RONDEBOSCH BOYS' HIGH SCHOOL

GRADE 11

MATHEMATICS PAPER 1
7 NOVEMBER 2016

MARKS: 150

TIME: 3 HOURS

EXAMINER: **S VERSTER**

MODERATOR: **P GHIGNONE**

This question paper consists of 7 questions.

Instructions

1.   Calculators may be used with answers correct to 2 decimal places, unless otherwise stated.

2.   All necessary working must be shown. Answers only will not necessarily be awarded full marks.

3.   Where necessary, leave answers with positive exponents.

4.   Graphs are not drawn to scale.

5.   Number your answers as the questions are numbered.

6.   Untidy work will be penalised.

7.   Only blue or black ink to be used.

8.   Sketches may be done in pencil.

Question 1

1.1   Solve for x:

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

    1.1.2 $12x^2 - 7x - 6 = 0$ (3)

    1.1.3 $2^{x+1} + 2^x = 48$ (3)

    1.1.4 $\sqrt{2x - 4} + x = 6$ (6)

    1.1.5 $x(x - 1) \le 6$ (4)

1.2   Solve for x and y:

    $x - y - 3 = 0$ and $x^2 - 3y^2 = 13$ (7)

1.3   Determine the nature of the roots of the quadratic equation $ax^2 + bx + c = 0$ if
    the following conditions are given: $a < 0, b > 0$ and $c = 0$, where $b \in Q$.   (3)

                                                                        [28]

Question 2

2.1   If $5^{-x} = 10$, determine the value of $\dfrac{2^{x-1} + 2^{x+1}}{5 \times 10^x}$, without the use of a calculator.   (4)

2.2   Two pumps are used to pump water from a river to fill a farm dam. When
    operating together they fill the dam in 12 days. Working separately, one pump
    fills the dam 4 days faster than the other pump. Find the number of days taken by
    the slowest pump if they work separately, correct to 2 decimal places.   (6)

2.3   If $y = (2x + 3)(x + 1)$, for what real value(s) of y will there be non-real values
    for x?   (5)

                                                                       [15]

Question 3

3.1   Given the quadratic sequence: $0; 3; 10; 21; \ldots$

      3.1.1   Determine the general term.   (4)

      3.1.2   Determine the 82nd term.   (2)

      3.1.3   Determine whether 820 is a term in the sequence.   (3)

3.2   The quadratic sequence $6; 13; x; y$ is given. If the sequence continues in this manner with a constant second difference of 2, determine the values of x and y. (4)

3.3   In a linear sequence the fourth term is -2 and the eighth term is -18.

      3.3.1   Find the nth term.   (4)

      3.3.2   Determine which term has a value of -178.   (2)

3.4   Given the sequence: $0; 5; 0; 8; 0; 11; 0; 14; \ldots$

      3.4.1   Determine the next two terms.   (2)

      3.4.2   Determine the sum of the first 100 terms.   (5)

                                                                     [27]

Question 4

FORMULAE: $F = \dfrac{x[(1 + i)^n - 1]}{i}$ $P = \dfrac{x[1 - (1 + i)^{-n}]}{i}$

4.1   Convert the interest rate of 13,4% p.a. compounded monthly into an effective
         annual interest rate.   (3)

4.2   Calculate the rate of depreciation required for a fridge to halve its value over 6
         years, on the reducing balance method.   (3)

4.3   Matthew is planning a gap year for 4 years' time. He estimates that he will need
         $R135\ 000$ to cover all his expenses. If interest is calculated at 8,2% p.a.
         compounded monthly:

   4.3.1   How much will be in the account if he can afford to save $R2000$ per
             month, starting in one month's time?   (3)

   4.3.2   Matthew's parents decided to contribute to his gap year fund to make up
             the difference he will need. How much would this lump sum need to be,
             if it is invested 3 years before the trip?   (4)

4.4   Jack inherits $R27\ 000$, which he invests in a savings account. Three years after he
         invested the initial amount, he withdraws Rx to make a down payment on a car.
         For the first 6 years interest is calculated at 5,4% p.a. compounded monthly after
         which, it changed to 6,3% p.a. compounded annually. Calculate the value of x if
         he has accumulated $R17\ 614,76$ in the savings account after 10 years.   (5)

                                                                                                                    [18]

Question 5

In the diagram the parabola, $f(x) = a(x - p)^2 + q$, intersects the $x -$ axis at A and $B(3; 0)$, has a turning point at $D(1; -8)$ and intersects the $y -$ axis at $C(0; -6)$. The graph $g(x) = -2^x + 4$ has co-ordinate E, which forms a straight vertical line joining f and g at D, while HJ is a horizontal line on the asymptote of g.
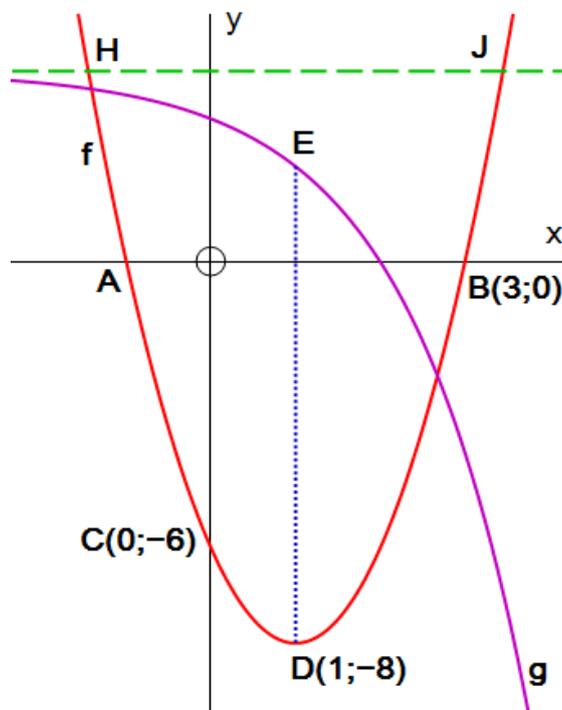
5.1   Determine the equation of the parabola, $f(x)$.   (4)

5.2   Determine the co-ordinates of A.   (2)

5.3   Write down the equation of the asymptote of $g(x)$.   (1)

5.4   Calculate the average gradient of $f(x)$ between B and D.   (2)

5.5   Determine the equation of the straight line that passes through BD.   (2)

5.6   If $f(x)$ is reflected in the $y -$ axis, determine the new equation of the graph in
       the form $y = ax^2 + bx + c$.   (3)

5.7   Determine the values of x where $\frac{g(x)}{f(x)} \geq 0$.   (3)

5.8   Calculate the length of ED.   (3)

5.9   Calculate the length of HJ, leaving your answer in surd form.   (4)
                                                                                                   [24]

Question 6
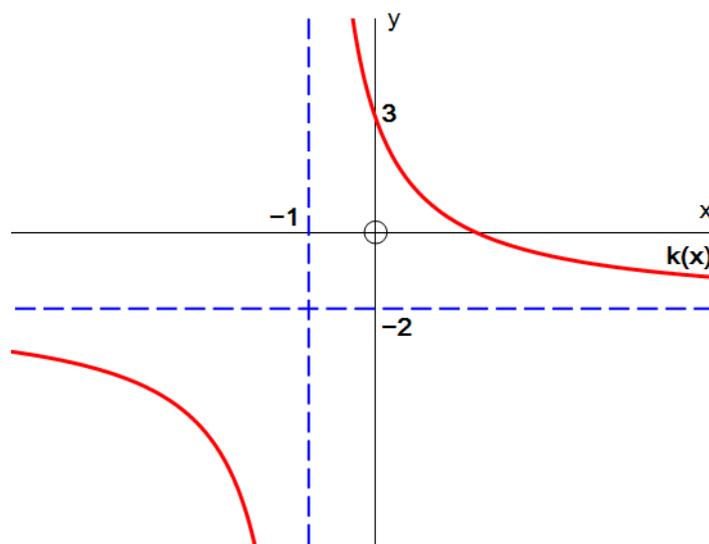
6.1   Given $h(x) = -3\left(\frac{1}{2}\right)^x - 1$

      6.1.1   Sketch the graph and clearly label any asymptotes and/or intercept(s) with axes.   (3)

      6.1.2   Find the range of $-h(x) + 2$.   (2)

6.2   Draw rough sketches of the following graphs on separate sets of axes:

      6.2.1 $y = mx + c$ where $m < 0$ and $c > 0$.   (2)

      6.2.2 $y = ax^2 + bx + c$ where $a < 0; b > 0$ and $c = 0$.   (3)

6.3   The sketch of $k(x) = \frac{a}{x+p} + q$ is shown below:

      6.3.1   Write down the equations of the asymptotes of $k(x)$.   (2)

      6.3.2   Determine the equation of $k(x)$.   (3)

      6.3.3   Determine the equation of the axis of symmetry that has a negative gradient.   (2)

6.4   Sketch the graph of $f(x) = ax^2 + bx + c$ if it is given that:

      •   The range of f is $(-\infty; 7]$.

      • $a \neq 0$

      • $b < 0$

      •   One root of f is positive and the other root of f is negative.   (4)

                                                                                   [21]

Question 7

7.1   420 drivers were interviewed about the number of accidents they were involved in during one calendar year. The results were summarised in the following table:

Age of driver:	Number of accidents:		Total:
	3 or fewer	More than 3	
35 years and younger	200	b	300
Older than 35 years	a	50	d
Total	270	c	420

7.1.1   Calculate the values of a, b, c and d.   (4)

7.1.2   Determine the probability that a driver will have:

a) more than 3 accidents.   (2)

b) more than 3 accidents and is older than 35 years old.   (2)

c) more than 3 accidents given that the driver is more than 35 years old. (2)

7.2 A and B are two independent events. $P(A) = 0,65$ and $P(B) = 0,3$.
Determine $P(A \text{ or } B)$.   (4)

7.3   Bob and Alice each have a bag that contains one ball of each of the colours blue, green, orange, red, and violet.

Alice randomly selects one ball from her bag and puts it into Bob's bag. Bob then randomly selects one ball from his bag and puts it into Alice's bag. What is the probability that after this process the contents of the two bags are again identical?   (3)

[17]