TEACHERS WITHOUT BORDERS PROGRAMME

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In Bill Gates words, at the Mandela Day 'Living Together' address: "Maintaining the quality of this country's higher education system while expanding access to more students will not be easy. But it's critical to South Africa's future" – working together, we can help achieve this."

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NOVEMBER EXAMINATIONS 2015

MATHEMATICS PAPER 1: GRADE 10

Marks: 100

Time: 2 hours

SESSION: 1

Date: 13 November 2015

Name of Learner: Memo **Grade:** _____

Name of Teacher: (Please circle)

For Examiner's use only:

	SECTION A						SECTION B			
Question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Cognitive Levels	1/2	1/2	2	2	2	2	3	3/4	3/4	
Actual Mark										
Possible Mark	9	8	8	9	6	13	20	17	10	100
Marker's Signature	NMM		IHA		WSO		FSC	MDB	SLO	

Read the following instructions carefully:

1. This examination paper consists of **13** pages and **9** questions. Please check that your paper is complete.
2. Read the questions carefully. Take note of the mark allocation and the wording of the questions.
3. Answer **ALL** the questions on the question paper in the spaces provided.
4. Only non-programmable, non-graphical calculators are permitted.
5. ALL CALCULATIONS AND WORKING DETAILS MUST BE SHOWN.
6. It is in your own interest to write legibly and to present your work neatly.
7. Unless otherwise stated, round off to ONE decimal place, where necessary.
8. Note that the diagrams and sketches are NOT drawn to scale.

SECTION A

QUESTION ONE: **[9 marks]**

Simplify the following fully:

1.1 $(2a-1)(a-3)$ (2)

$= 2a^2 - 6a - a + 3$ ✓m

$= 2a^2 - 7a + 3$ ✓a

1.2 $\frac{1}{x-1} - \frac{3}{x+1}$ (2)

$= \frac{(x+1) - 3(x-1)}{(x-1)(x+1)}$ ✓a

$= \frac{-2x+2}{(x+1)(x-1)}$

$= \frac{-2(x-1)}{(x+1)(x-1)} = -\frac{2}{x+1}$ ✓a

1.3 $\frac{5^{2x-1}.25^{x+1}.5}{25^{2x}}$ (3)

$= \frac{5^{2x-1} \cdot 5^{2(x+1)} \cdot 5}{5^{4x}}$ ✓m ✓m

$= 5^{2x-1+2x+2+1-4x}$

$= 5^2 = 25$ ✓a

1.4 $\frac{3^x + 3^{x+2}}{3^{x-1}}$ (2)

$= \frac{3^x(1+3^2)}{3^x \cdot 3^{-1}}$ ✓m ✓m

$= 30$ ✓a

QUESTION TWO: [8 marks]

Factorise the following fully.

2.1 $m^2 - 2m + 1$ (2)

$= (m-1)(m-1)$ ✓a ✓a
or $(m-1)^2$

2.2 $3x^2 - 3$ (2)

$= 3(x^2 - 1)$ ✓a
$= 3(x+1)(x-1)$ ✓a

2.3 $ax^2 - x^2 - 4ay^2 + 4y^2$ (2)

$= x^2(a-1) - 4y^2(a-1)$

$= (a-1)(x^2 - 4y^2)$ ✓a

$= (a-1)(x+2y)(x-2y)$ ✓a

2.4 Express this number line in interval notation: (2)

$x \in [-5; \infty)$
✓a ✓a

QUESTION THREE: [8 marks]

3.1 Solve these equations for x:

3.1.1 $x^{\frac{1}{3}} = 8$ (2)

$(x^{\frac{1}{3}})^3 = 8^3$ ✓m

$x = 512$ ✓a

3.1.2 $\frac{2x-3}{3} - 3x = \frac{2x}{6}$ (3)

$2(2x-3) - 18x = 2x$ ✓m ✓a

$4x - 6 - 18x = 2x$

$-16x = 6$

$x = -\frac{3}{8}$ ✓a

3.2 Solve for x and y: $x + 2y = 1$ and $2x + 3y = 6$ (3)

$x = 1 - 2y$

✓m $2(1-2y) + 3y = 6$

$2 - 4y + 3y = 6$

$y = -4$

$x = 1 - 2(-4)$

$x = 9$ ✓a

$y = -4$ ✓a

$2x + 4y = 2$

$2x + 3y = 6$ ✓m

$y = -4$

$2x + 4(-4) = 2$

$2x = 18$

$x = 9$ ✓a

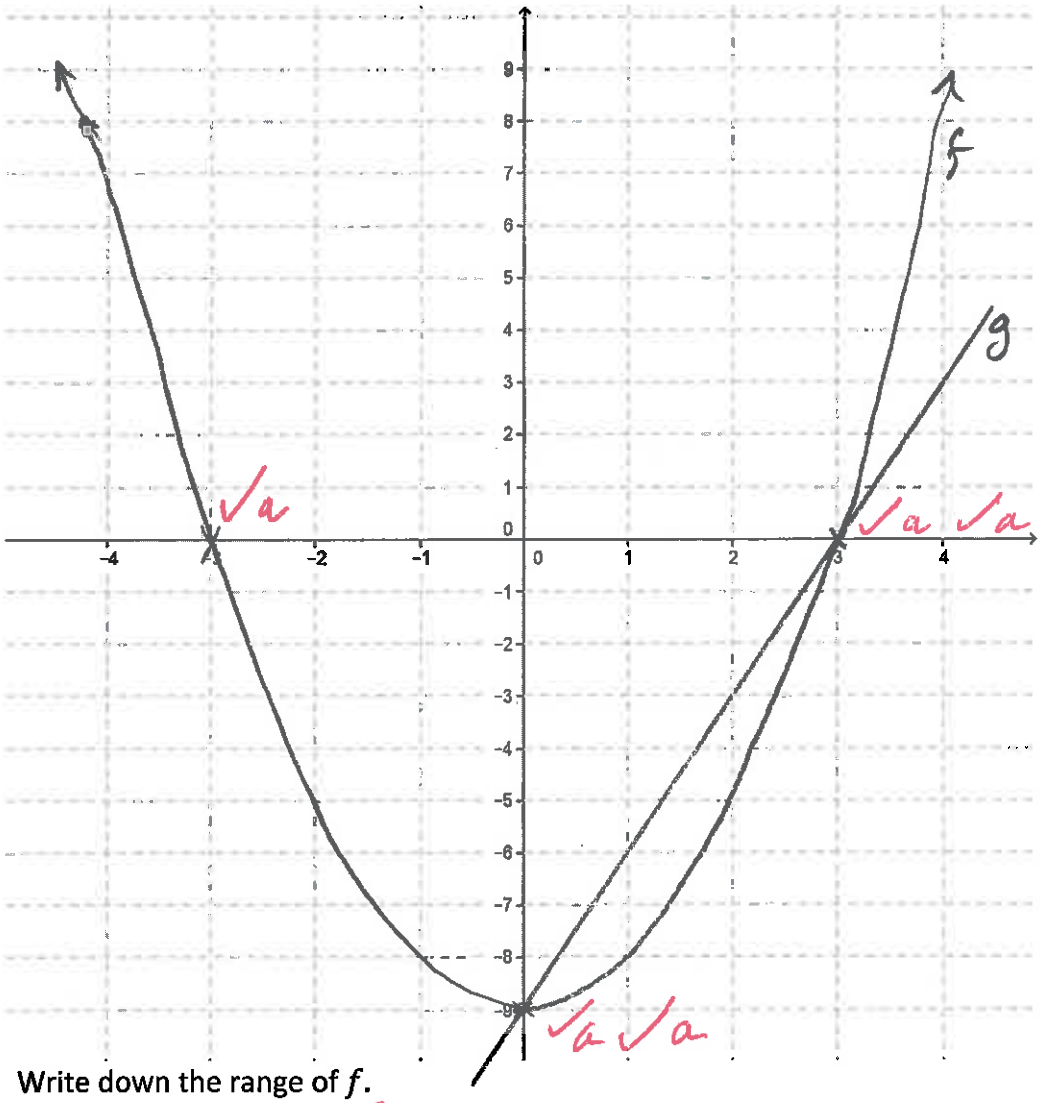
$y = -4$ ✓a

QUESTION FOUR: [9 marks]

4.1 On the set of axes below sketch the graphs of f and g where: (5)

$$f(x) = x^2 - 9 \qquad \text{and} \qquad g(x) = 3x - 9$$

Show all intercepts with the axes clearly.



4.2 Write down the range of f. (1)

$y \geq -9$ ✓a or $[-9; \infty)$

4.3 For what values of x is $f(x) > g(x)$? (2)

$x < 0$ ✓a or $x > 3$ ✓a

4.4 If f is moved up 5 units, what is the equation of the new function? (1)

$y = x^2 - 4$ ✓a

QUESTION FIVE: [6 marks]

5.1 Harry buys a fridge from Nakro which is priced at R12 700. He takes out a loan with PNB Bank for the full amount. The interest on the loan is 12,3% per annum, simple interest, and he pays off the loan over three years. How much are his monthly repayments, correct to the nearest cent? (3)

$A = 12\,700\left(1 + \frac{12,3}{100} \times 3\right)$ ✓a

$= R17\,386,30$

$\therefore$ Monthly $= R17\,386,30 \div 36$ ✓m

$= R482,95$. ✓a

5.2 Louis invested a sum of money in November 2010. In November 2015 the amount in the account was R 162 108. If the interest was 6,2% per annum, compounded annually, how much, accurate to the nearest rand, did Louis invest in November 2010? (3)

$162\,108 = P\left(1 + \frac{6,2}{100}\right)^5$ ✓a ✓a

$P = R120\,000$. ✓a

QUESTION SIX: [13 marks]

Simplify all fractions fully.

6.1 There are six red tokens and four yellow tokens in a bag.

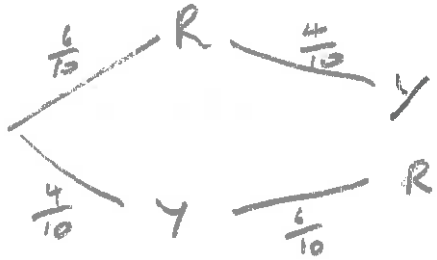
6.1.1 One token is chosen. What is the probability that a red token is chosen? (1)

$P(\text{Red}) = \frac{6}{10} = \frac{3}{5}$ ✓a

6.1.2 Two tokens are removed, one after the other, without replacement. What is the probability that they are both red? (Space for a tree diagram has been provided) (2)

$P(R,R) = \frac{6}{10} \times \frac{5}{9}$ ✓a $= \frac{1}{6}$ ✓a

6.1.3 Two tokens are removed, one after the other, with replacement. What is the probability that they are different colours? (Space for a tree diagram has been provided) (3)

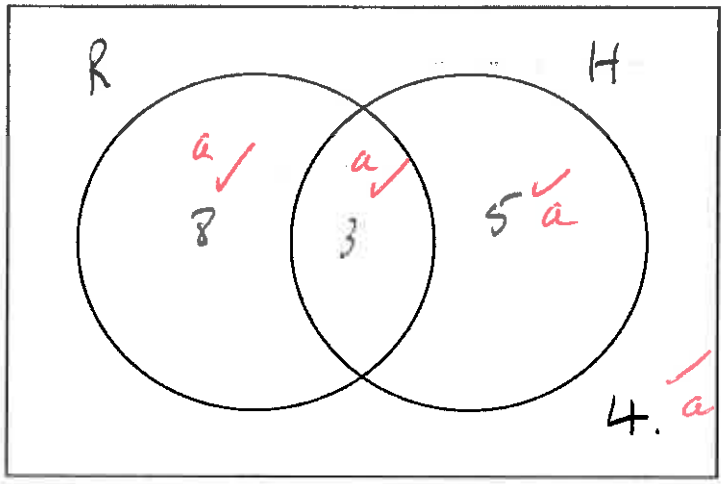


$\frac{6}{10} \times \frac{4}{10}$ ✓a $+ \frac{4}{10} \times \frac{6}{10}$ ✓a

$= \frac{48}{100} = \frac{24}{50}$ ✓a

6.2 Among a group of 20 boys, 11 play rugby, 8 play hockey and 3 play both sports.

6.2.1 Complete the Venn Diagram to represent the above information, and use the diagram to find the number of boys who play neither sport. (4)



No. = 20 − (8 + 3 + 5)

= 4.

6.2.2 A boy is chosen at random. What is the probability that he plays hockey? (1)

$P(H) = 8/20 = \frac{2}{5}$ ✓a

6.2.3 A boy is chosen at random. What is the probability that he plays hockey, but not rugby? (2)

$P(H \text{ but not } R) = \frac{5}{20}$ ✓a $= \frac{1}{4}$ ✓a

SECTION B

QUESTION SEVEN: **[20 marks]**

7.1 Solve for x : $ax - b = x$ (3)

$ax - x = b$ ✓m

$x(a-1) = b$

✓m $x = \frac{b}{a-1}$ ✓a

7.2 Solve for x: $5x^2 + 3 = 8x$ (4)

$5x^2 - 8x + 3 = 0$ ✓m

$(x-1)(5x-3) = 0$ ✓m

$\therefore x = 1$ or $x = 3/5$.

✓a ✓a

7.3 Simplify this expression fully : $\frac{1}{p^{-1}-t^{-1}}$ (3)

$= \frac{1}{\frac{1}{p} - \frac{1}{t}}$ ✓m

$= 1 \div \left(\frac{t-p}{pt}\right)$ ✓m

$= \frac{pt}{t-p}$ ✓a.

7.4 Factorise this expression fully: $\frac{y^2}{2} - \frac{13y}{2} + 18$ (3)

$= \frac{1}{2}(y^2 - 13y + 36)$ Divide by $\frac{2}{2} = 1/3$

$= \frac{1}{2}(y-4)(y-9)$. ✓a ✓m ✓a

or $(\frac{1}{2}y - 2)(y-9)$ etc.

7.5 Simplify as far as possible: (4)

$$\frac{1}{x+1}+\frac{2x}{x^2-1}+\frac{1}{1-x}$$

$= \frac{1}{x+1} + \frac{2x}{(x+1)(x-1)}$ ✓a $\frac{1}{x-1}$ ✓a

$= \frac{x-1+2x-(x+1)}{(x+1)(x-1)}$

$= \frac{2x-2}{(x+1)(x-1)}$

$= \frac{2(x-1)}{(x+1)(x-1)}$ ✓m

$= \frac{2}{x+1}$ ✓a

7.6 Solve for x: $2.9^x = \frac{2}{81}$ (3)

$9^x = \frac{1}{81}$ ✓a

$9^x = 9^{-2}$ ✓m

$x = -2$ ✓a

QUESTION EIGHT: [17 marks]

8.1 In the diagram there are two functions:

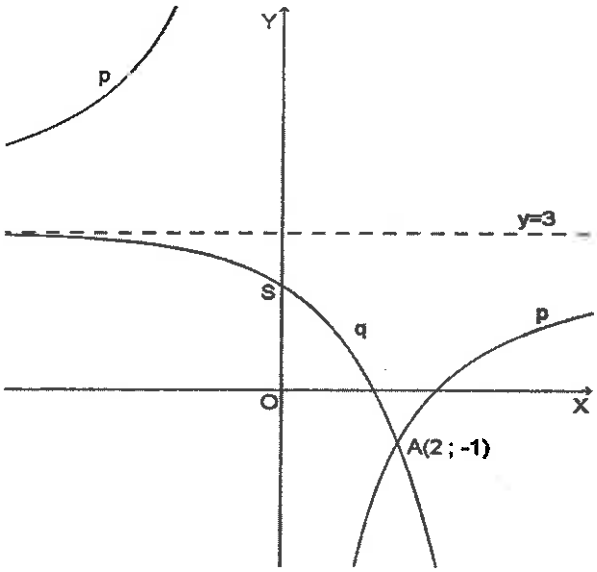
$p(x) = \frac{a}{x} + b$

and

$q(x) = m.2^x + t$

p and q have the same horizontal asymptote and meet at $A(2; -1)$

q crosses the y-axis at S.



8.1.1 Write down the range of p. (1)

$y \neq 3$ ✓a $(3; \infty)$ or $(-\infty; 3)$

8.1.2 Write down the range of q. (1)

$y < 3$ ✓a or $(-\infty; 3)$

8.1.3 Find the values of a and b. (3)

$b = 3$ ✓a $y = \frac{a}{x} + 3$.

$-1 = \frac{a}{2} + 3$ ✓m

$a = -8$. ✓a

8.1.4 Find the values of m and t. (4)

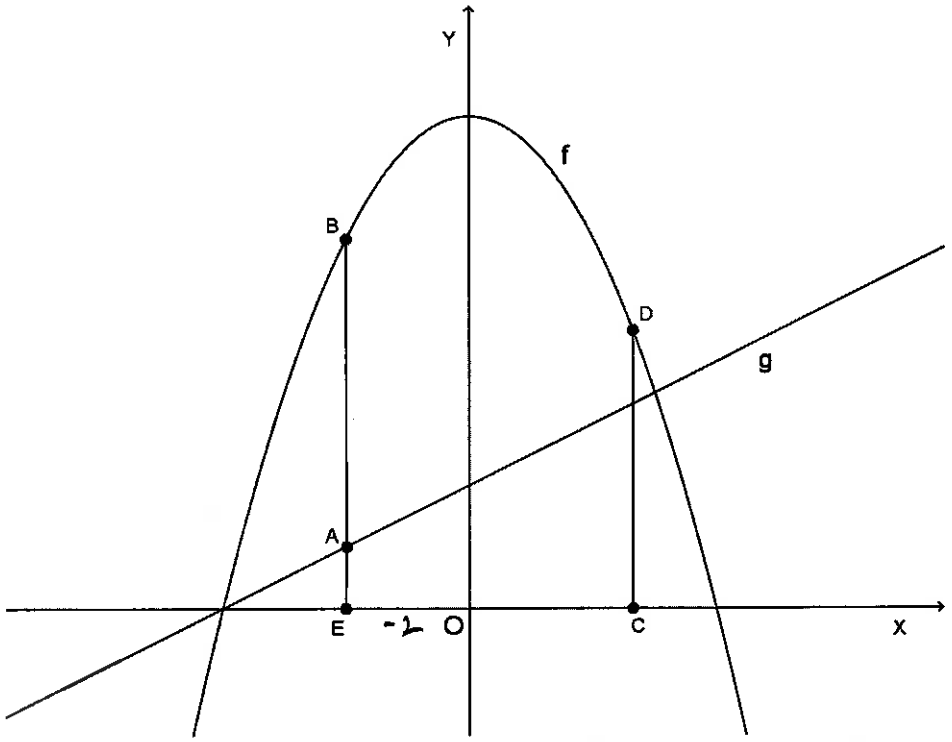
$y = m.2^x + 3$

$-1 = m.2^2 + 3$ ✓m ✓a.

$m = -1$ ✓a

$t = 3$ ✓a

8.2 In the diagram two functions are shown: $f(x) = 16 - x^2$ and $g(x) = x + 4$. The lines EAB and CD are perpendicular to the x-axis.



8.2.1 If OE is 2 units, calculate the lengths of AE and BE, and hence find AB. (4)

$AE = (-4) + 4 = 2$ ✓m

$BE = 16 - (-2)^2 = 12$ ✓m

$\therefore AB = 12 - 2$ ✓m

$= 10$ ✓a

8.2.2 If CD is 7 units, calculate the length of OC. (4)

$7 = 16 - x^2$ ✓m

$x^2 - 9 = 0$ ✓m

$(x - 3)(x + 3) = 0$ ✓m

$\therefore OC = 3$ units ✓a

QUESTION NINE: [10 marks]

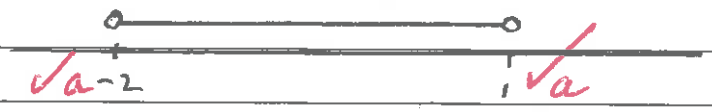
9.1 Solve this inequality for x and show the solution on a number line: (4)

$$-1 < 2 - 3x \leq 8, \quad x \in \mathbb{R}$$

$-3 < -3x < 6$. ✓m

$1 > x > -2$. ✓a

$-2 < x < 1$.



✓a -2 ✓a

9.2 What is the 2015th letter in this pattern? MATHMATHMATHMATHMA..... (2)
Show your working clearly.

$2015 \div 4$ has rem 3 . ✓m

$\therefore$ 2015th letter is T. ✓a

9.3 Nial and Liam each deposited the same sum of money into accounts at One Direction Bank in January 2010. The deposits earn the same simple interest paid annually. After four years, in January 2014, Nial has R1980 and after seven years, in January 2017, Liam has R2340. What was the initial deposit that both made, and what rate of simple interest did they earn (4)

$1980 = P(1 + i.4)$)✓a

$2340 = P(1 + i.7)$)

$\frac{1980}{1+4i} = \frac{2340}{1+7i}$ ✓m

$1980 + 13860i = 2340 + 9360i$

$4500i = 360$

$i = 8\%$ ✓a

$P = R1500$ ✓a

TOTAL 100 MARKS