basic education

Department:
Basic Education
**REPUBLIC OF SOUTH AFRICA**

# NATIONAL
# SENIOR CERTIFICATE

## GRADE 11

**MATHEMATICS P1**

**EXEMPLAR 2013**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 8 pages.**

**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1.      This question paper consists of 12 questions.

2.      Answer ALL the questions.

3.      Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.

4.      Answers only will NOT necessarily be awarded full marks.

5.      You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

6.      If necessary, round off answers to TWO decimal places, unless stated otherwise.

7.      Diagrams are NOT necessarily drawn to scale.

8.      Number the answers correctly according to the numbering system used in this question paper.

9.      Write neatly and legibly.

**QUESTION 1**

1.1     Solve for $x$:

    1.1.1        $(2x-1)(x+5)=0$                                                                    (2)

    1.1.2        $2x^2-4x+1=0$  (Leave your answer in simplest surd form.)                          (3)

1.2     Simplify, without the use of a calculator, the following expressions fully:

    1.2.1        $125^{\frac{2}{3}}$                                                                 (2)

    1.2.2        $(3\sqrt{2}-12)(2\sqrt{2}+1)$                                                       (3)

1.3     Given:     $\dfrac{x^2-x-6}{3x-9}$

    1.3.1        For which value(s) of $x$ will the expression be undefined?                         (2)

    1.3.2        Simplify the expression fully.                                                       (3)
                                                                                                    **[15]**

**QUESTION 2**

2.1     Given: $(x+2)(x-3)<-3x+2$

    2.1.1        Solve for $x$ if: $(x+2)(x-3)<-3x+2$                                                (4)

    2.1.2        Hence or otherwise, determine the sum of all the integers satisfying the
                 expression $x^2+2x-8<0$.                                                           (3)

2.2     Given: $\dfrac{4^{x-1}+4^{x+1}}{17.12^x}$

    2.2.1        Simplify the expression fully.                                                       (4)

    2.2.2        If $3^{-x}=4t$, express $\dfrac{4^{x-1}+4^{x+1}}{17.12^x}$ in terms of $t$.          (1)

2.3     Solve for $x$ and $y$ from the given equations:

         $3^y=81^x$          and          $y=x^2-6x+9$                                               (7)
                                                                                                    **[19]**

**QUESTION 3**

3.1     The solution to a quadratic equation is $x = \dfrac{3 \pm \sqrt{4-8p}}{4}$ where $p \in \mathbf{Q}$.

Determine the value(s) of $p$ such that:

3.1.1     The roots of the equation are equal                                    (2)

3.1.2     The roots of the equation are non-real                                    (2)

3.2     Given: $\sqrt{5-x} = x+1$

3.2.1     Without solving the equation, show that the solution to the above equation
lies in the interval $-1 \leq x \leq 5$.                                    (3)

3.2.2     Solve the equation.                                    (5)

3.2.3     Without any further calculations, solve the equation $-\sqrt{5-x} = x+1$.     (1)

**[13]**

**QUESTION 4**

4.1     Melissa has just bought her first car. She paid R145 000 for it. The car's value
depreciates on the straight-line method at a rate of 17% per annum. Calculate the
value of Melissa's car 5 years after she bought it.                                    (2)

4.2     An investment earns interest at a rate of 8% per annum compounded quarterly.

4.2.1     At what rate is interest earned each quarter of the year?                                    (1)

4.2.2     Calculate the effective annual interest rate on this investment.                                    (2)

4.3     R14 000 is invested in an account.

The account earns interest at a rate of 9% per annum compounded semi-annually for
the first 18 months and thereafter 7,5% per annum compounded monthly.

How much money will be in the account exactly 5 years after the initial deposit?     (5)

**[10]**

## QUESTION 5

The graphs below represent the growth of two investments, one belonging to Dumisani and one belonging to Astin. Both investments earn interest annually (only).
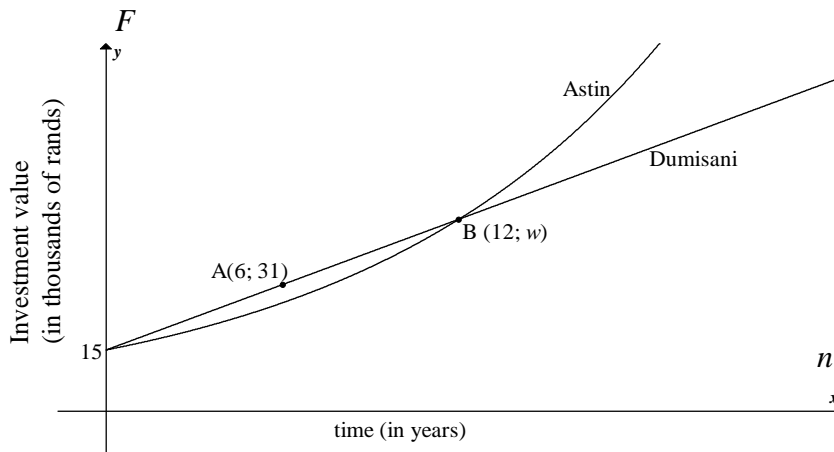


| 5.1 | What is the value of both initial investments? | (1) |
|---|---|---|
| 5.2 | Does Dumisani's investment earn simple or compound interest? | (1) |
| 5.3 | Determine Dumisani's interest rate. | (2) |
| 5.4 | Hence or otherwise, calculate the interest rate on Astin's investment. Give your answer correct to ONE decimal place. | (4) |

**[8]**

## QUESTION 6

6.1      Given:     $\dfrac{1}{2} ; \dfrac{1}{4} ; \dfrac{1}{8} ; \ldots ; \dfrac{1}{1\,024}$

        6.1.1      Explain how you will determine the $4^{\text{th}}$ term of the sequence. (2)

        6.1.2      Write a formula for the $n^{\text{th}}$ term of the sequence. (2)

        6.1.3      Determine the number of terms in the sequence. (2)

6.2      Given the linear pattern:    156 ; 148 ; 140 ; 132 ; …

        6.2.1      Write down the $5^{\text{th}}$ term of this number pattern. (1)

        6.2.2      Determine a general formula for the $n^{\text{th}}$ term of this pattern. (2)

        6.2.3      Which term of this linear number pattern is the first term to be negative? (3)

        6.2.4      The given linear number pattern forms the sequence of first differences of a quadratic number pattern $T_n = an^2 + bn + c$ with $T_5 = -24$.
                  Determine a general formula for $T_n$. (5)
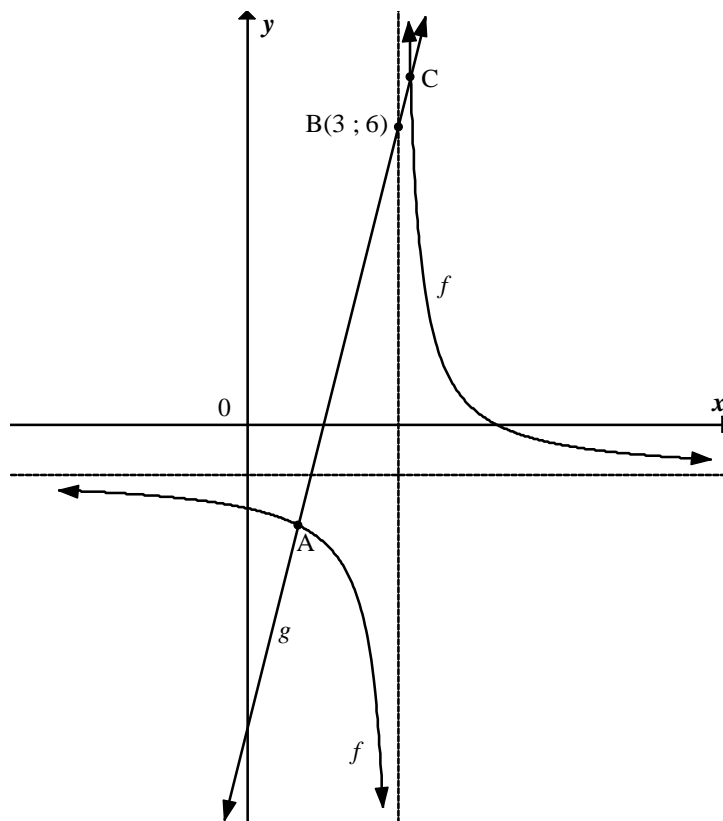
**[17]**

**QUESTION 7**

A given quadratic pattern $T_n = an^2 + bn + c$ has $T_2 = T_4 = 0$ and a second difference of 12.
Determine the value of the 3$^{rd}$ term of the pattern. **[6]**

**QUESTION 8**

The sketch below represents the graphs of $f(x) = \dfrac{2}{x-3} - 1$ and $g(x) = dx + e$.
Point B (3 ; 6) lies on the graph of $g$ and the two graphs intersect at points A and C.



| 8.1 | Write down the equations of the asymptotes of $f$. | (2) |
|---|---|---|
| 8.2 | Write down the domain of $f$. | (2) |
| 8.3 | Determine the values of $d$ and $e$, correct to the nearest integer, if the graph of $g$ makes an angle of 76° with the $x$-axis. | (3) |
| 8.4 | Determine the coordinates of A and C. | (6) |
| 8.5 | For what values of $x$ is $g(x) \geq f(x)$? | (3) |
| 8.6 | Determine an equation for the axis of symmetry of $f$ which has a positive slope. | (3) |

**[19]**

**QUESTION 9**

Given:  $f(x) = -x^2 + 2x + 3$  and  $g(x) = 1 - 2^x$

9.1     Sketch the graphs of $f$ and $g$ on the same set of axes.                    (9)

9.2     Determine the average gradient of $f$ between  $x = -3$  and  $x = 0$.                    (3)

9.3     For which value(s) of $x$ is $f(x).g(x) \geq 0$?                    (3)

9.4     Determine the value of $c$ such that the $x$-axis will be a tangent to the graph of $h$, where $h(x) = f(x) + c$.                    (2)

9.5     Determine the $y$-intercept of $t$ if $t(x) = -g(x) + 1$                    (2)

9.6     The graph of $k$ is a reflection of $g$ about the $y$-axis. Write down the equation of $k$.                    (1)
                                                                                        **[20]**

**QUESTION 10**

Sketch the graph of $f(x) = ax^2 + bx + c$ if it is also given that:

•     The range of $f$ is $(-\infty;7]$
•     $a \neq 0$
•     $b < 0$
•     One root of $f$ is positive and the other root of $f$ is negative.                    **[4]**

**QUESTION 11**

Given:       $P(W) = 0,4$
             $P(T) = 0,35$
             $P(T \text{ and } W) = 0,14$

11.1     Are the events  W  and  T  mutually exclusive? Give reasons for your answer.                    (2)

11.2     Are the events  W  and  T  independent? Give reasons for your answer.                    (3)
                                                                                        **[5]**

**QUESTION 12**

12.1    A group of 33 learners was surveyed at a school. The following information from the survey is given:

- 2 learners play tennis, hockey and netball
- 5 learners play hockey and netball
- 7 learners play hockey and tennis
- 6 learners play tennis and netball
- A total of 18 learners play hockey
- A total of 12 learners play tennis
- 4 learners play netball ONLY

12.1.1   A Venn diagram representing the survey results is given below. Use the information provided to determine the values of $a$, $b$, $c$, $d$ and $e$.
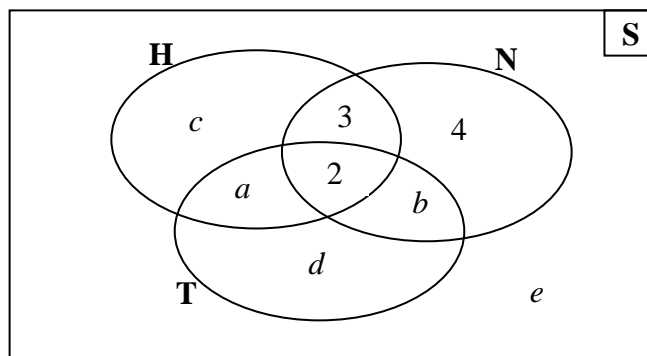


(5)

12.1.2   How many of these learners do not play any of the sports on the survey (that is netball, tennis or hockey)?                                                          (1)

12.1.3   Write down the probability that a learner selected at random from this sample plays netball ONLY.                                                                 (1)

12.1.4   Determine the probability that a learner selected at random from this sample plays hockey or netball.                                                            (1)

12.2    In all South African schools, EVERY learner must choose to do either Mathematics or Mathematical Literacy.

At a certain South African school, it is known that 60% of the learners are girls. The probability that a randomly chosen girl at the school does Mathematical Literacy is 55%. The probability that a randomly chosen boy at the school does Mathematical Literacy is 65%.

Determine the probability that a learner selected at random from this school does Mathematics.                                                                           (6)

**[14]**

**TOTAL:     150**