Beaulieu College

Mathematics Department

GRADE 11

MATHEMATICS

PAPER 1

Time:	2 ½ Hours		125 marks
Date:	10 November 2014		
Examiner:	Ms Smith	Moderator:	Mr Ruiz-Mesa

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of 9 pages. A **FORMULA SHEET** and an **ANSWER SHEET** are attached at the end of the paper.
2. Please check that your paper is complete.
3. Answer all the questions on the folio pages except for QUESTION 8 (b). QUESTION 8 (b) must be answered on the **ANSWER SHEET**. Please ensure that the answer sheet is detached and handed in with your answers.
4. Please note that diagrams are not necessarily drawn to scale.
5. All necessary working details must be shown.
6. Round your answers off to ONE decimal place unless stated otherwise.
7. Approved non-programmable and non-graphical calculators may be used, unless otherwise stated.
8. It is in your own interest to write legibly and to present your work neatly.

Good luck!

SECTION A

QUESTION 1

Simplify the following:

(a) $\dfrac{2x^2-9x-5}{10-2x}$ (3)

(b) $\dfrac{7^{a-2}.2^{a-2}}{14^{a-1}.2}$ (3)

(c) $\dfrac{3^{x+1}+3^x}{m.3^x+4.3^x}-\dfrac{3m-12}{m^2-16}$ (5)

[11]

QUESTION 2

Solve for x:

(a) $2x^2-5x=2$ (3)

(b) $x-2=-\sqrt{2x-5}$ (4)

(c) $(2-x)(x-6)>0$ (3)

[10]

(*Please turn over for Question 3.*)

QUESTION 3

(a) Determine the value(s) of k for which the equation $3x^2 + 2x - k + 1 = 0$ has real roots.

(4)

(b) Solve for x and y if:

$2^{3x+1} = 4^y$ and $x^2 + 2y = 29$ (6)

[10]

QUESTION 4

The following sequence of numbers forms a linear number pattern:

20 ; 23 ; 26 ; 29 ; … ; 101

(a) How many terms are there in the sequence? (3)

(b) All the even numbers are removed from the sequence to create a new sequence. Determine the sum of the first five numbers of the new sequence. (2)

[5]

QUESTION 5

(a) The following sequence is given: $x;\ \frac{x^2}{3};\ \frac{x^3}{9};\ \ldots$

(1) Write down the next term in the sequence. (1)

(2) Explain, in words, how each subsequent term in the sequence is formed. (2)

(b) If it is given that the second term of an arithmetic sequence is equal to 4 and the fifth term is equal to -17, determine the first term of the sequence and the common difference.

(5)

[8]

QUESTION 6

ALL ANSWERS IN THIS QUESTION MUST BE ROUNDED OFF TO TWO DECIMAL PLACES

(a) James wants to invest money at a bank that offers interest on investments at a rate of 6,5% per annum compounded monthly.

(1) Calculate the effective interest rate equivalent to this. (2)

(2) Determine how much James must invest now (as a lump sum) so that he has R18 200 in six years' time. (3)

(3) Draw a sketch graph showing the value of James' investment over the 6 year period. (3)

(b) Quintin buys an entertainment centre for R42 000. The depreciation rate on this item is 16% per annum using the reducing balance method. Calculate the value of his entertainment centre after 3 years. (2)

(c) Nicole opens a savings account by making an initial deposit of R3 700.
After 7 months, she deposits a further R4 900 into the account.
23 months after opening the account, she withdraws R2 800 from the account.
Four months later, she deposits R5 100 into the account.

Interest is paid at 5,8% per annum, compounded monthly, for the first year and 6,2%, compounded monthly, thereafter.

Determine the value of Nicole's investment after three years. (8)

[18]

SECTION A: [62]

SECTION B

QUESTION 7

A plant is being infected by bacteria. The following number pattern represents the number of bacterial cells in the plant at the end of every hour of infection:

3 ; 10 ; 19 ; 30 ; …

(a) Determine a general formula for the n^{th} term $\left(T_n \right)$ of the number pattern. (4)

(b) Determine the number of bacterial cells in the plant at the end of the first day. (2)

(c) The plant will die if the bacterial cells reach more than 2 110. Determine after how many hours the plant will die if the bacterial infection is left untreated. (3)

[9]

QUESTION 8

Given: $f(x) = 4^{-x} - 8$ and $g(x) = 3,5x - 7$

(a) Determine the x-intercept of the graph of f. (3)

(b) Sketch the graphs of f and g on the set of axes provided on the **ANSWER SHEET** at the end of the paper.

Clearly indicate all asymptotes and label all intercepts with the axes. (5)

(c) Write down the range of f. (2)

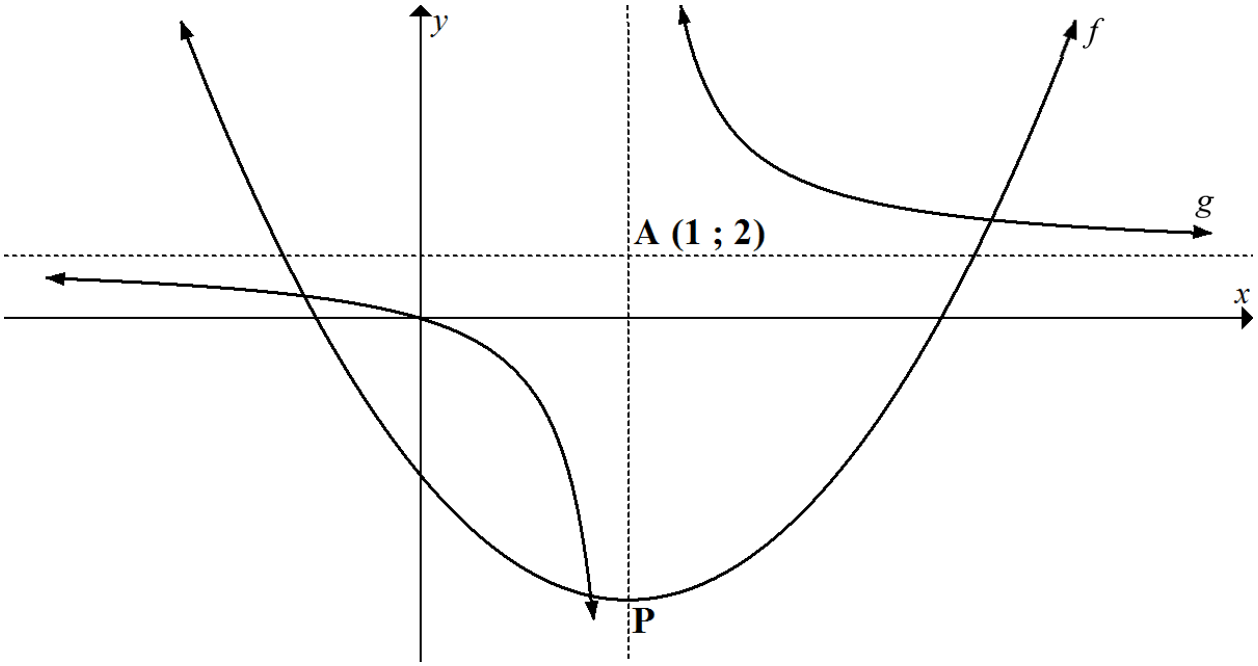
(d) Use your graphs to determine the value(s) of x for which $f(x).g(x) > 0$. (2)

[12]

QUESTION 9

The diagram below shows the graphs of $f(x)=4x^2-8x-5$ and $g(x)=\frac{a}{x-b}+c$.

$A(1;2)$ is the point where the asymptotes of g intersect and P, which lies on the vertical asymptote of g, is the turning point of f. The graph of g passes through the origin.



(a) Determine the values of a, b and c. (4)

(b) Determine the equations of the asymptotes of $g(x+3)-5$. (2)

(c) The graph of h, is the reflection of f in the y-axis.
Determine the coordinates of the turning point of h. (2)

(d) For which value(s) of k will $f(x)=k$ have two positive unequal roots? (2)

(e) How many solutions will there be to the equation $f(x)=g(x)$? (1)

[11]

QUESTION 10

Sketch the graph of $f(x) = a(x+p)^2 + q$ if it also given that:

- The range of f is $(-\infty ; 6]$.
- $a \neq 0$
- $p > 0$
- $f(0) > 0$

[4]

QUESTION 11

A group of 75 learners was surveyed at a school. The following information from the survey is given:

- 17 learners wear Nike and Adidas branded clothing
- 20 learners wear Nike and Puma branded clothing
- 21 learners wear Puma and Adidas branded clothing
- A total of 46 learners wear Nike branded clothing
- A total of 36 learners wear Puma branded clothing
- 4 learners wear Adidas branded clothing ONLY
- 9 learners wear all three brands of clothing

(a) Draw a Venn diagram to represent the above information. (8)

(b) Write down the probability that a learner selected at random from this sample wears Nike branded clothing ONLY. (1)

[9]

(*Please turn over for Question 12.*)

QUESTION 12

(a) Luke is an avid water polo player and wants to know more about his supporters.

At Beaulieu College, it is known that 54% of the learners are girls. The probability that a randomly chosen girl at the college has attended a water polo match is 18%. The probability that a randomly chosen boy at the college has attended a water polo match is 42%.

Determine the probability that a learner selected at random from the college has **never** attended a water polo match, correct to FOUR decimal places. (6)

(b) During a survey, 60 people were asked with which hand they write and what the colour of their hair is. The results are summarised in the table below:

		HAND USED FOR WRITING		
		Right	**Left**	**Total**
	Light	A	B	**20**
	Dark	C	D	**40**
	Total	**48**	**12**	**60**

If it is also given that the events "Hair Colour" and "Hand used for Writing" are independent events, determine the values of A, B and C. (5)

[11]

(*Please turn over for Question 13.*)

QUESTION 13

The radioactive decay of a substance is given by the formula:

$m(t) = 500(0,92)^t$ where $m(t)$ is the mass (in grams) of the radioactive substance and t is its age in years.

(a) Write down the initial mass of the radioactive material. (1)

(b) Write down the percentage by which the radioactivity decreases each year. (1)

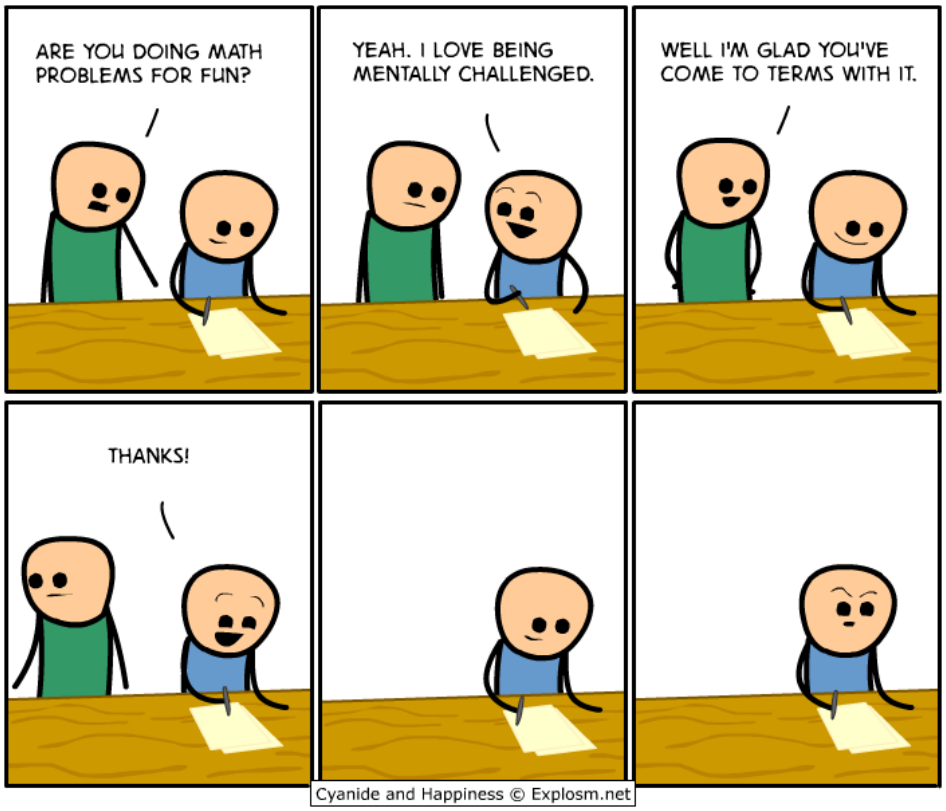
(c) Determine the mass of the substance after 50 years. (2)

(d) Determine the average rate of change of the radioactive substance between $t = 10$ and $t = 15$. (3)

[7]

SECTION B: [63]

TOTAL: [125]

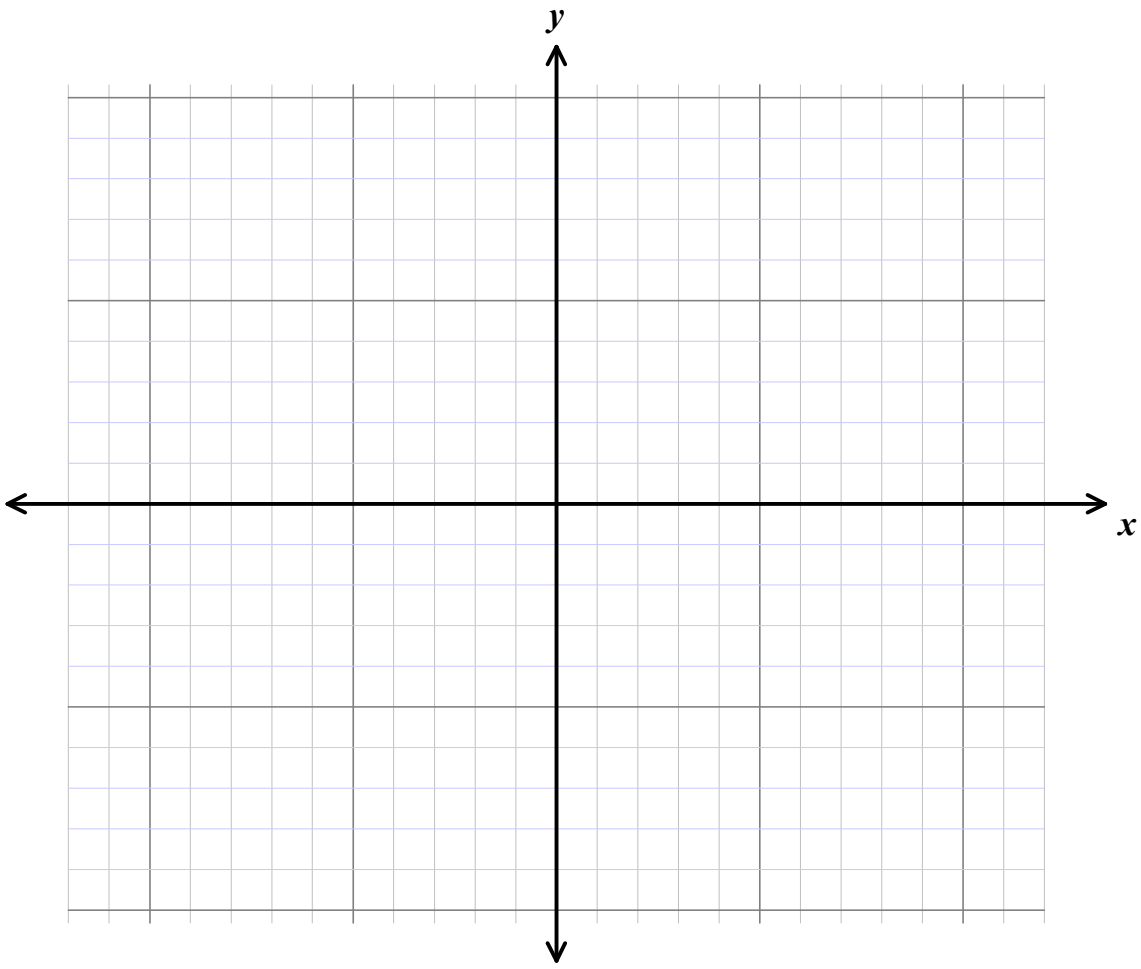


ANSWER SHEET

Name: _____

QUESTION 8 (b)

Please detach this page and hand in with your answers.



FORMULA SHEET

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

$$\mathrm{T}_n = a + (n-1)d$$

$$A = P(1+ni) \qquad A = P(1-ni)$$

$$A = P(1+i)^n \qquad A = P(1-i)^n$$

$$y = mx + c \qquad y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$P(A) = \frac{n(A)}{n(S)}$$

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