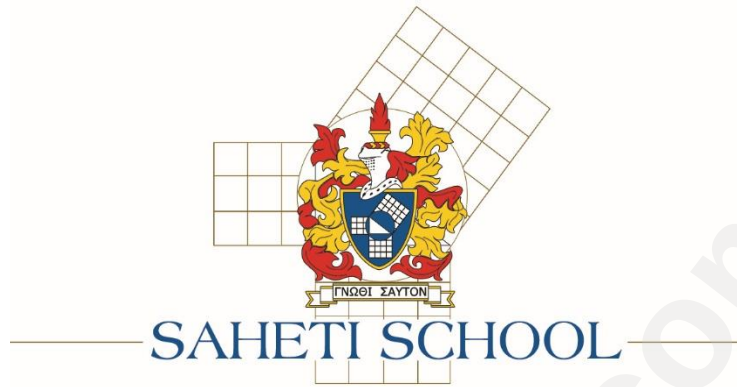




eduresourceza.com

NAME: _____



PRELIMINARY EXAMINATION 2019

MATHEMATICS GRADE 12

PAPER 1

Time: 3 hours

Total: 150

Examiner: P R Mhuka

Moderators: J Scalla
E Zachariou
M Torrani
N Ferreira

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 24 pages and a separate formula sheet. Please check that your paper is complete.
2. Read the questions carefully.
3. Answer all the questions.
4. Number your answers exactly as the questions are numbered.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. Answers must be rounded off to the first decimal place, unless otherwise stated.
7. All the necessary working details must be clearly shown.
8. It is in your own interest to write legibly and to present your work neatly.

Page 1 of 24

SECTION A- 77 MARKS

QUESTION 1:

a) 1) Find all values of x satisfying the inequality $-1 \leq 3x - 5 \leq 1$. (3)

2) Hence, find all values of y satisfying the inequality $-1 \leq \frac{3}{y} - 5 \leq 1$. (3)

b) Simplify $\frac{9^x \cdot 10^{x-2}}{6^{x-1} \cdot 15^x}$ (4)

c) Solve for x and show all your working $\sqrt{10x + 24} = x + 4$ (4)

[14]

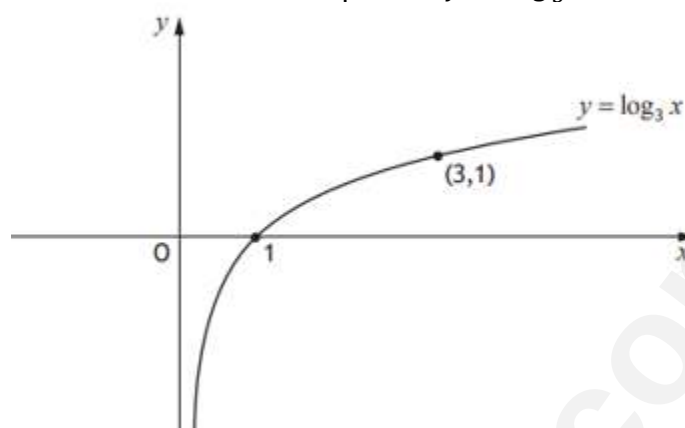
QUESTION 2:

a) The function $f(x) = 3x + k$ has domain $[1; \infty)$, where k is a constant.

1) Write down, in terms of k , the range of $f(x)$. (2)

2) Write down $f^{-1}(x)$, in terms of k . (3)

b) The diagram shows the curve with equation $y = \log_3 x$



1) Sketch the curve with equation $h(x) = 1 - \log_3 x$. (3)

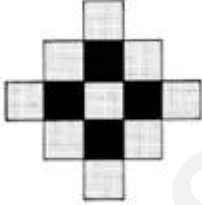
2) For which values of x is $h'(x) < 0$ (1)

[9]

QUESTION 3:

A large floor is to be covered with black and grey square tiles to make a chequered pattern.

The person laying the tiles must start at the centre of the floor and work outwards.

1 st arrangement	2 nd arrangement	3 rd arrangement	4 th arrangement
			
Lay a grey tile in the centre of the floor	Place black tiles against the edges of the grey tiles	Place grey tiles against the edges of the black tiles	Place black tiles against the edges of the grey tiles

a) How many tiles are there in the 4th arrangement? (1)

b) The number of tiles, T_n , needed to make the n^{th} arrangement is given by the formula $T_n = an^2 + bn + c$. Calculate the values of a , b and c . (4)

- c) Each tile measures 30cm by 30cm . How many tiles are needed to cover a room of 50 m^2 (3)

[8]

QUESTION 4:

- a) Given that $f(x) = 8x^2 - 5x - 6$, find $f'(x)$ from first principles. (5)

- b) Given $y = \frac{a}{x} + 10\sqrt{x}$ and that $\frac{dy}{dx} = 3$ when $x = 4$, find the value of the constant a . (4)

- c) The curve C has equation $y = x^3 + 4x^2 + kx + k^2$, where k is a constant.

- 1) Determine the derivative of C in terms of k . (2)

- 2) Find, in terms of k , the equation of the tangent to C at the point P where $x = 1$. (3)

- 3) Hence, show that the tangent at P does not pass through the point (2; 1) (4)

QUESTION 5:

[18]

- a) A man is granted a loan now at 4% pa simple interest. If the man needs R800 to repay the loan three months from now, then how much money will he need to repay the loan nine months from now? (4)

- b) A loan of R15 000 is to repaid by means of regular equal monthly payments of R500 starting one month after the loan was granted. Interest on the loan is charged at 12% pa compounded quarterly.

1) Calculate the interest rate per annum compounded monthly. (3)

2) Calculate the balance outstanding after the 14th payment. (4)

- c) R5000 was deposited into an account that earns interest at a rate of 8% pa compounded every three months. After 18 months an additional x rand was deposited into the account and the interest rate changed to 9% pa compounded every 4 months at this time. Two years after this additional deposit was made, the amount of money in the account was equal to R7 619,02. Determine x . (6)

[17]

2) Hence, find the value of u . (2)

c) Find $P(B' \cup D')$. (3)

d) A bus of 77 customers arrive at Harry's hotel. Of these 77 customers, 40 have booked a room and breakfast, 37 have booked a room without breakfast. Estimate how many of these 77 customers will book dinner. (2)

[12]

SECTION B-73 MARKS

QUESTION 7:

- a) Each day a bookshop sells copies of 10 different newspapers, one of which is The Times. A customer buys 3 different newspapers. Calculate the number of ways the customer can select his newspapers:

1) If there is no restriction. (2)

2) If 1 of the 3 newspapers is The Times. (2)

- b) Calculate the number of different even 5-digit numbers which can be formed using the digits 0, 2, 3, 4, 7 without repetition and assuming that a number cannot begin with a 0. (4)

[8]

QUESTION 8:

a) A geometric sequence has first term 80 and common ratio $\frac{1}{3}$.

1) Calculate the 7th term. (2)

2) Calculate $\sum_{n=1}^{\infty} T_n$ (2)

3) The first term of this geometric sequence is equal to the first term of an arithmetic sequence. The sum of the first five terms of this arithmetic sequence is 240. Find the common difference of this sequence. (4)

b) The sum of the first k positive integers can be written as

$$1 + 2 + 3 + \cdots + k = \frac{k(k+1)}{2}$$

Given $k = 105$, find, the sum of the integers between 1 and 105 inclusive which are not divisible by 3 or by 5. (6)

[14]

QUESTION 9:

Consider the quadratic equation $ax^2 + bx + c = 0$. Given that one of the roots is double the other root,

a) Show that $ac = \frac{2b^2}{9}$ (4)

b) Deduce that both roots are real. (2)

[6]

QUESTION 10:

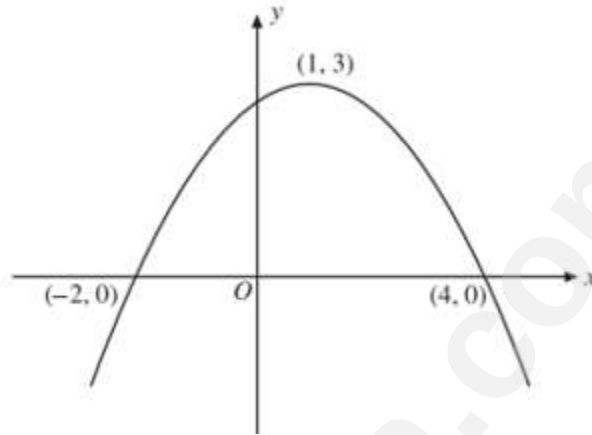
a) Given $f(x) = \frac{2}{x+3} - \frac{5}{2}$

1) Write down the equations of the asymptotes of $f(x)$ (2)

2) Make a neat drawing of $f(x)$. Clearly show the asymptote and intercepts with the axes. (4)

3) Write down the line of symmetry with the value of the x -intercept less than vertical asymptote. (2)

- b) The diagram shows a sketch of the graph $f(x) = ax^2 + bx + c$. The graph has a maximum point at $(1; 3)$ and intersects the x -axis at the points $(-2; 0)$ and $(4; 0)$.



- 1) Calculate the values of a, b and c . (4)

- 2) Sketch the graph of $f(2x)$ indicating all intercepts and turning point. (3)

- 3) Use the graph to find the values of t for which $f(2x) + t = 0$ has two positive roots. (3)

[18]

QUESTION 11:

(2;9) is a turning point on the graph $f(x) = ax^3 + 5x^2 + 4x + b$.

a) Determine the values of a and b in the equation of f . (5)

b) Sketch $f(x)$ indicating all intercepts with the axis and turning points. (5)

c) Write down the values of x where the graph is concave downward. (3)

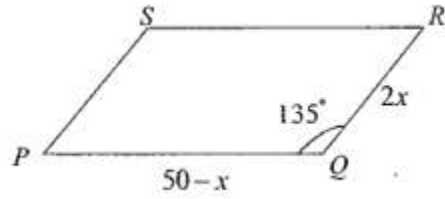
d) For which values of x is $f'(x) \leq 0$ and $f(x) < 0$ (3)

[16]

- 3) Between these two extremes there is one value of x which maximises the time taken. Calculate the value of x ? (4)

eduresourceza.com

- b) The diagram shows the parallelogram $PQRS$ whose side $PQ = (50 - x)cm$, $QR = 2x cm$ and $\angle PQR = 135^\circ$.



Calculate the area, A , of the parallelogram and hence find the exact maximum value of the area.

(5)

[11]