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SUBJECT
GRADE
EXAMINER
NAME
CLASS

Mathematics Paper 1

12

Mrs Eckert

DATE

MARKS

MODERATOR

DURATION

22 July 2014

150

Mrs Povall and Mrs Sillman

3 hours

QUESTION NO.	DESCRIPTION	POSSIBLE MARK	ACTUAL MARK
1	Algebra	26	
2	Calculus	20	
3	Number Patterns	7	
4	Functions	10	
5	Finance	16	
6	Calculus/Functions	21	
7	Calculus	10	
8	Number Patterns	17	
9	Functions	7	
10	Probability	5	
11	Probability	11	
TOTAL		150	

STUDENT'S
RESULT
COMMENT

TEACHER'S
SIGNATURE
PARENT'S
SIGNATURE

PLEASE READ THESE INSTRUCTIONS CAREFULLY:

1. This paper consists of **11** questions and **8** pages and a formula sheet. Please check that your paper is complete.
2. Answer all the questions.
3. Answers must be completed on folio paper provided.
4. Number your answers clearly and exactly as the questions are numbered in the questions paper.
5. You may use an approved non-programmable and non-graphics calculator unless otherwise stated.
6. Answers must be rounded correct to **TWO** decimal places, unless otherwise stated.
7. It is in your own interest to show all working details, to write legibly and to present your work neatly.
8. Diagrams are not drawn to scale.

GOOD LUCK!!!!

QUESTION 1

26 MARKS

All working must be shown in this question.

a) Solve for x

i) $(2x + 3)(x - 5)(x - \sqrt{3}) = 0$

i. If $x \in \mathbb{Z}$ (1)

ii. If $x \in \mathbb{Q}'$ (2)

ii) $x^2 - 6x + 5 < 0$ (4)

iii) $16^x \times \frac{1}{4^{x-1}} = \frac{1}{64}$ (3)

iv) $x^2 + 2x - 9 = 0$, by completing the square.
Give your answers in simplest surd form. (4)

b) Given that $(a; 6)$ is a point on the graph of $f(x) = 2^x$, find a correct to two decimal places. (3)

c) Solve simultaneously for x and y if:

$\log_2 x + \log_2 y = 4$ and $x + y = 10$ (5)

d) Prove that the equation $\left(1 - \frac{2}{\sqrt{x}}\right)\left(1 + \frac{2}{\sqrt{x}}\right) = 3$ has no real roots. (4)

QUESTION 2

20 MARKS

a) Determine $f'(x)$ by first principles if $f(x) = 3x^2 - 5$ (4)

b) Determine $\frac{dy}{dx}$ if: $y = \frac{6}{\sqrt[3]{x^6}} - \frac{x^6}{6}$ (3)

c) Given: $f(x) = ax^3 + q$; $f(2) = 3$ and $f'(2) = 12$

i) Write an expression for $f'(x)$. (1)

ii) Show that: $a = 1$ and $q = -5$. (4)

iii) Find the equation of the *normal* (a normal is a line perpendicular to the tangent) to the curve at $x = 2$. (3)

d) Vincent is required in a test to find the derivative of a function $f(x)$. However, by mistake he finds the inverse instead. He finds that:

$$f^{-1}(x) = \sqrt[3]{\frac{x+7}{2}}$$



Find the correct answer to the problem. (5)

QUESTION 3**7 MARKS**

The income from a farm stall at the end of the first week was R 180.
The income increases every week by R 25.



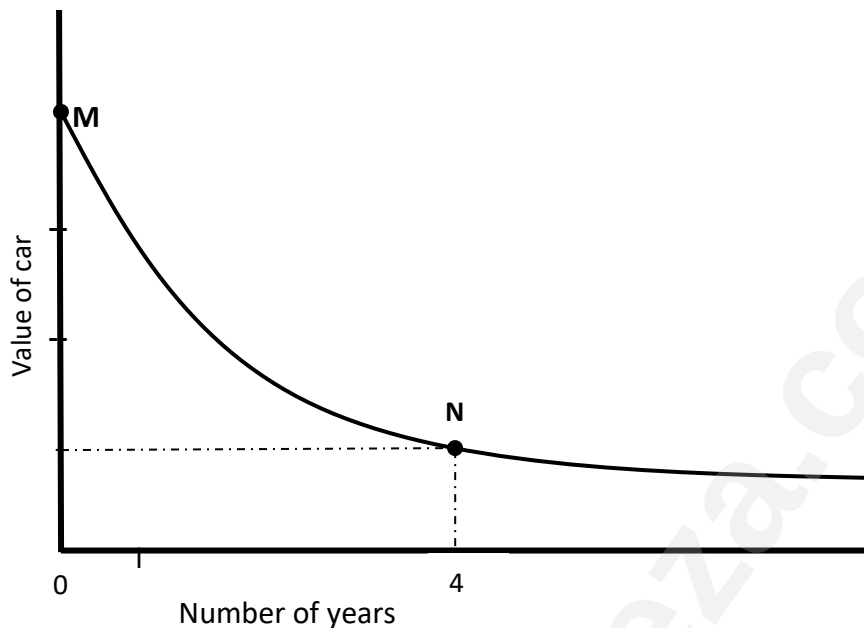
- a) What was the income at the end of the 15th week? (3)
- b) After how many weeks was the total income R 5 880? (4)

QUESTION 4**10 MARKS**

- a) Draw the graph of f if $f(x) = \left(\frac{1}{3}\right)^x$. Show the intercepts on the axes, where applicable, as well as the coordinates of one other point on your graph. (3)
- b) Write down the equation of f^{-1} in the form $y = \dots$ and sketch the graph of f^{-1} on the same system of axes. Show the intercepts on the axes, where applicable, and the coordinates of one other point on your graph. (4)
- c) If $(-1,77; 7) \in f(x)$ write down the value of $\log_{\frac{1}{3}} 49$, without using a calculator. (3)

QUESTION 5**16 MARKS**

- a) Dean buys a car for R 100 000. He drives the car for four years and then decides to sell the car. Suppose that after four years of depreciation, the car is worth one quarter of its original value. The depreciation of his car is represented in the graph below.



- i) What is the value of the car at M on the graph? (1)
 - ii) What is the value of the car at N on the graph? (1)
 - iii) Based on the graph, what type of depreciation took place? (1)
 - iv) Calculate the rate of depreciation as a percentage. Give your answer to the nearest whole number. (3)
- b) Tyron invested R 5 000 in a bank at 6,5% per annum compounded quarterly for 2,5 years.
- i) What is the effective interest rate of this investment? (2)
 - ii) Hence, or otherwise, how much is the investment worth at the end of 2,5 years? (4)
- c) Mahlatsi inherits R 250 000 and decides to invest it in a savings account earning interest at 5,8% compounded monthly. Calculate how many years it will take for his investment to be worth R 500 000. Give your answer to the nearest year. (4)

SECTION B

QUESTION 6

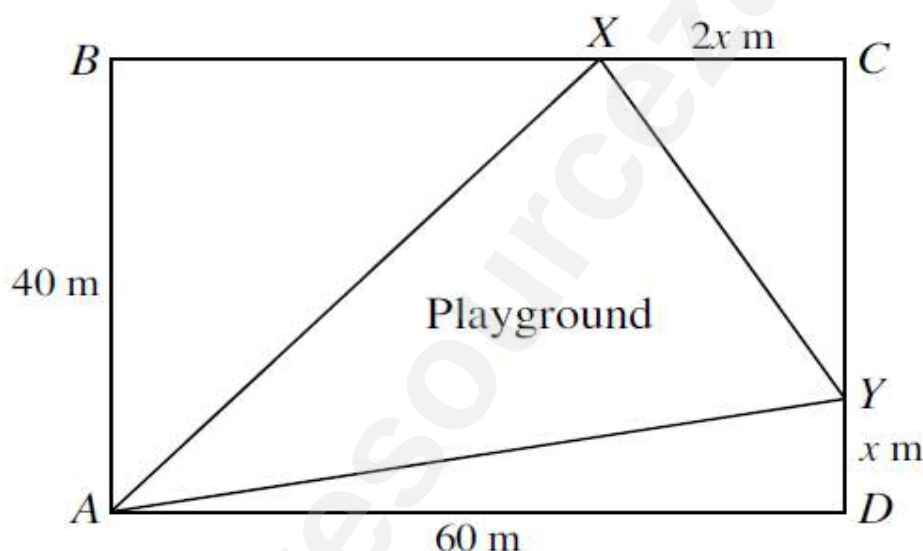
21 MARKS

Given: $g(x) = -x^3 + 14x^2 - 49x + 36$

- Show that $(x - 1)$ is a factor of g . (1)
- Hence, or otherwise, find the intercepts of the curve of g with the x -axis. (3)
- Determine the coordinates of the turning points of g . (5)
- Determine the x -coordinate of the point of inflection of g . (1)
- Draw a neat sketch of g , showing the intercepts on the axes and the coordinates of the turning points clearly on your graph. (4)
- Determine the equation of the tangent to the curve of g at $x = 2$. (4)
- Use your graph to determine for which values of k the equation $-x^3 + 14x^2 - 49x + k = 0$ will have three different real roots. (3)

QUESTION 7

10 MARKS



The diagram shows a plan for a rectangular park $ABCD$, in which $AB = 40\text{ m}$ and $AD = 60\text{ m}$. Points X and Y lie on BC and CD respectively and AX , XY and YA are paths that surround a triangular playground. The length of DY is $x\text{ m}$ and the length of XC is $2x\text{ m}$.

- Write an expression for the length BX , in terms of x . (1)
- Show that the area, $A\text{ m}^2$, of the playground is given by $A = x^2 - 30x + 1200$ (5)
- Given that x can vary, find the minimum area of the playground. (4)

QUESTION 8

17 MARKS

- a) If I cut a pizza with a single cut then I get two pieces. If I cut a pizza with two single cuts then I get three pieces. If I cut a pizza with three single cuts then I get six pieces.



The number of pieces (p) with n cuts is given by the formula $p = an^2 + bn + c$. What is the number of pieces I can get with six single cuts?

(5)

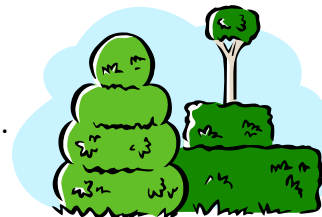
- b) Michael saved R 400 during the first month of his working life. In each subsequent month, he saved 10% more than what he had saved in the previous month.



- i) How much did he save in the 7th working month? (4)
 ii) How much did he save altogether in his first 7 working months? (3)

- c) A shrub of height 110 cm is planted. At the end of the first year the shrub is 120 cm tall. Thereafter the growth of the shrub each year is half of its growth in the previous year.

- i) The new growth in every year forms a geometric sequence. Write down the new growth for the first three years.
 ii) Prove that the height of the shrub will never exceed 130 cm.

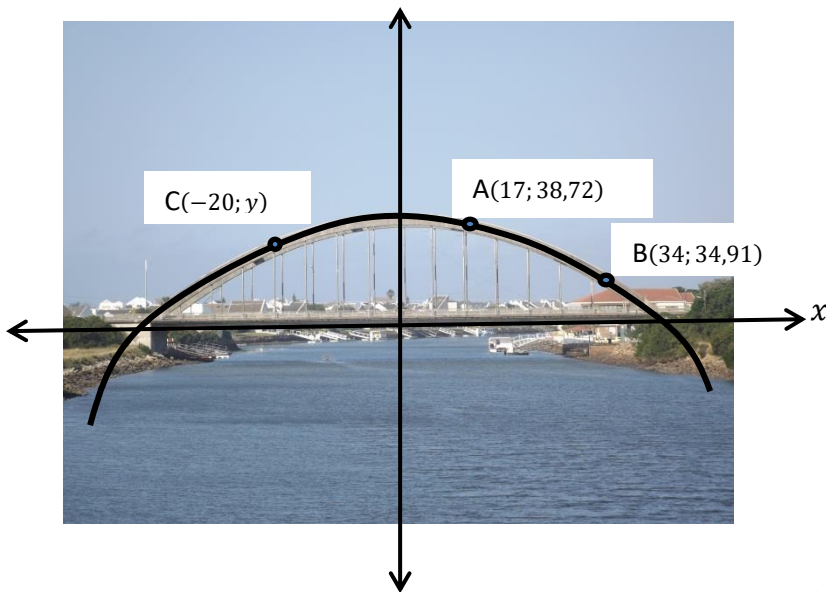


(2)

(3)

QUESTION 9**7 MARKS**

The Nico Malan Bridge is an arch bridge that was built over the Kowie River in Port Alfred. The bridge was completed in 1972. The road was built 3,43 m above the water.



- If the curve that was used to model the bridge passes through point A(17; 38,72) and point B(34; 34,91), show that the equation of the curve is $f(x) = -0,0044x^2 + 40$, where x (in metres) is the horizontal distance from the centre of the arch and y (in metres) is the height above the road. (3)
- What is the distance the bridge spans over the river? Give your answer in metres. (1)
- If a person jumps from point C, how long will it take him to reach the water if the average speed he is falling at is 14,3 m/s. (3)

QUESTION 10**5 MARKS**

Statistics show that Thomas Müller scores in 72% of Germany's matches. If he does score in a particular game, the probability that the team will win the match is 0,76. If he does not score, the probability that they win is only 0,58.

- Represent the information as a tree diagram. (3)
- What is the probability that Germany wins a match? (2)



QUESTION 11

11 MARKS

All answers involving factorials must be calculated, e.g. $5! = 120$.

a) Using the letters in the word “**DISILLUSION**”, determine:

- i) The number of eleven letter “words” that can be formed. (3)
- ii) The probability that the new word will **NOT** have the two “L’s” next to one another. (4)

b) If $P(A) = \frac{3}{8}$ and $P(B) = \frac{1}{4}$, find:

- i) $P(A \cup B)$ if A and B are mutually exclusive events. (1)
- ii) $P(A \cup B)$ if A and B are independent events. (3)