basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS

MATHEMATICS P1

2017

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 11 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 et cetera 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 $3x^2 + 10x + 6 = 0$ (correct to TWO decimal places) (3)

1.1.2 $\sqrt{6x^2 - 15} = x + 1$ (5)

1.1.3 $x^2 + 2x - 24 \geq 0$ (3)

1.2 Solve simultaneously for x and y:

$5x + y = 3$ and $3x^2 - 2xy = y^2 - 105$ (6)

1.3 1.3.1 Solve for p if $p^2 - 48p - 49 = 0$ (3)

1.3.2 Hence, or otherwise, solve for x if $7^{2x} - 48(7^x) - 49 = 0$ (3)

[23]

QUESTION 2

2.1 Given the geometric sequence: $3\ ;\ 2\ ;\ k\ ;\ ...$

2.1.1 Write down the value of the common ratio. (1)

2.1.2 Calculate the value of k. (2)

2.1.3 Calculate the value of n if $T_n = \frac{128}{729}$. (4)

2.2 In a Mathematics competition, the total prize money for the finalists is R30 500. Each finalist will receive a part of the prize money according to his/her position at the end of the competition. The table below shows the position of the finalists at the end of the competition and the prize money received.

POSITION OF THE FINALIST AT THE END OF THE COMPETITION	PRIZE MONEY
Last	R100
Second from last	R250
Third from last	R400
Fourth from last	R550
. . . .	. . . .
First	Rx

2.2.1 Calculate the prize money of the finalist finishing 18th from last. (2)

2.2.2 Calculate x. (6)

[15]

QUESTION 3

Given the quadratic sequence: 0; 17; 32; ...

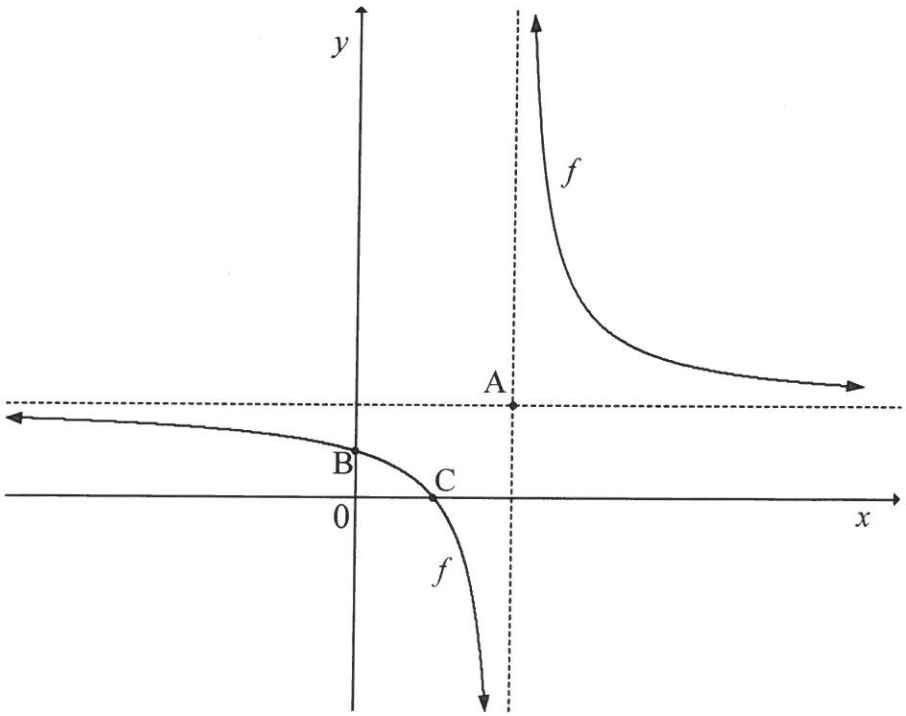
3.1 Determine an expression for the general term, T_n, of the quadratic sequence. (4)

3.2 Which terms in the quadratic sequence have a value of 56? (3)

3.3 Hence, or otherwise, calculate the value of $\sum_{n=5}^{10} T_n - \sum_{n=11}^{15} T_n$. (4)
[11]

QUESTION 4

The sketch below shows the graph of $f(x) = \frac{6}{x-4} + 3$. The asymptotes of f intersect at A. The graph f intersects the x-axis and y-axis at C and B respectively.



4.1 Write down the coordinates of A. (1)

4.2 Calculate the coordinates of B. (2)

4.3 Calculate the coordinates of C. (2)

4.4 Calculate the average gradient of f between B and C. (2)

4.5 Determine the equation of a line of symmetry of f which has a positive y-intercept. (2)
[9]

QUESTION 5

Given: $f(x) = x^2 - 5x - 14$ and $g(x) = 2x - 14$

5.1 On the same set of axes, sketch the graphs of f and g. Clearly indicate all intercepts with the axes and turning points. (6)

5.2 Determine the equation of the tangent to f at $x = 2\frac{1}{2}$. (2)

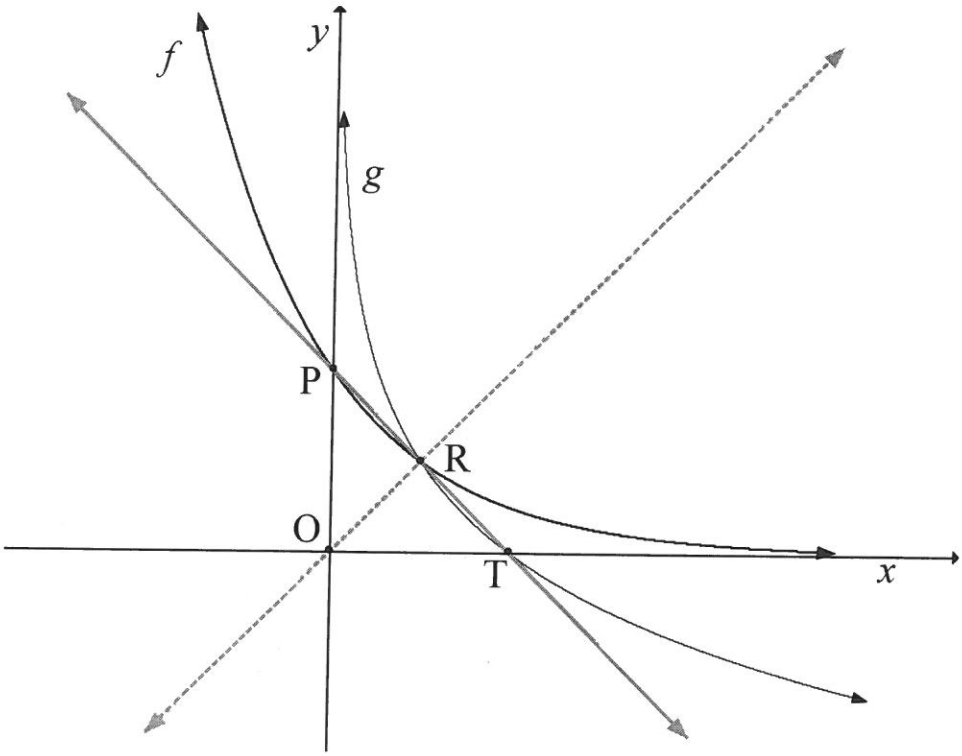
5.3 Determine the value(s) of k for which $f(x) = k$ will have two unequal positive real roots. (2)

5.4 A new graph h is obtained by first reflecting g in the x-axis and then translating it 7 units to the left. Write down the equation of h in the form $h(x) = mx + c$. (2)

[12]

QUESTION 6

In the sketch below, P is the y-intercept of the graph of $f(x) = b^x$. T is the x-intercept of graph g, the inverse of f. R is the point of intersection of f and g. Straight lines are drawn through O and R and through P and T.



6.1 Determine the equation of g (in terms of b) in the form $y = \ldots$ (2)

6.2 Write down the equation of the line passing through O and R. (1)

6.3 Write down the coordinates of point P. (1)

6.4 Determine the equation of the line passing through P and T. (2)

6.5 Calculate the value of b. (5)

[11]

QUESTION 7

7.1 A company bought a new machine for R500 000. After 3 years, the machine has a book value of R331 527. Calculate the yearly rate of depreciation if the machine was depreciated according to the reducing-balance method. (3)

7.2 Musa takes a personal loan from a bank to buy a motorcycle that costs R46 000. The bank charges interest at 24% per annum, compounded monthly.

How many months will it take Musa to repay the loan, if the monthly instalment is R1 900? (4)

7.3 Neil set up an investment fund. Exactly 3 months later and every 3 months thereafter he deposited R3 500 into the fund. The fund pays interest at 7,5% p.a., compounded quarterly. He continued to make quarterly deposits into the fund for 6½ years from the time that he originally set up the fund.

Neil made no further deposits into the fund, but left the money in the same fund at the same rate of interest. Calculate how much he will have in the fund 10 years after he originally set it up. (6)

[13]

QUESTION 8

8.1 Given $f(x)=3-2x^2$. Determine $f'(x)$, using first principles. (5)

8.2 Determine $\frac{dy}{dx}$ if $y=\frac{12x^2+2x+1}{6x}$. (4)

8.3 The function $f(x)=x^3+bx^2+cx-4$ has a point of inflection at (2 ; 4). Calculate the values of b and c. (7)

[16]

QUESTION 9

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

9.1 Write down the coordinates of the y-intercept of f. (1)

9.2 Calculate the coordinates of the x-intercepts of f. (5)

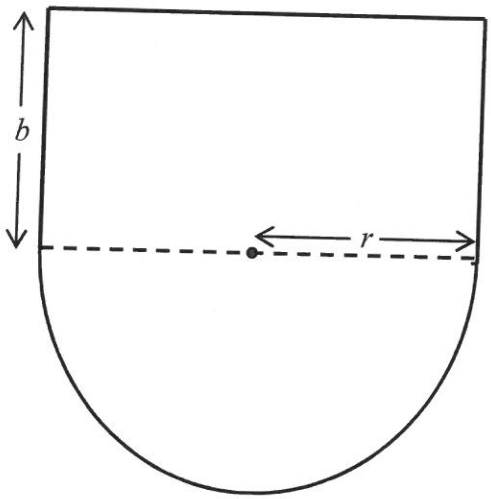
9.3 Calculate the coordinates of the turning points of f. (6)

9.4 Sketch the graph of f in your ANSWER BOOK. Clearly indicate all intercepts with the axes and the turning points. (3)

9.5 Write down the values of x for which $f'(x)<0$. (2)

[17]

QUESTION 10



The figure above shows the design of a theatre stage which is in the shape of a semicircle attached to a rectangle. The semicircle has a radius r and the rectangle has a breadth b. The perimeter of the stage is 60 m.

10.1 Determine an expression for b in terms of r. (2)

10.2 For which value of r will the area of the stage be a maximum? (6)

[8]

QUESTION 11

11.1 The letters of the word EQUATION are randomly used to form a new word consisting of five letters. How many of these words are possible if letters may not be repeated? (2)

11.2 It is given that two events, A and B, are independent. $P(A)=\frac{2}{5}$ and $P(B)=0,35$. Calculate P(A or B). (4)

11.3 Grade 12 learners in a certain town may choose to attend any one of three high schools. The table below shows the number of Grade 12 learners (as a percentage) attending the different schools in 2016 and the matric pass rate in that school (as a percentage) in 2016.

SCHOOLS	NUMBER OF LEARNERS ATTENDING (%)	MATRIC PASS RATE (%)
A	20	35
B	30	65
C	50	90

If a learner from this town, who was in Grade 12 in 2016, is selected at random, determine the probability that the learner:

11.3.1 Did not attend School A (2)

11.3.2 Attended School B and failed Grade 12 in 2016 (3)

11.3.3 Passed Grade 12 in 2016 (4)

[15]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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