Province of the
EASTERN CAPE
EDUCATION

ASSESSMENT & EXAMINATIONS
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NSC 2016 CHIEF MARKER'S REPORT

SUBJECT	MATHEMATICS

PAPER	1

DATE OF EXAMINATION:	28/10/16	DURATION:	3 hours

This report is aimed at providing valuable feedback to schools, subject advisors, teachers and learners about common errors committed by candidates in the answering of questions, to assist teachers and subject advisors to identify areas that need to be given special attention in the teaching and learning of the subject in 2017.

Your responses will be based on two parts:

Section 1: General overview of Learner performance in the question paper as a whole

Section 2: Comment on candidates' performance on individual questions (Detailed explanations must be provided **per question** as follows: (You may include sub questions where necessary)

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

(b) Why the question was poorly answered?

(c) Provide suggestion for improvement in relation to teaching and learning

(d) Describe any other specific observations relating to responses of learners

(e) Any other comments useful to teachers, subject advisors, teacher development

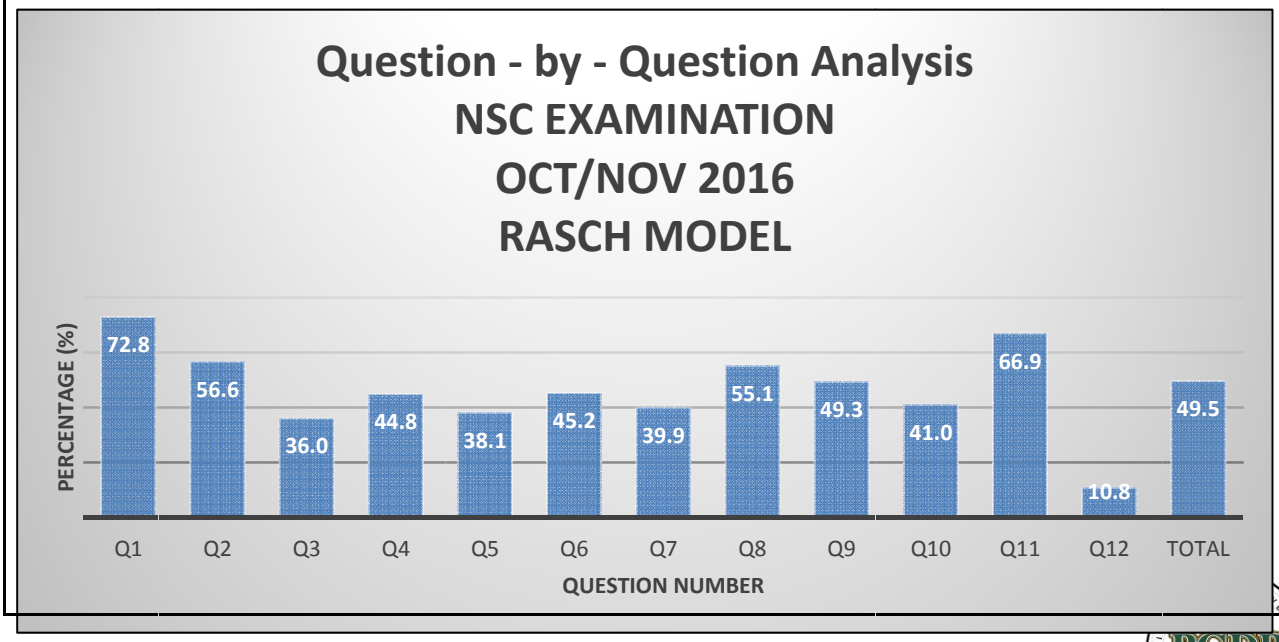
REPORT FORMAT
(General overview of Learner Performance in the question paper as a whole)

Candidate results covered the spectrum from no marks to close to full marks. To my knowledge not one candidate scored full marks for the paper. The nature of the paper and the performance by candidates makes it very difficult to see signs of improvement in most districts. There are also genuine centres of excellence where a significant number of candidates were able to achieve level 7. However there are again as in 2015 also quite a number of underperforming centres. We are aware of the fact that there are many contributing factors. Analysis of the sample of 100 scripts drawn from good, average and weak centres indicates that candidates performed best in questions [1, 11, 2 and 8], average performance in questions [4, 6, 9 and 10] and below average performance in questions requiring understanding and application [3, 5 and 7] and the worst answered question [12] . Question 12 was quite challenging to most of the candidates. While there seems to be continued improvement in performing routine operations in a familiar context, candidates still struggle to apply knowledge in an unfamiliar context. Functions which are at the core of the curriculum also continue to be a challenge for candidates. Candidates do well when they are asked to sketch but perform poorly when they need to show understanding and when required to apply knowledge. Candidates struggled with explaining themselves and obtaining solutions from the graphs Other topics with poor performance were inequalities, sequences where some terms are eliminated by a certain condition, quadratic pattern with more than one term having an unknown, failed to use common sense in 3.2.2, obtaining solution for 4.5, unfamiliar format of hyperbola in Q5, reading and establishing the value of n to be used in the finance question(Q7), notation used in 8.2, relationship between f, f' and f'', rate of change type question and counting principles. Many candidates fail to show working or are sloppy with mathematical notation. This causes them to lose unnecessary, easy marks. Most learners show competence and confidence using their calculator correctly. It is important that teachers ensure that candidates are exposed to all types of questions so that learners can become used to thinking more broadly about the underlying mathematical concepts in their work and learn to apply knowledge. A more detailed question-by-question and topic specific analysis follows below.

RASCH ANALYSIS SAMPLE AVERAGES P1

Question	1	2	3	4	5	6	7	8	9	10	11	12	Total
Ave %	72.8	56.6	36.0	44.8	38.1	45.2	39.9	55.1	49.3	41.0	66.9	10.8	49.5

The overall average for Mathematics Paper 1 was **49.5%** in the sample of 100 scripts.



SECTION 2: Comment on candidates' performance in individual questions

(It is expected that a comment will be provided for each question on a separate sheet).

NB – THE GRAPHICAL REPRESENTATION OF LEARNER PERFORMANCE FOR EACH SUB-QUESTION IS INCLUDED AND CLEARLY SHOWS IF IT WAS WELL OR POORLY ANSWERED.

QUESTION 1[24 marks]

QUESTION 1

1.1 Solve for x:

1.1.1 $x(x-7)=0$ (2)

1.1.2 $x^2-6x+2=0$ (correct to TWO decimal places) (3)

1.1.3 $\sqrt{x-1}+1=x$ (5)

1.1.4 $3^{x+3}-3^{x+2}=486$ (4)

1.2 Given: $f(x)=x^2+3x-4$

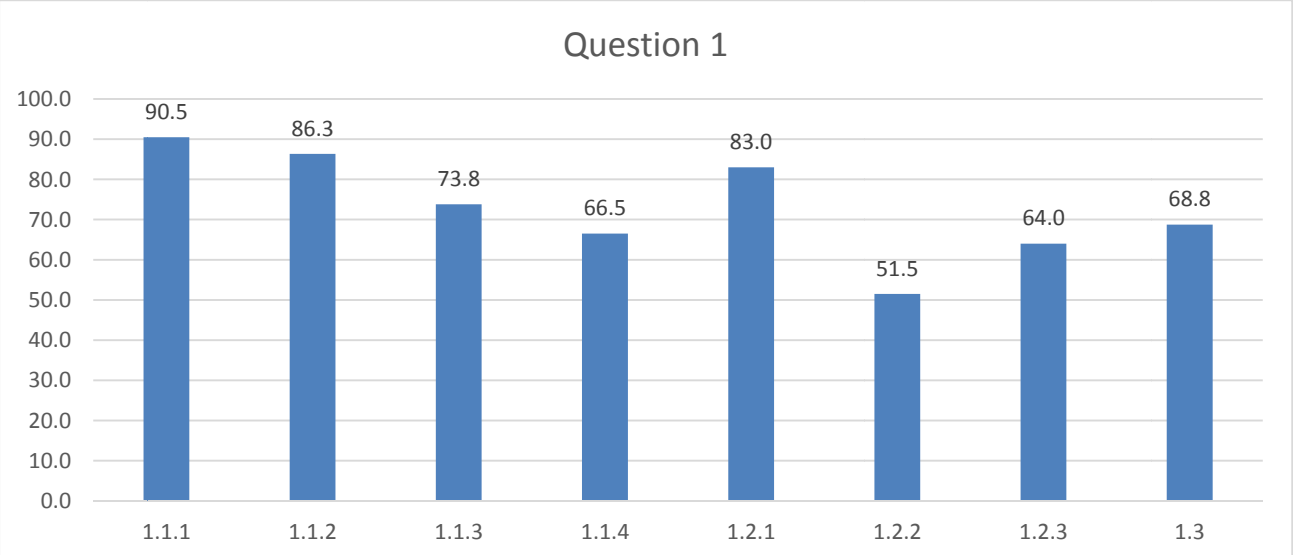
1.2.1 Solve for x if $f(x)=0$ (2)

1.2.2 Solve for x if $f(x)<0$ (2)

1.2.3 Determine the values of x for which $f'(x) \geq 0$ (2)

1.3 Solve for x and y: $x=2y$ and $x^2-5xy=-24$ (4)

[24]



General Comments:

This question was attempted by every candidate and most achieved good marks throughout, except for questions 1.2.2, 1.1.4 and 1.2.3. The question gave candidates a good start to the paper and boosted their confidence. Although the format of this question is very predictable some candidates still lack the basic skills of solving quadratic equations, inequalities and simultaneous equations. Factorizing skills play an important role in answering question 1 and too many candidates lack these basic skills taught in grades 9 and 10. All the sub-questions were quite routine, Question 1 is the question where candidates are expected to get good marks and this is confirmed by the graph above.

1.1.1	This question was well answered by most candidates. Candidates that performed poorly in this question are those that expanded/multiplied out and then made mistakes. No marks awarded / No CA was applied in such cases.
1.1.2	The question was answered well. Most candidates scored full marks here, as this is a routine question. Very few candidates lost marks for rounding off. This shows great improvement in comparison with previous years. All calculations should be shown. Full marks were not awarded for correct answers only or if the substitution step was not shown. This was a question where the candidates had to show all their calculations to be awarded full marks. Only one mark was penalized for incorrect rounding to two decimals for the whole paper.
1.1.3	This question was well answered by most candidates. Many candidates squared terms individually, ie. $\left(\sqrt{x-1}\right)^2+(1)^2=(x)^2$ This was regarded as a Mathematical Breakdown and no marks were awarded. We still have candidates that square brackets incorrectly, ie. $(x-1)^2=x^2+1/x^2-1$ This is unacceptable at Grade 12 level. Answers should be tested. Although both answers were valid, some candidates simply just disregarded one. This resulted in them losing a mark. Furthermore, this question could easily be solved by inspection. Candidates should guard against the inspection method though, because it might eliminate other possible solutions. The following is worth mentioning: Sometimes incorrect mathematics or errors still leads to correct answer. Be careful for such cases. $\sqrt{x-1}+1=x$ $(x-1)^2+1=x$ $x^2-2x+1+1-x=0$ $x^2-3x+2=0$ $(x-1)(x-2)=0$ $x=1 \ \ or \ \ x=2$
1.1.4	This question was fairly well answered. Many learners knew what they were expected to do. They still struggle to factorise correctly, especially when they didn't use 3^x .
1.2.1	This question was very well answered. The candidates that did poorly in this question did not understand the notation. Eg. They substituted x by 0 and ended up with: $f(x)=(0)^2+3(0)-4$ $=-4$
1.2.2	The first part of this question was done in 1.2.1. This was the worst answered sub-question in question 1. It is clear that most candidates still don't have a clear understanding of inequalities, ie lack of understanding of the theory. Educators should explain this section to learners from first principles using the sign-table. Many learners still treat the inequality as an equality. Very few learners have a conceptual understanding of inequalities. When teaching this section, multiple representation should be used, ie sketches and table method instead of just pure algebraic manipulation. Drawing a parabola is considered a method of solving the inequality and should not be regarded as the solution. Candidates must be able to write down the correct solution using correct notation. They should also understand the difference between "OR" and "AND". The answer must be given as an inequality and not in graphical form. Educators should consider teaching the option of using a table in solving the inequality so that learners might get a better understanding of the problem.
1.2.3	It was fairly well answered. The way in which the question was set made it easy, ie. it reduced to solving a simple linear inequality. Most candidates got the mark for finding the first derivative but then made a

	mistake in finding the correct answer.
1.3	This question was well answered. This question was attempted by most candidates. Candidates made simplification mistakes and this caused problems later. Many candidates used one solution (only the positive) and lost 1 mark. Common mistakes: • $(2y)^2 = 2y^2$ - mostly in cases where they omitted the brackets. $-6y^2 = -24$ • $y^2 = 4$ $y = 2$ / *in some cases* $y = 4$ This made them loose unnecessary marks.

QUESTION 2 [11 marks]

QUESTION 2

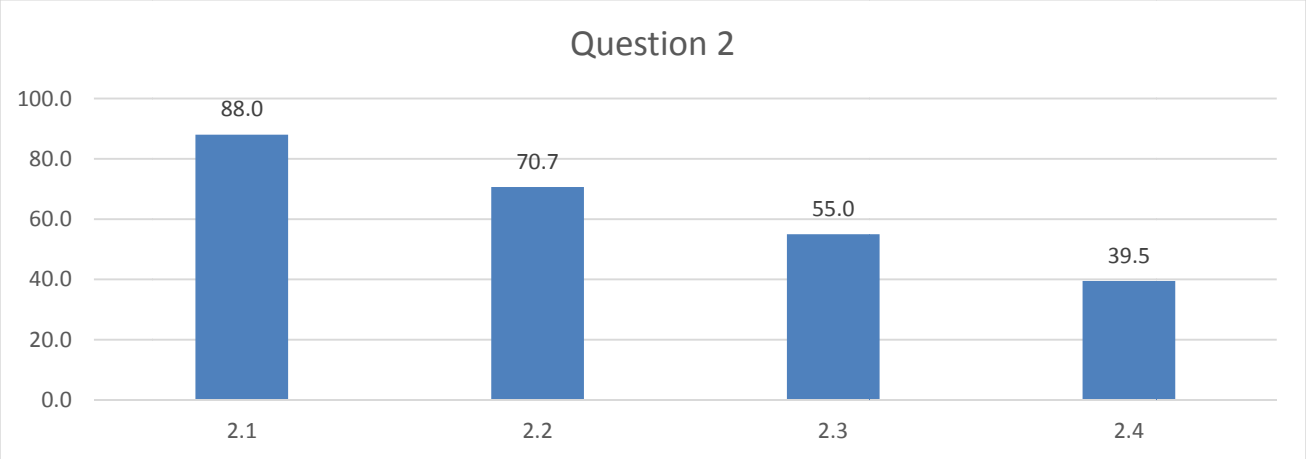
Given the finite arithmetic sequence: 5 ; 1 ; –3 ; ... ; –83 ; –87

2.1 Write down the fourth term (T_4) of the sequence. (1)

2.2 Calculate the number of terms in the sequence. (3)

2.3 Calculate the sum of all the negative numbers in the sequence. (3)

2.4 Consider the sequence: 5 ; 1 ; –3 ; ... ; –83 ; –87 ; ... ; –4 187
Determine the number of terms in this sequence that will be exactly divisible by 5. (4)
[11]



GENERAL COMMENTS:

This question tested knowledge of the arithmetic sequences & series and was answered by most candidates. It was one of the top 3 better answered questions. Questions 2.1, 2.2 and 2.3 were answered fairly well but many candidates found 2.4 extremely challenging. No marks were awarded if candidates used the wrong formula.

2.1	Most candidates could answer this question as can be seen from the graph above.
2.2	Well answered by most candidates. Some candidates still substituted – 87 for n, finding Tn.
2.3	Not well answered. Most candidates mixed up n = 22 with a = 5 or n = 24 with a = - 3. Those who used n = 24 with a = 5 did not realise they have to subtract the two positive terms.
2.4	Candidates experienced great difficulty with this question. It is also a question where we had many different responses yielding the correct answer.

QUESTION 3 [15 marks]

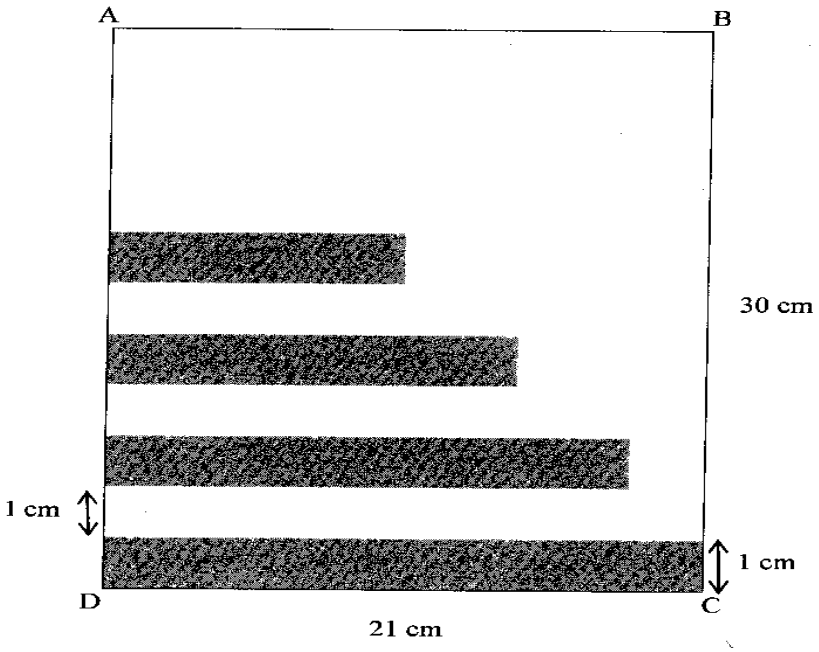
QUESTION 3

3.1 The first four terms of a quadratic number pattern are $-1 \; ; \; x \; ; \; 3 \; ; \; x+8$

3.1.1 Calculate the value(s) of x. (4)

3.1.2 If $x = 0$, determine the position of the first term in the quadratic number pattern for which the sum of the first n first differences will be greater than 250. (4)

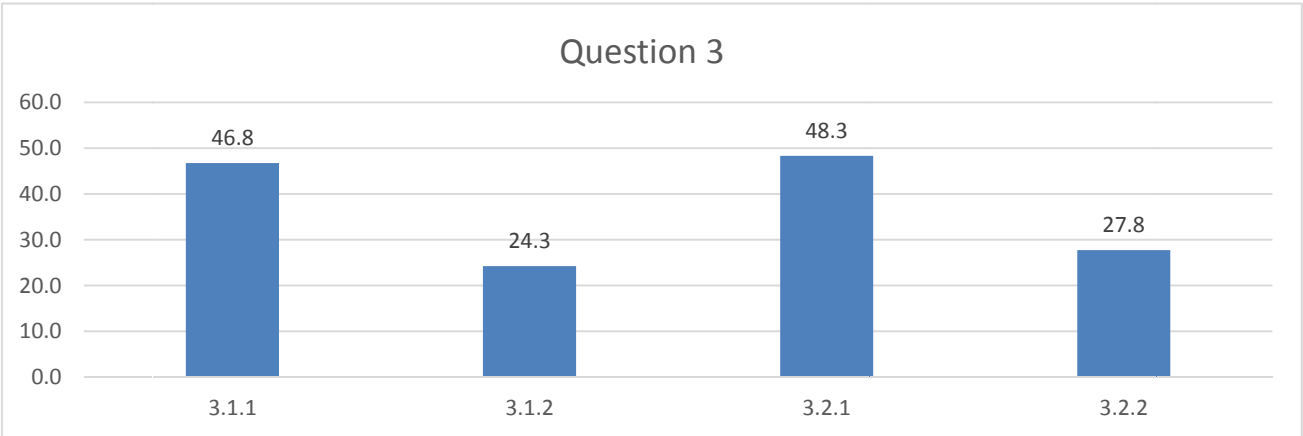
3.2 Rectangles of width 1 cm are drawn from the edge of a sheet of paper that is 30 cm long such that there is a 1 cm gap between one rectangle and the next. The length of the first rectangle is 21 cm and the length of each successive rectangle is 85% of the length of the previous rectangle until there are rectangles drawn along the entire length of AD. Each rectangle is coloured grey.



3.2.1 Calculate the length of the 10th rectangle. (3)

3.2.2 Calculate the percentage of the paper that is coloured grey. (4)

[15]



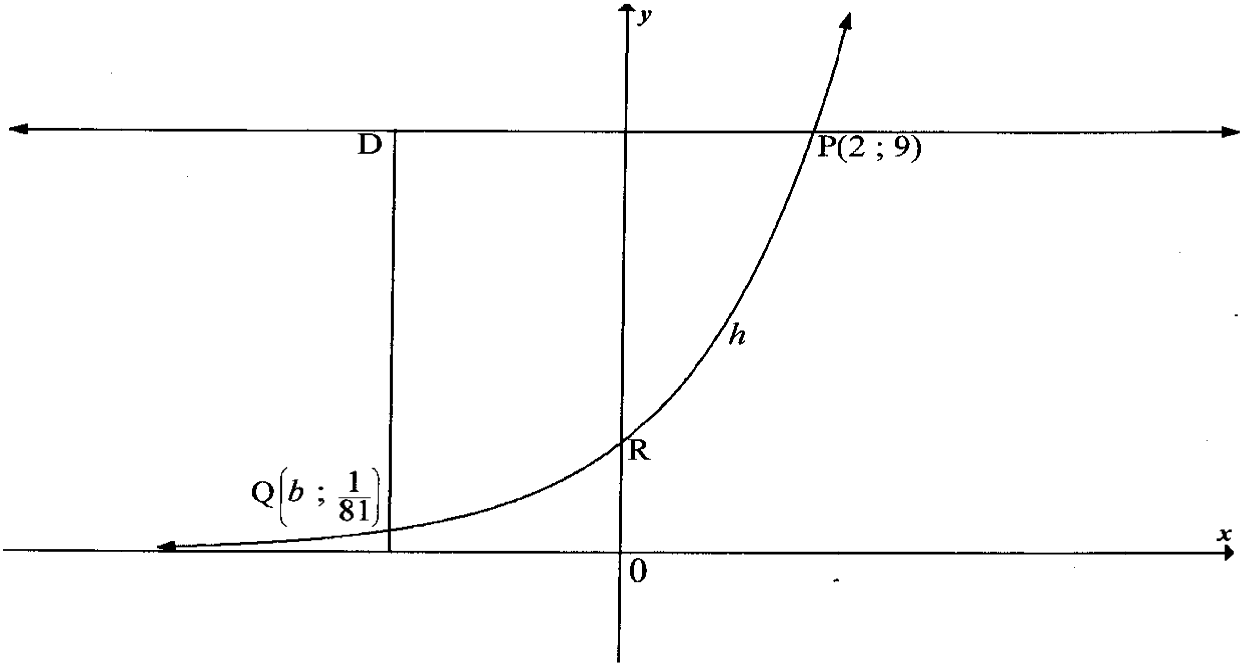
GENERAL COMMENTS: This question tested knowledge and application of quadratic patterns as well as geometric sequences. Candidates struggled with this question. Questions 3.1.2 was made more difficult in the way it was phrased and 3.2.2 was also found challenging by most candidates.	
3.1.1	Most candidates struggled with all the x's in the first and the second differences. Mistakes were made because candidates did not use brackets. This led to incorrect signs and final answer.
3.1.2	Candidates experienced great difficulty in this question. Some candidates with good manipulation skills got to n > 15,8 and wrote $\therefore$ n = 16, not realising what the question actually asked and what their answer was referring to. Many candidates worked out the general (n^{th}) term of the quadratic sequence $T_n = n^2 - 2n$ and simply stated $T_n = n^2 - 2n > 250$ not realising that they are mixing up the terms of the quadratic sequence with the sum of the terms of the sequence of first differences. Although this works out to an answer (n = 16.84 $\therefore$ n = 17) close to the correct one, it is actually a breakdown. • The correct solution going that route is: $T_n - T_1(quadratic) = S_{n-1}(sequence\,of\ \ first\ differences)$ $\therefore\ n^2 - 2n - (-1) > 250$ $n^2 - 2n - 249 > 0$ $(n - 16,81)(n + 14,81) > 0$ $\therefore\ n > 16,81 \quad or \quad n < -14,81$ $\therefore\ n = 17$
3.2.1	This question was well answered by many candidates. Variety of methods were used. Formula ; multiply 9th term by r : writing out all 10 terms.
3.2.2	Poorly answered. Most candidates struggled to see that n = 15. This could easily be obtained by simply dividing 30 by 2. Some candidates actually worked out the area of the page but got stuck there.

QUESTION 4 [11 marks]

QUESTION 4

Sketched below is the graph of $h(x) = a^x$, $a > 0$. R is the y-intercept of h.

The points P(2 ; 9) and $Q\left(b ; \frac{1}{81}\right)$ lie on h.



4.1 Write down the equation of the asymptote of h. **(1)**

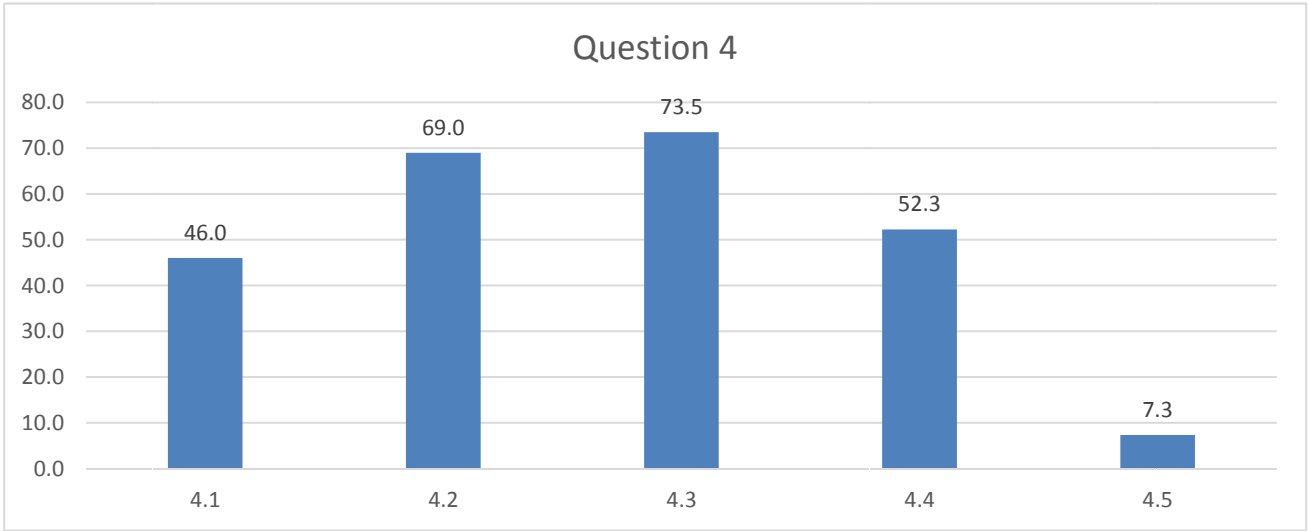
4.2 Determine the coordinates of R. **(1)**

4.3 Calculate the value of a. **(2)**

4.4 D is a point such that DQ $\parallel$ y-axis and DP $\parallel$ x-axis. Calculate the length of DP. **(4)**

4.5 Determine the values of k for which the equation $h(x+2)+k=0$ will have a root that is less than -6. **(3)**

[11]



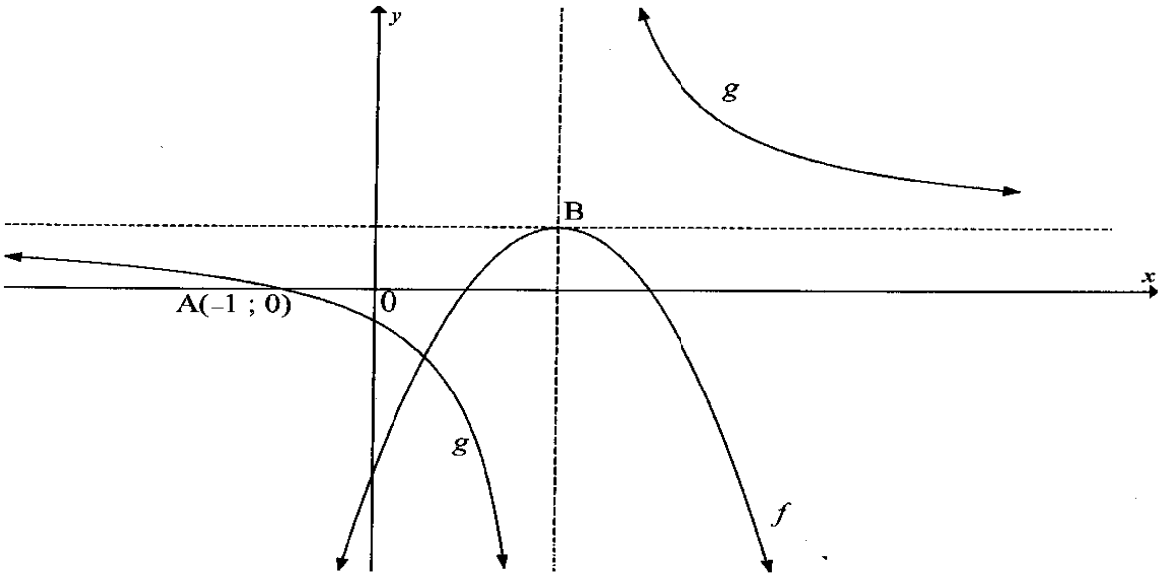
GENERAL COMMENTS: Question 4 tested knowledge of the exponential function. Candidates who lacked the mathematical knowledge and skills could not get the correct answers. Fairly well answered, except for questions 4.4 and 4.5.	
4.1	Not well answered. Candidates must know to give an equation when asked for it. Concepts must not be taught in isolation. Eg. When speaking of an asymptote, teachers should make learners aware where to look algebraically and graphically. This was purely a knowledge question.
4.2	Fairly well answered. Also a knowledge question. Some candidates still get confused when writing the coordinate form. They write R(1 ; 0) instead of R(0 ; 1).
4.3	This question was well answered. Some candidates lost 1 mark for leaving their answer as $a = \pm 3$.
4.4	Many candidates struggled with this question. They did not realise that they had to find the value of b first. Many candidates also resorted to the distance formula.
4.5	Most/All candidates experienced great difficulty with this question. Algebraic manipulation – very difficult. Candidates could not see the transformations involved and thus could not read The answer from the graph. This was after 8.2 the worst answered sub-question.

QUESTION 5 [14 marks]

QUESTION 5

Sketched below is the parabola f, with equation $f(x) = -x^2 + 4x - 3$ and a hyperbola g, with equation $(x - p)(y + t) = 3$.

- B, the turning point of f, lies at the point of intersection of the asymptotes of g.
- A$(-1\,;\,0)$ is the x-intercept of g.



5.1 Show that the coordinates of B are $(2\,;\,1)$ (2)

5.2 Write down the range of f. (1)

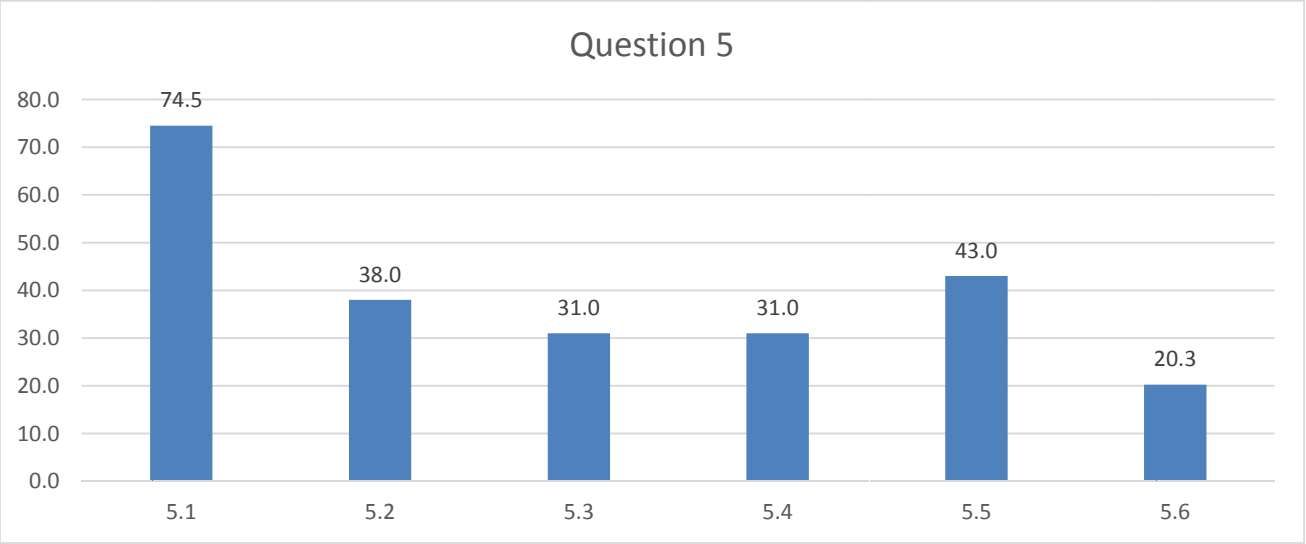
5.3 For which value(s) of x will $g(x) \geq 0$? (2)

5.4 Determine the equation of the vertical asymptote of the graph of h if $h(x) = g(x + 4)$ (1)

5.5 Determine the values of p and t. (4)

5.6 Write down the values of x for which $f(x).g'(x) \geq 0$ (4)

[14]



GENERAL COMMENTS:

This question tested knowledge of the parabola and the hyperbola. It also tested the understanding of calculus in relation to functions and graphs. It was experienced as a difficult question by most candidates. The unfamiliar form of the hyperbola contributed greatly to its challenging nature. Educators are again advised to teach the prescribed curriculum and not to rely too much on past papers. This question was well within the boundaries of the curriculum.

5.1	This sub-question was well answered. Many candidates got 2 marks for this sub-question. The marks were awarded for method rather than the answers.
5.2	Not well answered. Concepts of domain and range should be revised often. Candidates should be aware when endpoints should be included or excluded, especially in cases where asymptotes are involved.
5.3	Candidates found this question very challenging. More practice required on reading answers from the sketch. g(x) being a hyperbola had even the strong candidates struggling.
5.4	This can be seen as a routine question. Most candidates probably struggled because the hyperbola was given in an unfamiliar form. Although the coordinates of B(2 ; 1) were given, still poorly answered. Candidates must be encouraged to fill in information on the sketch. This will allow them to read solutions from the sketch.
5.5	Poorly answered. The fact that the equation of the hyperbola was given in an unfamiliar form posed a challenge to candidates. The bracket (y + t) caused further problems resulting in t = -1.
5.6	Although this question is no longer unfamiliar, the majority of candidates still struggled to even get close to the answer. Many candidates only managed to get (1/4) for x = 1 or x = 3.

QUESTION 6 [10 marks]

QUESTION 6

Given: $f(x) = -x + 3$ and $g(x) = \log_2 x$

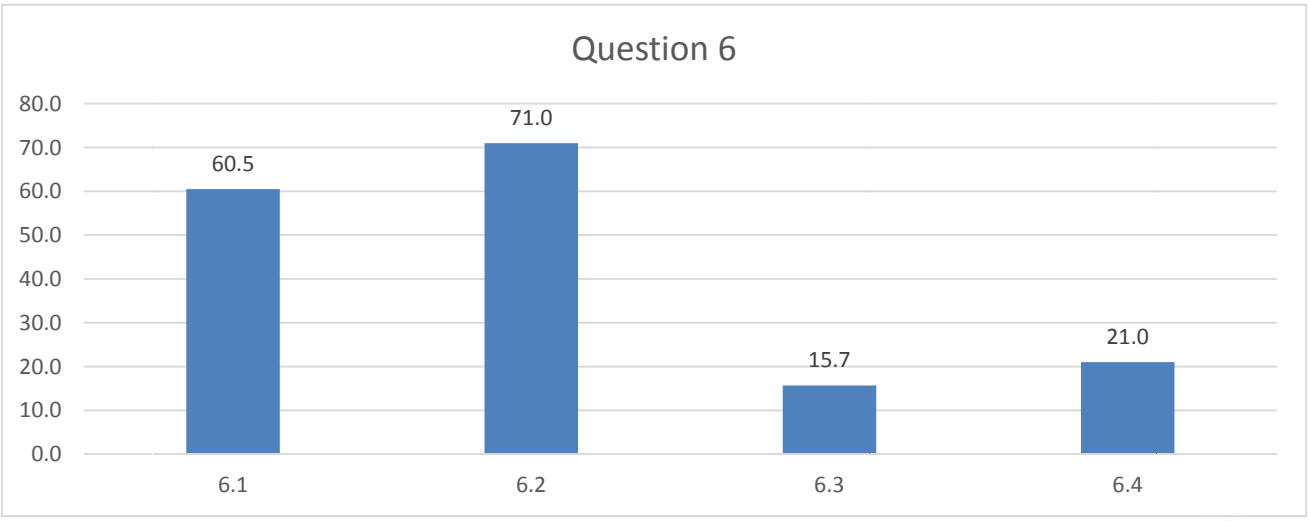
6.1 On the same set of axes, sketch the graphs of f and g, clearly showing ALL intercepts with the axes. (4)

6.2 Write down the equation of $g^{-1}(x)$, the inverse of g, in the form $y = \ldots$ (2)

6.3 Explain how you will use QUESTION 6.1 and/or QUESTION 6.2 to solve the equation $\log_2(3 - x) = x$. (3)

6.4 Write down the solution to $\log_2(3 - x) = x$. (1)

[10]



GENERAL COMMENTS:

This question tested the straight line, log graph and inverse functions. This question was not well answered at all. Questions 6.1 and 6.2 was well answered, but 6.3 and 6.4 was poorly answered.
Candidates did well in sketching and finding the inverse function. They struggled to explain themselves in 6.3 and finding the solution in 6.4. Educators should revise functions more often in grade 12 as the bulk of this module is completed in grade 11.

6.1	Fairly well answered. Many candidates calculated the x- and y-intercepts for the straight line. Some candidates did not know the shape of f(x). Fewer candidates managed to sketch the log graph with many getting 1 mark for the x-intercept.
6.2	This question was very well answered. Most candidates got the mark for interchanging x and y, while a large number just wrote down the answer correctly.
6.3	Poorly answered. Most candidates really struggled to explain/express themselves in words. Mark allocation in the memo however was more for mathematical manipulation. Most candidates did not do the manipulation because the question stated "Explain".
6.4	Many candidates got x = 1 from inspection $\left(\log_2(3-1)=1\right)\Rightarrow \log_2 2=1$ and did not necessarily follow from 6.3.

QUESTION 7 [15 marks]

QUESTION 7

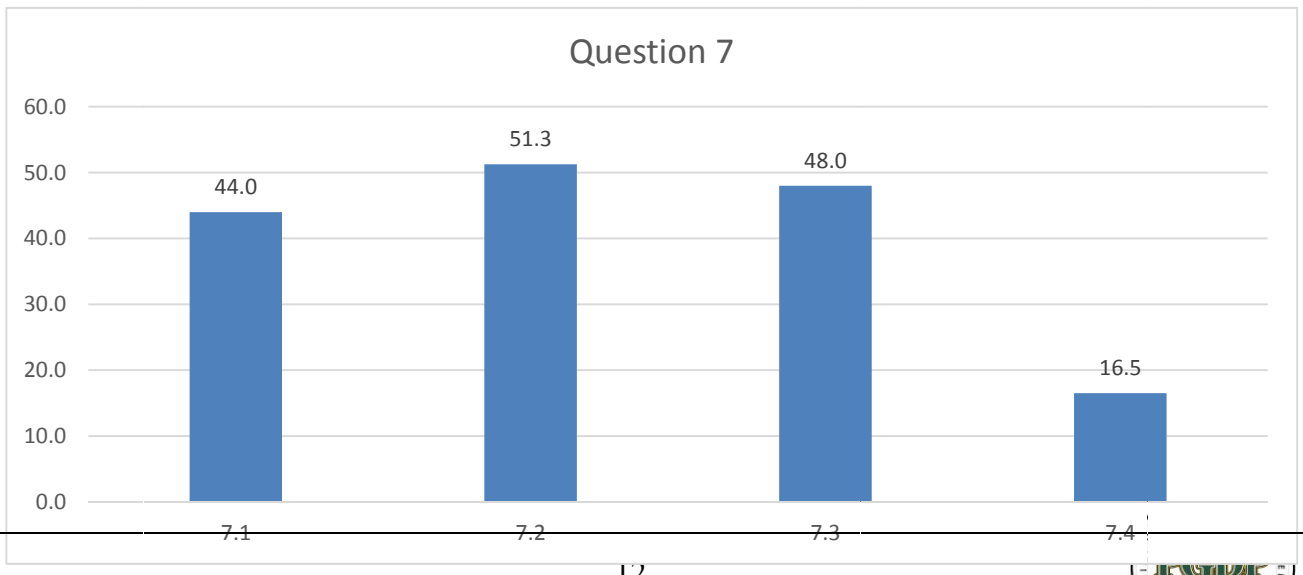
On 1 June 2016 a bank granted Thabiso a loan of R250 000 at an interest rate of 15% p.a. compounded monthly, to buy a car. Thabiso agreed to repay the loan in monthly instalments commencing on 1 July 2016 and ending 4 years later on 1 June 2020. However, Thabiso was unable to make the first two instalments and only commenced with the monthly instalments on 1 September 2016.

7.1 Calculate the amount Thabiso owed the bank on 1 August 2016, a month before he paid his first monthly instalment. (2)

7.2 Having paid the first monthly instalment on 1 September 2016, Thabiso will still pay his last monthly instalment on 1 June 2020. Calculate his monthly instalment. (4)

7.3 If Thabiso paid R9 000 as his monthly instalment starting on 1 September 2016, how many months sooner will he repay the loan? (5)

7.4 If Thabiso paid R9 000 as a monthly instalment starting on 1 September 2016, calculate the final instalment to repay the loan. (4)
[15]



GENERAL COMMENTS:

This question tested knowledge and interpretation of Financial Maths. The question was quite challenging to most candidates. Question was answered poorly. Candidates simply attempted questions without really understanding what is required of them. They really struggled to establish the value of n to be used. Some learners showed a complete lack of understanding and basic skills and used incorrect formulae. Any other formula was considered as the wrong formula and no marks were awarded. Question 7.4 was very poorly answered. Even some of the stronger candidates forgot to add interest on last instalment. Teachers must emphasize that learners must take care not to round values too soon and only when giving the final answer. Most candidates use their calculators very well in this section.

7.1	This question was not answered as well as expected. Candidates got confused because they worked in months. Many struggled to use the correct value of n. This had a snowball effect on the questions that followed.
7.2	In contrast with 7.1 candidates did better in 7.2 probably because marks were allocated for i and n independently from the formula.
7.3	Question was not answered well at all. Many candidates just scored (1/5) for substituting R9000. They still struggle with the algebraic manipulation to make n the subject of the formula. The negative signs also causes problems, especially when they start introducing logs. Some just stopped at 36 payments and thus not answering the question.
7.4	This was one of the worst answered sub questions. Most candidates did not even attempt this question. Most who got max (2/4) for finding the balance/final instalment but failed to add interest. A few candidates actually scored (4/4). Many different methods are available to find the balance/final instalment. Candidates must not forget to add the interest when required.
	More practice and drilling in financial maths are necessary so that learners can distinguish between the different formulae. Educators should use the different terminologies in class. Financial maths requires two crucial skills which are often neglected by learners. These are reading skills and calculator skills. The learners must read the financial maths question very carefully and make sure that they understand what is asked. Calculator work is essential when doing financial maths and this should be practised.

QUESTION 8 [16 marks]

QUESTION 8

8.1 Determine $f'(x)$ from first principles if $f(x) = 3x^2$ (5)

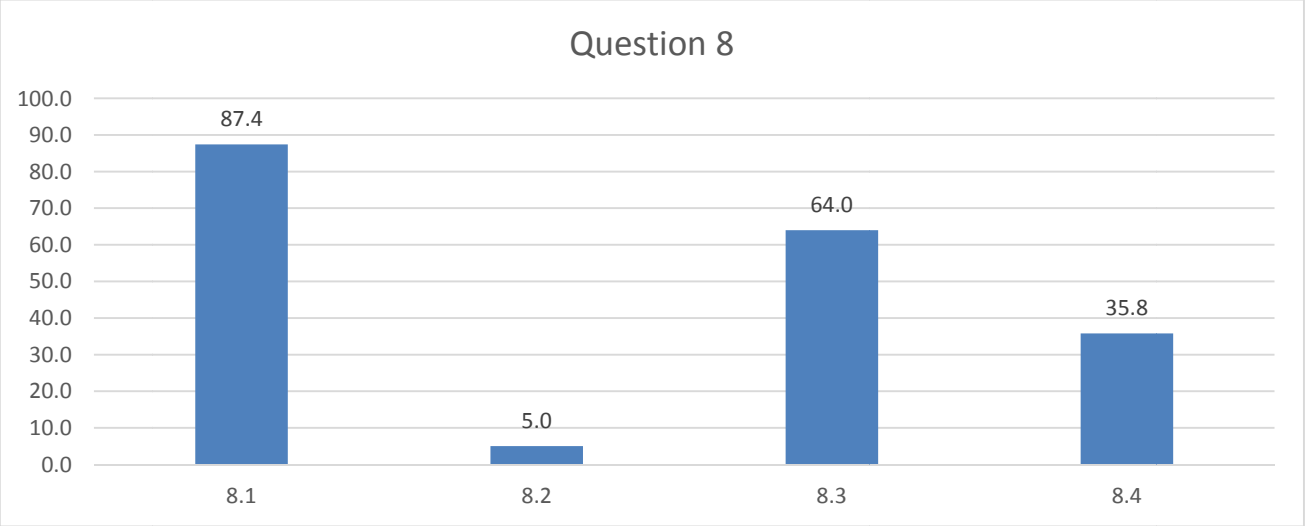
8.2 John determines $g'(a)$, the derivative of a certain function g at $x = a$, and arrives at the answer: $\lim_{h \to 0} \frac{\sqrt{4+h}-2}{h}$

Write down the equation of g and the value of a. (2)

8.3 Determine $\frac{dy}{dx}$ if $y = \sqrt{x^3} - \frac{5}{x^3}$ (4)

8.4 $g(x) = -8x + 20$ is a tangent to $f(x) = x^3 + ax^2 + bx + 18$ at $x = 1$. Calculate the values of a and b. (5)

[16]



GENERAL COMMENTS:

This was one of the better answered questions solely as a result of 8.1 and 8.3. Questions 8.2 was the worst answered sub-question in the entire paper. Q 8.4 was also poorly answered. This is the question where teachers should emphasize notation. Candidates were penalized one mark for incorrect notation in Question 8. Educators must feel confident in teaching calculus. Cluster groups can be formed to support each other in understanding and sharing teaching strategies for calculus. Most learners experience calculus as an abstract section and struggle to answer any higher level questions. It is important that learners be given experiences which promote understanding rather than recipes. In teaching calculus, teachers should encourage learners to do many application problems, so that they develop an appreciation for its power and confidence in the methods.

8.1	This question was very well answered as can be seen from the graph above. This is a routine and very predictable question. Most candidates used the correct formula and knew what to do. A few candidates still had difficulty to simplify $3(x+h)^2$ correctly. They end up with $3(x^2+2xh+h^2) \quad = 3x^2+2xh+h^2$. Simplification and notation errors were made which resulted in some marks being lost. One mark is penalised for notation errors in the whole of question 8. Teachers should note that omitting the brackets in the following step is not mathematically correct and could be penalised in future: $$\lim_{h\to 0}(6x+3h)$$ Common notation errors are the following and these errors were penalised: • If $f'(x)$ was not shown as part of the formula. • If an equal sign was written between the lim and the fraction part.
8.2	This was the worst answered sub question in the whole question paper. The overwhelming majority of the candidates had no idea what to do. The question was inaccessible to most candidates. A selected few candidates scored marks in this question. Most candidates did not write anything so it is difficult to highlight any mistakes.
8.3	This question was fairly well-answered by most candidates. Many struggled to convert from surd form $\left(\sqrt{x^3}\right)$ to exponential form $\left(x^{\frac{3}{2}}\right)$. Many wrote $\sqrt{x^3}=x^{\frac{1}{3}}$. Notation is still a concern in this question. Candidates do not know at which step they must start writing $\frac{dy}{dx}$.
8.4	Poorly answered by most candidates. They struggle to set up the correct equations from the given information and therefore could not determine the values of a and b. The concept of relating the first derivative to the gradient, as well as the relationship between x- and y-coordinates needs attention. Solving two linear equations simultaneously should be revised in grades 11 and 12.

QUESTION 9 [13 marks]

QUESTION 9

For a certain function f, the first derivative is given as $f'(x) = 3x^2 + 8x - 3$

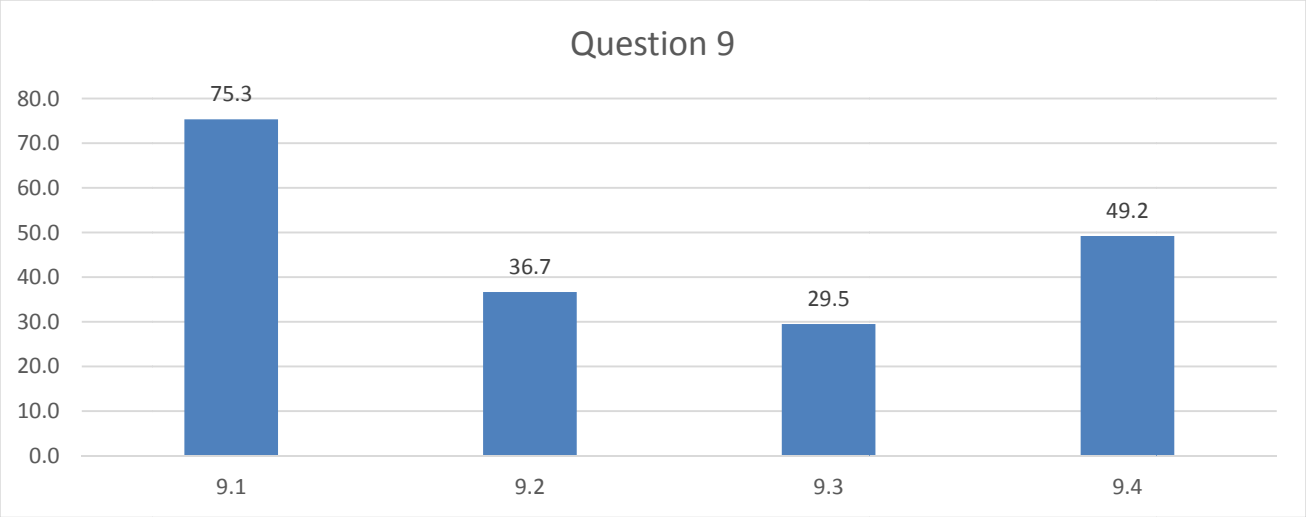
9.1 Calculate the x-coordinates of the stationary points of f. (3)

9.2 For which values of x is f concave down? (3)

9.3 Determine the values of x for which f is strictly increasing. (2)

9.4 If it is further given that $f(x) = ax^3 + bx^2 + cx + d$ and $f(0) = -18$, determine the equation of f. (5)

[13]



GENERAL COMMENTS

This question tested the cubic function, the relationship between f, f' and f''. This question was challenging and thus poorly answered, except for question 9.1.

When teaching this section learners should understand the following independent results for a function

If then is a point on the graph.
If then the graph has a gradient of 3 at the point where
If then the graph is concave up at the point where
If then is an -intercept.
If then is a -intercept.
If then the graph has a stationery point at

9.1	Well answered by most candidates. They saw a familiar trinomial and just solved for x. Candidates did not really understand that the x-intercepts of f' is the same as the x-coordinates of the stationary points. More time should be spend to get candidates to see these connections/relationships.
9.2	This question was disappointingly poorly answered. Candidates linked the concept of concavity with the second derivative but then they did not know which inequality sign to use. Most candidates used an equal sign. (Helpful - See note in 2015 Report regarding concavity)
9.3	Poorly answered. The concept of increasing and decreasing w.r.t functions/graphs is still a major challenge to candidates, not knowing the relationship with the gradient of the tangent to a graph. If this is understood they can easily be read from a graph but in this case no sketch available. Candidates can be encouraged to make rough sketches to assist them in answering these questions. Multiple representation should be encouraged so that candidates are not dependent on one method only. The memo just gives the answer, but a lot of work had to be done to come to that conclusion. (No sketch)
9.4	This question was surprisingly better answered than the previous two questions. Many of the above average learners just wrote done the answer. It was also clear that many learners did not know what to do at all.
	Educators must feel confident in teaching calculus. Cluster groups can be formed to support each other in understanding and sharing teaching strategies for calculus. Most learners experience calculus as an abstract section and struggle to answer any higher level questions. Teachers should try and keep calculus simple and structured and teach the basic principles as not to confuse learners.

QUESTION 10 [8 marks]

QUESTION 10

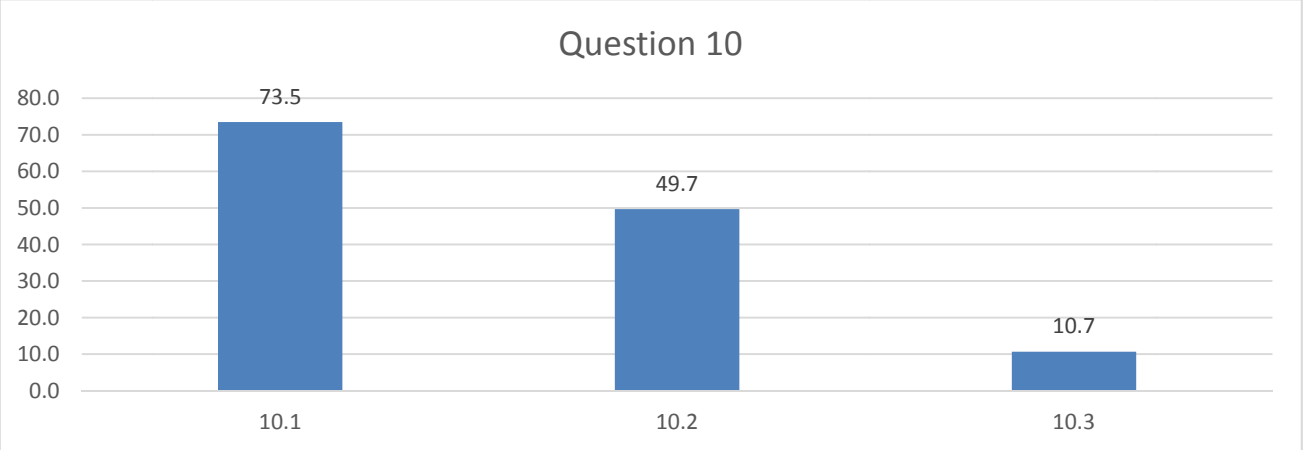
The number of molecules of a certain drug in the bloodstream t hours after it has been taken is represented by the equation $M(t) = -t^3 + 3t^2 + 72t$, $0 < t < 10$.

10.1 Determine the number of molecules of the drug in the bloodstream 3 hours after the drug was taken. (2)

10.2 Determine the rate at which the number of molecules of the drug in the bloodstream is changing at exactly 2 hours after the drug was taken. (3)

10.3 How many hours after taking the drug will the rate at which the number of molecules of the drug in the bloodstream is changing, be a maximum? (3)

[8]



GENERAL COMMENTS:

This question is still a challenge to learners. With the exception of 10.3 this question as a whole was answered better than in previous years, clearly showing that some work was done to improve the performance in this section. Last year it was the worst answered question but this year is falls amongst the average answered questions. Candidates still found it difficult to decide whether to use M(t), M'(t) or M''(t).

10.1	This question was well answered by those who attempted it, with the majority of candidates scoring marks. Most candidates got to the correct answer. Very few calculations errors. Again, the good calculator skills helped the candidates to get the correct answer.
10.2	Many leaners who attempted this question scored some marks. Some just substituted t = 2 again.
10.3	Most learners did not know that they were required to find the second derivative. They simply worked with the first derivative, solved for t = 6 or t = - 4, but this was not worth any marks if they did not use the answers to find the t-value for the turning point. They could have also used the first derivative with other methods to determine t.

QUESTION 11 [8 marks]

QUESTION 11

A survey was conducted among 100 boys and 60 girls to determine how many of them watched TV in the period during which examinations were written. Their responses are shown in the partially completed table below.

	WATCHED TV DURING EXAMINATIONS	DID NOT WATCH TV DURING EXAMINATIONS	TOTALS
Male	80	*a*	
Female	48	12	
Totals	*b*	32	160

11.1 Calculate the values of a and b. (2)

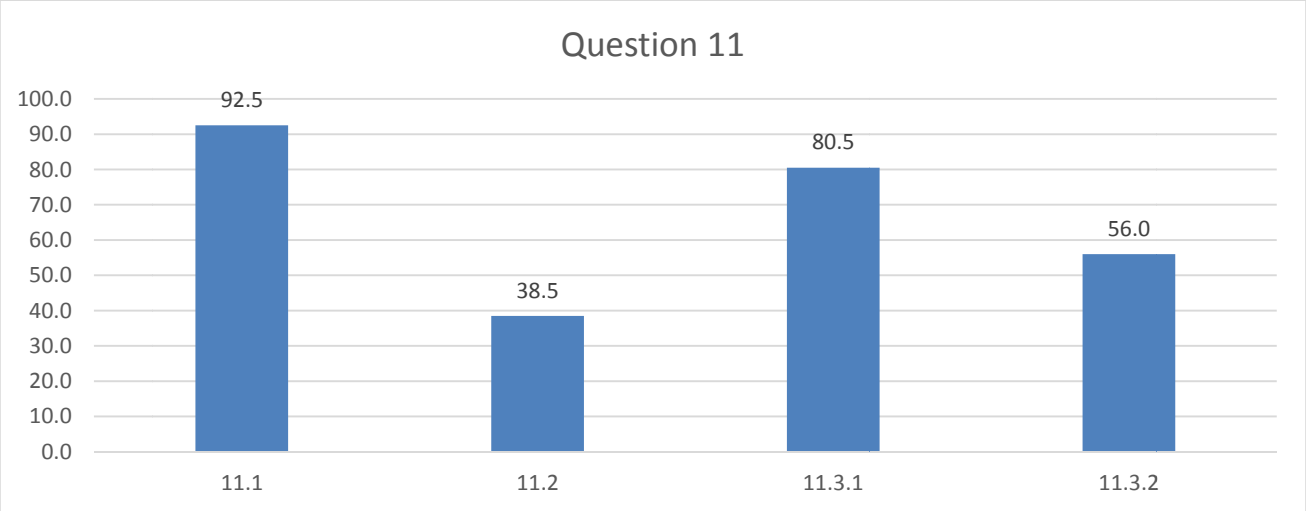
11.2 Are the events 'being a male' and 'did not watch TV during examinations' mutually exclusive? Give a reason for your answer. (2)

11.3 If a learner who participated in this survey is chosen at random, what is the probability that the learner:

11.3.1 Watched TV in the period during which the examinations were written? (2)

11.3.2 Is not a male and did not watch TV in the period during which examinations were written? (2)

[8]



GENERAL COMMENTS:

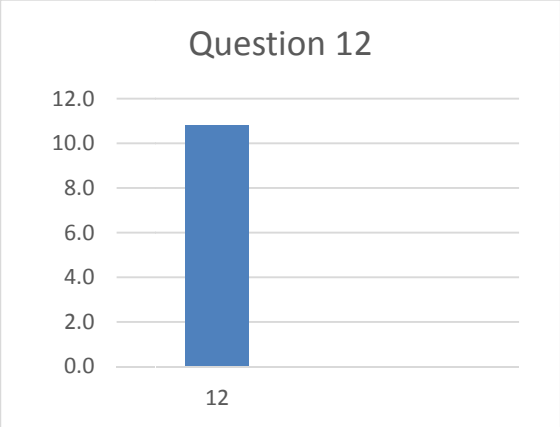
This was the third year that probability was tested as part of the core syllabus. This question tested probability using the contingency table. Candidates found this question very accessible and quite easy. Teachers can note that it is not necessary to simplify fractions when answering probability questions and that answers can be given as proper and improper fractions, decimal fractions and percentages.

11.1	This question was very well answered by most candidates. It only required common sense really. Purely knowledge.
11.2	This question was answered poorly. Many candidates got 1 mark for saying No but could not give a reason relating to the contingency table.
11.3.1	Well answered. A common mistake was that some candidates only wrote down 128 not realising that probability should be a proper fraction. Thus losing both marks
11.3.2	This question was fairly well answered. Candidates who could not read the answer from the table tried other methods and got confused and stopped. Eg. $P(not\ Male) = 1 - P(Male)$ $= 1 - \frac{100}{160}$ $= \frac{3}{8}$ Some candidates **assumed** that the events are independent and worked it out and got to the correct answer. (This is not always true – so coincidence) $P(Female \cap No\,TV) = P(Female) \times P(No\,TV)$ $= \frac{60}{160} \times \frac{32}{160}$ $= \frac{3}{40}$

QUESTION 12 [5 marks]

QUESTION 12

The digits 1 to 7 are used to create a four-digit code to enter a locked room. How many different codes are possible if the digits may not be repeated and the code must be an even number bigger than 5 000? **[5]**



GENERAL COMMENTS: (NO sub-questions)

12	Poorly answered question. Candidates really struggled to bring all the constraints together. Most candidates just had no clue of what to do and wrote down something with factorial. Counting principle is still a section where support is needed. The fact that the problem had to

	be broken up into various cases added to its complexity.

QUESTIONS 1 to 12
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
SEE COMMENTS ABOVE. THE GRAPHICAL REPRESENTATION CLEARLY INDICATES HOW THE LEARNERS PERFORMED IN EVERY SUB-QUESTION.

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

(c) Provide suggestions for improvement in relation to Teaching and Learning
Some of the more specific suggestions have been made at the various sub-questions.
Educators should drill basic mathematical skills in grades 8 and 9.
Topics covered and completed in grade 10 and 11 should be revised during grade 12 year by making use of worksheets and short informal tests and well-prepared assignments.
Educators should not assume that learners know how to use their calculators. They should be taught. Get help from manufacturers to run workshops.
Many candidates fell flat in this paper because of a lack of understanding of the basic mathematical concepts. Don't coach learners for exams; Teach the syllabus.
Work out as many previous papers as possible to familiarize learners with the various ways of asking the same question. This should not be your only source of revision.
Encourage learners to work independently.
Educators should try to introduce more unseen questions to brighter learners.
Teachers as well as learners must be committed in teaching and studying the subject.
Test learners on the use of the correct formula.
Integrate topics for higher level questions.
Candidates copy formulae incorrectly from the formula sheet.
We should really strife for Mathematical proficiency / excellence.

(d) Describe any other specific observations relating to responses of learners
There are still many learners taking mathematics who lack very basic skills.
Calculation errors cost marks.
Candidates do not read the instructions/questions and do not motivate/explain an answer if asked for a motivation or explanation.
The language barrier remains a problem for many candidates.
Motivate candidates to set work out neatly with a clear line or space between questions. If at all possible candidates should answer questions in numerical order.
Furthermore, candidates must refrain from dividing the page in two and doing questions alongside each other. The answer book has more than enough pages. They may also use a second book.
Candidates must note that working must be shown and that answers only are often not awarded full marks. Point out the instruction that states that an answer only will not necessarily be awarded full marks.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Educators must treat grade 10, 11 and 12 as one unit and not only focus on grade 12.
Focus should be placed on the training and development of grade 8 and 9 educators. The understanding of basic skills stems from these grades.
Educators need to constantly upgrade their own mathematical knowledge and skills. Communicate with educators for surrounding schools and contact subject specialists.
If available, make use of technology in teaching certain topics. 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 visit schools frequently.
Subject advisors could use a memo discussion session for non-markers to enrich them.
When setting tests teachers should also include unseen higher order questions.

SIGNATURE OF CHIEF MARKER: _____