

RONDEBOSCH BOYS' HIGH SCHOOL



Mathematics Paper 1

13 November 2015

Grade 11

MARKS: 150

TIME: 3 hours

Examiner: S Carletti

Moderator: P Ghignone

This question paper consists of 9 pages

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagram, graphs, et cetera which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Write neatly and legibly.

QUESTION 1

1.1 Solve for x :

1.1.1 $(2x + 1)(3x - 4) = 0$ (2)

1.1.2 $9^{2x-1} = \frac{3^x}{3}$ (3)

1.1.3 $-3x^2 + 4x = -2$ (correct to 2 decimal places) (4)

1.1.4 $\sqrt{2x-3} + 3 = x$ (5)

1.2

1.2.1 Solve for x : $2x^2 - 3x \geq 5$ (4)

1.2.2 Hence solve for x if $2x^2 - 3x \geq 5$ AND $-x + 5 < 8$ (3)

1.3 Solve for x and y :

$2x - y = 7$ and $x^2 - xy = 12$ (6)

1.4 Consider the function g that has roots $x = \frac{12 \pm \sqrt{114 - 38k}}{2k - 3}$ The roots of g are equal and $g(-1) = 50$.Determine the equation of g in the form $g(x) = ax^2 + bx + c$. (5)1.5 Given: $4x^2 - 24x + p = 0$ The roots of the equation are rational and have a ratio of 5 : 7. Calculate the value of p and the roots. (4)

[36]

QUESTION 2

2.1 Simplify

$$\frac{3^{2x}-4}{2^x \cdot 3^x - 2^{x+1}} \quad (3)$$

2.2 A rectangle has length $(9 + 5\sqrt{3})$ cm and area $(15 + 7\sqrt{3})$ cm². Find, without using a calculator, the width of the rectangle, giving your answer in the form $(m + n\sqrt{3})$ cm, where m and n are integers. (5)

2.3 Let $f(x) = x^{(x+1)}(x + 2)^{(x+3)}$

Find, without using a calculator, the value of

$$f(0) + f(-1) + f(-2) \quad (4)$$

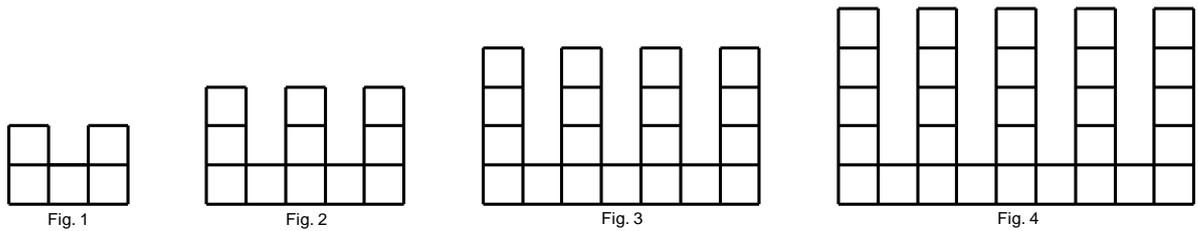
[12]

QUESTION 3

3.1 Given: $10 - 3y ; 7 ; 15 ; 8y + 1$

The pattern above is a quadratic sequence. Determine the value of y . (4)

3.2 A pattern is created using blocks as shown below. This pattern continues indefinitely.



3.2.1 Write down the number of blocks in each of the four figures above. (2)

3.2.2 Determine the number of blocks in Figure n , i.e. find T_n . (4)

3.2.3 How many blocks are there in the 10th figure? (2)

3.2.4 You have 600 blocks and you want to use as many of them as you can to make a shape that follows the above pattern. How many blocks will be on the bottom row of the biggest shape? (5)

3.3 You write down some numbers in a sequence of 100 numbers that form a quadratic pattern. Unfortunately a clumsy friend spilt his coffee all over the numbers. The beginning and end of the sequence is unaffected by the coffee stain. What you see below is all that is left visible. Find the numbers that should be in position p ; q and r .

Pattern p - 4
 First difference - 3
 Second difference - 2



 r
 q

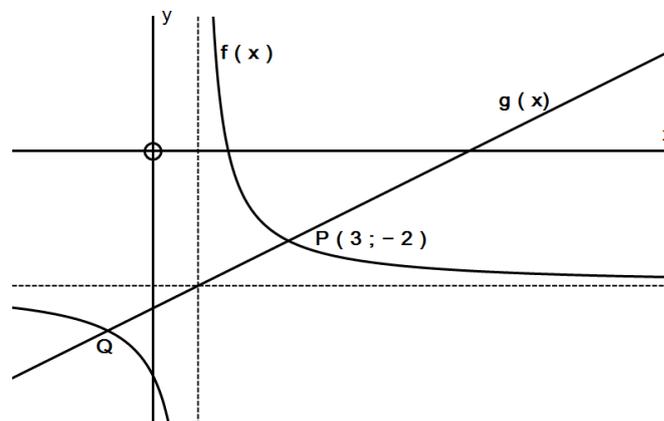
(6)
 [23]

QUESTION 4

- 4.1 A bank quotes an interest rate of 8,7% p.a. compounded monthly. Calculate the effective interest rate. (3)
- 4.2 A woman buys a car costing R249 999. Calculate the value of the car, three years later, if it has a reducing balance depreciation rate of 18% p.a. (3)
- 4.3 A woman is saving for her daughter's university fees. She decides to put money into a fixed deposit paying 8% p.a. compounded annually. She starts her savings with R10 000. After three years she deposits another R40 000. A final deposit of R80 000 is made eight years after the initial deposit. How much money is accumulated in the fixed deposit at the end of ten years? (5)
- 4.4 A man invests R10 000 for five years. The interest rate is 10% p.a. compounded monthly for the first two years. It then changes to $x\%$ p.a. compounded quarterly for the next three years. At the end of five years, there is R18 440,95 in the account. Calculate the value of x correct to the nearest integer. (3)
- [14]

QUESTION 5

Given $f(x) = \frac{2}{x-1} - 3$ and $g(x) = \frac{1}{2}x - \frac{7}{2}$. The two graphs intersect at P (3; -2) and Q.



- 5.1 Write down the equations of the two asymptotes. (2)
- 5.2 Write down the range of $f(x)$. (2)
- 5.3 Calculate the x -intercept of $f(x)$. (3)
- 5.4 Write down the co-ordinates of Q. (2)
- [9]

QUESTION 6

Given $f(x) = -x^2 - 6x + 16$ and $g(x) = 2x + 7$

- 6.1 Find $f(0) - g(0)$ (2)
- 6.2 Express $f(x) = -x^2 - 6x + 16$ in the form $f(x) = a(x + p)^2 + q$ (3)
- 6.3 Hence, or otherwise, write down the co-ordinates of the turning point of $f(x)$ (2)
- 6.4 Draw a neat sketch of $f(x)$ and $g(x)$, on the same set of axes, showing the intercepts with the axes as well as the co-ordinates of any turning points. (6)
- 6.5 The graphs of f and g intersect at $x = -9$ and $x = 1$. For which value(s) of x is:
- 6.5.1 $f(x) \geq g(x)$ (1)
- 6.5.2 $f(x) \cdot g(x) \geq 0$ (2)
- 6.5.3 $x \cdot f(x) \geq 0$ (2)
- 6.6 Find the equation of the graph obtained if $g(x)$ is reflected in the x -axis. (2)
- 6.7 Find the equation of the graph obtained if $f(x)$ is rotated 180° about the origin. (3)
- [23]

QUESTION 7

7.1 Given $f(x) = \left(\frac{1}{2}\right)^x$. Find, without using a calculator, the value of x if:

$$4f(x + 1) = \sqrt{2} \quad (4)$$

7.2 A hyperbola in the form $y = -\frac{4}{x+p} + q$ has lines of symmetry $y = x + 3$ and $y = -x - 7$. Find the value of p and q .

(4)

7.3 The line $\frac{x}{a} + \frac{y}{b} = 1$, where a and b are positive constants, meets the x -axis at P and the y -axis at Q.

7.3.1 Find the co-ordinates of P and Q in terms of a and b . (1)

7.3.2 It is now given that $PQ = \sqrt{45}$ and that the gradient of the line PQ is $-\frac{1}{2}$. Find the values of a and b . (4)

[13]

QUESTION 8

8.1 In a restaurant, 40% of the customers choose steak for their main course. If a customer chooses steak, the probability that he will choose ice cream to follow is 0,6. If he does not have steak, the probability that he will choose ice cream is 0,3. Find the probability that a customer picked at random will choose ice cream. (3)

8.2 In a large garden there are seven fruit trees and thirteen other types of trees. Six of the trees have birds nesting in them but only two of these are fruit trees.

8.2.1 Copy and complete the table below to illustrate this information.

	Fruit tree	Other tree	Total
Bird's nest	2		6
No nest			
Total	7	13	

(2)

The owner of the garden has given permission for Abdul to play in the garden but has instructed him not to climb any fruit trees or trees that have birds nesting in them.

Abdul selects a tree at random to climb.

8.2.2 Find the probability that Abdul will have followed the owner's instructions. (2)

8.2.3 Given that Abdul climbs a fruit tree, find the probability that the tree has birds nesting in it. (2)

8.3 Events A and B are such that:

- $P(A) = P(B)$
- $P(A \text{ and } B) = 0,1$
- $P(A \text{ or } B) = 0,7$

Using a Venn diagram, or otherwise, find $P(A')$ (5)

8.4 A and B are two events in a sample space where $P(A) = 0,3$; $P(A \text{ or } B) = 0,8$ and $P(B) = k$.

Determine the value of k if:

8.4.1 A and B are mutually exclusive. (2)

8.4.2 A and B are independent. (4)

[20]

Total marks: 150