

BEAULIEU COLLEGE



Beaulieu College

A division of Kyalami Schools NPC

PRELIMINARY EXAMINATIONS

GRADE 12

MATHEMATICS

PAPER 1

Time: 3 Hours

150 marks

Date: 11 September 2020

Examiner: Ms Smith

Moderator: Mr Ruiz-Mesa

EXAMINATION NUMBER:

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TEACHER:

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Ruiz-Mesa

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Scholefield

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Smith

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of 24 pages, including two pages with additional space for working. An Information Sheet of 2 pages (i–ii) is also provided. Please check that your paper is complete.
2. Write the last three digits of your examination number in the space provided above and answer all the questions on the question paper.
3. Please note that diagrams are not necessarily drawn to scale.
4. All necessary working details must be shown.
5. Round your answers off to **ONE** decimal place unless stated otherwise.
6. Approved non-programmable and non-graphical calculators may be used, unless otherwise stated.
7. It is in your own interest to write legibly and to present your work neatly.

SECTION A
QUESTION 1

(a) Solve for x in each of the following:

(1) $3^x(2x+5) = 0$ (2)

(2) $x - \sqrt{x-4} = 6$ (5)

(3) $x^2 + 3x \geq 10$ (4)

$$(4) \quad \frac{4^{2x}}{2} = 2^{-x} \cdot 2^{x+1} \quad (4)$$

- (b) If 6 and -3 are the roots of the equation $x^2 + bx + c = 0$, determine the values of b and c . (3)

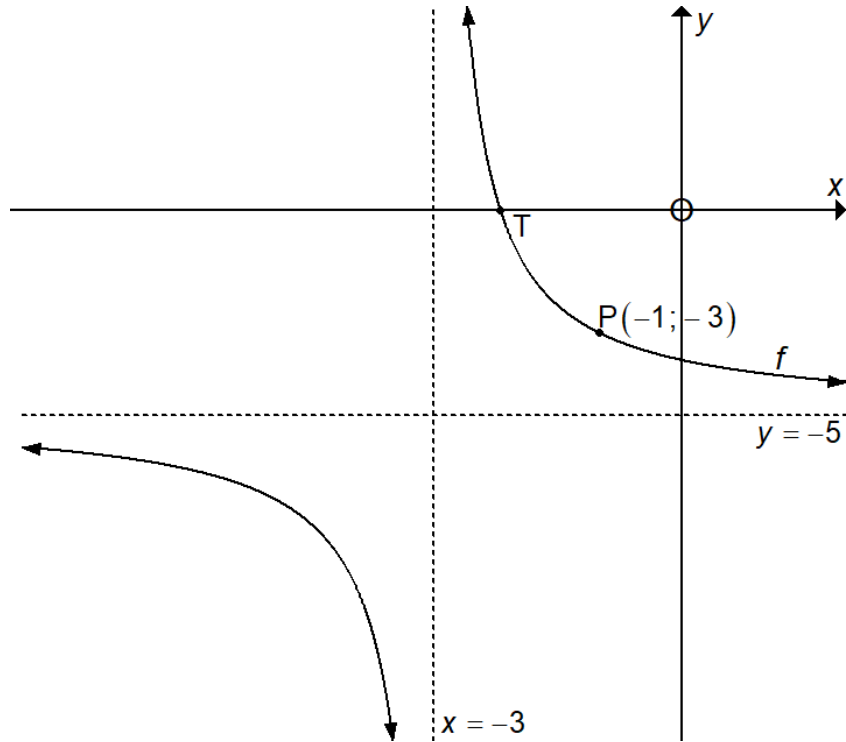
- (c) Given: $3x^2 - 7x + k = 0$
 (1) Solve for x in terms of k . (2)

- (2) If $k \neq 0$, determine a value for k such that the roots of the equation will be rational and not equal. (2)

[22]

QUESTION 2

The diagram below shows the graph of $f(x) = \frac{a}{x+p} + q$. The lines $x = -3$ and $y = -5$ are the asymptotes of f . $P(-1; -3)$ is a point on f and T is the x -intercept of f .



- (a) Determine the values of a , p and q . (4)

- (b) Determine the coordinates of T, the x -intercept of f . (3)

- (c) If the graph of f is symmetrical with respect to the line $y = -x + c$, determine the value of c . (2)

[9]

QUESTION 3

Round off your answers to 2 decimal digits where necessary.

Malusi decides to buy a car for R245 000. He takes out a loan from the bank for the full amount, repayable monthly over four and a half years. The bank charges interest at 11,5% per annum compounded monthly. Payments start 1 month after the loan is received.

- (a) Calculate Malusi's monthly instalments. (3)

- (b) Calculate the outstanding balance at the end of two years, i.e. immediately after the 24th payment. (3)

- (c) Making reference to your answer to (b), how much of the total monthly instalments paid over the 2 year period went towards paying the bank's interest charges? (3)

- (d) The car depreciates in value at 20% per annum on a reducing balance. Showing ALL your calculations, would Malusi be able to sell the car after two years at the depreciated value and pay off the outstanding balance on the loan? (3)

- (e) Malusi could have chosen not to take out a loan. He could have rather deposited R34 000 per quarter into an investment account, earning interest at 8% per annum, compounded quarterly.
Determine how long it would have taken before he had enough money in the investment account to purchase the car. (Assume that the price of the car remains constant.) (4)

[16]

QUESTION 4

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

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- (b) Determine:

$$(1) \quad \frac{dy}{dx} \text{ if } y = \sqrt[3]{x^2} - \frac{4}{x^5} \quad (3)$$

$$(2) \quad D_x \left[\frac{2x^2 + 5x - 12}{x + 4} \right] \quad (3)$$

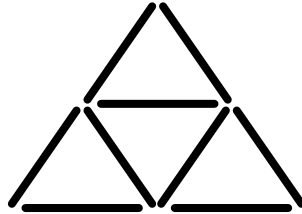
[11]

QUESTION 5

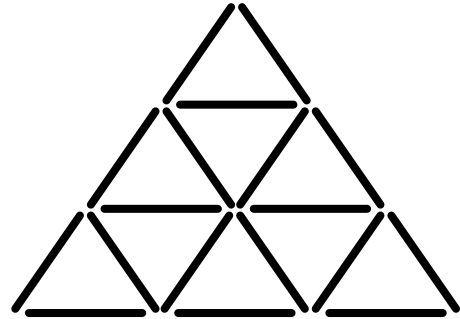
(a) The first three patterns formed by the arrangement of toothpicks are shown below:



Pattern 1



Pattern 2



Pattern 3

(1) How many toothpicks will the fourth pattern have? (1)

(2) Determine the n^{th} term of the sequence. (4)

(3) How many toothpicks will be required to form the 11^{th} pattern? (2)

- (b) In an arithmetic sequence, the fourth term is $2p - 4$, the seventh term is -6 and the twelfth term is -26 . Determine the value of p . (4)

- (c) Given the geometric series $2x + x^2 + \frac{1}{2}x^3 + \dots$

- (1) Determine the value(s) of x for which the series will converge. (3)

- (2) Determine the sum to infinity if $x = \frac{2}{5}$. (3)

[17]

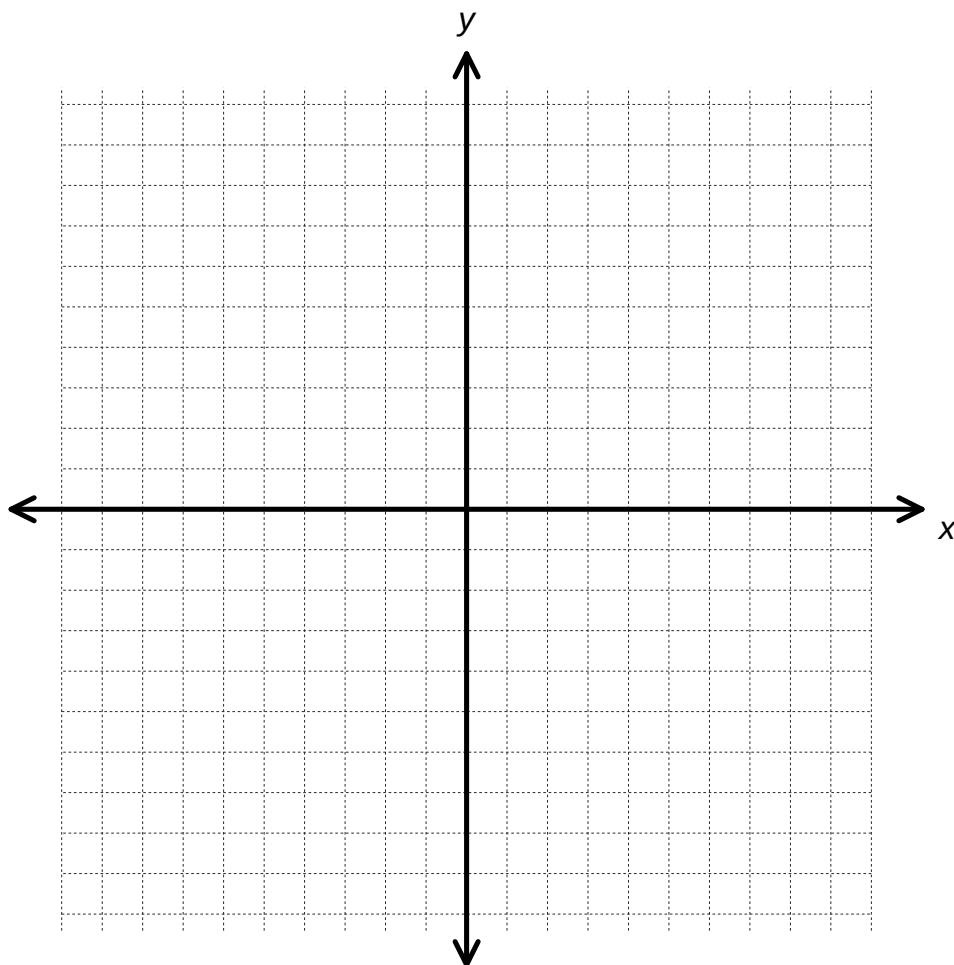
TOTAL SECTION A: [75]

SECTION B
QUESTION 6

Given: $p(x) = 3^x$

- (a) Write down the equation of p^{-1} in the form $y = \dots$ (2)

- (b) Sketch the graphs of p and p^{-1} on the same set of axes, given below.
Clearly show all the intercepts with the axes. (4)



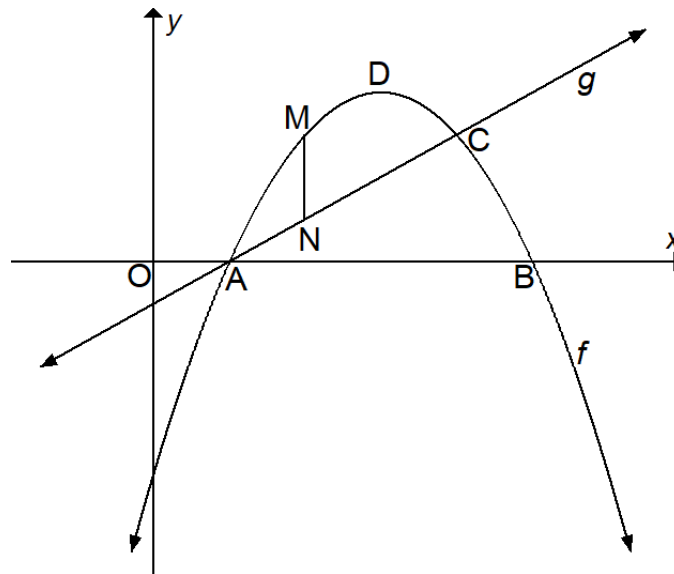
- (c) Determine the value(s) of x for which $p^{-1}(x) \leq 1$. (2)

- (d) Determine the domain of the graph of t if t is formed by shifting the graph of p^{-1} three units to the left. (2)

[10]

QUESTION 7

The diagram below shows the graphs of the functions $f(x) = -x^2 + 6x - 5$ and $g(x) = x - 1$.



- (a) Determine the value(s) of x for which $f(x) \geq g(x)$. (5)

- (b) Determine the value(s) of x for which $f'(x) \cdot g(x) < 0$. (4)

- (c) Determine the value(s) of t for which the equation
- $$-(x+t)^2 + 6(x+t) - 5 = (x+t) - 1 \text{ has one positive and one negative root.} \quad (2)$$

- (d) Determine the largest possible value of MN if MN is parallel to the y -axis with M a point on the graph of f and N a point on the graph of g . (6)

[illegible]

[17]

QUESTION 8

(a) Consider the following pattern:

$$1 + 2 + 3 + 4 = 10$$

$$5 + 6 + 7 + 8 = 26$$

$$9 + 10 + 11 + 12 = 42$$

Determine the sum of the terms in the 120th row.

(4)

(b) Given: $\sum_{n=1}^{\infty} 3 \cdot p^n = 6$

Determine the value of p .

(4)

[8]

QUESTION 9

- (a) Determine the coordinates of the points on the curve $y = \frac{4}{x}$ where the gradient of the tangent to the curve is -1 . (5)

- (b) $g(x) = ax^3 + bx^2 + cx - 5$. The gradient at any point on the graph of g is given by $6x^2 - 24$. Determine the values of a , b and c . (6)

(c) A cubic polynomial, h , has the following properties:

- $h'(-1) = h'(3) = 0$
- $h(-3) = h(3) = 0$
- h decreases for $x < -1$ or $x > 3$.

(1) Sketch the graph of h .

(5)

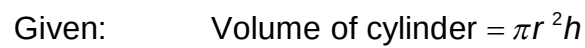


(2) Determine the value(s) of x for which $h''(x) < 0$.

(2)

[18]

In the diagram below, shows a cylinder that is set centrally inside a hemisphere. The radius of the hemisphere is 16 cm.



(7)

[illegible]

Page 19 of 24

QUESTION 11

(a) If $P(A) = \frac{3}{8}$ and $P(B) = \frac{1}{4}$, determine (leaving your answers as common fractions):

(1) $P(A \cup B)$ if A and B are mutually exclusive events. (2)

(2) $P(A \cup B)$ if A and B are independent events. (4)

- (b) During a TV game show, contestants have to answer randomly generated questions within a fixed time. The probability of answering the first question correctly is 0,9. Whenever a question is answered correctly, the next question generated is more difficult and the probability of a correct answer is reduced by 0,15. This means that the probability of getting the second answer correct (if the first answer is correct) will be 0,75.

Whenever a question is answered incorrectly, the next question generated is of the same standard and the probability of it being answered correctly remains unchanged.

Determine, correct to THREE decimal places, the probability of a contestant getting the second answer correct.

(4)

- (c) Jared, Chloe, Amy, Luzandi, Michelle and Keaarshen want to take a photo for the magazine. If they are randomly placed in a row, in how many of the possible photos will Luzandi and Michelle NOT stand next to each other?

(5)

[15]

TOTAL SECTION B: [75]

TOTAL: [150]

[illegible]

[illegible]

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MARKING GRID

Question	Algebra	Functions & Graphs	Finance	Differential Calculus	Patterns & Sequences	Probability
1	/22					
2		/9				
3			/16			
4				/11		
5					/17	
6		/10				
7		/17				
8					/8	
9				/18		
10				/7		
11						/15
TOTAL PER TOPIC	/22	/36	/16	/36	/25	/15
TOTAL MARK				/150		