basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

GREENBURY SECONDARY SCHOOL

GRADE 11

MATHEMATICS PAPER ONE

NOVEMBER 2015

MARKS: 150 **EXAMINER :** R. DEMRUGARAM

TIME: 3 Hours **MODERATOR:** S. MUNILAL

This question paper consists of 7 pages and 10 questions.

INSTRUCTIONS AND INFORMATION:

Read the following instructions carefully before answering the questions:

1. This question paper consists of 10 questions and 7 pages.
2. Answer all the questions.
3. Clearly show all calculations, diagrams, graphs, etc 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 your answers to TWO decimal places, unless stated otherwise.
7. Number your answers correctly according to the numbering system used in this question paper.
8. Diagrams are not necessarily drawn to scale.
9. It is in your own interest to write neatly and legibly.

p.t.o. Question One...

QUESTION ONE:

1.1. Solve for x :

1.1.1. $(2x-4)(3^x-27)=0$ (2)

1.1.2. $3x^2-4x=5$ (correct to 2 decimal places.) (5)

1.1.3. $x^{\frac{2}{3}}-x^{\frac{1}{3}}=6$ (Hint: let $x^{\frac{1}{3}}=k$) (5)

1.2. Determine the sum of the integers of the solution to
$x^2+x-6\leq 0$ (4) [16]

QUESTION TWO:

2.1. Solve for x and y simultaneously:

$y - x + 3 = 0$
$x^2-3=y+2x$ (6)

2.2. Simplify the following without the use of a calculator:

2.2.1. $\frac{10^{x+3}\cdot 5^{x-1}}{50^{x+2}}$ (5)

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

2.3. If $a+b=1$, determine the maximum value of ab (4) [19]

QUESTION THREE:

3.1. Without solving the equation
determine the nature of the roots of:

$x^2+3=3x$

(4)

3.2. Prove that the equation:

$3mx^2-(2m+3n)x+2n=0$

has rational roots for all rational values of m and n. (6) [10]

p.t.o. Question Four....

QUESTION FOUR:

4.1. Consider the sequence:

8 ; 11 ; 14 ; .....

4.1.1. Extend the sequence by two terms. (2)
4.1.2. Is this sequence linear or quadratic?
Give a reason for your answer. (2)
4.1.3. Find the general term. (2)
4.1.4. Find the tenth term. (2)

4.2. Consider the sequence:

-1 ; 2 ; 7 ; 14 ; ....

4.2.1. Extend the sequence by two terms. (2)
4.2.2. Is this sequence linear or quadratic?
Give a reason for your answer. (2)
4.2.3. Find the general term. (2)
4.2.4. Which term of the sequence is equal to 623? (2)

4.3. If $Tn = (-2)^{n-1}$

4.3.1. Write down the first 4 terms of the sequence. (4)
4.3.2. What pattern do you notice? (2)
4.3.3. What is the sum of the first 4 terms? (2)
4.3.4. Which term will be equal to 64? (2) [26]

QUESTION FIVE:

5.1. Calculate the effective annual rate of interest if the nominal rate is 7 % per annum compounded monthly. (4)

5.2. A laptop costing R12 000 is purchased. Determine the book value of the laptop 3 years later if depreciation is calculated at 15 % p.a. according to the straight line method. (3)

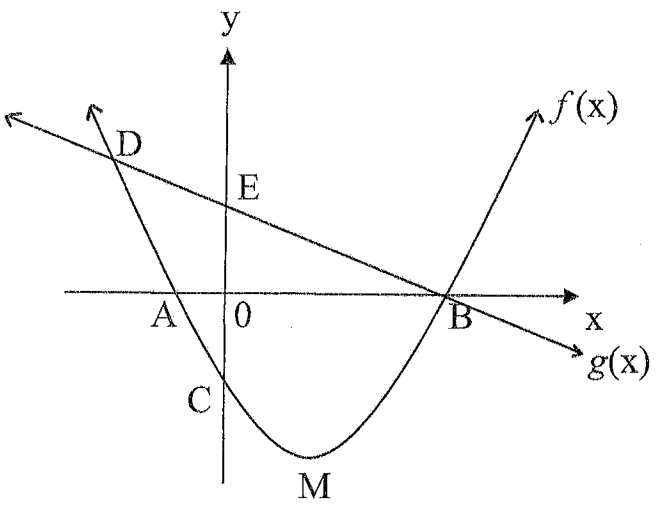
p.t.o. Question 5.3...

5.3. R 200 000 is invested for a period of 4 years at an interest rate of 6.5 % p.a. compounded monthly for the first 2 years. After the second year R10 000 is added to the account and interest changes to 8 % p.a. compounded quarterly for the next two years. Calculate the value of the investment at the end of 4 years. (5)

5.4. Karan bought a fridge for R6 000. He paid R7 125 in total over 3 years. Determine the compounded annually rate of interest that was charged. (5) [17]

QUESTION SIX:

6.1. $f(x) = 2x^2 - 4x - 6$
$g(x) = -2x + 6$; M is the turning point of $f(x)$.



6.1.1. Calculate the coordinates of the intercepts A, B and C. (5)

6.1.2. Calculate the coordinates of the turning point M. (3)

6.1.3. If both graphs intersect at B and D, calculate the coordinates of D. (3)

6.1.4. Use the graph to solve the inequality $f(x) \cdot g(x) < 0$ (3)

6.1.5. For which value(s) of x is $f(x)$ strictly increasing? (2)

6.2. With reference to the above graph calculate the average gradient between the points B and D of f. (3) [19]

p.t.o. Question Seven...

QUESTION SEVEN:

The graph of $f(x) = \frac{-1}{x - 3} + 2$

7.1. Determine the y – intercept of f. (2)

7.2. Write down the **equations** of the asymptotes of f. (2)

7.3. For what value(s) of x is $f(x) = 0$? (3)

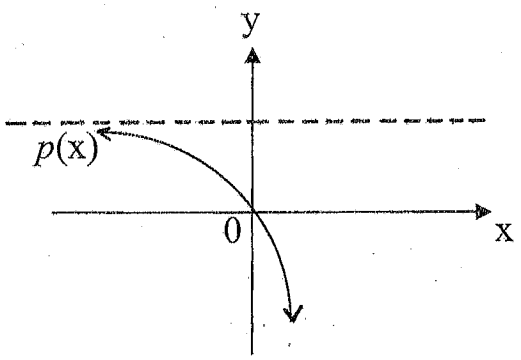
7.4. Draw a neat sketch of $f(x)$. (5)

7.5. Write down **one** equation of the line of symmetry of $f(x)$. (2) [14]

QUESTION EIGHT:

$p(x) = t \cdot 3^x + 1$; (t is a constant)

passes through the point (0 ; 0)



8.1. Show that t = -1. (2)

8.2. If p is shifted 4 units to the left to give a new function h, write down the equation of h in the form y = ... (3) [5]

p.t.o... Question Nine....

QUESTION NINE:

9.1. Given the following probabilities:
P(A) = 0, 35 ; P(B) = 0, 2 ; P(A or B) = 0, 48

9.1.1. Determine P (A and B) if events A and B are not mutually exclusive. (3)

9.1.2. Are events A and B mutually exclusive? Give a reason for your answer. (2)

9.1.3. Are events A and B independent? Give a reason for your answer. (3)

9.2. A blue bag and a green bag each contain marbles. The blue bag has 5 yellow and 10 red marbles while the green bag has 6 yellow and 4 red marbles.
If each bag has an equal chance of being selected, determine the probability of selecting a yellow marble from the blue bag or a yellow marble from the green bag with the aid of a tree diagram. Show all outcomes. (5) [13]

QUESTION TEN:

250 people have been interviewed at a local flea market and asked their drink preference:

- 145 drink coffee
- 130 drink tea
- 90 drink milo
- 27 people indicated that they do not drink any of these
- 25 people drink all three
- 60 drink coffee and tea
- 35 drink milo and tea

Let x be the number of people that drink coffee and milo but not tea

10.1. Draw a Venn diagram representing this information and show that x = 47. (6)

10.2. Determine the probability that a person:

10.2.1. drinks only tea. (2)

10.2.2. drinks milo or tea. (3) [11]

TOTAL : 150

2015 FINAL EXAMINATION

GRADE 11 MATHEMATICS PAPER 1

MARKING MEMORANDUM

QUESTION ONE :

1.1.1. $2x = 4$ or $3^x = 3^3$

$x = 2$ ✓A $\quad x = 3$ ✓A (2)

1.1.2. $3x^2 - 4x - 5 = 0$ ✓A

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ ✓M

$x = \frac{4 \pm \sqrt{(-4)^2 - 4(3)(-5)}}{2(3)}$ ✓CA

$x = 2{,}12$ ✓CA or $x = -0{,}79$ ✓CA (5)

1.1.3. $x^{\frac{2}{3}} - x^{\frac{1}{3}} = 6$

$x^{\frac{1}{3}} = k$

$k^2 - k - 6 = 0$ ✓A

$(k+2)(k-3) = 0$

$k = -2$ ✓A or $k = 3$ ✓A

$x^{\frac{1}{3}} = -2$ or $x^{\frac{1}{3}} = 3$

$x = -8$ ✓CA or $x = 27$ ✓CA (5)

1.2. $x^2 + x - 6 \leq 0$

$(x+3)(x-2) \leq 0$ ✓A

-3 ✓A $\leq x \leq 2$ ✓A

Sum $= -3 - 2 - 1 + 0 + 1 + 2$

$= -3$ ✓CA (4)

[16]

QUESTION TWO :

2.1. $y - x + 3 = 0$

$y = x - 3$ ✓A

$x^2 - 3 = y + 2x$

$x^2 - 3 = x - 3$ ✓CA $+ 2x$

$x^2 - 3x = 0$ ✓CA

$x(x-3) = 0$

$x = 0$ or $x = 3$ ✓CA

$y = -3$ ✓CA or $y = 0$ ✓CA

$(0;-3)$; $(3;0)$ (6)

2.2.1. $\frac{10^{x+3} \cdot 5^{x-1}}{50^{x+2}}$

$= \frac{(2 \cdot 5)^{x+3} \cdot 5^{x-1}}{(2 \cdot 5^2)^{x+2}}$ ✓A ✓A

$= \frac{2^{x+3} \cdot 5^{x+3} \cdot 5^{x-1}}{2^{x+2} \cdot 5^{2x+4}}$ ✓CA

$= 2^{x+3-x-2} \cdot 5^{x+3+x-1-2x-4}$

$= 2^1 \cdot 5^{-2}$

$= \frac{2}{25}$ ✓CA (5)

2.2.2. $\frac{2^{2x+3} - 3 \cdot 2^{x-1}}{2^{x-2}}$

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

$= 26$ ✓CA (4)

2.3. $a + b = 1$

$a = 1 - b$ ✓

$ab = (1-b)(b)$

$= b - b^2$

$= -b^2 + b$ ✓

$x = -\frac{b}{2a}$ ✓

$x = +\frac{1}{2}$

$y = \frac{1}{4}$ ✓

OR

$y = -(b^2 - b)$ ✓

$y = -\left[b^2 - b + \frac{1}{4} - \frac{1}{4}\right]$

$y = -(b - \frac{1}{2})^2 + \frac{1}{4}$

$\therefore$ max value is ✓ $\frac{1}{4}$ (4)

[19]

GREENBURY SECONDARY SCHOOL

DEPARTMENT OF MATHS & SCIENCES

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28/05/2015

QUESTION THREE :

3.1. $x^2 - 3x - 3 = 0$ ✓A

$\Delta = b^2 - 4ac$ ✓A

$= (-3)^2 - 4(1)(-3)$

$= 21$ ✓A

∴ ROOTS ARE REAL, IRRAT, UNEQUAL ✓CA (4)

3.2. $3mx^2 - (2m + 3n)x + 2n = 0$

$\Delta = (-2m - 3n)^2 - 4(3m)(2n)$ ✓A

$= 4m^2 + 12mn + 9n^2 - 24mn$ ✓A

$= 4m^2 - 12mn + 9n^2$ ✓A

$= (2m - 3n)^2$ ✓A [10]

Δ IS A PERFECT SQUARE ✓A

∴ ROOTS ARE RATIONAL FOR ALL m AND n ✓A (6)

QUESTION FOUR :

4.1.1. 17; 20 ✓A ✓A (2)

4.1.2. LINEAR ✓A; $d = 3$ ✓A (2)

4.1.3. $T_n = a + (n-1)d$

$T_n = 8 + (n-1)(3)$

$T_n = 8 + 3n - 3$

$T_n = 3n + 5$ ✓A ✓A (2)

4.1.4. $T_{10} = 3(10) + 5$ ✓CA

$= 35$ ✓CA (2)

4.2.1. 23; 34 ✓A ✓A (2)

4.2.2. QUADRATIC. SECOND DIFF = 2 ✓A ✓A (2)

4.2.3. $a = 1, b = 0, c = -2$

$T_n = n^2 - 2$ ✓A ✓A (2)

4.2.4. $n^2 - 2 = 625$ ✓A

$n^2 = 625$

$n = 25$ ✓CA

∴ 25th term is 623. (2)

4.3.1. 1; −2; 4; −8; ... ✓A ✓A ✓A ✓A (4)

4.3.2. terms double ✓A with sign ✓A alternating (2)

4.3.3. sum $= -5$ ✓CA (2)

4.3.4. $(-2)^{n-1} = 64$ ✓CA

$(-2)^{n-1} = (-2)^6$

$n - 1 = 6$

$n = 7$ ✓CA

∴ 7th term is 64 (2)

[26]

QUESTION FIVE :

5.1. $1 + i = \left(1 + \frac{i^m}{m}\right)^m$ ✓A

$1 + i = \left(1 + \frac{7}{1200}\right)^{12}$ ✓A

$i = 7{,}23\%$ p.a ✓CA (

5.2. $A = P(1 - in)$ ✓A

$A = 12000\left(1 - \frac{15}{100}(3)\right)$ ✓A

$A = R6600$ ✓CA (3)

5.3. $A_1 = P(1 + i)^n$ ✓A

$= 200\,000\left(1 + \frac{6{,}15}{1200}\right)^{2\times 12}$ ✓A

$= 227\,685{,}79$ ✓CA

$A_2 = 227685{,}79\left(1 + \frac{8}{400}\right)^{4\times 2}$ ✓CA ✓CA

$= R266\,770{,}19$ ✓CA (5)

5.4. $A = P(1 + i)^n$

$7125 = 6000(1 + i)^3$ ✓A

$\frac{7125}{6000} = (1 + i)^3$ ✓CA

$\sqrt[3]{\frac{7125}{6000}} = 1 + i$ ✓CA

$i = \sqrt[3]{\frac{7125}{6000}} - 1$ ✓CA

$i = 5{,}90\%$ p.a ✓CA (5)

[17]

QUESTION SIX:

6.1.1. $2x^2 - 4x - 6 = 0$ ✓A

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$

$x = 3$ or $x = -1$ ✓CA

$A(-1;0)$ ✓CA ; $B(3;0)$ ✓CA

$C(0;-6)$ ✓A (5)

6.1.2. $x = \frac{-b}{2a}$ ✓A

$= \frac{-(-4)}{2(2)}$ OR $x = 2$ ✓✓ (answer only)

$= 2$ ✓A

$M(2;-6)$ ✓CA (3)

6.1.3. $2x^2 - 4x - 6 = -2x + 6$ ✓A

$2x^2 - 4x + 2x - 6 - 6 = 0$

$2x^2 - 2x - 12 = 0$

$2(x^2 - x - 6) = 0$

$(x+1)(x-3) = 0$

$x = -1$ or $x = 3$ ✓CA

$D(-1;8)$ ✓CA (3)

6.1.4. $x > 3$ AND $-1 < x < 3$

SOL: $x > -1$; $x \neq 3$ ✓CA ✓CA (3)

6.1.5. $x > 2$ ✓CA (2)

6.2.

$B(3;0)$; $D(0;6)$

$AG = \frac{6-0}{0-3}$ ✓CA ✓CA

$= -2$ ✓CA (3)

[19]

QUESTION SEVEN:

7.1. $y = \frac{-1}{0-3} + 2$ ✓A

$y = 2\frac{1}{3}$

$(0; 2\frac{1}{3})$ ✓CA (2)

7.2. $x = 3$ ✓A

$y = 2$ ✓A (2)

7.3. $0 = \frac{-1}{x-3} + 2$ ✓A

$\frac{1}{x-3} = 2$

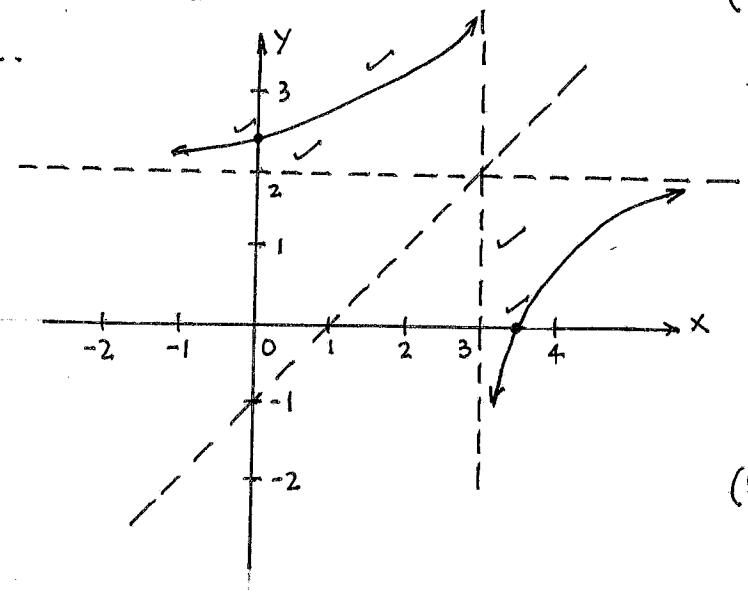
$1 = 2(x-3)$ ✓CA

$1 = 2x - 6$

$7 = 2x$

$x = 3\frac{1}{2}$ ✓CA (3)

7.4.



(5)

7.5. $y = x - 1$ ✓✓ or $y = -x + 5$ (2)

[14]

QUESTION EIGHT:

8.1. $p(x) = t \cdot 3^x + 1$

$0 = t \cdot 3^0 + 1$ ✓A

$0 = t + 1$

$t = -1$ ✓A (2)

8.2. $h(x) = -3^{x+4} + 1$ ✓A ✓A (3)

[5]

QUESTION NINE:

9.1.1. $P(A \text{ and } B)$

$= P(A) + P(B) - P(A \text{ or } B)$ ✓

$= 0{,}35 + 0{,}2 - 0{,}48$ ✓

$= 0{,}07$ ✓ (3)

9.1.2. NO ✓ $P(A \text{ AND } B) = 0{,}07$ ✓

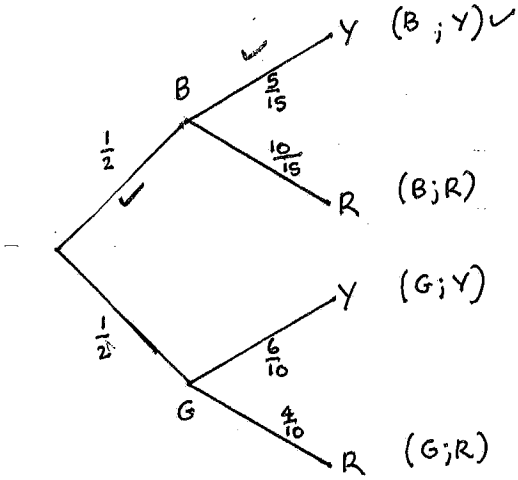
$\neq 0$ (2)

9.1.3. YES ✓ $P(A \text{ AND } B) = 0{,}07$ ✓

$P(A) \times P(B) = 0{,}35 \times 0{,}2$

$= 0{,}07$ ✓ (3)

9.2.



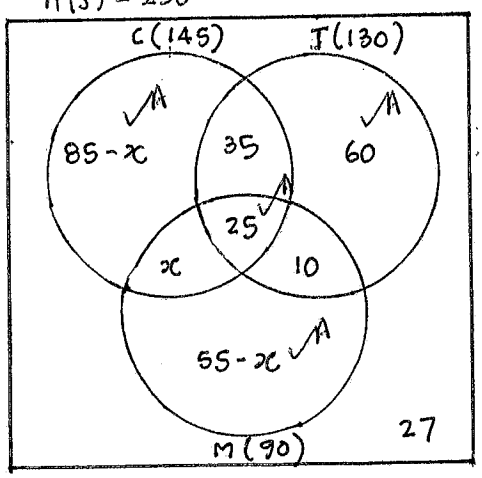
$P = \left(\frac{1}{2} \times \frac{5}{15}\right) + \left(\frac{1}{2} \times \frac{6}{10}\right)$ ✓

$= \frac{7}{15}$ ✓

(5) [13]

QUESTION TEN:

10.1. $n(s) = 250$



N.B. any one of two diagrams

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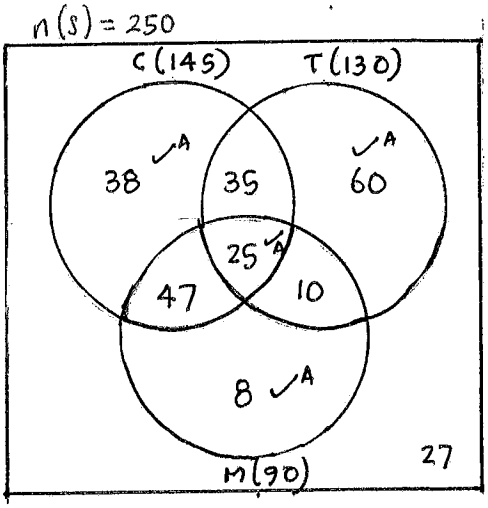

$85 - x + x + 25 + 35 + 60 + 10 + 55 - x + 27 = 250$ ✓A

$-x = -47$

$x = 47$ ✓ (6)

10.2. $P(\text{only tea}) = \frac{60}{250} = \frac{6}{25} = 0{,}24$ ✓CA (2)

⊛ If answers are not simplified for give full credit ⊛

TOTAL : 150

10.2 & 10.3

10.3. $P(M \text{ or } T)$

$= P(M) + P(T) - P(M \text{ and } T)$

$= \frac{90}{250} + \frac{130}{250} - \frac{35}{250}$ ✓CA

$= \frac{185}{250}$

$= \frac{37}{50} = 0{,}74$ ✓CA

(3) [11]