



**ST MARY'S DSG, KLOOF**  
**TRIAL EXAMINATIONS**  
**MATHEMATICS PAPER 1**

**GRADE 12**  
**TIME: 3 HOURS**  
**EXAMINER: MR NORTON**

**AUGUST 2015**  
**TOTAL: 150 MARKS**  
**MODERATOR: MRS VAN ROOYEN**

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**PLEASE READ THESE INSTRUCTIONS CAREFULLY:**

1. This question paper consists of 9 pages and an Information Sheet of 2 pages (i - ii). Please check that your paper is complete.
  2. Read the questions carefully.
  3. Answer all the questions.
  4. Please start each of the three sections on a new sheet of paper. You must hand in each section separately.
  5. Number your answers exactly as the questions are numbered.
  6. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
  7. Round off your answers to two decimal digits where necessary.
  8. All the necessary working details must be clearly shown.
  9. It is in your own interest to write legibly and to present your work neatly.
  10. Please hand in this question paper.
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## SECTION A

## QUESTION 1

(a) Solve the following equations for  $x$ :

(1)  $x^2 - 7x = 18$  (3)

(2)  $x^2 \leq x$  (4)

(3)  $y = x^2 - 4$  and  $y = -x + 1$  (4)

(4)  $(2^x - 5)^3 = 1$  (4)

(b) Find  $\frac{dy}{dx}$  where  $y = \left(x - \frac{1}{x}\right)\left(x + \frac{1}{x}\right)$ , leaving your answer simplified with positive exponents. (4)

(c) Determine the equation of the tangent to the curve  $y = x^2 + 2$  at  $x = 2$ . (5)

(d) Determine the sum of the first 30 terms of an arithmetic series that starts: (3)

$$31 + 28 + 25 + \dots$$

(e) Simplify as far as possible, showing all working, leaving your answer with positive exponents:  $(x^{-1} + y^{-1})^{-1}$  (3)

[30]

## QUESTION 2

Consider the functions  $f(x) = \frac{3}{x-2} + 3$  and  $g(x) = x^2 - 2x + 1$

(a) Write down the equations of the asymptotes of  $f$ . (2)

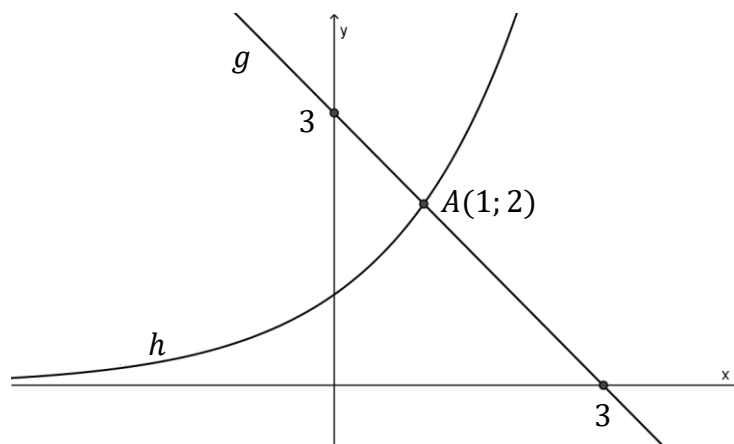
(b) Describe the translation of the graph  $h(x) = \frac{3}{x-1} - 1$  underwent to become  $f(x)$ . (2)

(c) Give the equation of  $j(x)$ , which represents  $g(x)$  reflected about the  $y$ -axis. (2)

[6]

**QUESTION 3**

The graph below shows the function  $g(x) = -x + 3$  and  $h(x) = b^x$ . The two functions intersect at  $A(1; 2)$ .



- (a) Determine the value of  $b$ . (2)
- (b) If the point  $A(1; 2)$  lies on  $h$ , determine the new coordinates of  $A'$  if we were to reflect function  $h$ :
  - (1) in the line  $y = x$ ?
  - (2) in the  $x$ -axis? (2)
- (c) Write down the inverse function of  $h(x)$  in the form  $h^{-1}(x) =$  (2)
- (d) Determine the range of  $h(x) - 5$  (2)
- (e) For what values of  $x$  is  $-2^x \cdot x + 6 \cdot 2^{x-1} < 0$ ? (4)

**[12]**

**QUESTION 4**

- (a)  $P(A) = 0,3$  and  $P(B) = 0,4$ . Determine  $P(A \text{ and } B)$  if  $P(A \text{ or } B) = 0,6$ . (3)
- (b) The numbers of Grade 11s and 12s that have different types of phones is given in the following table:

	<b>Grade 11</b>	<b>Grade 12</b>	<b>Total</b>
<b>iPhone</b>	76	69	145
<b>Android</b>	23	20	43
<b>Total</b>	99	89	<b>188</b>

- (1) What is the probability that a student in Grade 11 or 12 would has an iPhone? (2)
- (2) A teacher finds a lost Android phone. What is the probability that it belongs to a Grade 12 student? (2)

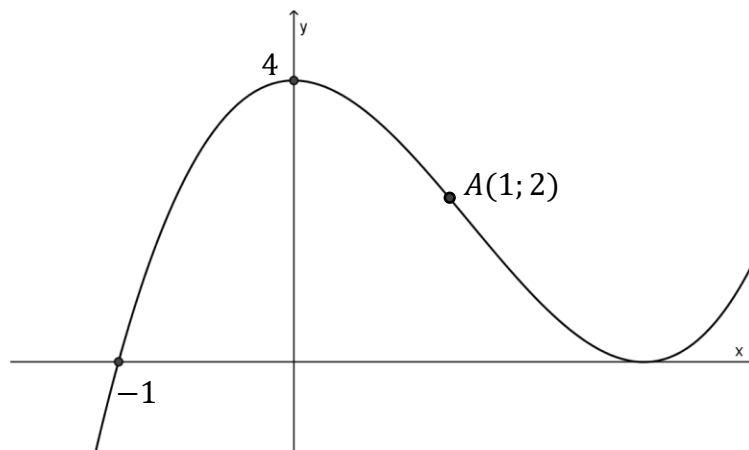
**[7]****[Section A: 55 marks]**

## SECTION B

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## QUESTION 5

The function  $y = ax^3 + bx^2 + c$  is represented by the graph below. It has an  $x$ -intercept of  $-1$ , a  $y$ -intercept of  $4$ , and passes through point  $A(1; 2)$ .



- (a) Show that the function is  $y = x^3 - 3x^2 + 4$ . (4)
- (b) Show that  $A$  is the point of inflection of the function. (4)
- (c) For what values of  $k$  would the function  $y = x^3 - 3x^2 + 4 + k$  have three roots? (3)

[11]

## QUESTION 6

Consider the function  $f(x) = \frac{2}{x} + 2$ .

- (a) Find the derivative of  $f(x)$  by first principles. (4)
- (b) Solve for  $x$  if  $f^{-1}(x) = f'(x)$ . (5)

[9]

**QUESTION 7**

Choose the correct answer from the options given. Write down only the letter of the option that you choose.

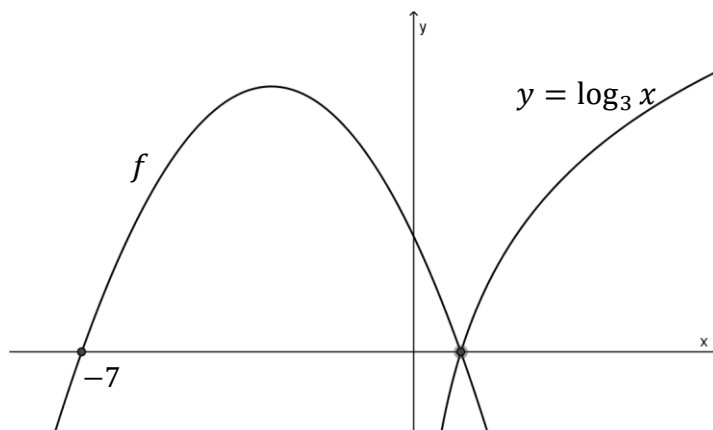
(a) Determine  $\frac{dy}{dx}$  if  $y = -\frac{1}{4x}$ : (2)

- A.  $\frac{1}{4x^2}$       B.  $-\frac{1}{4}$       C.  $4x^{-2}$       D.  $\frac{x}{4}$

(b) An object moves from its starting position and its motion is described by the equation  $s(t) = 20t - t^2$ , where  $s$  is the displacement in metres and  $t$  the time in seconds. The velocity, when  $t = 5$ , is: (2)

- A. 18 m/s      B. 50 m/s      C. 75 m/s      D. 10 m/s

(c) The equation of the axis of symmetry of  $f$  is: (2)



- A.  $x = -3$       B.  $y = -3$       C.  $x = -\frac{7}{2}$       D.  $y = -\frac{7}{2}$

(d) Given that  $f'(x) = 2x - 5$ , which one of the following statements is true? (2)

- A.  $f$  has a root at  $x = \frac{5}{2}$       B.  $f$  has a turning point at  $x = \frac{5}{2}$   
 C. The gradient of the tangent at  $x = 0$  is 2      D. The gradient of  $f(x)$  is 2.

(e) The maximum value of  $a^{2-(x-3)^2}$  is: (2)

- A.  $a$       B.  $\frac{1}{a}$       C.  $a^2$       D.  $\frac{1}{a^2}$

**[10]**

**QUESTION 8**

Solve the equation  $x^3 + (3 - a)x^2 + (2 - 3a)x - 2a = 0$  for  $x$ , given that  $x = a$  is one solution.

**[5]****QUESTION 9**

Solve the following equations for  $x$ :

(a)  $\sum_{r=1}^{\infty} x^{r-1} = \frac{3}{2}$  (5)

(b)  $a^x = a\sqrt{a\sqrt{a}}$  (4)

**[9]****[Section B: 44 marks]****SECTION C****PLEASE START A NEW SHEET OF PAPER NOW.**

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**QUESTION 10**

Snow White meets seven dwarves - Doc, Grumpy, Happy, Sleepy, Bashful, Sneezzy, and Dopey - in a forest after running away from her evil stepmother. The dwarves line up to introduce themselves to Snow White.

(a) How many different ways could they arrange themselves in line to meet Snow White if their positions are determined randomly? (3)

(b) If Bashful is never first and Dopey is always last:

(1) How many ways of arranging themselves are there now? (4)

(2) Hence, what is the probability that Bashful will not be first and Dopey will be last? (3)

**[10]**

**QUESTION 11**

(a) If the second term of an arithmetic sequence is  $b^2 + 2c$  and the fifth term is  $4b^2 - c$ .

(1) Determine the common difference in terms of  $b$  and  $c$ . (3)

(2) Determine values for  $b$  and  $c$  if  $T_2 = 11$  and  $T_3 = 7$ . (6)

(b) The first three terms of a geometric series are:  $2x - 2$ ;  $x^2 - 3x + 2$  and  $x - 2$ .

(1) Determine all possible values of  $x$ . (4)

(2) If the series is converging, determine  $S_\infty$ . (4)

**[17]**

**QUESTION 12**

A student loan of R 150 000 is granted by a bank at the start of a student's studies at an interest rate of 8,5% per annum, compounded monthly. The student graduates exactly 3 years after the loan was taken out. The first repayment is made one month after she graduates. The loan is then repaid in monthly instalments over a period of five years from the date of graduation.

(a) What is the balance of the loan to be repaid on the date that the student graduates? (3)

(b) What will the monthly instalments to repay the loan be? (4)

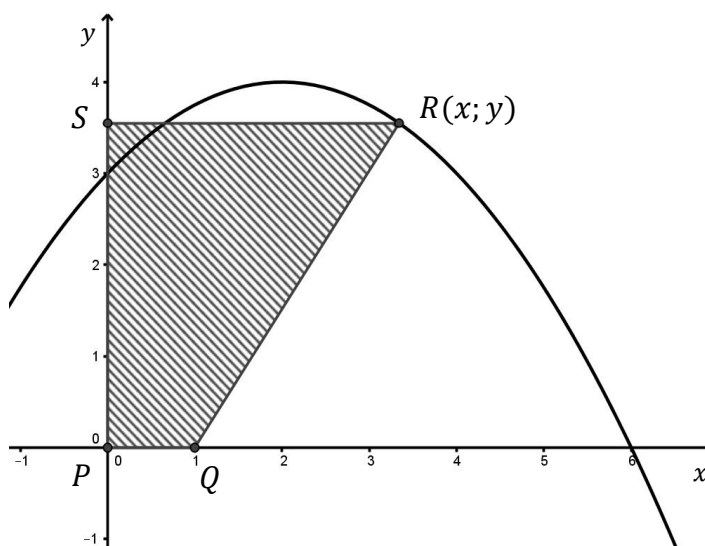
(c) After 12 repayments, the bank changes the interest rate to 9,0% per annum, compounded monthly. Determine the new monthly repayments for the remainder of the loan. (8)

**[15]**



**QUESTION 13**

A trapezium is drawn where  $P$  is fixed at the origin,  $Q$  is fixed at  $(1; 0)$  and  $R$  can move along a path defined by the parabola  $y = -\frac{x^2}{4} + x + 3$  for  $0 < x < 6$ .  $RS$  is parallel to  $PQ$ .



The area of a trapezium is calculated using the formula:  $Area = \frac{a+b}{2} \times h$

- (a) Show that the area of  $PQRS$  is given by the formula: (5)

$$A = -\frac{x^3}{8} + \frac{3x^2}{8} + 2x + \frac{3}{2}$$

- (b) Calculate the maximum area of  $PQRS$ . (4)

[9]

[Section C: 51 marks]

Total: 150 marks

**Analysis Grid**

Quest	K	R	CP	PS	Alg	Seq	Fin	Func	Calc	Prob
1	3	20	7		23	3			4	
2	2	4						6		
3		8		4				12		
4		7								7
5		8	3					7	4	
6		4	5					5	4	
7		6	4					4	6	
8				5	5					
9		5	4		4	5				
10		3	7							10
11			17			17				
12		4	11				15			
13			4	5					9	
	5	69	62	14	32	25	15	34	27	17