St Andrew's School for Girls

SKILLED FOR LIFE

MATHEMATICS PAPER 1

Grade 11

November 2016

Examiner/s	JS, CS, LP
Moderator/s	LP, CS, JS, GK
Marks	150
Time	3 hours
Instructions:	Answers to 1 dp unless otherwise stated. Circle the name of your teacher. Show all necessary working out.

NAME									
Teacher:		**GK**		**CSw**		**LP**		**JSt**	
Q1		**Q2**		**Q3**		**Q4**		**Q5**	
Q6		**Q7**		**Q8**		**Q9**		**Q10**	
Q11		**Q12**		**Q13**		**Q14**		**Q15**	
Q16									

/150

SECTION A 90 Marks

Question 1 [6 marks]

Solve for x in terms of m:

(a) $3x^2 = m$ (2)

(b) $(mx + 1)(x – m) = 0$ (2)

(c) $– 2x < 4 – 10m$ (2)

Question 2 [19 marks]

Solve for x:

(a) $–3(3x + 1)(x – 4) < 0$ (3)

(b) $2x + \sqrt{x + 1} = 1$ (5)

(c) $\frac{1}{\sqrt[4]{x}} = 2$ (2)

(d) $2^{x+2} + 2^x = 20$ (3)

(e) Solve for x and y: (6)

$2x - y = 8$ and $x^2 - xy + y^2 = 19$

Question 3 [7 marks]

(a) Simplify and write as a single fraction

$$\frac{3^{x+1} + 3^x}{k.3^x + 3^x.2^2} - \frac{3k-12}{k^2-16}$$ (5)

(b) Simplify $\frac{5^{2x}-1}{5^{x}-1}$ (2)

Question 4 [2 marks]

If $B = \frac{\sqrt{x-5}}{x-2}$, determine the values of x for which:

(a) B is undefined (1)

(b) B is non-real (1)

Question 5 [16 marks]

(a) Given the **arithmetic series** : 2 + 9 + 16 + ... (to 251 terms).

(1) Write down the formula for the n^{th} term in the series. (2)

(2) Calculate the 251^{st} term of the series. (1)

(3) Express the series in sigma notation. (1)

(4) Calculate the sum of the series. (2)

(5) How many terms in the series are divisible by 4? (3)

(b) In a **converging geometric series** $S_\infty = \frac{40}{3}$ and $T_2 = \frac{5}{2}$;
calculate the possible value(s) of the first term. (7)

Question 6 [10 marks]

Given the function $f(x) = 4.2^{x-1} + 1$

(a) State the equation of the asymptote. (1)

(b) State the domain and range of the function. (2)

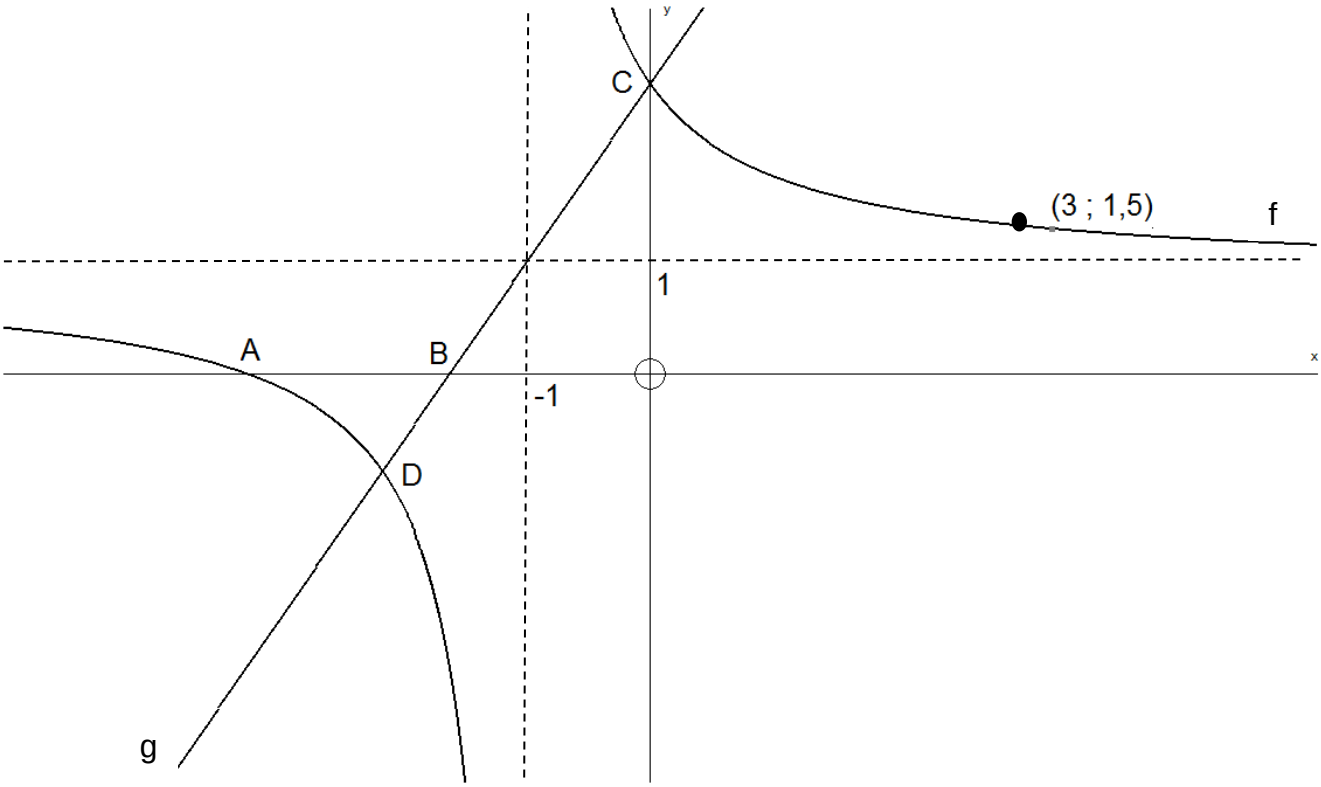
(c) Determine the equation of $g(x)$ if $g(x)$ is formed when $f(x)$ is reflected over the x-axis. (2)

(d) Determine the equation of $h(x)$ if $h(x)$ is formed when $f(x)$ is shifted 2 units right and 3 units down. (2)

(e) In the space below, using your own axes, make a neat sketch graph of $f(x)$.
Show all intercepts and asymptotes. (3)

Question 7 [17 marks]

Sketched on the axis below are the functions $f(x)$ and $g(x)$. A and B are the x-intercepts of the functions. C is the common y-intercept of the two functions. D is one of the points of intersection of the two functions. The point (3 ; 1,5) lies on $f(x)$



(a) State the equations of the asymptotes of $f(x)$. (2)

(b) Determine the equation of $f(x)$. (3)

(c) Determine the equation of the axis of symmetry with a positive gradient of $f(x)$. (2)

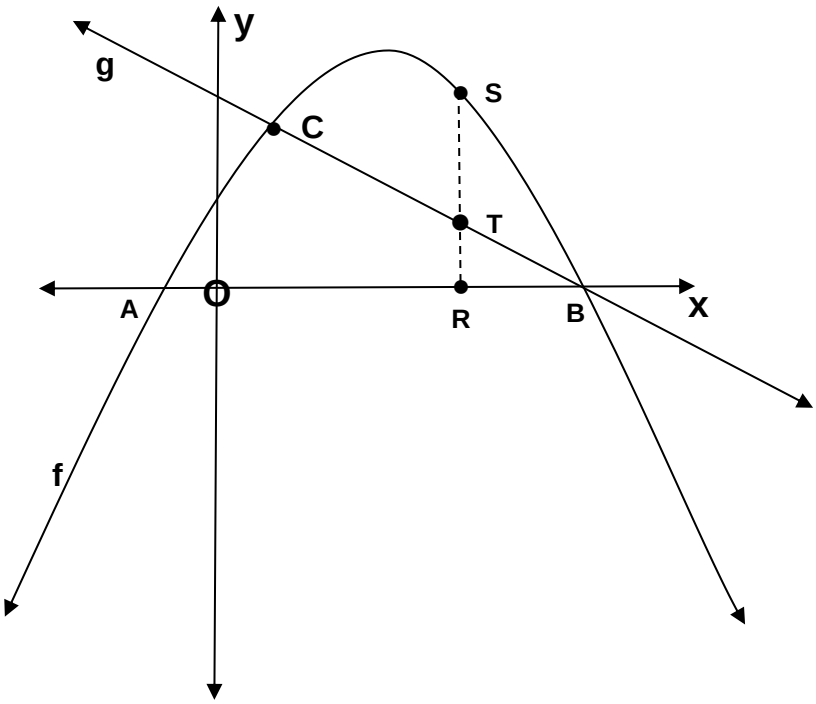
(d) Hence determine the coordinates of A and C. (3)

(e) Given that $g(x)$ passes through the point of intersection of the asymptotes of $f(x)$, show that $g(x) = 2x + 3$. (2)

(f) Determine the co-ordinates of D. (5)

Question 8 [13 marks]

The graphs of $f(x) = -x^2 + 7x + 8$ and $g(x) = -3x + 24$ are sketched below.
The graphs intersect at B and C. A and B are the x-intercepts of f(x). S, T and R are on the same vertical straight line.



(a) Determine the length of AB. (3)

(b) Calculate the coordinates of C. (4)

(c) If ST = 9 units determine the length of OR. (3)

(4) For which values of x is:

(a) $f(x) \geq g(x)$ (2)

(b) $f(x).g(x) < 0$ (1)

SECTION B 60 Marks

Question 9 [19 marks]

(a) Convert an interest rate of 14% p.a. compounded monthly to an interest rate per annum compounded quarterly.(2 dp) (3)

(b) Peter wants to take out a loan for a house over 20 years. He has approached two financial institutions and was offered two different options. The two options are shown in the table below:

Variables	**Option 1**	**Option 2**
Loan amount	R 950 000	R 950 000
Interest rate (compounded monthly)	12%	11,8%
Repayments	R x per month	R10 328,16 per month
Bank charges	R 0	R 200 per month
Commission	R 6 000	R 0

Note:
A commission is a once-off payment which is paid separately from the loan repayments.

(1) Determine the total cost of **option 1**. (6)

(2) Which option is the best? Provide relevant calculations to justify your answer. (3)

(3) If Peter took **option 1,** but decided to rather make his repayments R 13 000 per month, how long (in months, to the nearest month) would it take him to pay off his home loan. (4)

(4) Using your answer in (3), if Peter did take **option 1** and paid R 13 000 per month, determine his outstanding balance after 6 years. (3)

Question 10 [9 marks]

Given the quadratic sequence: $-1\ ;\ -7\ ;\ -11\ ;\ p\ ;\ \ldots.$

(a) Write down the value of p. (1)

(b) Determine the n^{th} term of the sequence. (3)

(c) The first difference between two consecutive terms of the sequence is 96. Calculate the values of these two terms. (5)

Question 11 [4 marks]

Show that $k^2x^2 + 2 = kx - x^2$ has non-real roots for all values of k. (4)

Question 12 [4 marks]

For all values of x, $x^2 + 6x - 2 = (x + p)^2 + q$.

(a) Find the values of p and q. (2)

(b) **Hence** solve the equation $x^2 + 6x - 2 = 0$ (answers in surd form) (2)

Question 13 [5 marks]

Given that: $P(A) = 0,5$ $P(\text{not } B) = 0,6$ $P(A \text{ and } B) = 0,2$

(1) Draw a Venn diagram to represent this information (4)

(2) Hence, determine $P(A \text{ or } B)$ (1)

Question 14 [7 marks]

Grade 9 learners are considering their subjects for grade 10. They have to choose between Physical Sciences and Geography and between Life Sciences and Accounting. They cannot take both Geography and Physical Sciences and they cannot take both Life Sciences and Accounting. The contingency table below shows the results of their choices:

	Physical Sciences	Geography	Total
Life Sciences	18		30
Accounting		9	
Total			50

(a) Complete the table (1)

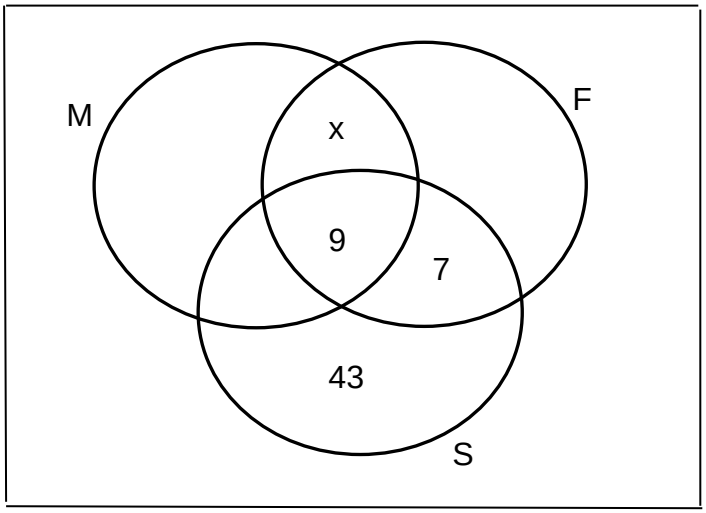
(b) Determine the probability that a learner chosen at random will do Life Sciences and Geography. (1)

(c) Given that a learners does Physical Sciences, determine the probability that they will take Accounting. (2)

(d) Using an appropriate rule, determine whether taking Accounting and Geography are independent events. (3)

Question 15 [7 marks]

The following Venn diagram illustrates the complaints from 175 customers at a restaurant. The complaints were put into 3 categories: menu, food and service.



- 77 customers complained about the service
- 80 customers complained about the food
- 65 customers complained about the menu

(a) Complete the Venn diagram in terms of x (3)

(b) Hence, show that x = 4 (2)

(c) Determine the probability that a customer, selected at random, complained about <u>at least</u> two categories. (2)

Question 16 [5 marks]

(a) Bongani rushed from work to the soccer stadium at 165 km/h to see his favourite team. They lost the game, so feeling sad he drove home taking the same route, at 110 km/h. Calculate Bongani's average speed for the whole trip. (It is not 137,5 km/h) (3)

(b) Without using a calculator and showing all working, evaluate: (2)

$$\sqrt{5967628^2 - 5967626 \text{ x } 5967630}$$