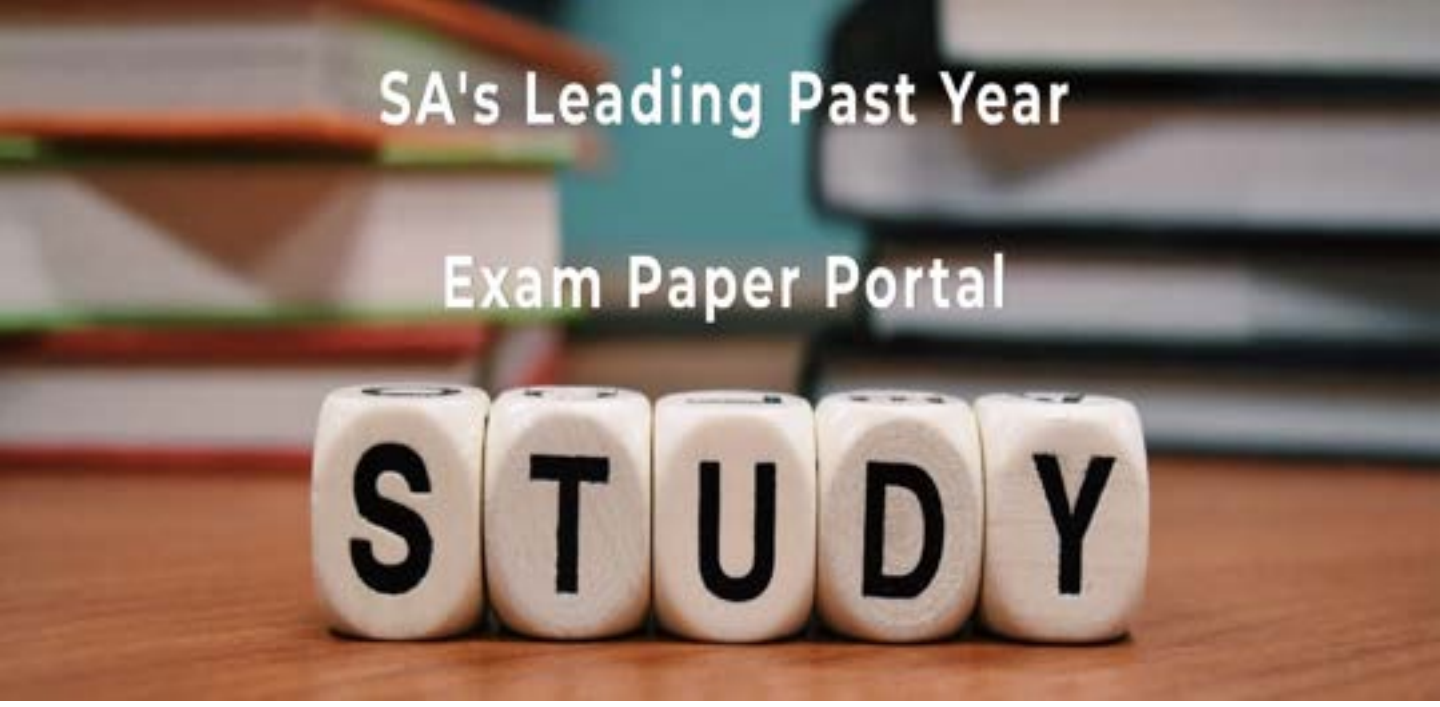

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PREPARATORY EXAMINATION

GRADE 12

MATHEMATICS P1

SEPTEMBER 2019

TIME: 3 HOURS

MARKS: 150

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 this question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $-\frac{2}{x^2}+\frac{1}{8}=0$ (3)

1.1.2 $2x^2+9x-24=0$ (Correct to TWO decimal places) (4)

1.1.3 $x=2\sqrt{x}+3$ (4)

1.2 Given that: $f(x)=2x^2+x-6$

1.2.1 Solve for $\boldsymbol{x}$ if $f(x)\geq 0$ (3)

1.2.2 Determine the sum of all integers satisfying $f(x)<0$ (2)

1.3 Given that $x^2-2xy-8y^2=0$

1.3.1 Determine the value of the ratio $\frac{x}{y}$ (3)

1.3.2 Hence, solve for x and y, if $y+2x=4$ (6)

[25]

QUESTION 2

2.1 Given the quadratic sequence 1; 6; 15; 28; …

2.1.1 Write down the second difference. (1)

2.1.2 Determine the nth term. (4)

2.1.3 Calculate which term of the sequence equals 2701. (3)

2.2 Given the arithmetic series: 10 + 15 + 20 + 25 + … + 185

2.2.1 How many terms are there in the series? (3)

2.2.2 Calculate the sum of all the natural numbers from 10 to 185 that are NOT divisible by 5. (6)

[17]

QUESTION 3

Given that: $\sum_{n=1}^{\infty} 63p^{n-1} = \frac{189}{2}$

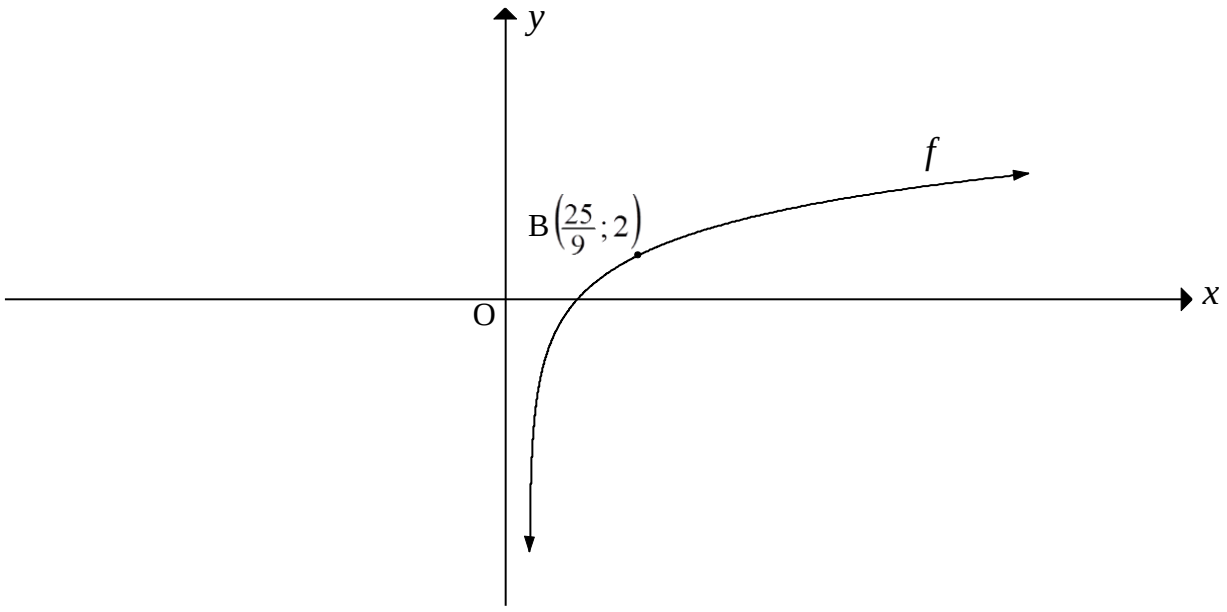
3.1 Solve for *p*. (4)

3.2 If it is further given that $p = \frac{1}{3}$, determine the **smallest value of *n*** such that $T_n < \frac{1}{6561}$. (5)

[9]

QUESTION 4

In the diagram, the graph of $f(x) = \log_a x$ is drawn. $B\left(\frac{25}{9}; 2\right)$ is a point on *f*.



4.1 Determine the value of ***a***. (2)

4.2 Determine the value(s) of *x* for which $f(x) \leq 0$. (2)

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

4.4 B// is the reflection of B on the graph $g(x)=\left(\frac{3}{5}\right)^x$.

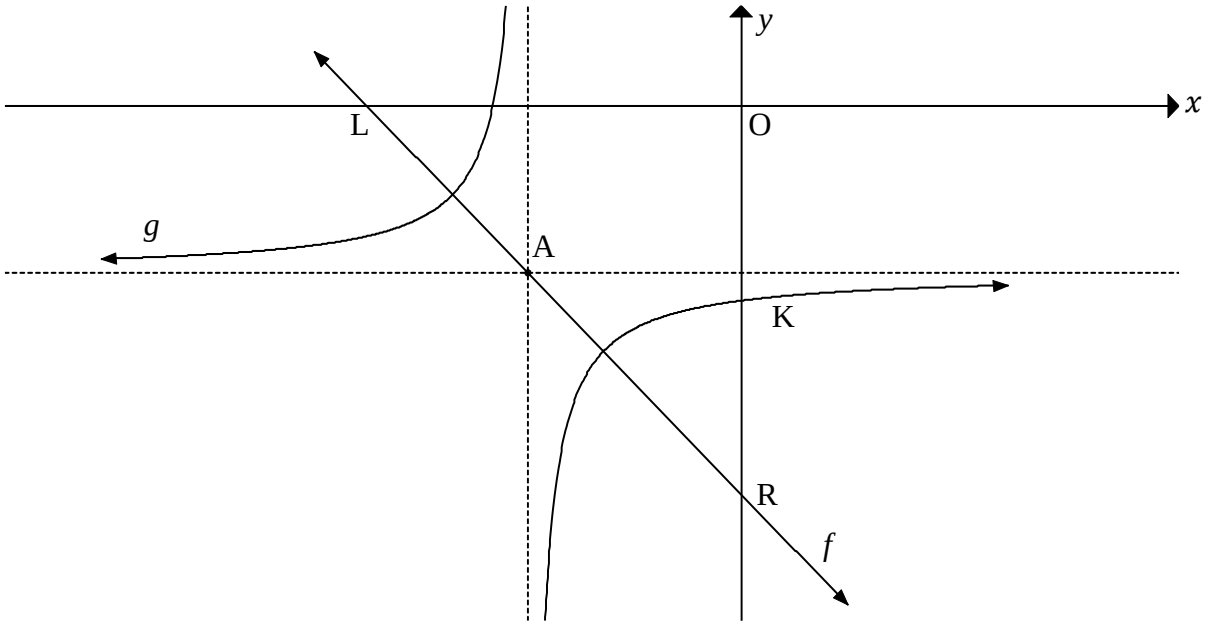
Write down the coordinates of B//. (2)

4.5 Determine for which value(s) of x will $f^{-1}(x) > \frac{25}{9}$. (2)

[10]

QUESTION 5

In the diagram below, the graph of $g(x) = \frac{-2}{x+4} - 3$ is drawn. The graph f passes through A, the point of intersection of the asymptotes of g, and cuts the x-axis and the y-axis at L and R respectively. K is the y-intercept of g.



5.1 Determine the equation of f in the form $y = mx + c$. (3)

5.2 Write down the equation of the asymptotes of $g(x-2) + 1$. (2)

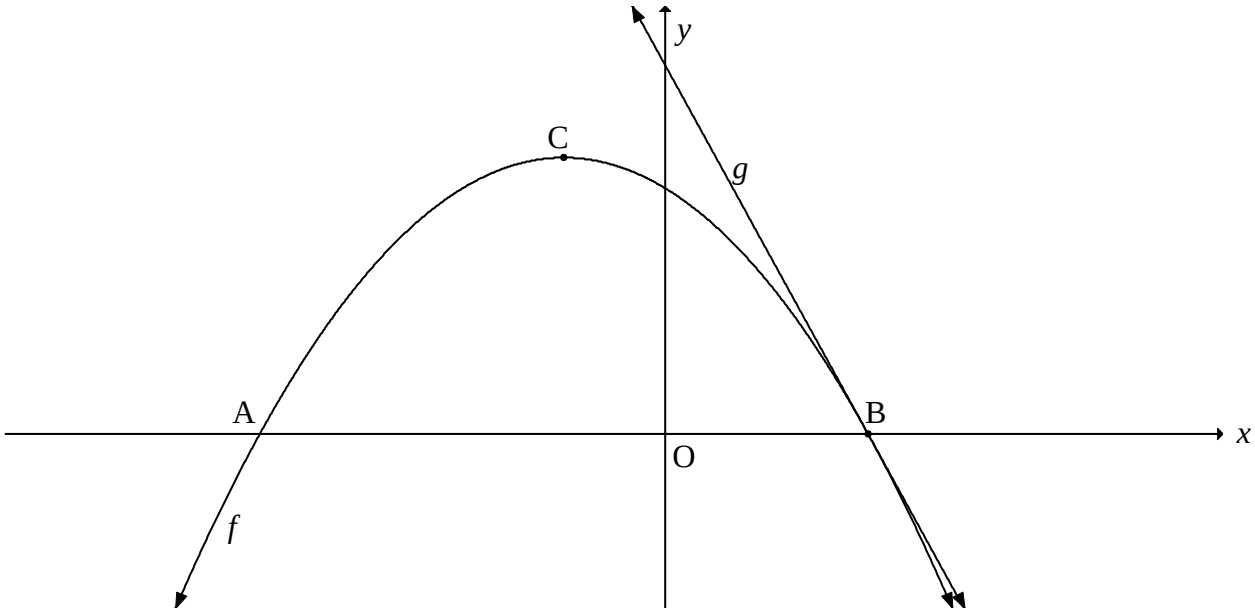
5.3 Calculate the length of KR. (3)

5.4 The graph of h, where h is the reflection of f in the line $y = -7$, passes through the point S(– 4 ; p). Calculate the area of ΔARS. (4)

[12]

QUESTION 6

In the diagram below, the graphs of $f(x) = ax^2 + bx + 16$ and $g(x) = -12x + 24$ are drawn. The graph of g is a tangent to the graph of *f* at B. A and B are the *x*-intercepts of *f* and C, the turning point.



6.1 Calculate the coordinates of B. (2)

6.2 Determine the values of a and b. (6)

6.3 If it is given that $f(x) = -2x^2 - 4x + 16$, determine:

6.3.1 The range of *f* (5)

6.3.2 The value(s) of x for which $f'(x)$. g(x) > 0 (2)

[15]

QUESTION 7

The Northern Cape Department of Education bought 50-tablets for a total amount of R800 000 in order for teachers to do a coding course in the province.

7.1 Calculate:

7.1.1 The price of one tablet (1)

7.1.2 The book value of a tablet after 3 years, if the rate of depreciation is 18% p.a. on reducing-balance method. (2)

7.1.3 The number of years it would take for the price of a tablet to be R21 200, if the rate of inflation is 5,8% p.a. compounded annually. (Give an answer to the nearest year.) (3)

7.2 John bought a house and took out a loan for R900 000. The loan is repaid over 20 years and the interest on the loan is 8% p.a. compounded monthly.

Calculate the:

7.2.1 Monthly payments (4)

7.2.2 Interest paid on the last two years (5)
[15]

QUESTION 8

8.1 Determine:

8.1.1 $f'(x)$ from first principles if $f(x) = 3x^2$ (5)

8.1.2 $\frac{d}{dx}\left(\sqrt{x^3} - x + \frac{3}{x^2}\right)$ (3)

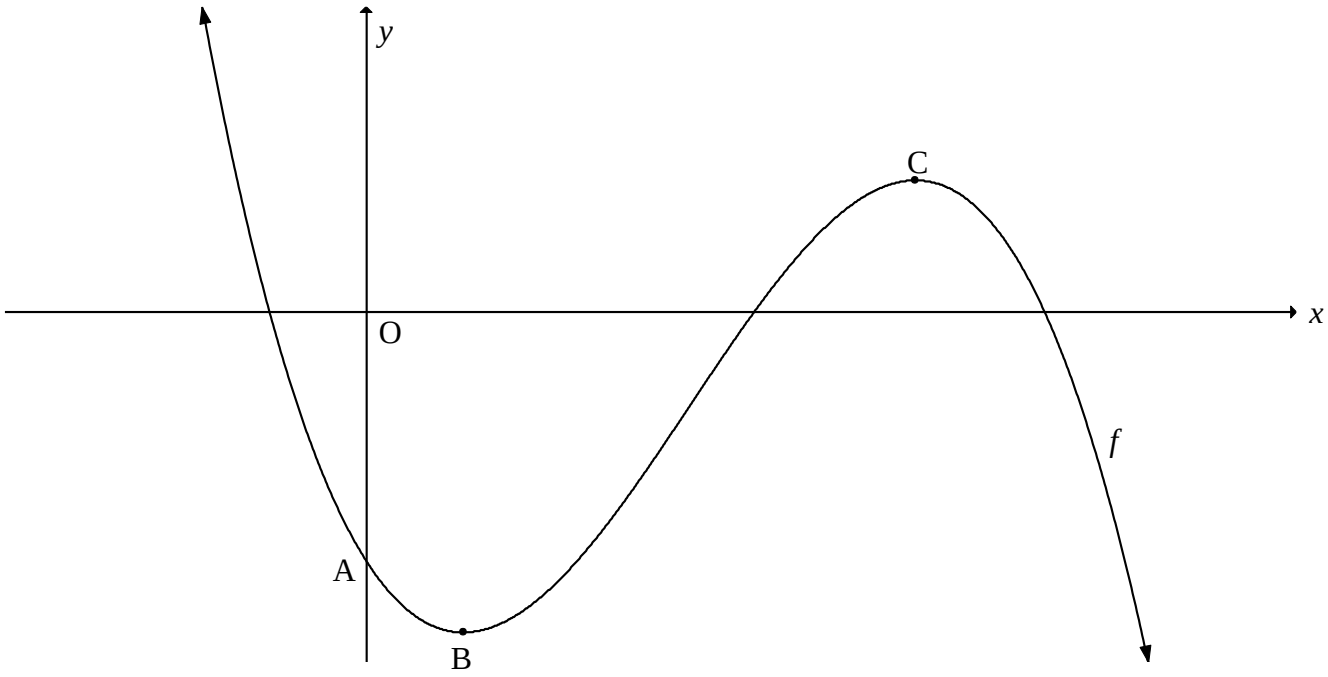
8.2 Given that $g(x) = -4x + 12$ and $g(x) = f'(x)$.

8.2.1 Calculate the x coordinate of the turning point of f. (2)

8.2.2 Determine the values of x for which the graph of f will be decreasing. (2)
[12]

QUESTION 9

In the diagram, the graph of $f(x) = -x^3 + 10x^2 - 17x - 28$ intersects the *y*-axis at A.
B and C are the turning points of *f*.



9.1 Write down the coordinates of A. (1)

9.2 Calculate the coordinates of B and C. (6)

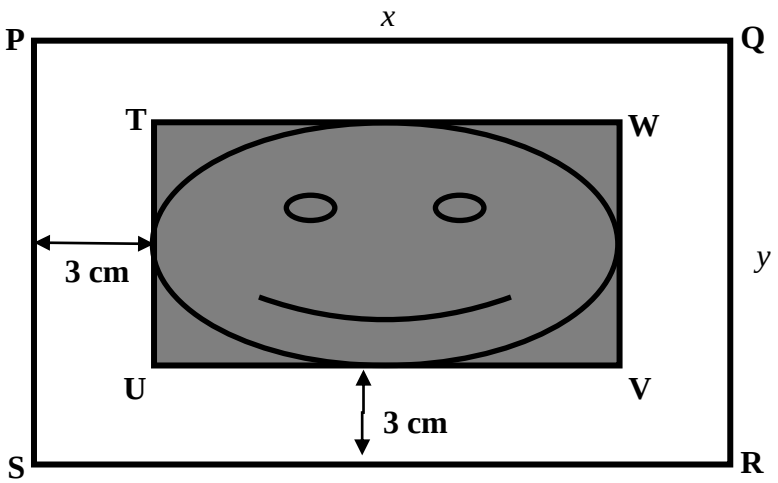
9.3 For which value(s) of *x* is *f* concave up? (4)

9.4 Determine the value(s) of *p* for which $f(x) = p$ has only one positive root. (2)

[13]

QUESTION 10

In the diagram below, TUVW is a rectangular picture. The picture is framed such that there is a 3 cm space around the picture. The perimeter of the rectangle PQRS is 70 cm.
PQ = *x* units and QR = *y* units.



Calculate the maximum area of the picture TUVW. **[8]**

QUESTION 11

11.1 Mandisa is visiting a restaurant. The probability that she will order tea is 0,4 and the probability that she will order cake is 0,5. The probability that she will order tea or cake is 0,8.

11.1.1 Calculate the probability that:

(a) Mandisa will order neither tea nor cake (1)

(b) She will order tea and cake (2)

11.1.2 Let T and C represents the events of Tea and Cake respectively. Are the events T and C mutually exclusive? Motivate your answer. (2)

11.2 Seven learners, Bonolo, Jeffrey, Themba, Richard, Thandeka, Godfrey and Palesa are standing in a line.

11.2.1 In how many ways can the learners be arranged in a line? (2)

11.2.2 In how many ways can the learners be arranged if Bonolo, Jeffrey and Themba must be next to one another in any order? (3)

11.2.3 What is the probability that Thandeka and Palesa will not be standing next to each other? (4)

[14]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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