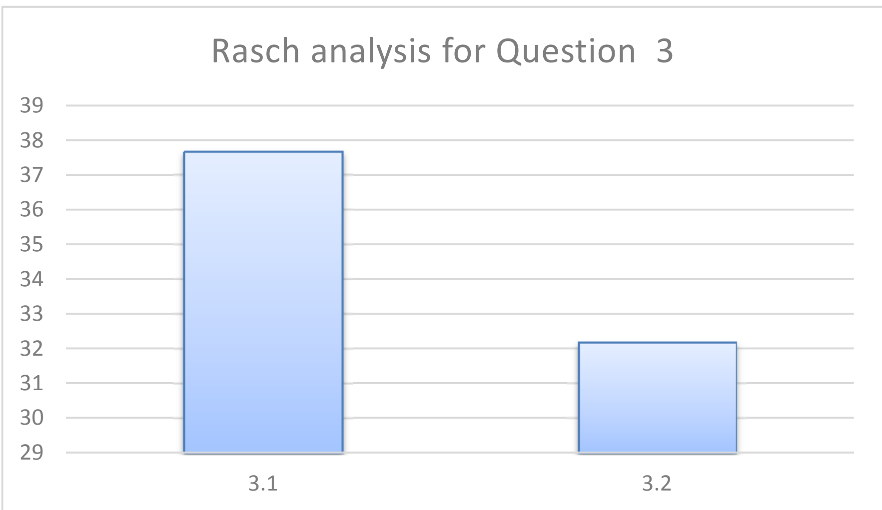
3.2 A steel pavilion at a sports ground comprises of a series of 12 steps, of which the first 3 are shown in the diagram below.

Each step is 5 m wide. Each step has a rise of $\frac{1}{3}$ m and has a tread of $\frac{2}{3}$ m, as shown in the diagram below.



The open side (shaded on sketch) on each side of the pavilion must be covered with metal sheeting. Calculate the area (in m^2) of metal sheeting needed to cover both open sides.

(6)
[9]



This was one of the worst answered questions and many candidates did not even attempt it.

3.1 This question tested the understanding of sigma notation. There are a few concepts that need to be remembered when teaching sigma notation.

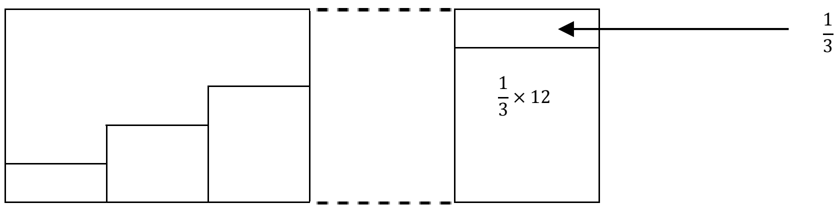
1. Calculating the number of terms/values is crucial in working with sigma notation. Although we are busy with maths, it is good to sometimes give "life" to concepts. E.g. if given the following:

$$\sum_{k=\text{✿}}^{\text{☺}} f(k)$$

Number of terms/values = $\text{☺} - \text{✿} + 1$

1. When starting off with sigma notation it is a good idea to start without making the conventional connection to number sequences and series. Expose learners to various expressions as well as various combinations of starting and ending values.

3.2 This question was a lovely problem-solving question that was answered very poorly. Educators must emphasise the importance of reading the question very carefully. Many candidates only worked with the three steps shown in the diagram although it was clearly mentioned that the pavilion consists of 12 steps, **of which the first 3 are shown.**
This question gave the opportunity to candidates to think outside the box and various approaches could be followed to calculate the area of the open sides. The most popular option was a vertical breakup of one side and then doubling the area. A horizontal breakup could similarly be done.
It was very pleasing to experience the creative thinking of candidates who stacked the vertical breakups into one tall rectangle with dimensions of $26m \times \frac{2}{3}m$.
Alternatively one could flip and join the two sides to form a large rectangle with dimensions $8m \times \frac{13}{3}m$, as shown in the sketch below for only 4 steps.



FOR 12 STEPS:

Length = $\frac{2}{3} \times 12 = 8m$ Height = $\left(\frac{1}{3} \times 12\right) + \frac{1}{3}$

Area = $\left(\frac{1}{3} \times 12 + \frac{1}{3}\right) \times (8) = \frac{104}{3}$

General comments

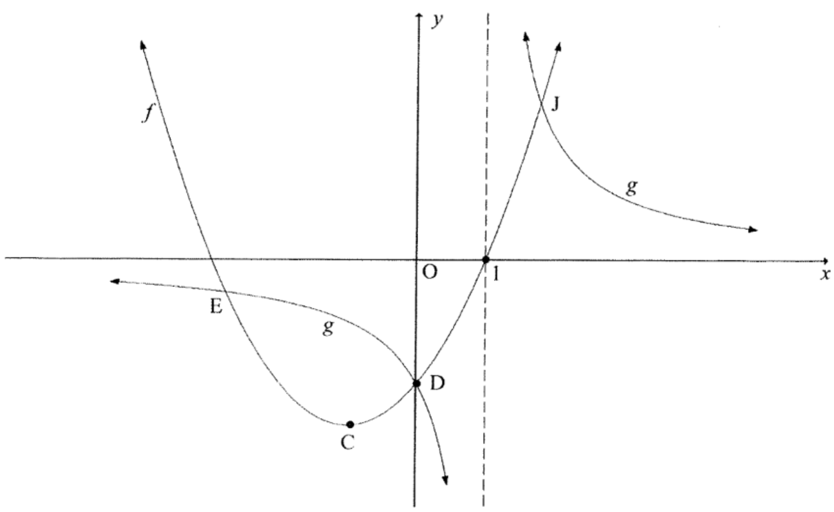
- Expose learners to more problem-solving questions.
- Stock up with equipment in models for topics like area and volume.

QUESTION 4

QUESTION 4

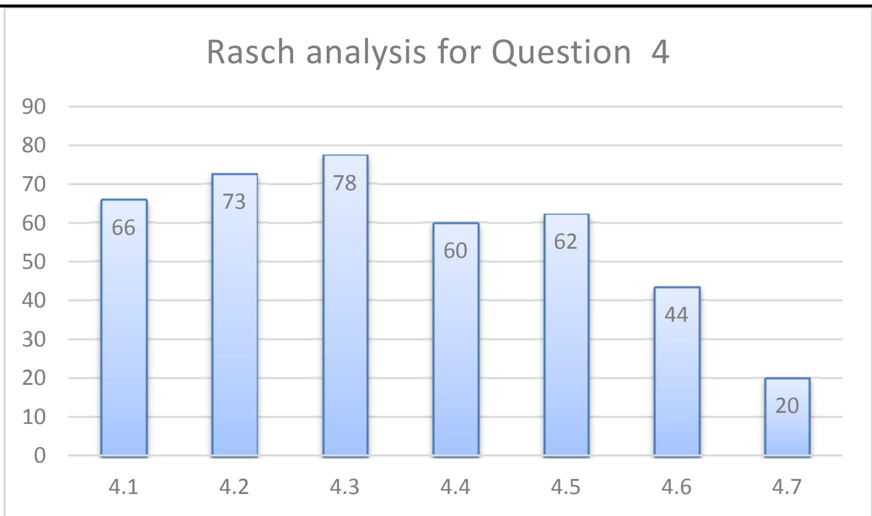
Below are the graphs of $f(x) = x^2 + bx - 3$ and $g(x) = \dfrac{a}{x+p}$.

- f has a turning point at C and passes through the x-axis at $(1\ ;0)$.
- D is the y-intercept of both f and g. The graphs f and g also intersect each other at E and J.
- The vertical asymptote of g passes through the x-intercept of f.



4.1	Write down the value of p.	(1)
4.2	Show that $a = 3$ and $b = 2$.	(3)
4.3	Calculate the coordinates of C.	(4)
4.4	Write down the range of f.	(2)
4.5	Determine the equation of the line through C that makes an angle of $45°$ with the positive x-axis. Write your answer in the form $y = \ldots$	(3)
4.6	Is the straight line, determined in QUESTION 4.5, a tangent to f? Explain your answer.	(2)
4.7	The function $h(x) = f(m - x) + q$ has only one x-intercept at $x = 0$. Determine the values of m and q.	(4)

[19]



This question included routine questions (4.1-4.5) on functions but was poorly answered. The majority of functions are completed in grade 11 and learners must be motivated and assisted in revisiting this topic at the beginning of grade 12. Functions form a critical part of the syllabus and can be integrated in many other topics.

4.2 Learners cannot substitute the values for a and b and continue to prove that they correlate with the information in the sketch. No marks are awarded in this event.

4.3 By the end of grade 12 learners have many options to determine the turning point of a quadratic function.

1) $\left(\frac{-b}{2a}; f\left(\frac{-b}{2a}\right)\right)$
2) Using the derivative to calculate x if $f'(x) = 0$ and substituting into f.
3) Completing of the square.
4) Determining the x-intercepts and calculating the x-value of the midpoint.

Candidates made substitution errors that resulted in a positive axis of symmetry. Although the graphs of paper 1 is not necessarily on scale, candidates should have realized that they have made a mistake and worked through their response to correct the error. Simply changing the value to a negative value is not the way to go. Candidates worked with -1 as the x-coordinate of C, without showing any calculations, assumingly measuring on the sketch. Assuming values to answer a question does not yield any further marks.
Many candidates used the value for a from 4.2 and substituted that as the a-value for $f(x) = 3x^2 + 2x - 3$. When setting papers, teachers must avoid similar confusions by making use of different letters for different graphs.

The use of the calculator (e.g. Casio 911) to determine the coordinates of the turning point is not permitted. An answer only scored only 1 mark. Similar calculators must be used as a checking device.

4.4 Questions relating to the range of a function is regarded in the CAPS document as a level 1 cognitive level. Candidates show little understanding of the concept.

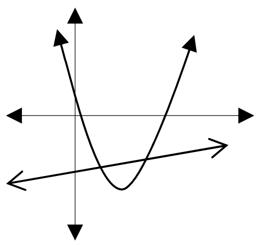
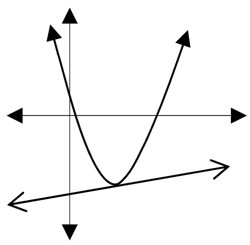
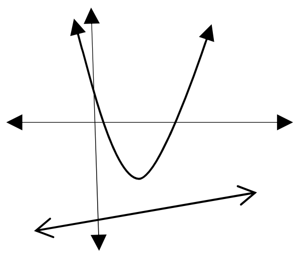
4.5 The essence of this question was to test knowledge of the gradient of a straight line with a $45°$ inclination. Too many candidates simply assumed that the line passed through either D or the x-intercept $(x = 1)$ of f and therefore used $\frac{\Delta y}{\Delta x}$. Only one mark was then awarded for substitution of C and the gradient.

4.6 Candidates struggled to deliver a clear mathematical explanation as to why the straight line $(y = x - 3)$ is not a tangent to f.
There were many possible ways to express the explanation as to why the line is not a

tangent. The following options are the essential ones:

- The line goes through C as well as D because of a y-intercept of -3 for f and the line. Stating that the line **cuts** the graph does not imply two points. A vertical line **cuts** a graph only once.
- The line intersects f at two points (C and D).
- If the line is a tangent at C, the gradient must be 0 as the tangent at a turning point will be a horizontal line.

The correct use of mathematical concepts and vocabulary must be used. Learners must state that "the line intersects f at two points" rather than "the line touches f at two points". The correct concept is that if the points of intersection of a straight line (excluding a vertical line) and a quadratic function are equal, then that line is a tangent. If the gradient of the tangent is 0, then it will be a tangent at the turning point.
Although not directly connected to question 4, educators can make use of GeoGebra (free download) to illustrate the following to learners and make the connection between algebraic calculations and graphs.
Given: $f(x) = ax^2 + bx + c$ and $g(x) = mx + k$
Solving for x if $f(x) = g(x)$ will yield the following possible results.
Note: The

$\Delta > 0$	$\Delta = 0$	$\Delta < 0$
Two unequal solutions	**Two** equal solutions	No real solution
		
Secant (Line of intersection) (Cuts f twice)	Tangent (Touches f once)	Does not touch or cut f

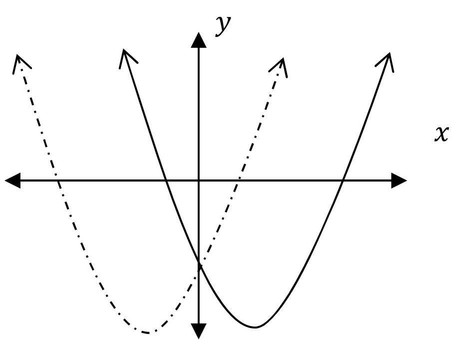
4.7 This question was answered extremely poorly. The following explanation aims in breaking down the thinking behind this question.

$h(x) = f(m - x) + q$

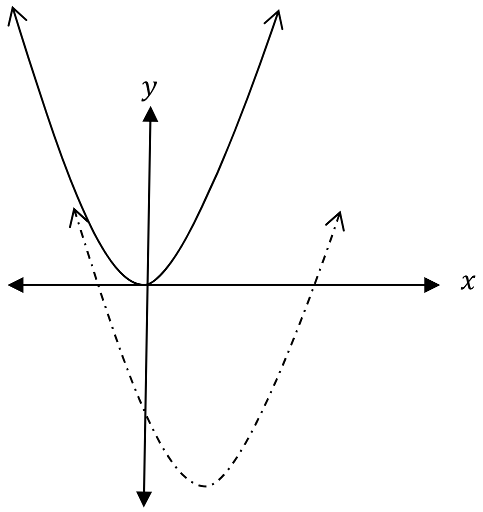
Step 1: $\therefore h(x) = f(-x + m) + q$

$h(x) = f[-(x + m)] + q$

$f[-(x + m)]$ gives the reflection of f in the y-axis. Turning point is now $(1; -4)$.



Step 2: To get only one x-intercept at $(0; 0)$ $f[-(x+m)]$ must now be translated 4 units upwards and 1 unit to the left.



$$\therefore h(x) = f(-x+m) + q$$

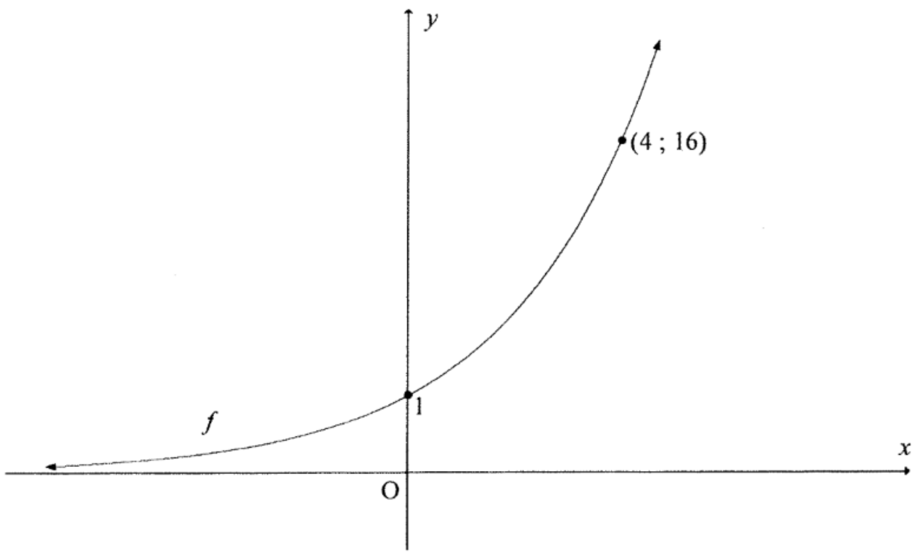
$$h(x) = f[-(x+1)] + 4 = f(-x-1) + 4$$

$$\therefore q = 4 \text{ and } m = -1$$

QUESTION 5

QUESTION 5

Sketched below is the graph of $f(x)=k^x\ ;\ k>0$. The point $(4\ ;\ 16)$ lies on f.



5.1 Determine the value of k.

5.2 Graph g is obtained by reflecting graph f about the line $y=x$. Determine the equation of g in the form $y=\ldots$

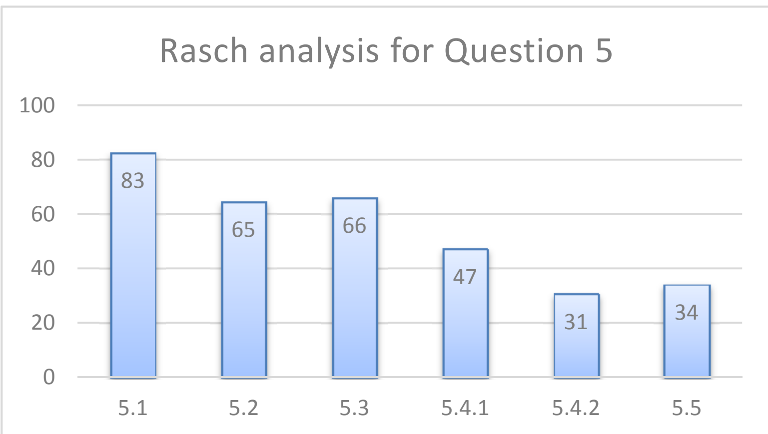
5.3 Sketch the graph g. Indicate on your graph the coordinates of two points on g.

5.4 Use your graph to determine the value(s) of x for which:

5.4.1 $f(x)\times g(x)>0$

5.4.2 $g(x)\leq -1$

5.5 If $h(x)=f(-x)$, calculate the value of x for which $f(x)-h(x)=\dfrac{15}{4}$



This question covers the exponential and log functions. It was refreshing to see that the

traditional question of asking the equation of the inverse of f in the form $y = \cdots$ in 5.1 was changed to the equation if f was reflected in the line $y = x$. The equation of the inverse function can be given in terms of k.
5.3 Educators can once again make use of GeoGebra to illustrate the relation between a function and its inverse function. Candidates did not make use of the given sketch to draw the graph of the inverse function. Four easy marks were lost.
5.4 Educators should practise a variety of questions of this nature, especially with the stronger learners. It will always be a popular way to test interpretation of functions. Candidates who showed confidence in answering 5.4.2 made the common error of giving the solution as $x \leq \frac{1}{2}$ and omitted the restriction to the left caused by the asymptote to give $0 < x \leq \frac{1}{2}$ as the solution. Learners who make use of interval notation must clearly show if they are using squared brackets or round brackets. Brackets at infinity($+\ or\ -$) must always be round brackets.
5.5 This question was answered very poorly. A common mistake was to set up the equation as $2^x - (-2^x) = \frac{15}{4}$. Candidates who attempted this question often only scored the first mark.
General comments • Revisit transformations from grade 8 and 9 when teaching functions. • Emphasise the importance of $log_2 x$ in stead of $log_x 2$. • Teach the interpretation of graphs from grade 10. • Integrate topics from grade 10. •

QUESTION 6

QUESTION 6

6.1 Two friends, Kuda and Thabo, each want to invest R5 000 for four years. Kuda invests his money in an account that pays simple interest at 8,3% per annum. At the end of four years, he will receive a bonus of exactly 4% of the accumulated amount. Thabo invests his money in an account that pays interest at 8,1% p.a., compounded monthly.

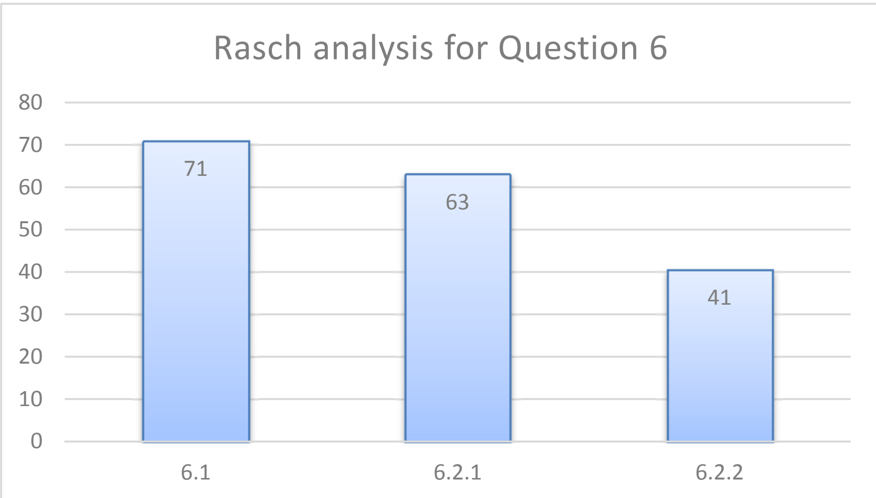
Whose investment will yield a better return at the end of four years? Justify your answer with appropriate calculations. (5)

6.2 Nine years ago, a bank granted Mandy a home loan of R525 000. This loan was to be repaid over 20 years at an interest rate of 10% p.a., compounded monthly. Mandy's monthly repayments commenced exactly one month after the loan was granted.

6.2.1 Mandy decided to make monthly repayments of R6 000 instead of the required R5 066,36. How many payments will she make to settle the loan? (5)

6.2.2 After making monthly repayments of R6 000 for nine years, Mandy required money to fund her daughter's university fees. She approached the bank for another loan. Instead, the bank advised Mandy that the extra amount repaid every month could be regarded as an investment and that she could withdraw this full amount to fund her daughter's studies. Calculate the maximum amount that Mandy may withdraw from the loan account. (4)

[14]



6.1 The finance section was once again answered very poorly. Question 6.1 was a routine question from grade 11 and candidates could score some marks in this question.

6.2 Most candidates simply attempted this question without really understanding what was required. They showed a complete lack of understanding of basic financial skills and concepts and used incorrect formulae.
Learners must carefully read the wording of the question when n is calculated.
This question stated: “How many payments will she make to settle the loan?”
Calculation lead to $n = 157,4$. The nature of the question requires that the value must be rounded up and conclude that she will make 158 payments. It was also accepted if

candidates stated that it will be 157 full payments and one smaller payment.
General comments • Teachers must use correct mathematical language when teaching finance. • make sure that learners know when to use which formula when doing finance.

QUESTION 7

QUESTION 7

7.1 Determine $f'(x)$ from first principles if it is given that $f(x) = 4 - 7x$. (4)

7.2 Determine $\frac{dy}{dx}$ if $y = 4x^8 + \sqrt{x^3}$ (3)

7.3 Given: $y = ax^2 + a$

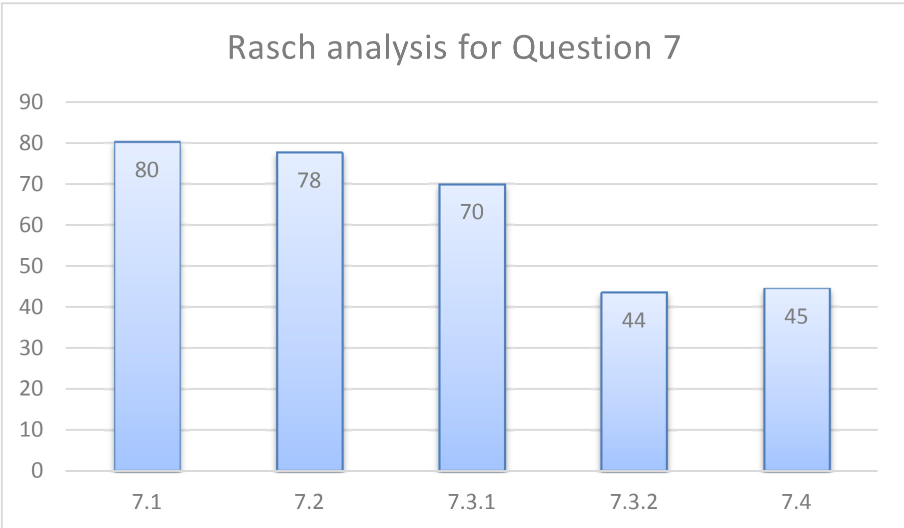
Determine:

7.3.1 $\frac{dy}{dx}$ (1)

7.3.2 $\frac{dy}{da}$ (2)

7.4 The curve with equation $y = x + \frac{12}{x}$ passes through the point A(2 ; b). Determine the equation of the line perpendicular to the tangent to the curve at A. (4)

[14]



Question 7 is a very predictable question and was one of the best answered questions.

7.1 Many candidates attempted this question and scored marks. Educators must emphasise the importance of writing down the complete formula and taking care to use the correct notation throughout the solution.
The following are regarded as notation errors and are penalised:

- If $f'(x)$ was not shown as part of the formula.
- If the lim is omitted too soon.
- If an equal sign was written between the lim and the fraction part.

7.2 and 7.3 was answered poorly with candidates not knowing how to write the surd in exponential form or understanding the difference between $\frac{dy}{dx}$ and $\frac{dy}{da}$.

7.4 Most candidates did not attempt this question. Those who did mostly only scored

the mark for substituting $x = 2$ to get the coordinates of $A(2; 8)$. Too many candidates used the gradient formula to calculate the gradient of the tangent. Candidates did not know the relationship between the gradient of the tangent and the line perpendicular to the tangent.
In the understanding of this question it is once again necessary to repeat the following concepts when working with functions and derivatives.

If $f(2) = 3$ then $(2\,;3)$ is a point on the graph.

If $f'(2) = 3$ then the graph has a gradient of 3 at the point where $x = 2$.

If $f(2) = 0$ then $(2; 0)$ is an x-intercept.

If $f(0) = 2$ then $(0; 2)$ is a y-intercept.

If $f'(2) = 0$ then the graph has a stationary point at $x = 2$.

If $f''(2) = 0$ then the graph has an inflection point at $x = 2$.

If $f''(2) = 3$ then the graph is concave up at the point where $x = 2$.

If $f''(2) = -3$ then the graph is concave down at the point where $x = 2$.

QUESTION 8

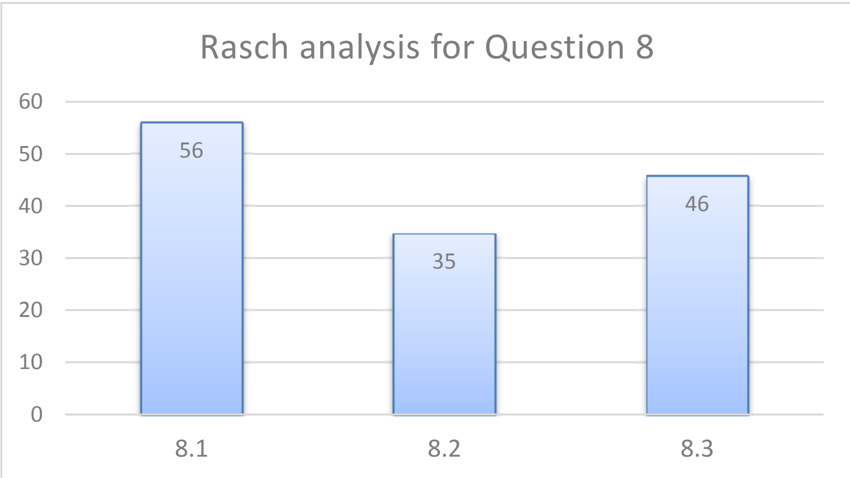
QUESTION 8

After flying a short distance, an insect came to rest on a wall. Thereafter the insect started crawling on the wall. The path that the insect crawled can be described by $h(t)=(t-6)(-2t^2+3t-6)$, where h is the height (in cm) above the floor and t is the time (in minutes) since the insect started crawling.

8.1 At what height above the floor did the insect start to crawl?

8.2 How many times did the insect reach the floor?

8.3 Determine the maximum height that the insect reached above the floor.



Application of calculus has always been one of the worst answered questions. This year was no exception. The simple nature of the given function did give more opportunities for candidates to score marks.
It was evident that candidates struggled to interpret the function correctly.
This is once again an opportunity to make use of GeoGebra to give visual interpretation of the story behind the function.
Candidates successfully solved for $h(t)=0$ but then concluded that the insect reached the floor 6 times. Understanding the application is always a big hurdle.
Question 8.3 was well attempted and candidates were able to get $t=1$ and $t=4$.
If this question is put in graphical perspective it can easily be seen that $t=4$ will yield the maximum value.
If $h(t)$ is expanded, learners must visualize a possible graph of 

It is not always advisable to draw an accurate graph of the function, but basic graphical concepts of quadratic and cubic functions can be helpful in understanding and answering application of calculus.

QUESTION 9

QUESTION 9

Given: $f(x) = 3x^3$

9.1 Solve $f(x) = f'(x)$ (3)

9.2 The graphs f, f' and f'' all pass through the point $(0 ; 0)$.

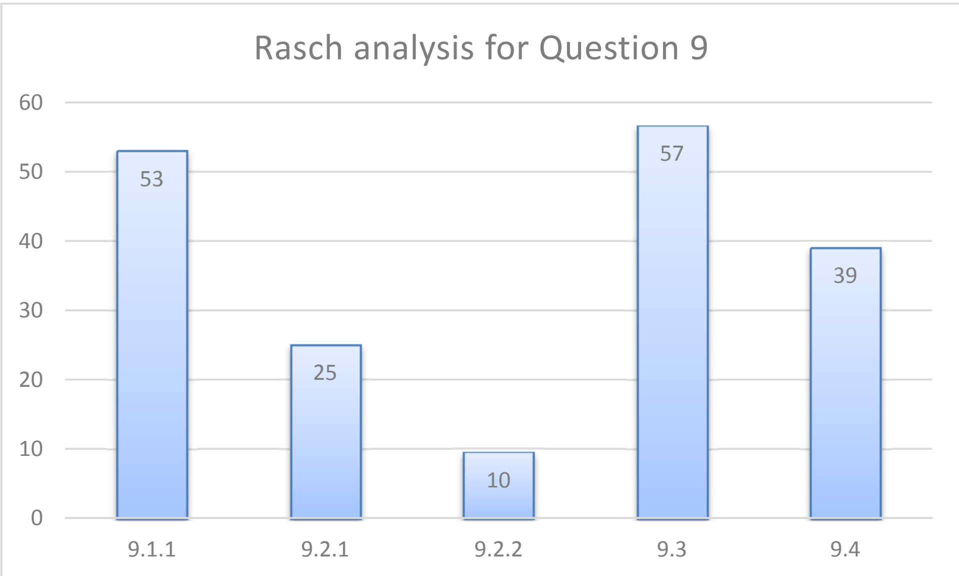
9.2.1 For which of the graphs will $(0 ; 0)$ be a stationary point? (1)

9.2.2 Explain the difference, if any, in the stationary points referred to in QUESTION 9.2.1. (2)

9.3 Determine the vertical distance between the graphs of f' and f'' at $x = 1$. (3)

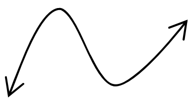
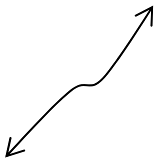
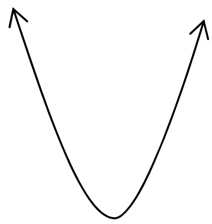
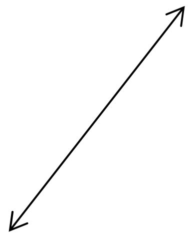
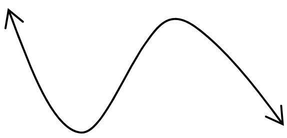
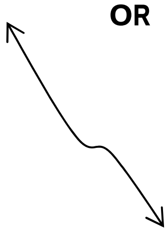
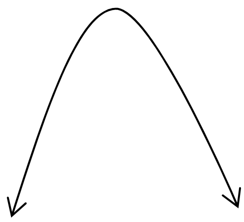
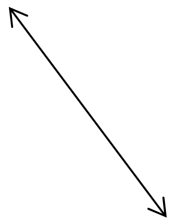
9.4 For which value(s) of x is $f(x) - f'(x) < 0$? (4)

[13

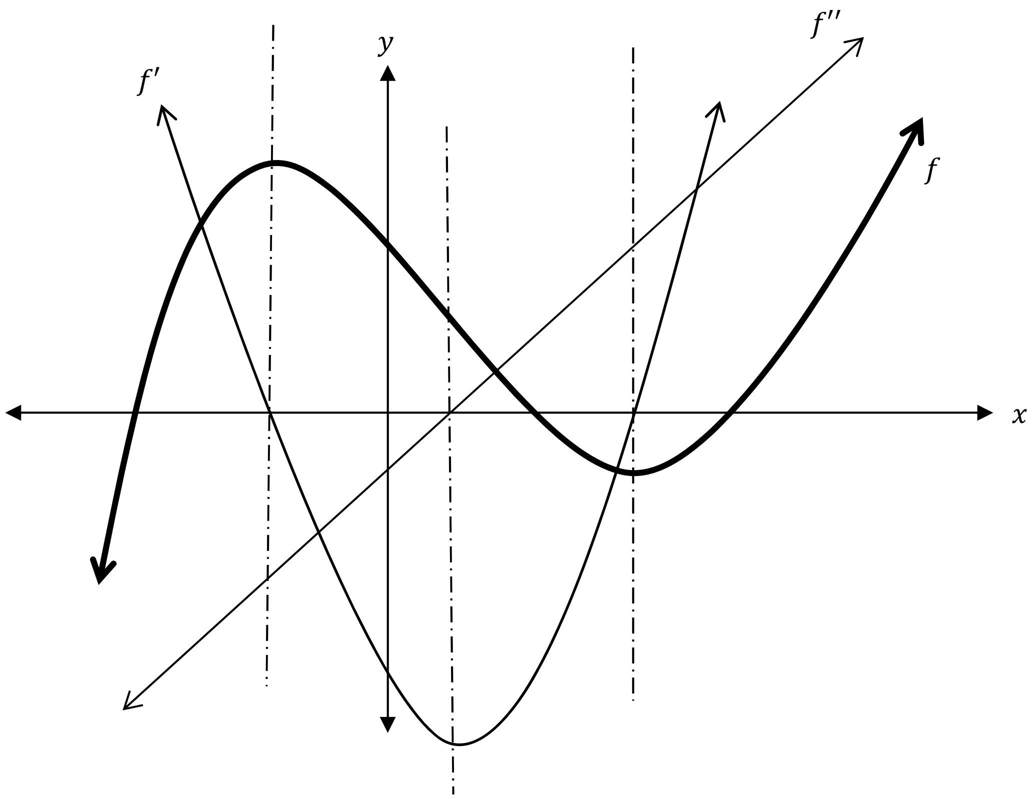


This was a very innovative yet daring way of testing cubic functions and clearly separated the good candidates from the exceptional candidates. The initial reaction to this question was very negative and labelled as unfair. One must not confuse unfair questions with unfamiliar questions. This was a very unfamiliar question that really tested the concepts of calculus and functions.
It can be very helpful if the learner can visuslize the following connection between f, f' and f''.

Given $h(x) = ax^3 + bx^2 + cx + d$

Graph of h	Graph of h'	Graph of h''
Cubic	Quadratic	Linear
If $a > 0$  **OR** 	Minimum turning point 	Increasing 
If $a < 0$  **OR** 	Maximum turning point 	Decreasing 

Graphs of f, f' and f'' together.



Educators can show the correlation between the following points on the combined sketch.

1. x-values of turning points of $f \leftrightarrow x$-value of x-intercepts of f'.

2. x-value of turning point of $f' \leftrightarrow x$-intercept of f''.
3. x-intercept of $f'' \leftrightarrow x$-value of point of inflection of f.

This combined sketch can also assist in interpreting the cubic function if the graph of the derivative function is given.

9.1 Candidates managed to set up the equation of $3x^3 = 9x^2$ followed by $3x^3 - 9x^2 = 0$. A common serious mistake thereafter is to divide by x or x^2. This implies that one possible solution is lost.
Learners solve these equations rotely, not making the connection that they are actually calculating the points of intersection of $f(x)$ and $f'(x)$.

9.2 The memo demanded specific mathematical terminology to be used in the answering of 9.2.2 where the difference in the stationary points was asked.

Stationary points are calculated by first solving f'(x)=0. The stationary points can then either be defined as turning points or inflection points. See the figures below, extracted from "Mind the Gap: Mathematics".

figure 1

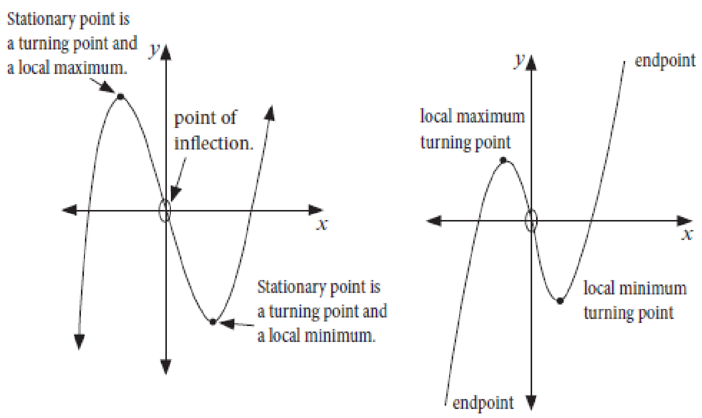
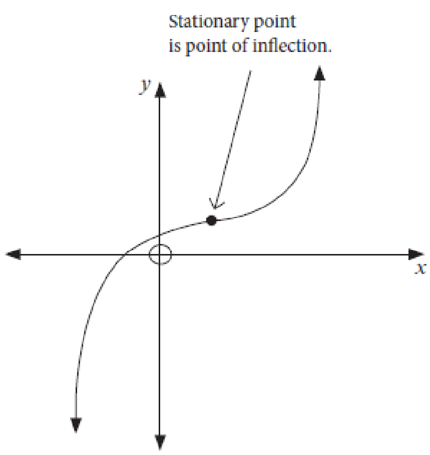


figure 2



When working with the quadratic function, the stationary point is therefore a turning point.

9.4 The initial perception is that cubic inequalities are not specified in the syllabus. This question must be viewed in the context of functions and the application of inequalities.

Many candidates could work up to the factorized step.
$3x^2(x-3)<0$
$3x^2$ will be positive for all real values of x.
$\therefore$ the focus is on finding when $x-3<0$ which is when $x<3$.
Because $3x^2(x-3)$ must be negative and **NOT** equal to 0 the restriction of
$x<3$; $x \neq 0$ is included.

The inequality can also be solved graphically as indicated on the marking guideline.

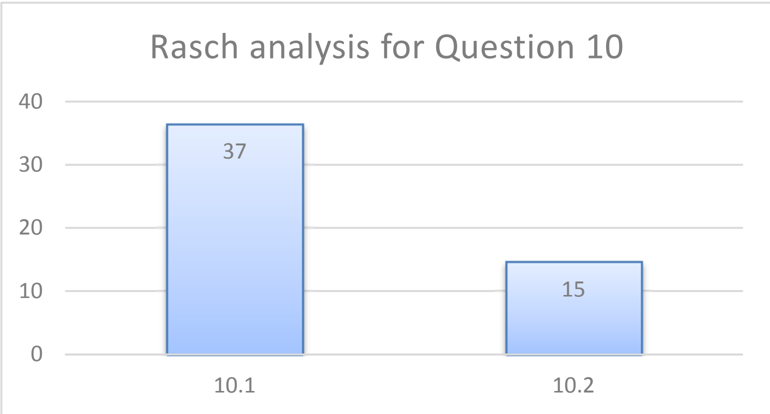
QUESTION 10

QUESTION 10

The school library is open from Monday to Thursday. Anna and Ben both studied in the school library one day this week. If the chance of studying any day in the week is equally likely, calculate the probability that Anna and Ben studied on:

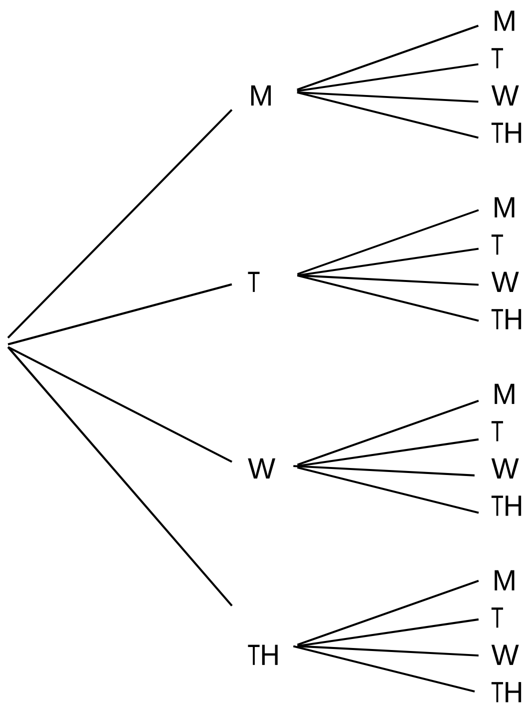
10.1 The same day (2)

10.2 Consecutive days (3)
[5]



Candidates once again did not read the information given. It is stated that the library is open four days of the week. Any reference to studying "any day in the week" still applies to only the four days that the library is open and not seven days. Continuous accuracy was applied to candidates who continued with seven days and they could score 4 out of 5. Various approaches were possible to solve both the questions. The tree diagram was the most popular approach although many candidates drew an incorrect tree diagram. Tree diagram for Anna followed by Ben.

Anna **Ben**



Same day	**Consecutive days**
*	
	*
*	
	*
*	
	*
*	
$P(same) = \frac{4}{16}$	$P(consecutive)$ $= \frac{3}{16} \times 2$ Multipy by 2 because their order can swop.

QUESTION 11

QUESTION 11

11.1 Events **A** and **B** are independent. P(A) = 0,4 and P(B) = 0,25.

11.1.1 Represent the given information on a Venn diagram. Indicate on the Venn diagram the probabilities associated with each region. (3)

11.1.2 Determine P(**A** or NOT **B**). (2)

11.2 Motors Incorporated manufacture cars with 5 different body styles, 4 different interior colours and 6 different exterior colours, as indicated in the table below.

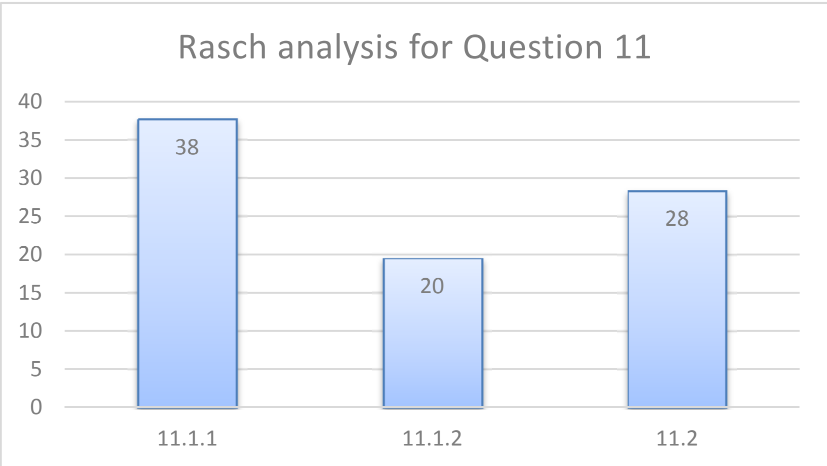
BODY STYLES	INTERIOR COLOURS	EXTERIOR COLOURS
Five body styles	Blue	Silver
		Blue
	Grey	White
	Black	Green
		Red
	Red	Gold

The interior colour of the car must NOT be the same as the exterior colour.

Motors Incorporated wants to display one of each possible variation of its car in their showroom. The showroom has a floor space of 500 m^2 and each car requires a floor space of $5 m^2$.

Is this display possible? Justify your answer with the necessary calculations. (6)

[11]



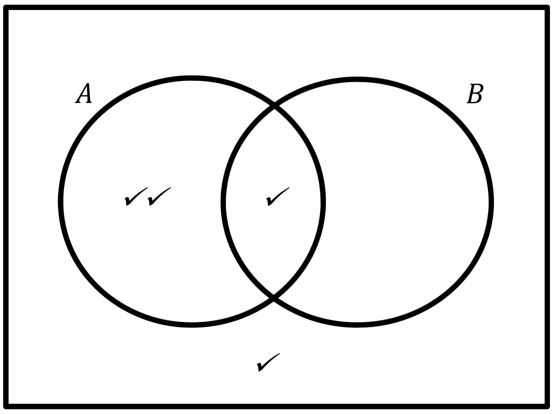
This question was answered very poorly with many candidates not answering 11.2.

11.1 Educators must emphasise the relationships between the different types of events, their Venn diagrams and the influence it has on the general law for probability.
The essence of this question was that for independent events

$$P(AandB) = P(A) \times P(B) = 0{,}1.$$

Candidates who applied this rule neglected to subtract the 0,1 from the $P(A) = 0{,}4$ to complete the sector in the Venn diagram for $P(only\ A)$.

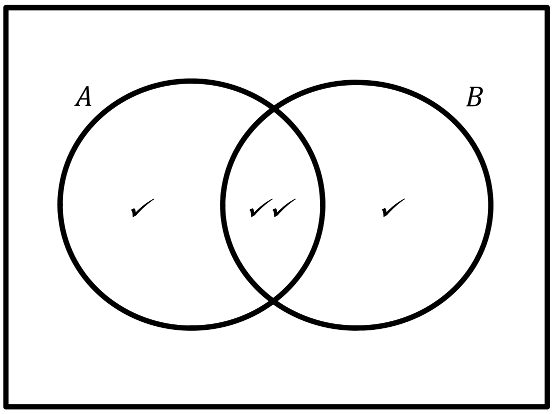
There are various approaches to solving this question and educators must familiarize themselves with the methods of using probability rules as well as solving directly from the Venn diagram. Ask questions relating to independent events from Venn diagram.



$P(A\ or\ not\ B)$ vs $P(A\ and\ not\ B)$

Place ticks in all sectors of A.
Place ticks in all sectors of $not\ B$.

$P(A\ or\ not\ B)$ are all sectors with 1 or 2 ticks.
$P(A\ and\ not\ B)$ are all sectors with 2 ticks.



$P(A\ or\ B)$ vs $P(A\ and\ B)$

Place ticks in all sectors of A.
Place ticks in all sectors of B.

$P(A\ or\ B)$ are all sectors with 1 or 2 ticks.
$P(A\ and\ B)$ are all sectors with 2 ticks.

∴ ✓✓ implies "*and*"
✓ or ✓✓ implies "*or*"

Consistent accuracy was not applied in 11.1.2 if the probability of the sample space in 11.1.1 was not equal to 1. Most candidates did not fill in $P(AorB)'$.

11.2 Candidates struggled to interpret the information and restrictions set for the manufacturing of cars. Those who attempted the question often simply responded with $5 \times 4 \times 6 = 120$.
The variations for setting probability questions are so vast that educators must refrain from constantly presenting similar types of questions. This applies for testing counting principles as well.

Although answered extremely poorly, it was pleasing to see that some candidates had very creative ways of solving the question. Well done.

The following general suggestions, observations and additional comments are given annually. A word of thanks must go out to all the dedicated educators who are really trying their best, often under difficult circumstances

GENERAL SUGGESTIONS FOR IMPROVEMENT IN RELATION TO TEACHING AND LEARNING
The foundation for basic mathematical skills must be laid in grade 8 and 9.
Educators should not assume that learners know how to use their calculators.
Don't simply coach learners for exams. Teach the syllabus. This approach applies even more for learners who intend to study further in Mathematics. We need to ensure the integrity of assessments.
Motivate learners to work through previous papers as to familiarize themselves with the various ways of asking the same topic.
Encourage learners to work independently during the year. Learners can benefit from study groups as well but the final 'test' depends on the individual's ability to think.
Educators should try to introduce more unseen questions to brighter learners. Integrate topics for higher level questions.
Teachers as well as learners must be committed in teaching and studying the subject.
Test learners on the selection of the correct formula from the information sheet. Make the information sheet available during all tests (formal and informal) and examinations in grade 12.
Learners must realize that they cannot expect great things to happen if they don't put in effort and some sacrifices to achieve their dreams.
Do not only focus on improving weaker learners but also focus on enriching stronger learners. Make an effort to look for higher order questions. Use the Independent Examination Board papers as reference as well.

OBSERVATIONS RELATING TO RESPONSES OF LEARNERS
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.

ADDITIONAL COMMENTS USEFUL TO TEACHERS, SUBJECT ADVISORS, TEACHER DEVELOPMENT ETC.
Educators are encouraged to make use of this report throughout the year and not only read through once.
Educators must regard grades 10, 11 and 12 as one unit and not only focus on grade 12.
Focus should be placed on the training and development of grades 8 and 9 educators. The understanding of basic skills is promoted in these grades.
Educators need to constantly upgrade their own mathematical knowledge and skills, communicate with educators from surrounding schools and contact subject

specialists.
When setting tests teachers should also include unseen higher order questions.
If available, make use of technology in teaching certain topics. As mentioned, several times in the report, GeoGebra can be used to illustrate and teach various topics.
Be an enthusiastic maths teacher. You are involved in teaching a great subject.
Teachers should teach understanding and not only knowledge.
Subject advisors to continue visiting schools and assist educators in various ways.
Subject advisors could use a memo discussion session for non-markers to enrich them.
ECDOE must ensure that there is a Mathematics subject advisor appointed in each district.
All stakeholders must be congratulated for the various programs that have been implemented in our province to improve Mathematics.