EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

2022 NSC CHIEF MARKER'S REPORT

SUBJECT	**MATHEMATICS**		
QUESTION PAPER	~~1~~	2	3
DURATION OF QUESTION PAPER	**3 HOURS**		
PROVINCE	**EASTERN CAPE**		
DATES OF MARKING	**08/12/2022**		

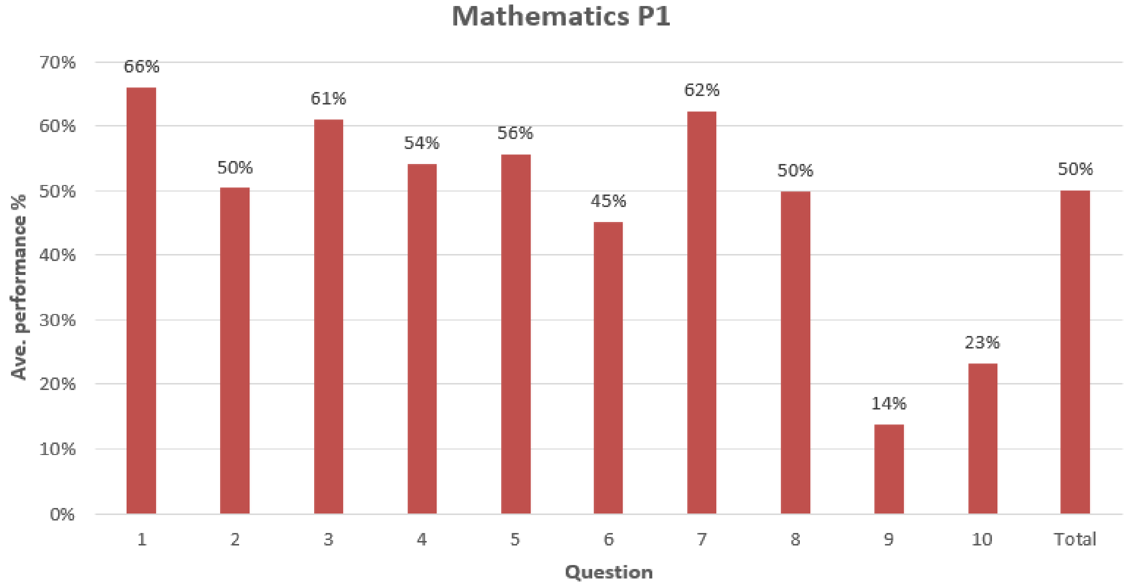
SECTION 1: (General overview of Learner Performance in the question paper as a whole)

- **Below average learners did badly in this paper as can be seen from the high % of pupils who failed.**
- **Average learners scored good marks but was challenged by the higher order questions to gain above average marks.**
- **Above average learners did well but it was clear that the higher order questions were a challenge and therefor the decline in numbers who scored 90% and above.**
- **There were however pupils who scored close to full marks for the paper.**

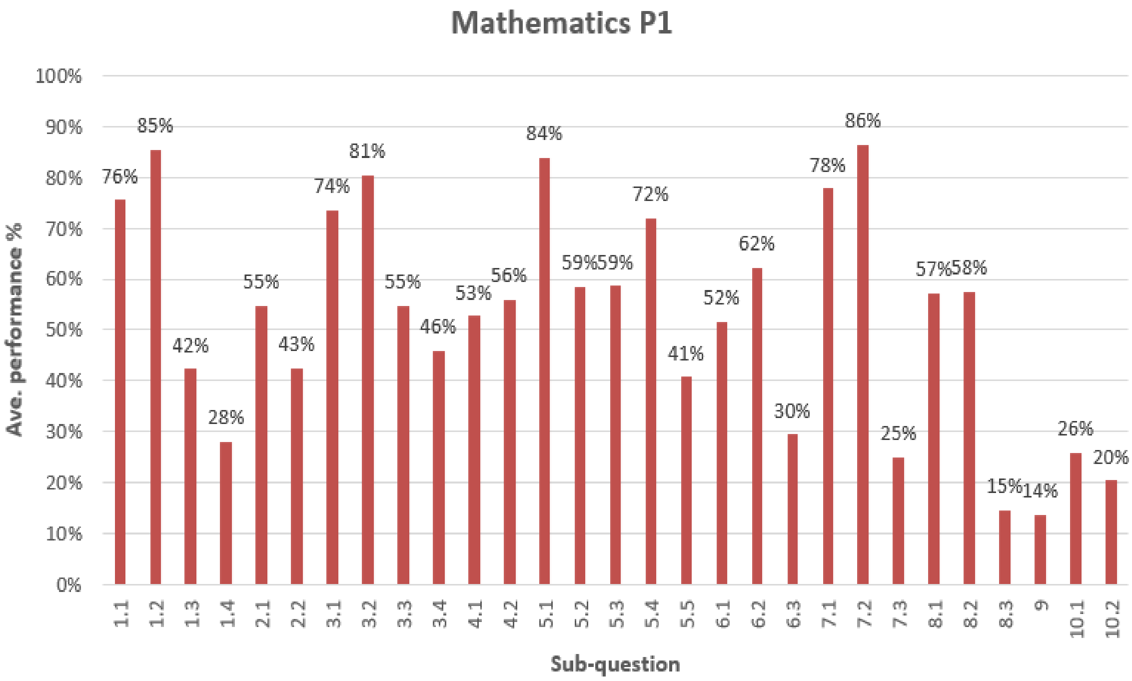
Candidate results covered the full spectrum from no marks to almost full marks. The graph below shows an analysis of the marks for 100 scripts drawn from good, average and weak candidates with an even distribution of marks from 0 to almost full marks. The graph indicates that these candidates performed best in routine questions (1, 2 and 7) and worst in questions requiring applications and higher order thinking (3, 10 and 11).

More questions in 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 question from 100 scripts sampled.



Average performance per sub question of 100 scripts sampled.



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?
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 overall achievement of all 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.

QUESTION 1

1.1 Solve for x:

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

1.1.2 $2x^2-6x+1=0$ (correct to TWO decimal places)

1.1.3 $x^2-90>x$

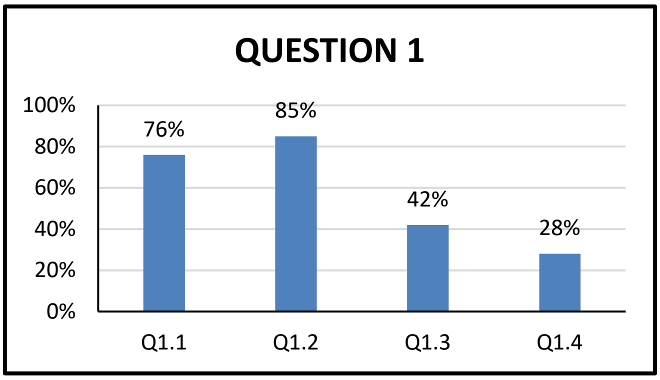
1.1.4 $x-7\sqrt{x}=-12$

1.2 Solve for x and y simultaneously:

$$2x-y=2$$
$$xy=4$$

1.3 Show that $2.5^n-5^{n+1}+5^{n+2}$ is even for all positive integer values of n.

1.4 Determine the values of x and y if: $\dfrac{3^{y+1}}{32}=\sqrt{96^x}$



1.1.1	Full marks awarded for the answers. Some candidates did not recognise that it was already in factorised form and multiplied the two binomials. Transposing remains a problem among the weaker learners. This question was well answered by the majority of the candidates.
1.1.2	Well answered by the majority of candidates. Educators need to stress the importance of showing the substitution into the formula. Full marks were awarded for answers only as the usage of the calculator were tested. If candidates show the substitution into the formula they can score a mark even if they use the calculator incorrectly. This is the only question where candidates were penalised for rounding.
1.1.3	Well answered by candidates that had a good understanding of inequalities. Other candidates could only score 2 marks (for standard form and critical values), they could not interpret the inequality correctly. Educators need to revise this section from the grade 11 syllabus.
1.1.4	Partially well answered. This is also a section that need thorough revision in grade 12 as learners do not realise that they need to isolate the surd. Some changed the $\sqrt{x}$ to $x^{\frac{1}{2}}$ and tried factorising which they could not do. Some candidates squared both sides without isolating the surd.
1.2	This was the second best answered questions in the paper. Some learners forgot to find the $y - value$ after solving for x first.
1.3	This question tested learner's knowledge on Exponents and most could score 2/3 marks as they could not explain themselves in their final answer. Most learners ended with this answer - $22(5^2)$. The marking guideline wanted them to explain their answer or show that it is a multiple of 2 for the third mark.
1.4	Another exponential/ surd question that needed simultaneous solution. This was beyond most candidate's ability and was poorly answered. Educators need to instil the basic laws of exponents and surds to their learners.

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.
- Solving for x by squaring both sides need to be revised. Testing of answers must also be drilled into learners.

QUESTION 2

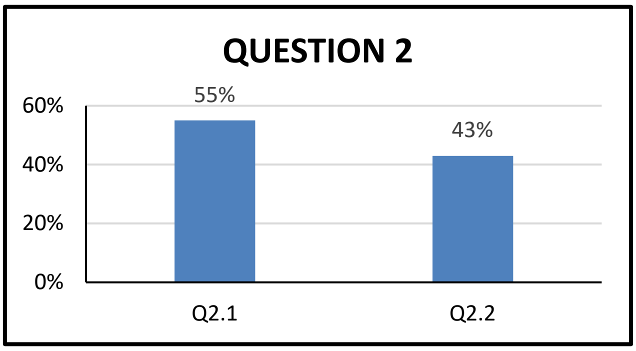
2.1 The first term of a geometric series is 14 and the 6^{th} term is 448.

2.1.1 Calculate the value of the constant ratio, r. (2)

2.1.2 Determine the number of consecutive terms that must be added to the first 6 terms of the series in order to obtain a sum of 114 674. (4)

2.1.3 If the first term of another series is 448 and the 6^{th} term is 14, calculate the sum to infinity of the new series. (3)

2.2 If $\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$, determine the value of k.



2.1.1 Well answered by most candidates. Below average learners however only attempted this question towards the end of their answer book. This clearly indicates that this section was either not taught or not sufficient revision was done.

2.1.2 This question tested learner's knowledge and understanding of geometric series. The wording in this question could have been phrased better for example; Determine the …. that must be added to the **SUM OF THE** …., The amount of reading to interpret the question could have partially played a role as to why candidates did not do well in this question.

2.1.3 An easy question where the given geometric series had to swopped. The common mistake amongst learners were that they did not adhere to the rule: $-1 < r < 1$. Somehow, they got a ratio of 2 and still tried to work out the sum to infinity. This constituted a breakdown as learners had to realise that they can only find the sum to infinity if $r = 2$.
2.2 This question tested knowledge of sigma notation of an Arithmetic series. Most learners knew what to do but some interchange n and k in the sum of an arithmetic series. This caused them to lose marks. The conclusion of "top – bottom + 1" were also lacking by some candidates.

QUESTION 3

It is given that the general term of a quadratic number pattern is $T_n = n^2 + bn + 9$ and the first term of the first differences is 7.

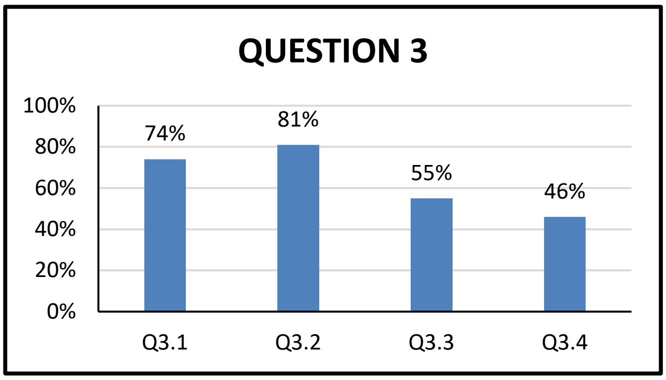
3.1 Show that $b = 4$. (2)

3.2 Determine the value of the 60^{th} term of this number pattern. (2)

3.3 Determine the general term for the sequence of first differences of the quadratic number pattern. Write your answer in the form $T_p = mp + q$. (3)

3.4 Which TWO consecutive terms in the quadratic number pattern have a first difference of 157? (3)

[10]



3.1 Well answered question by most candidates.

3.2 The best answered sub question as learners could now use the $b = 4$ given in 3.1 to answer this question.

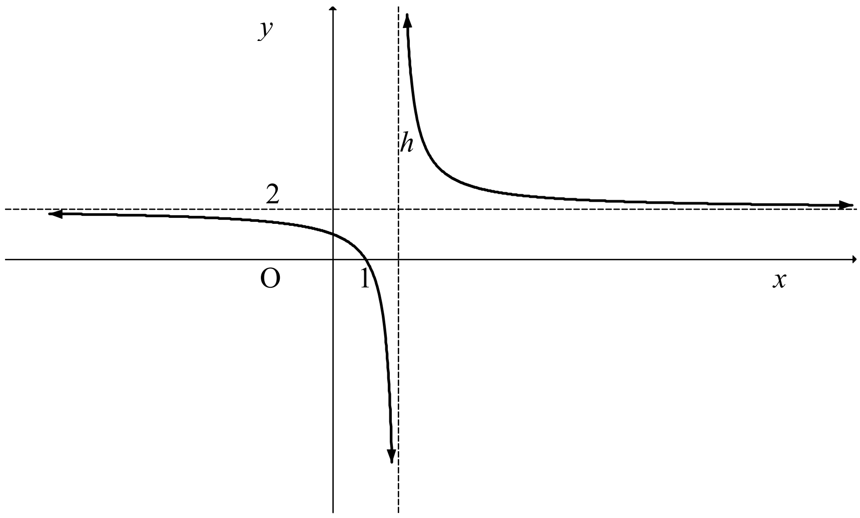
3.3 An easy question but learners performed poorly as they could not determine the equation of the first differences. Educators need to stress that learners should answer the question in the format that were given. Many learners left the equation in the form of $T_n =$ …. whereas the question wanted in the format of $T_p =$ ….. Learners were not penalized for this but it is something that must be instilled at schools.

3.4 A fairly predictable question that tested insight of quadratic patterns. Learners who could not get the correct answer in 3.3 only scored 1 mark for equating their wrong equation to 157. Educators need to stress the importance of natural numbers when dealing with patterns as learners need to realise that when they get to decimals that something went wrong somewhere. A most common error by learners:

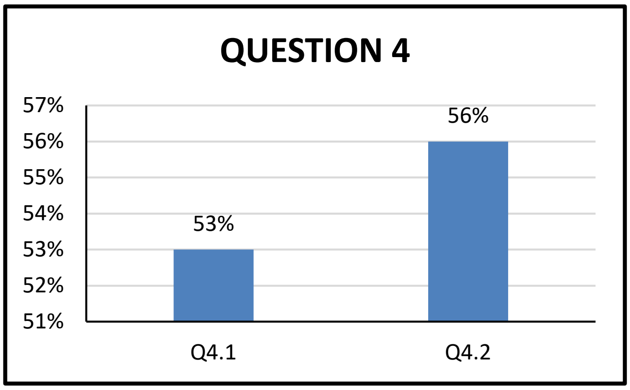
$T_n = n^2 + 4n + 9 = 157.$

QUESTION 4

4.1 Sketched below is the graph of $h(x)=\dfrac{1}{x+p}+q$. The asymptotes of h intersect at (1 ; 2).



4.1.1	Write down the values of p and q.	(2)
4.1.2	Calculate the coordinates of the x-intercept of h.	(2)
4.1.3	Write down the x-coordinate of the x-intercept of g if $g(x)=h(x+3)$.	(2)
4.1.4	The equation of an axis of symmetry of h is $y=x+t$. Determine the value of t.	(2)
4.1.5	Determine the values of x for which $-2\leq\dfrac{1}{x-1}$.	(3)



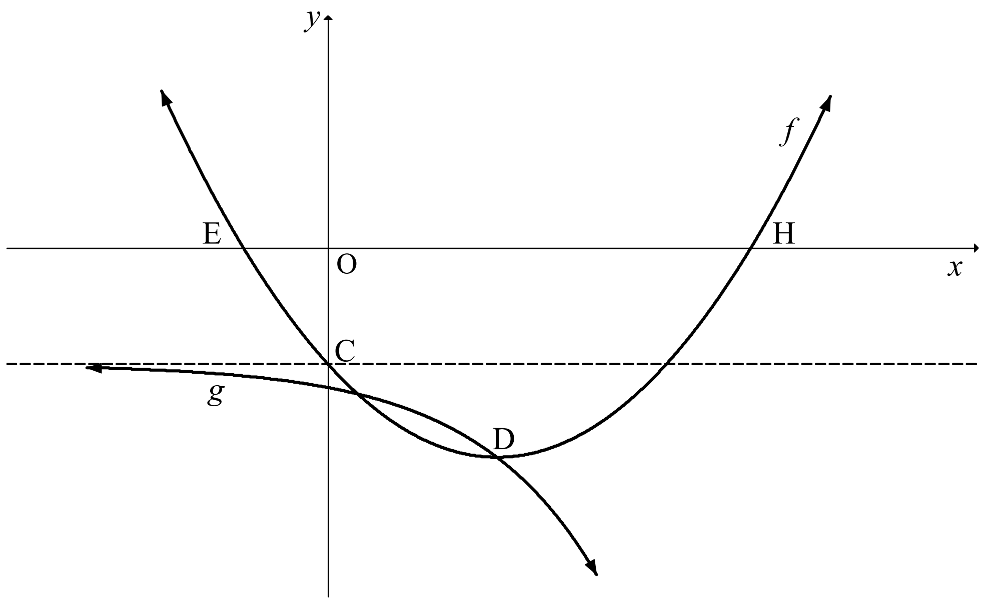
4.1.1 Well answered yet there are learners who have a problem regarding the asymptotes: $x+p=0$, $x=-p$. many learners wrote that $p=1$ instead of $p--1$. Other learners used x and y instead of p and q.

4.1.2 This was straightforward as learners could use the given asymptotes to determine the $x-intercept$. Learners must interpret the sketch and realise that the $x-intercept$ was between 0 and 1 and therefore cannot be negative. They must always refer to the diagram to look at the logical conclusion of their answers.

4.1.3 This question is based on the grade 10 syllabus where translation of functions is introduced. More practice and explanation need to be revised in grade 12. They struggled to interpret what they had to do.
4.1.4 Well answered question on symmetry. This is a routine question yet many learners misinterpreted the question and could not give the value of t.
4.1.5 This question tested the pupil's knowledge of Inequalities regarding the given diagram. The mistake that the vast majority of pupils made was as follows: (trying to solve it algebraically) $-2 \leq \frac{1}{x-1}$ $-2(x-1) \leq 1$ This constitute a BD(break down) Educators need to revise inequalities as mentioned before, we cannot multiply across an inequality sign. The denominator is critical to the solution.

4.2 The graphs of $f(x) = x^2 - 4x - 5$ and $g(x) = a.2^x + q$ are sketched below.

- E and H are the x-intercepts of f.
- C is the y-intercept of f and lies on the asymptote of g.
- The two graphs intersect at D, the turning point of f.



4.2.1 Write down the y-coordinate of C. (1)

4.2.2 Determine the coordinates of D. (2)

4.2.3 Determine the values of a and q. (3)

4.2.4 Write down the range of g. (1)

4.2.5 Determine the values of k for which the value of $f(x) - k$ will always be positive. (2)

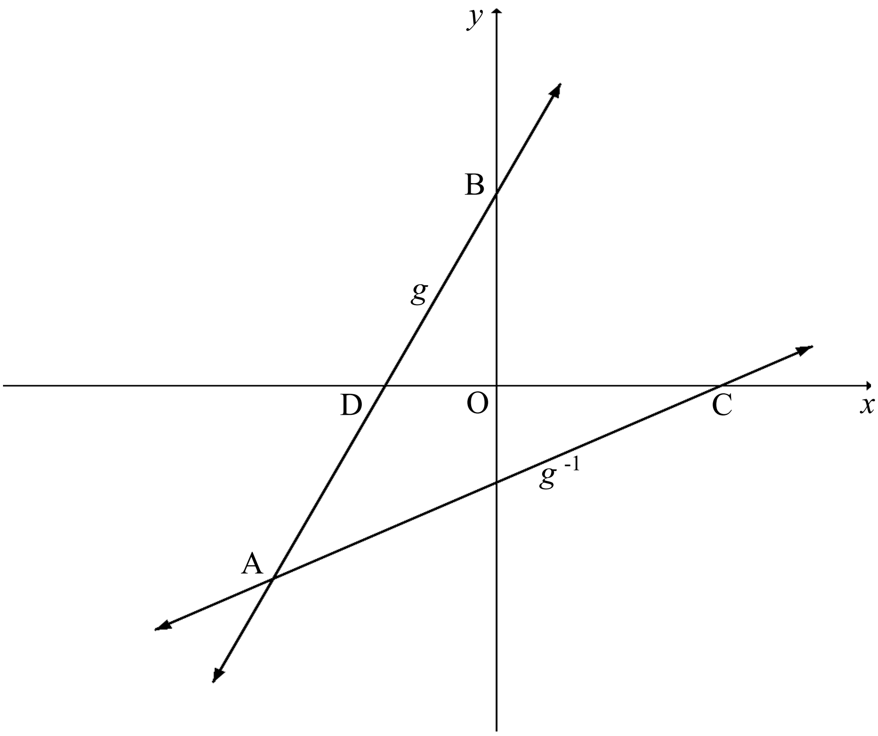
[20]

4.2.1 Straightforward and well answered.
4.2.2 Well answered. Once again learners need to refer to the diagram to ensure that their answers make sense according to the given diagram.
4.2.3 As mentioned before, learners need to refer to the diagram given to fully comprehend what the question required. They need to draw comparisons between the given functions to gain the necessary information. Most learners failed to do this.
4.2.4 The concept of Domain and Range is lacking by below average learners. This was an easy mark to score if learners knew that the range has to deal with the $y - values$.
4.2.5 Poorly answered question, yet a lot of learners got the -9 value but the inequality showing the wrong way.
General comments: This question had a lot of sub questions and educators need to inform pupils to leave a space open between sub questions. Marking of these 1 / 2-mark questions are easily overlooked by markers as they tend to see it as one whole answer of a previous question.

QUESTION 5

The graphs of $g(x) = 2x + 6$ and g^{-1}, the inverse of g, are shown in the diagram below.

- D and B are the x- and y-intercepts respectively of g.
- C is the x-intercept of g^{-1}.
- The graphs of g and g^{-1} intersect at A.



5.1 Write down the y-coordinate of B. (1)

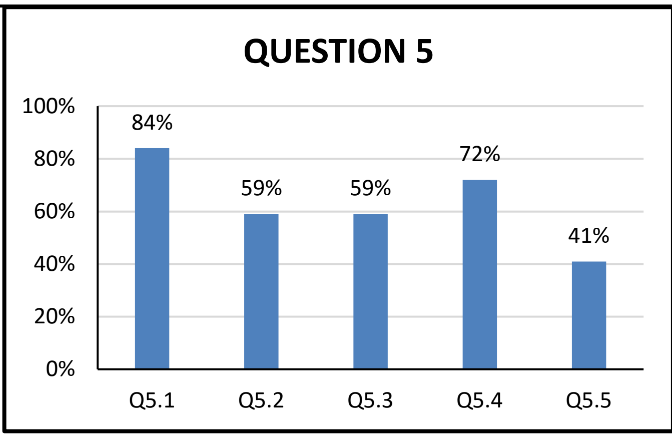
5.2 Determine the equation of g^{-1} in the form $g^{-1}(x) = mx + n$. (2)

5.3 Determine the coordinates of A. (3)

5.4 Calculate the length of AB. (2)

5.5 Calculate the area of ΔABC. (5)

[13]



5.1 Well answered as they had to refer to the graph to interpret the $y - intercept.$

5.2 Straightforward question to find the inverse. Some candidates scored only 1 mark for swopping x and y . They could not make y the subject of the new equation. This is a concept that is being taught in the grade 10 syllabus.

5.3 To find the coordinates of **A,** learners had to equate the two equations, that is the given one and the one they were asked to determine in **5.2.** However, if they referred to the sketch, they should have realized that the coordinates of **A** should be the same value as it is a point of intersection of the two linear functions. If the equation determined in **5.2** is wrong then the coordinates of **A** will not be the same. This is a concept that most learners did not realise and just carried on in answering the questions. Continuous accuracy applied throughout the marking process but where there are fundamental flaws in the Mathematical concepts it was heavily penalised.

5.4 The concept of the distance formula, using the coordinates of **A** and the coordinates of **B**, to determine the distance of **AB**. Good marks were obtained because of CA marking. Educators need to alert pupils of always referring to their diagrams when answering questions on Functions.

5.5 This question led to so many different possible solutions and was difficult to mark as top learners came up with a variety of ways to determine the area of the triangle. The Marking guideline however cannot make provision for all the different types of solutions:
Three ways of solving the question are on the marking guideline but there are many other ways of getting to the answer.
One such interesting method from a learner is as follows:
Refer to diagram above; Working out the area of **Triangle BCD =** $\frac{1}{2} \times \mathbf{9} \times \mathbf{6} = \mathbf{27}$
Then determining the equation of the perpendicular height from D to AC. A good grasp of analytical geometry shown. The candidate further determines the coordinates of the point of intersection of the Perpendicular height and the line AC then continues to work out the length of the perpendicular height from D to AC.

$m_{AC} = \frac{1}{2}$

$m_{DK} = -2$

$DK = -2x + c$

$0 = -2(-3) + c$

$c = -6$

$AC = \frac{1}{2}x - 3 \quad DK = 2x - 6$

$\frac{1}{2}x - 3 = 2x - 6$

$x = -\frac{6}{5}$

$y = -\frac{18}{5}$

Length of DK (perpendicular height) $=\frac{9\sqrt{5}}{5}$

$\boldsymbol{Area\ of\ \Delta DAC = \frac{1}{2} \times \sqrt{180} \times \frac{9\sqrt{5}}{5} = 27}$

Area of two triangles =54 units squared

QUESTION 6

6.1 R12 000 was invested in a fund that paid interest at m% p.a., compounded quarterly. After 24 months, the value of the investment was R13 459.

Determine the value of m. (4)

6.2 On 31 January 2022, Tino deposited R1 000 in an account that paid interest at 7,5% p.a., compounded monthly. He continued depositing R1 000 on the last day of every month. He will make the last deposit on 31 December 2022.

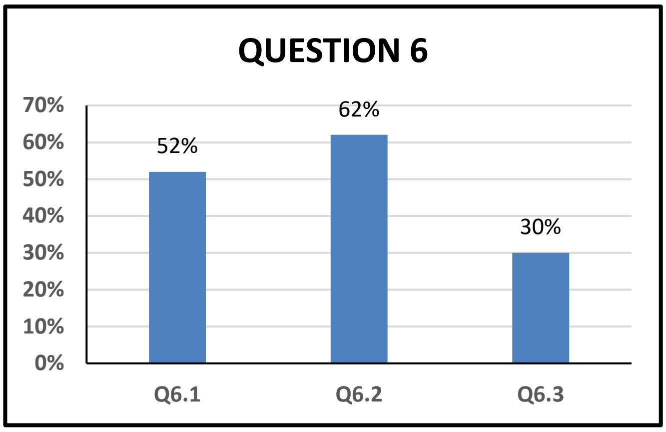
Will Tino have sufficient funds in the account on 1 January 2023 to buy a computer that costs R13 000? Justify your answer by means of an appropriate calculation. (4)

6.3 Thabo plans to buy a car that costs R250 000. He will pay a deposit of 15% and take out a loan for the balance. The interest on the loan is 13% p.a., compounded monthly.

6.3.1 Calculate the value of the loan. (1)

6.3.2 The first repayment will be made 6 months after the loan has been granted. The loan will be repaid over a period of 6 years after it has been granted. Calculate the MONTHLY instalment. (5)

[14]



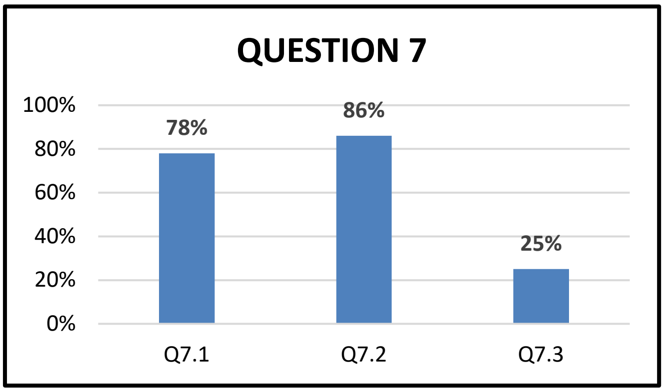
6.1 An easy question where the challenge was to convert the months into years or directly into quarters. Most candidates used the 24 months as is and did not convert it to quarters.

6.2 The best answered question in the Finance section. Those who got it wrong had no clue about Finance or somehow misinterpreted the months of the total payments.

6.3 In this question most learners forgot about deferred payments and therefore this question was poorly answered. **6.3.1** were well answered but there were some learners who could not determine 15% of R250 000. Some learners even forgot to subtract the deposit from the cost amount of the loan.

QUESTION 7

7.1	Determine $f^{/}(x)$ from first principles if $f(x) = x^2 + x$.	(5)
7.2	Determine $f^{/}(x)$ if $f(x) = 2x^5 - 3x^4 + 8x$.	(3)
7.3	The tangent to $g(x) = ax^3 + 3x^2 + bx + c$ has a minimum gradient at the point $(-1 ; -7)$. For which values of x will g be concave up?	(4)
		[12]

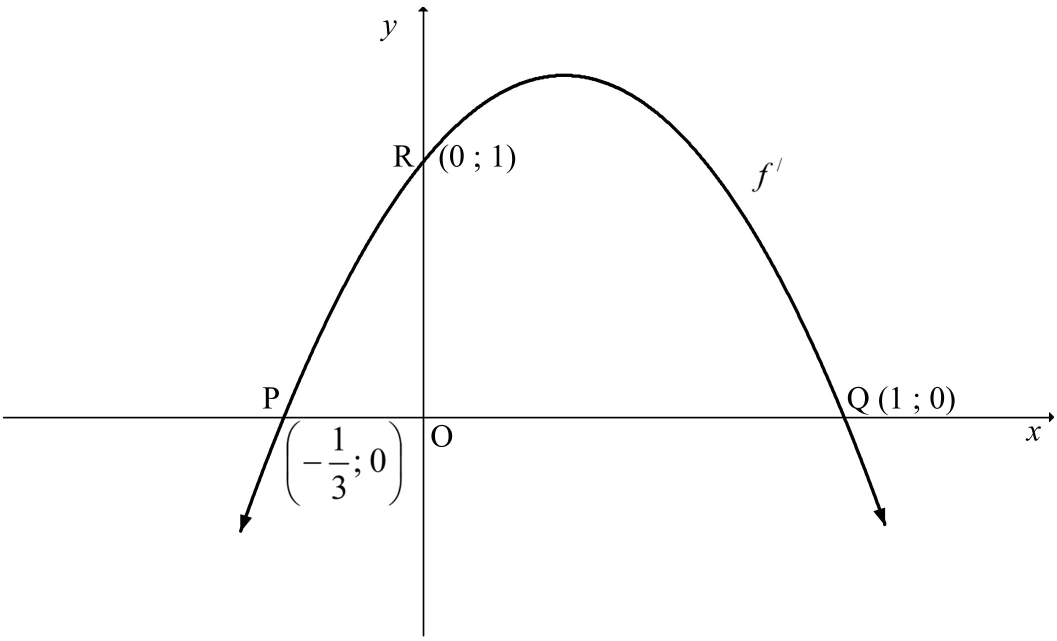


7.1 Was well answered as it is now a very predictable question on first principles. Educators need to drill this into learners as it is a very easy way to score marks. Different types of examples must be given to learners until they get the concept correct.
7.2 This was the best answered sub question in the paper and most learners scored full marks (3) for this question. Hopefully this is not a trend of future questions like this. Educators must still teach the normal differentiation rules, including examples with fractions as exponent and surds.
7.3 Most learners only scored 1 mark for this question and that was for determining the first derivative. Learners did not know what to do after that. This was a higher order question and insight and knowledge of calculus was crucial in the answering of this question. This was also a different way of testing concavity and the understanding of it. As can be seen from the 100 scripts sampled that only the above average learners scored marks for this question.

QUESTION 8

The graph of $y = f^{/}(x) = mx^2 + nx + k$ is drawn below.

The graph passes the points $P\left(-\frac{1}{3}\,;\,0\right)$, $Q(1\,;\,0)$ and $R(0\,;\,1)$.



8.1 Determine the values of m, n and k. (6)

8.2 If it is further given that $f(x) = -x^3 + x^2 + x + 2$:

8.2.1 Determine the coordinates of the turning points of f. (3)

8.2.2 Draw the graph of f. Indicate on your graph the coordinates of the turning points and the intercepts with the axes. (5)

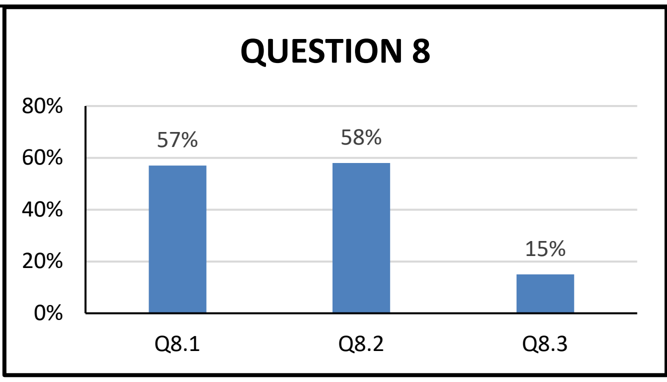
8.3 Points E and W are two variable points on $f^{/}$ and are on the same horizontal line.

- h is a tangent to $f^{/}$ at E.
- g is a tangent to $f^{/}$ at W.
- h and g intersect at D($a\,;\,b$).

8.3.1 Write down the value of a. (1)

8.3.2 Determine the value(s) of b for which h and g will no longer be tangents to $f^{/}$. (2)

[17]



8.1 Fairly well answered. The cubic equation was given in 8.2 and some learners could relate the two and therefore only gave the answers. Only 1 mark was awarded if the values of m, n and k were given without any working. This mark was given for the value of $k = 1$ as it can be seen from the graph. Learners need to look at the mark allocation (6) and therefore needed to show how they got to the values of the required unknowns.

8.2 This question was disappointingly poorly answered and this shows that Calculus remains a thorn in the flesh of most learners. Learners tried to work out the $x - values$ of the Turning point although it was given on the diagram. Educators need to explain to their learners that the $x - intercepts$ of the first derivative of a cubic function is also the $x - values$ of the Turning point of the cubic function.

Some of the common errors in this question:

Learners did not realise that it was a decreasing function

That it only had one x intercept.

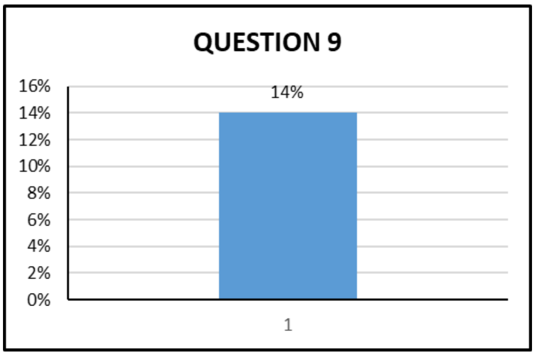
They could not use the calculator correctly to determine the $y - coordinate$ of the turning point.

8.3 Poorly answered. The bullets used in this question is commendable as it gives a learner less information to comprehend at a time. This unfortunately did not have the desired effect as this question was beyond most learners understanding of Calculus.

QUESTION 9

Given $f(x) = x^2$.

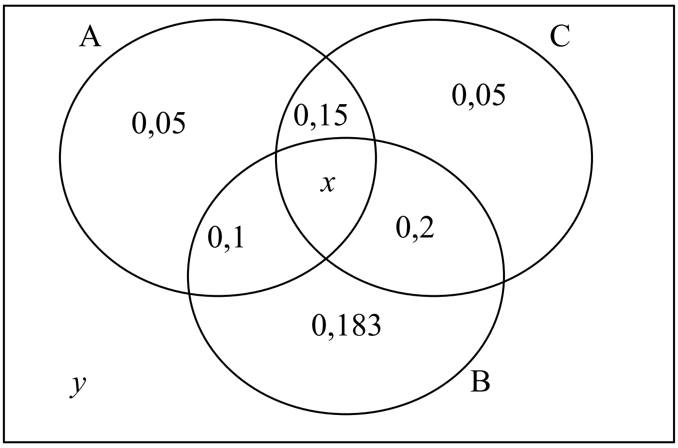
Determine the minimum distance between the point $(10 ; 2)$ and a point on f. **[8]**



This was the worst answered question in the entire paper. It is clear that the application of Calculus question remains beyond most learners understanding of Calculus. This question was something similar to a question in the 2017 paper (remember Bennie). Revising past papers would have alerted pupils to this type of question.

QUESTION 10

10.1 A, B and C are three events. The probabilities of these events (or any combination of them) occurring is given in the Venn-diagram below



10.1.1 If it is given that the probability that at least one of the events will occur is 0,893, calculate the value of:

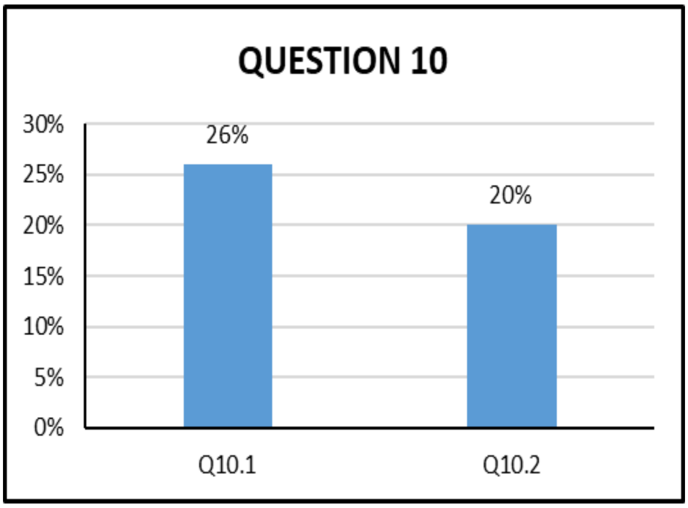
(a) y, the probability that none of the events will occur. (1)

(b) x, the probability that all three events will occur. (1)

10.1.2 Determine the probability that at least two of the events will take place. (2)

10.1.3 Are events B and C independent? Justify your answer. (5)

10.2	A four-digit code is required to open a combination lock. The code must be even-numbered and may not contain the digits 0 or 1. Digits may not be repeated.		
	10.2.1	How many possible 4-digit combinations are there to open the lock?	(3)
	10.2.2	Calculate the probability that you will open the lock at the first attempt if it is given that the code is greater than 5 000 and the third digit is 2.	(5) **[17]**
		TOTAL:	**150**



10.1 Probability remains a problem in general with the vast majority of candidates. This year was no different to previous years and the 100 sample scripts proves this.
The number of decimal places given may have caused confusion as some has 2 decimals and others 3 decimals. The answers 0.36 and 0,36008 was interpreted differently by some candidates and this was discussed at the Marking Guideline meeting. It was then agreed to allocate marks depending on the learner's conclusion with enough evidence. Learners were therefore not disadvantaged.
One interesting solution that a learner gave was in terms of x as he/she could not determine the value of x. He /She determined the probability of B and C in terms of x as well as the product of B and C in terms of x. He /She could however not draw a conclusion of independent events.

10.2 Poorly answered by the majority of learners. The word "**even-numbered**" as predicted by educators definitely had an influence on the interpretation of it. Luckily this was discussed at length at the Marking Guideline discussion and although not part of the official Marking Guideline it was unanimously agreed to accept the different interpretations of the word mentioned above.

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 familiarise 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 realise that they cannot expect great things to happen if they don't put in effort and sacrifice to achieve their dreams.

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.

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.

ADDITIONAL COMMENTS USEFUL TO TEACHERS, SUBJECT ADVISORS, TEACHER DEVELOPMENT ETC.

Educators are encouraged to make use of this report throughout the year as topics are discussed and not 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.

Teachers should also try and set their "own" test and not just copy and paste from previous papers.

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

NOVEMBER 2022

MARKS: 150

TIME: 3 hours

This question paper consists of 9 pages and 1 information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

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

1.1.2 $2x^2-6x+1=0$ (correct to TWO decimal places) (3)

1.1.3 $x^2-90>x$ (4)

1.1.4 $x-7\sqrt{x}=-12$ (4)

1.2 Solve for x and y simultaneously:

$2x-y=2$
$xy=4$ (5)

1.3 Show that $2.5^n-5^{n+1}+5^{n+2}$ is even for all positive integer values of n. (3)

1.4 Determine the values of x and y if: $\frac{3^{y+1}}{32}=\sqrt{96^x}$ (4)

[25]

QUESTION 2

2.1 The first term of a geometric series is 14 and the 6^{th} term is 448.

2.1.1 Calculate the value of the constant ratio, r. (2)

2.1.2 Determine the number of consecutive terms that must be added to the first 6 terms of the series in order to obtain a sum of 114 674. (4)

2.1.3 If the first term of another series is 448 and the 6^{th} term is 14, calculate the sum to infinity of the new series. (3)

2.2 If $\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$, determine the value of k. (5)

[14]

QUESTION 3

It is given that the general term of a quadratic number pattern is $T_n = n^2 + bn + 9$ and the first term of the first differences is 7.

3.1 Show that $b = 4$. (2)

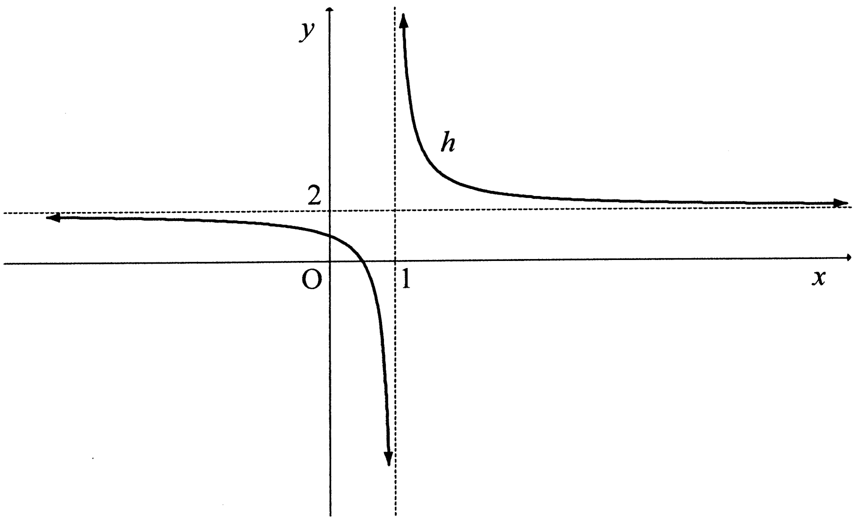
3.2 Determine the value of the 60^{th} term of this number pattern. (2)

3.3 Determine the general term for the sequence of first differences of the quadratic number pattern. Write your answer in the form $T_p = mp + q$. (3)

3.4 Which TWO consecutive terms in the quadratic number pattern have a first difference of 157? (3)
[10]

QUESTION 4

4.1 Sketched below is the graph of $h(x) = \dfrac{1}{x+p} + q$. The asymptotes of h intersect at (1 ; 2).



4.1.1 Write down the values of p and q. (2)

4.1.2 Calculate the coordinates of the x-intercept of h. (2)

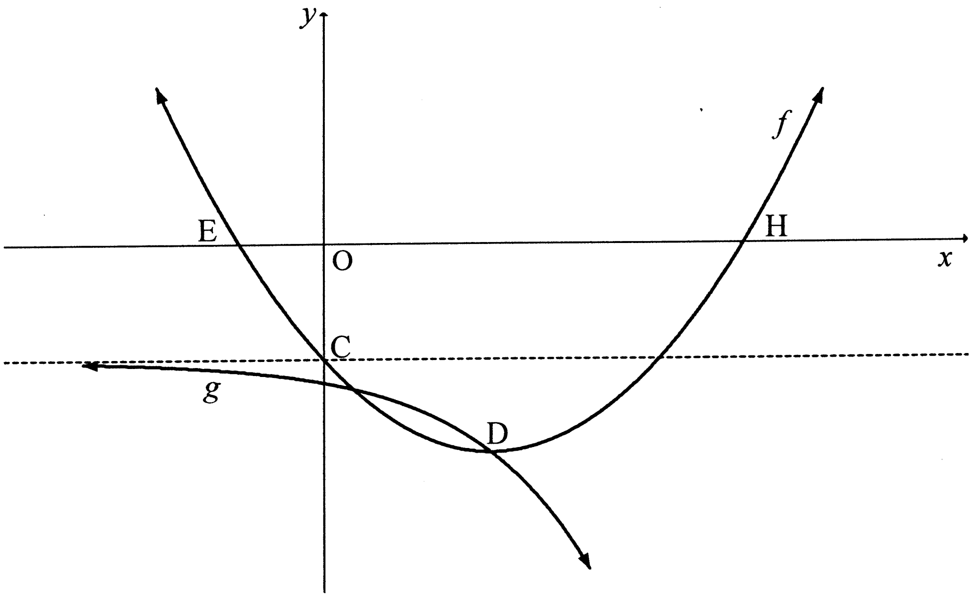
4.1.3 Write down the x-coordinate of the x-intercept of g if $g(x) = h(x+3)$. (2)

4.1.4 The equation of an axis of symmetry of h is $y = x + t$. Determine the value of t. (2)

4.1.5 Determine the values of x for which $-2 \le \dfrac{1}{x-1}$. (3)

4.2 The graphs of $f(x) = x^2 - 4x - 5$ and $g(x) = a.2^x + q$ are sketched below.

- E and H are the x-intercepts of f.
- C is the y-intercept of f and lies on the asymptote of g.
- The two graphs intersect at D, the turning point of f.



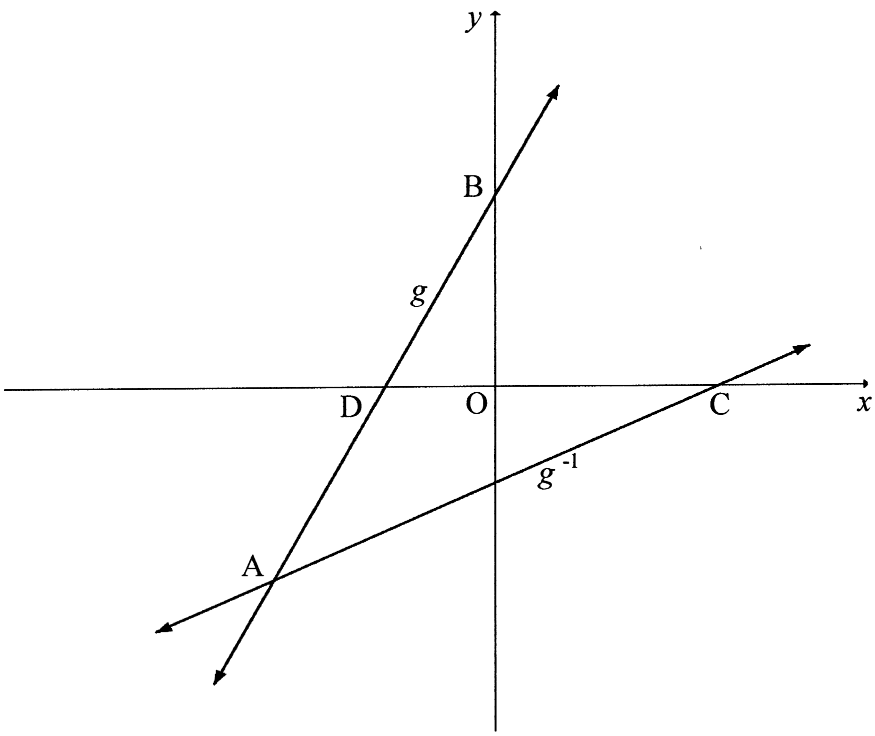
4.2.1	Write down the y-coordinate of C.	(1)
4.2.2	Determine the coordinates of D.	(2)
4.2.3	Determine the values of a and q.	(3)
4.2.4	Write down the range of g.	(1)
4.2.5	Determine the values of k for which the value of $f(x) - k$ will always be positive.	(2)

[20]

QUESTION 5

The graphs of $g(x) = 2x + 6$ and g^{-1}, the inverse of g, are shown in the diagram below.

- D and B are the x- and y-intercepts respectively of g.
- C is the x-intercept of g^{-1}.
- The graphs of g and g^{-1} intersect at A.



5.1 Write down the y-coordinate of B. (1)

5.2 Determine the equation of g^{-1} in the form $g^{-1}(x) = mx + n$. (2)

5.3 Determine the coordinates of A. (3)

5.4 Calculate the length of AB. (2)

5.5 Calculate the area of ΔABC. (5)
[13]

QUESTION 6

6.1 R12 000 was invested in a fund that paid interest at *m*% p.a., compounded quarterly. After 24 months, the value of the investment was R13 459.

Determine the value of *m*. (4)

6.2 On 31 January 2022, Tino deposited R1 000 in an account that paid interest at 7,5% p.a., compounded monthly. He continued depositing R1 000 on the last day of every month. He will make the last deposit on 31 December 2022.

Will Tino have sufficient funds in the account on 1 January 2023 to buy a computer that costs R13 000? Justify your answer by means of an appropriate calculation. (4)

6.3 Thabo plans to buy a car that costs R250 000. He will pay a deposit of 15% and take out a loan for the balance. The interest on the loan is 13% p.a., compounded monthly.

6.3.1 Calculate the value of the loan. (1)

6.3.2 The first repayment will be made 6 months after the loan has been granted. The loan will be repaid over a period of 6 years after it has been granted. Calculate the MONTHLY instalment. (5)

[14]

QUESTION 7

7.1 Determine $f'(x)$ from first principles if $f(x) = x^2 + x$. (5)

7.2 Determine $f'(x)$ if $f(x) = 2x^5 - 3x^4 + 8x$. (3)

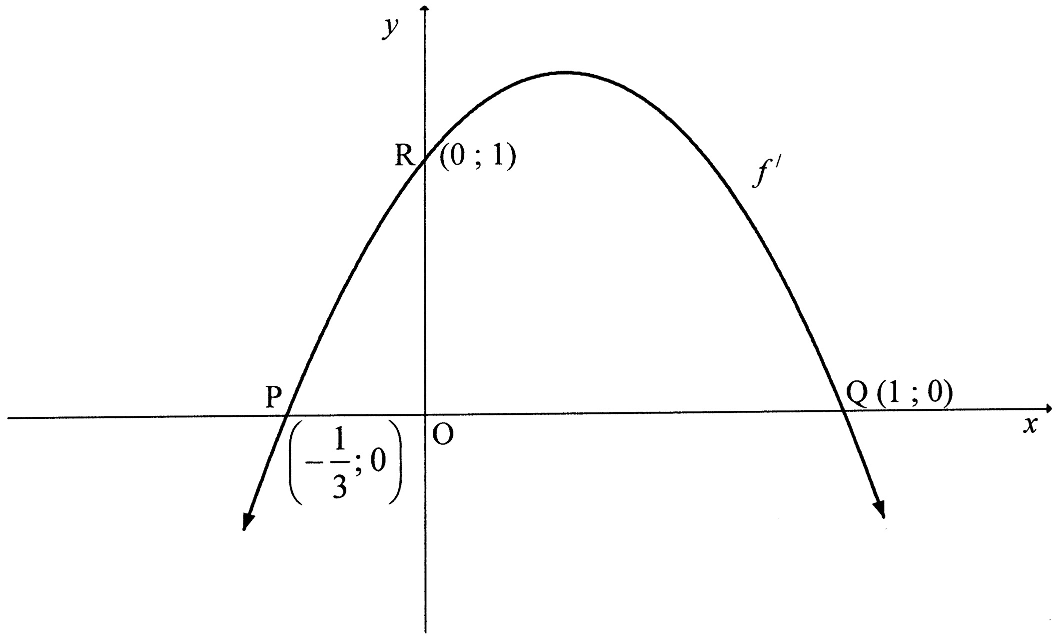
7.3 The tangent to $g(x) = ax^3 + 3x^2 + bx + c$ has a minimum gradient at the point $(-1\,;-7)$. For which values of x will g be concave up? (4)

[12]

QUESTION 8

The graph of $y = f'(x) = mx^2 + nx + k$ is drawn below.

The graph passes the points $P\left(-\frac{1}{3}; 0\right)$, $Q(1; 0)$ and $R(0; 1)$.



8.1	Determine the values of m, n and k.	(6)

8.2 If it is further given that $f(x) = -x^3 + x^2 + x + 2$:

8.2.1	Determine the coordinates of the turning points of f.	(3)
8.2.2	Draw the graph of f. Indicate on your graph the coordinates of the turning points and the intercepts with the axes.	(5)

8.3 Points E and W are two variable points on f' and are on the same horizontal line.

- h is a tangent to f' at E.
- g is a tangent to f' at W.
- h and g intersect at D(a ; b).

8.3.1	Write down the value of a.	(1)
8.3.2	Determine the value(s) of b for which h and g will no longer be tangents to f'.	(2)

[17]

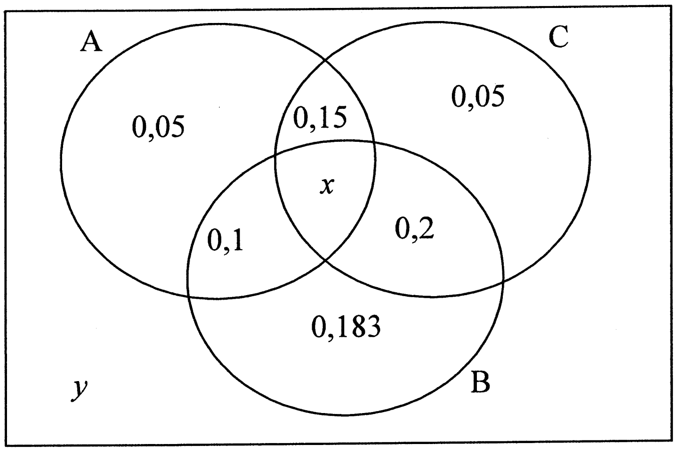
QUESTION 9

Given $f(x) = x^2$.

Determine the minimum distance between the point $(10 ; 2)$ and a point on f. **[8]**

QUESTION 10

10.1 A, B and C are three events. The probabilities of these events (or any combination of them) occurring is given in the Venn-diagram below



10.1.1 If it is given that the probability that at least one of the events will occur is 0,893, calculate the value of:

(a) y, the probability that none of the events will occur. (1)

(b) x, the probability that all three events will occur. (1)

10.1.2 Determine the probability that at least two of the events will take place. (2)

10.1.3 Are events B and C independent? Justify your answer. (5)

10.2 A four-digit code is required to open a combination lock. The code must be even-numbered and may not contain the digits 0 or 1. Digits may not be repeated.

10.2.1 How many possible 4-digit combinations are there to open the lock? (3)

10.2.2 Calculate the probability that you will open the lock at the first attempt if it is given that the code is greater than 5 000 and the third digit is 2. (5)

[17]

TOTAL: 150

INFORMATION SHEET

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $\quad A = P(1-ni)$ $\quad A = P(1-i)^n$ $\quad A = P(1+i)^n$

$T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}[2a + (n-1)d]$

$T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r-1}\ ;r \neq 1$ $\quad S_\infty = \frac{a}{1-r}\ ;\ -1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $\quad P = \frac{x[1-(1+i)^{-n}]}{i}$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad \mathrm{M}\left(\frac{x_1 + x_2}{2};\frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc.\cos A$

$area\ \Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\quad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\quad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum x}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$ $\quad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE 12/*GRAAD 12*

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2022

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 20 pages.
Hierdie nasienriglyne bestaan uit 20 bladsye.

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -11- 13
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

2022-11-13

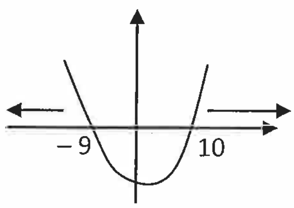
NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking guidelines.

LET WEL:

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.*
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.*

QUESTION1/*VRAAG* 1

1.1.1	$(3x-6)(x+2)=0$ $x=2$ or $x=-2$	✓ $x=2$ ✓ $x=-2$ (2)
1.1.2	$2x^2-6x+1=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{6\pm\sqrt{(-6)^2-4(2)(1)}}{2(2)}$ $x=2{,}82$ or $x=0{,}18$	✓ correct substitution into correct formula ✓ 2,82 ✓ 0,18 (3)
1.1.3	$x^2-90>x$ $x^2-x-90>0$ $(x+9)(x-10)>0$ CV: $x=-9$ or $x=10$  $x<-9$ or $x>10$ **OR/OF** $(-\infty;-9)$ or $(10;\infty)$	✓ standard form ✓ critical values ✓✓ $x<-9$ or $x>10$ (4)

1.1.4	$x-7\sqrt{x}=-12$ $x+12=7\sqrt{x}$ $(x+12)^2=(7\sqrt{x})^2$ $x^2+24x+144=49x$ $x^2-25x+144=0$ $(x-16)(x-9)=0$ $x=16$ or $x=9$	✓ isolating the root ✓ squaring both sides ✓ standard form ✓ both answers (4)
	OR/*OF* $x-7\sqrt{x}+12=0$ $(\sqrt{x}-3)(\sqrt{x}-4)=0$ or let $\sqrt{x}=k$ $\sqrt{x}=3$ or $\sqrt{x}=4$ $x=9$ or $x=16$	**OR/*OF*** ✓ standard form ✓ factors ✓ answers ✓ both answers for x (4)
1.2	$2x-y=2$ $y=2x-2$ ....(1) $xy=4$ ....(2) (1) in (2): $x(2x-2)=4$ $2x^2-2x-4=0$ $x^2-x-2=0$ $(x-2)(x+1)=0$ $x=2$ or $x=-1$ $y=2$ $y=-4$	✓ eq 1 ✓ substitution ✓ standard form ✓ x-values ✓ y-values (5)

	OR/*OF*	**OR/*OF***
	$2x - y = 2$	
	$x = \frac{1}{2}y + 1$ ....(1)	✓ eq 1
	$xy = 4$ ....(2)	
	(1) in (2):	
	$y\left(\frac{1}{2}y + 1\right) = 4$	✓ substitution
	$\frac{1}{2}y^2 + y - 4 = 0$	✓ standard form
	$y^2 + 2y - 8 = 0$	
	$(y+4)(y-2) = 0$	
	$y = -4$ or $y = 2$	✓ y-values
	$x = -1$ $x = 2$	✓ x-values (5)
	OR/OF	**OR/OF**
	$2x - y = 2$ ....(1)	
	$y = \frac{4}{x}$ ....(2)	✓ eq 2
	(2) in (1):	
	$2x - \frac{4}{x} = 2$	✓ substitution
	$2x^2 - 2x - 4 = 0$ $x^2 - x - 2 = 0$	✓ standard form
	$(x-2)(x+1) = 0$	
	$x = 2$ or $x = -1$ $y = 2$ $y = -4$	✓ x-values ✓ y-values (5)
	DEPARTMENT OF BASIC EDUCATION PRIVATE BAG X895, PRETORIA 0001 2022 -11- 13 APPROVED MARKING GUIDELINE PUBLIC EXAMINATION	

	OR/OF $2x - y = 2$ ....(1) $x = \frac{4}{y}$ ....(2) (2)in (1): $2\left(\frac{4}{y}\right) - y = 2$ $8 - y^2 - 2y = 0$ $y^2 + 2y - 8 = 0$ $(y+4)(y-2) = 0$ $y = -4$ or $y = 2$ $x = -1$ $x = 2$	**OR/OF** ✓ eq 2 ✓ substitution ✓ standard form ✓ y-values ✓ x-values (5)
1.3	$2.5^n - 5^{n+1} + 5^{n+2} = 2.5^n - 5^n.5^1 + 5^n.5^2$ $= 5^n(2 - 5 + 25)$ $= 5^n(22)$ $2(5^n(11))$ **OR/OF** Any integer multiplied by an even number will be even	✓ exp law ✓common factor ✓answer/explanation (3)
1.4	$\frac{3^{y+1}}{32} = \sqrt{96^x}$ $\frac{3^{y+1}}{2^5} = (96)^{\frac{x}{2}}$ $3^{y+1}.2^{-5} = 2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ $-5 = \frac{5x}{2}$ $\therefore x = -2$ $y + 1 = \frac{x}{2}$ $y + 1 = \frac{-2}{2}$ $\therefore y = -2$	✓ $\frac{3^{y+1}}{2^5} = (96)^{\frac{x}{2}}$ ✓ $3^{y+1}.2^{-5} = 2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ ✓ $x = -2$ ✓ $y = -2$ (4)

	OR/OF $\frac{3^{y+1}}{32}=\sqrt{96^{x}}$ $\left(\frac{3^{y+1}}{2^{5}}\right)^{2}=\left(\sqrt{(96)^{x}}\right)^{2}$ $\frac{3^{2y+2}}{2^{10}}=2^{5x}.3^{x}$ $3^{2y+2}.2^{-10}=2^{5x}.3^{x}$ $-10=5x$ $\therefore x=-2$ $2y+2=-2$ $\therefore y=-2$	**OR/OF** ✓ $\left(\frac{3^{y+1}}{2^{5}}\right)^{2}=\left(\sqrt{(96)^{x}}\right)^{2}$ ✓ $3^{2y+2}.2^{-10}=2^{5x}.3^{x}$ ✓ $x=-2$ ✓ $y=-2$ (4)
		[25]

QUESTION 2/*VRAAG* 2

2.1.1	$a=14$ $T_6=14r^5=448$ $r^5=32$ $\therefore r=2$ Answer only: full marks	✓ $T_6=14r^5=448$ ✓ $r=2$ (2)
2.1.2	$T_n=14(2)^{n-1}$ $S_n=\dfrac{14(2^6-1)}{2-1}$ $S_6=882$ 114 674 – 882 = 113 792 $113\,792=896\left(2^n-1\right)$ $128=2^n$ $n=7$ **OR/OF** $S_n=\dfrac{a(r^n-1)}{r-1}$ $114\,674=\dfrac{14(2^n-1)}{2-1}$ $8\,191=2^n-1$ $2^n=8\,192$ $n=\log_2 8\,192$ $n=13$ $\therefore$ 7 more terms must be added to the first 6 terms.	✓ substitution into correct formula ✓ $S_6=882$ ✓ $128=2^n$ ✓ 7 (4) **OR/OF** ✓ substitution into correct formula ✓ $2^n=8\,192$ ✓ $n=13$ ✓ 7 (4)
2.1.3	$r=\dfrac{1}{2}$ OR $448r^5=14$ $\therefore r=\dfrac{1}{2}$ $S_\infty=\dfrac{a}{1-r}$ $S_\infty=\dfrac{448}{1-\frac{1}{2}}$ $S_\infty=896$	✓ $r=\dfrac{1}{2}$ ✓ substitution ✓ answer (3)

2.2	$\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$ $T_1=\frac{1}{6}$ $T_2=\frac{1}{3}+\frac{1}{6}=\frac{3}{6}$ $d=\frac{3}{6}-\frac{1}{6}=\frac{1}{3}$ $\frac{121}{6}=\frac{n}{2}\left[2\left(\frac{1}{6}\right)+(n-1)\left(\frac{1}{3}\right)\right]$ $\frac{121}{3}=n\left[\frac{1}{3}+\frac{1}{3}n-\frac{1}{3}\right]$ $\frac{121}{3}=\frac{1}{3}n^2$ $121=n^2$ $n=11$ $\therefore k=10$	✓ $T_1=\frac{1}{6}$ ✓ d ✓ substitution ✓ value of n ✓ value of k (5)
	OR/*OF*	**OR/*OF***
	$\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$ $a=\frac{1}{6}$ $l=\frac{1}{3}k+\frac{1}{6}$ $n=k+1$ $S_n=\frac{n}{2}[a+l]$ $\frac{121}{6}=\frac{k+1}{2}\left[\frac{1}{6}+\frac{1}{3}k+\frac{1}{6}\right]$ $\frac{121}{6}=\frac{k+1}{2}\left[\frac{1}{3}k+\frac{1}{3}\right]$ $\frac{121}{6}=\frac{k+1}{2}\left[\frac{k+1}{3}\right]$ $\frac{121}{6}=\frac{(k+1)^2}{6}$ $k+1=\pm\sqrt{121}$ $k+1=11$ $k=10$	✓ $a=\frac{1}{6}$ ✓ l ✓ $n=k+1$ ✓ $\frac{121}{6}=\frac{(k+1)^2}{6}$ ✓ value of k (5)
		[14]

QUESTION 3/*VRAAG* 3

3.1	$3a+b=7$ $3+b=7$ $b=4$ **OR/OF** $T_2-T_1=7$ $4+2b+9-(1+b+9)=7$ $b=4$	✓ $3a+b=7$ ✓ $3+b=7$ (2) **OR/OF** ✓ $T_2-T_1=7$ ✓ substitution (2)
3.2	$T_n=n^2+4n+9$ $T_{60}=(60)^2+4(60)+9$ $=3849$ Answer only: full marks	✓ substitution ✓ answer (2)
3.3	14 ; 21 ; 30 ; 41; First difference: 7 ; 9 ; 11 ; … Common 2nd difference: 2 $T_p=2p+5$ Answer only: full marks **OR/*OF*** First difference: 7 ; 9 ; 11 ; … $T_n=a+(n-1)d$ $T_p=7+(p-1)(2)$ $T_p=2p+5$	✓first difference ✓ 2 ✓ $2p+5$ (3) **OR/*OF*** ✓first difference ✓ 2 ✓ $2p+5$ (3)
3.4	$157=2p+5$ $p=76$ $\therefore$ Between T_{76} and T_{77} **OR/OF** $T_{n+1}-T_n=157$ $(n+1)^2+4(n+1)+9-(n^2+4n+9)=157$ $n^2+2n+1+4n+4+9-n^2-4n-9=157$ $2n=152$ $n=76$ $\therefore$ Between T_{76} and T_{77}	✓ $157=2p+5$ ✓ $p=76$ ✓ T_{76} and T_{77} (3) **OR/OF** ✓ $T_{n+1}-T_n=157$ ✓ $n=76$ ✓ T_{76} and T_{77} (3)
		[10]

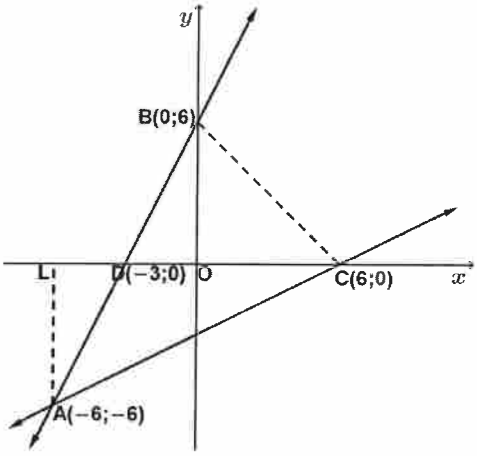
QUESTION 4/*VRAAG* 4

4.1.1	$p = -1$ and $q = 2$	✓ $p = -1$ ✓ $q = 2$ (2)
4.1.2	$\frac{1}{x-1} + 2 = 0$ $-2x + 2 = 1$ $x = \frac{1}{2}$ $\left(\frac{1}{2}\ ;\ 0\right)$	✓ $= 0$ ✓ answer (2)
4.1.3	$x = \frac{1}{2} - 3$ $= \frac{-5}{2}$ Answer only: full marks	✓ -3 ✓ $x = \frac{-5}{2}$ (2)
4.1.4	$y = x + t$ $2 = 1 + t$ $t = 1$	✓subst $(1\ ;\ 2)$ ✓ $t = 1$ (2)
4.1.5	$-2 \leq \frac{1}{x-1}$ Answer only: full marks $\frac{1}{x-1} + 2 \geq 0$ $\therefore x \leq \frac{1}{2}$ or $x > 1$ **OR/*OF*** $x \in \left(-\infty\ ;\ \frac{1}{2}\right]$ or $(1\ ;\ \infty)$	✓ $\frac{1}{x-1} + 2 \geq 0$ ✓ $x \leq \frac{1}{2}$ ✓ $x > 1$ (3)
4.2.1	$y = -5$	✓ answer (1)
4.2.2	$x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore D(2\ ;\ -9)$ **OR/*OF*** $f^{/}(x) = 2x - 4$ $2x - 4 = 0$ $x = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore D(2\ ;\ -9)$	✓ $x = 2$ ✓ $y = -9$ (2) **OR/*OF*** ✓ $x = 2$ ✓ $y = -9$ (2)

4.2.3	$q=-5$ $-9=a(2)^2-5$ $-4=4a$ $a=-1$ $\therefore g(x)=-2^x-5$	✓ $q=-5$ ✓ substitution of $(2\,;-9)$ ✓ $a=-1$ (3)
4.2.4	$y\in(-\infty\,;-5)$ OR $y<-5;y\in R$	✓answer (1)
4.2.5	$k<-9$	✓ -9 ✓ $k<-9$ (2)
		[20]

QUESTION 5/*VRAAG 5*

5.1	$g(x)=2x+6$ $y=6$	✓ $y=6$ (1)
5.2	$y=2x+6$ $x=2y+6$ $y=\frac{1}{2}x-3$ Answer only: Full marks	✓ swop x and y ✓ equation (2)
5.3	$\frac{1}{2}x-3=2x+6$ $x-6=4x+12$ $3x=-18$ $x=-6$ $A(-6;-6)$ **OR/*OF*** $2x+6=x$ $x=-6$ $y=-6$	✓equating ✓$x=-6$ ✓ $y=-6$ (3) **OR/*OF*** ✓equating ✓$x=-6$ ✓$y=-6$ (3)
5.4	$AB=\sqrt{(6)^2+(12)^2}$ $=\sqrt{180}=6\sqrt{5}=13{,}42$	✓substitution ✓answer (2)

		
5.5	$BC=\sqrt{6^2+6^2}=\sqrt{72}=6\sqrt{2}$ $AB = AC = \sqrt{180}$ symmetry of g and g^{-1} $\perp h=(\sqrt{180})^2-\left(\frac{\sqrt{72}}{2}\right)^2$ $=\sqrt{162}=9\sqrt{2}$ area of $\Delta ABC =\frac{1}{2}BC\times h$ $=\frac{1}{2}\times\sqrt{72}\times\sqrt{162}=54$ units^2	✓ BC ✓ AB = AC /midpoint (3 ; 3) ✓ $\perp h$ (A) ✓ substitution ✓ answer (A) (5)
	OR/*OF* $\tan B\hat{D}C=2$ $\therefore B\hat{D}C=63{,}43°$ $\tan D\hat{C}A=\frac{1}{2}$ $\therefore D\hat{C}A=26{,}57°$ $\therefore D\hat{A}C=36{,}86°$ (ext angle triangle) Area of $\Delta ABC=\frac{1}{2}\left(\sqrt{180}\right)\left(\sqrt{180}\right)\sin 36{,}86°$ $=53{,}99$ units^2	**OR/*OF*** ✓ $B\hat{D}C=63{,}43°$ ✓ $D\hat{A}C=36{,}86°$ ✓ $AC=\sqrt{180}$ ✓ substitution into the correct formula ✓ answer (A) (5)
	OR/OF Area of ΔABC = Area of ΔBDC + Area of ΔADC $=\frac{1}{2}DC.BO+\frac{1}{2}DC.height$ $=\frac{1}{2}(9)(6)+\frac{1}{2}(9)(6)$ $=54$ units^2	**OR/OF** ✓ Areas (ΔBDC+ΔADC) ✓ $\frac{1}{2}DC.BO$ ✓ $\frac{1}{2}DC.height$ ✓ substitution ✓ answer (A) (5)
		[13]

QUESTION 6/*VRAAG* 6

6.1	$A = P(1+i)^n$ $13\,459 = 12\,000\left(1+\frac{m}{400}\right)^8$ $\left(1+\frac{m}{400}\right)^8 = 1{,}121...$ $1+\frac{m}{400} = \sqrt[8]{1{,}121..}$ $\frac{m}{400} = 0{,}0144...$ $\therefore m = 5{,}78\%$	✓ 8 ✓ subst into correct formula ✓ $1+\frac{m}{400} = \sqrt[8]{1{,}121..}$ ✓ 5,78 % (4)
6.2	$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $F = \frac{1\,000\left[\left(1+\frac{0{,}075}{12}\right)^{12} - 1\right]}{\frac{0{,}075}{12}}$ $= R12\,421{,}22$ He won't be able to buy the computer because R13 000 – R12 421,22 = R578,78 **OR/OF** He won't be able to buy the computer because R12 421,22 < R13 000	✓ $\frac{0{,}075}{12}$ ✓ 12 ✓ answer ✓ conclusion (4)
6.3.1	Loan amount = 85% × R250 000 = R212 500 **OR/OF** Loan amount = R250 000 – (15% × R250 000) = R212 500	✓ answer (1) **OR/OF** ✓ answer (1)
6.3.2	$A = 212\,500\left(1+\frac{0{,}13}{12}\right)^5$ $A = 224\,262{,}53$ $P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $224\,262{,}53 = \frac{x\left[1-\left(1+\frac{0{,}13}{12}\right)^{-67}\right]}{\frac{0{,}13}{12}}$ $\therefore x = R4\,724{,}96$	✓ $A = 212\,500\left(1+\frac{0{,}13}{12}\right)^5$ ✓ answer ✓ substitution into correct formula ✓ -67 ✓ answer (5)
		[14]

DEPARTMENT OF BASIC EDUCATION
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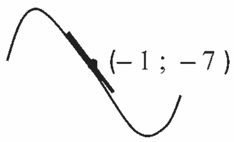
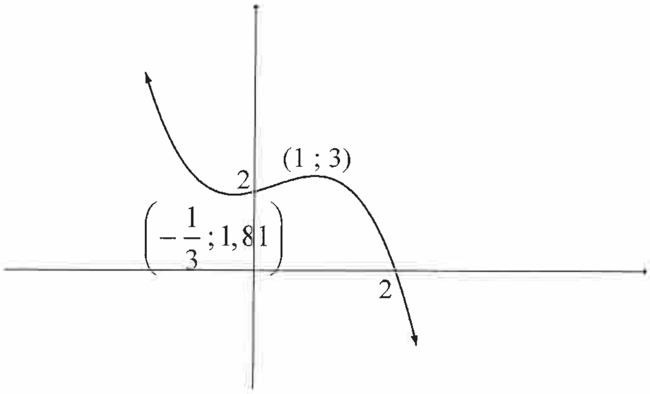
QUESTION 7/*VRAAG* 7
Notation penalty only in Question 7.1

7.1	$f(x)=x^2+x$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $f'(x)=\lim_{h\to 0}\frac{(x+h)^2+(x+h)-(x^2+x)}{h}$ $f'(x)=\lim_{h\to 0}\frac{x^2+2xh+h^2+x+h-x^2-x}{h}$ $=\lim_{h\to 0}\frac{2xh+h^2+h}{h}$ $=\lim_{h\to 0}\frac{h(2x+h+1)}{h}$ $\therefore f'(x)=2x+1$	✓substitution into the formula ✓ $x^2+2xh+h^2+x+h$ ✓ $2xh+h^2+h$ ✓common factor ✓answer (5)
	OR/*OF* $f(x)=x^2+x$ $f(x+h)=(x+h)^2+(x+h)=x^2+2xh+h^2+x+h$ $f(x+h)-f(x)=x^2+2xh+h^2+x+h-x^2-x$ $=2xh+h^2+h$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{2xh+h^2+h}{h}$ $=\lim_{h\to 0}\frac{h(2x+h+1)}{h}$ $\therefore f'(x)=2x+1$	**OR/*OF*** ✓ $x^2+2xh+h^2+x+h$ ✓ $2xh+h^2+h$ ✓substitution into the formula ✓common factor ✓answer (5)
7.2	$f(x)=2x^5-3x^4+8x$ $f'(x)=10x^4-12x^3+8$	✓ $10x^4$ ✓ $-12x^3$ ✓ 8 (3)
7.3	$g(x)=ax^3+3x^2+bx+c$ $g'(x)=3ax^2+6x+b$ $g''(x)=6ax+6$ $g''(-1)=6a(-1)+6=0$ $\therefore a=1$ For concave up $g''(x)>0$ $6x+6>0$ $x>-1$	✓ $g'(x)=3ax^2+6x+b$ ✓ $g''(-1)=6a(-1)+6=0$ ✓ $a=1$ ✓ $x>-1$ (4)

	OR/OF Min gradient at (– 1 ; – 7) implies: at $x = -1$ - point of inflection and g will be positive cubic hence $a > 0$ Since g is concave up $x > -1$	**OR/OF** ✓ point of inflection ✓✓ $a > 0$ ✓ $x > -1$ (4)
	OR/OF  Since g is concave up $x > -1$  (– 1 ; y) Since g is concave up $x > -1$ Answer only: $\frac{1}{4}$	**OR/OF** ✓✓pos graph ✓point of inflection ✓ $x > -1$ (4)
		[12]

QUESTION 8/*VRAAG 8*

8.1	$f'(x)=mx^2+nx+k$ $f'(x)=m\left(x+\frac{1}{3}\right)(x-1)$ $1=m\left(0+\frac{1}{3}\right)(0-1)$ $1=-\frac{1}{3}m$ $\therefore m=-3$ $f'(x)=-3\left(x+\frac{1}{3}\right)(x-1)$ $f'(x)=-3\left(x^2-\frac{2}{3}x-\frac{1}{3}\right)$ $f'(x)=-3x^2+2x+1$ $\therefore n=2$ $\therefore k=1$ **OR/OF** $k=1$ $0=m+n+1$ and $\frac{1}{9}m-\frac{1}{3}n+1=0$ $m+n=-1$ (1) $m-3n=-9$ (2) (1) – (2) $4n=8$ $\therefore n=2$ $m+2=-1$ $\therefore m=-3$	✓ substitution of $\left(-\frac{1}{3};0\right)$ and (1 ; 0) ✓ substitution of (0 ; 1) ✓ $m=-3$ ✓ $f'(x)=-3\left(x^2-\frac{2}{3}x-\frac{1}{3}\right)$ ✓ $n=2$ ✓ $k=1$ (6) **OR/OF** ✓ $k=1$ ✓ $m+n=-1$ ✓ $m-3n=-9$ ✓ $4n=8$ ✓ $n=2$ ✓ $m=-3$ (6)
8.2.1	$f(x)=-x^3+x^2+x+2$ $f\left(-\frac{1}{3}\right)=\frac{49}{27}=1{,}81$ T.P$\left(-\frac{1}{3};\frac{49}{27}\right)$ $f(1)=3$ T.P$(1;3)$	✓ x-coordinates of the TP ✓ T.P$\left(-\frac{1}{3};\frac{49}{27}\right)$ ✓ T.P$(1;3)$ (3)

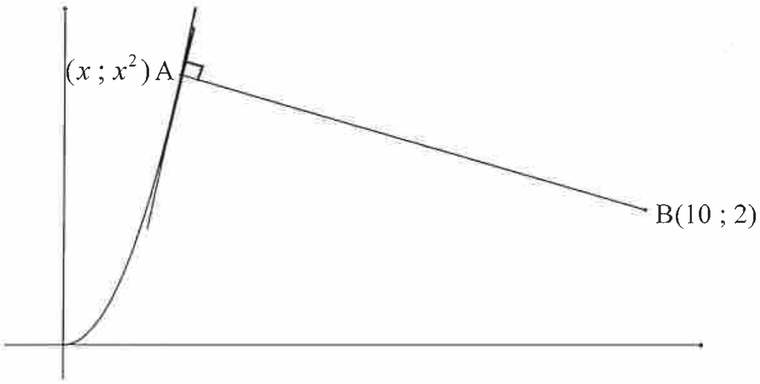
<table>
<tr><td>8.2.2</td><td>$f(x)=-x^3+x^2+x+2$
$-x^3+x^2+x+2=0$
$(x-2)(-x^2-x-1)=0$
$x=2$ or no solution

</td><td>✓ $x=2$

✓one x-intercept
✓ two turning points
✓y-intercept
✓ shape: neg cubic
(5)</td></tr>
<tr><td>8.3.1</td><td>$a=\dfrac{-\frac{1}{3}+1}{2}$
$=\frac{1}{3}$
OR/OF
$f'(x)=-3x^2+2x+1$
$f''(x)=-6x+2$
$f''(a)=-6a+2=0$
$-6a=-2$
$a=\frac{1}{3}$</td><td>✓ answer (1)
OR/OF

✓ answer (1)</td></tr>
<tr><td>8.3.2</td><td>$b<\frac{4}{3}$ units</td><td>✓$\frac{4}{3}$
✓ $b<\frac{4}{3}$ (2)</td></tr>
<tr><td></td><td></td><td>**[17]**</td></tr>
</table>

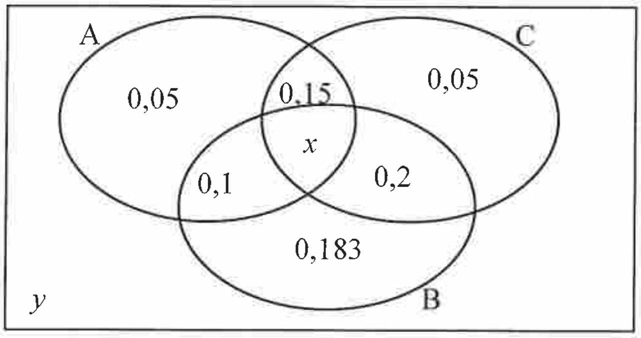
QUESTION9/*VRAAG* 9

9.1	Any point on f : $\left(x\,;x^2\right)$	✓ $\left(x\,;x^2\right)$
	$\text{distance}=\sqrt{(x-10)^2+(x^2-2)^2}$	✓ substitution
	$=\sqrt{x^2-20x+100+x^4-4x^2+4}$	✓ simplification
	$=\sqrt{x^4-3x^2-20x+104}$	✓ answer
	For min distance	
	$\frac{d}{dx}\left(x^4-3x^2-20x+104\right)=0$	
	$4x^3-6x-20=0$	✓ $4x^3-6x-20$
	$(x-2)(4x^2+8x+10)=0$	✓ derivative = 0
	$\Delta=8^2-4(4)(10)=-96$ $\therefore$ no roots	
	$\therefore x=2$	✓ $x=2$
	$d=\sqrt{2^4-3(2)^2-20(2)+104}=2\sqrt{17}=8{,}25$	✓ answer (A) (8)



9.2	$m_{AB}=\frac{y_2-y_1}{x_2-x_1}=\frac{x^2-2}{x-10}$	✓ m_{AB}
	$\therefore m_{\tan g}=-\frac{x-10}{x^2-2}$	✓ $m_{\tan g}=-\frac{x-10}{x^2-2}$
	$f'(x)=2x$	✓ $f'(x)=2x$
	$\therefore 2x=-\frac{x-10}{x^2-2}$	✓ equating
	$-2x^3+4x=x-10$	
	$2x^3-3x-10=0$	✓ standard form
	$x=2$	✓ $x=2$
	$y=(2)^2=4$	
	$\therefore AB=\sqrt{(2-10)^2+(4-2)^2}$	✓ substitute into distance
	$=2\sqrt{17}=8,25$	✓ answer (A) (8)
		[8]

QUESTION 10/*VRAAG* 10



10.1.1(a)	$y = 1 - 0{,}893 = 0{,}107$ (0,11)	✓ $y = 1 - 0{,}893$ (1)
10.1.1(b)	$x = 0{,}893 - 0{,}733$ $= 0{,}16$	✓ $x = 0{,}893 - 0{,}733$ (1)
10.1.2	P(at least 2 events) = 0,1 + 0,15 + 0,16 + 0,2 = 0,61 Answer only: Full Marks	✓ values ✓ answer (2)
10.1.3	P(B) = 0,643 P(C) = 0,56 P(B and C) = 0,36 P(B) × P(C) = 0,643 × 0,56 = 0,36 $\therefore$ P(B and C) = P(B) × P(C) $\therefore$ B and C are independent	✓ P(B) = 0,643 ✓ P(C) = 0,56 ✓ P(B and C) = 0,36 ✓ P(B) × P(C) = 0,36 ✓ independent because P(B and C) = P(B) × P(C) (5)
10.2.1	$7\times6\times5\times4=840$	✓ 4✓ 7 ✓ $7\times6\times5\times4=840$ (3)
10.2.2	start with 5, 7, 9 or start with 6 or start with 8 $(3\times5\times1\times3)+(1\times5\times1\times2)+(1\times5\times1\times2)$ $=45+10+10$ $=65$ $P=\frac{65}{840}=\frac{13}{168}=0{,}08$ **OR/*OF*** ends in 4 or ends in 6 or ends in 8 $(5\times5\times1\times1)+(4\times5\times1\times1)+(4\times5\times1\times1)$ $=25+20+20$ $=65$ $P=\frac{65}{840}=\frac{13}{168}=0{,}08$	✓$(3\times5\times1\times3)=45$ ✓$(1\times5\times1\times2)=10$ ✓$(1\times5\times1\times2)=10$ ✓65 ✓ answer (5) **OR/*OF*** ✓$(5\times5\times1\times1)=25$ ✓$(4\times5\times1\times1)=20$ ✓$(4\times5\times1\times1)=20$ ✓65 ✓ answer (5)
		[17]

TOTAL/*TOTAAL*: 150