



ST MARY'S DSG, KLOOF

GRADE: 12

AUGUST 2017

**TRIALS EXAMINATION  
MATHEMATICS P1**

TIME: 3 HOURS  
ASSESSOR: J Kinsey

TOTAL: 150 MARKS  
MODERATORS: J van Rooyen  
E Robertson

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EXAMINATION NUMBER: \_\_\_\_\_

**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

1. This question paper consists of 10 typed pages. There is one blank page. Page 10 is a diagram sheet.
2. Answers must be written on folio paper.
3. There are 3 sections. Start each section on a new folio sheet.
4. **Write your number and Maths teacher's name on the top of each section.**
5. Hand in the diagram sheet, page 10, with Section B.
6. A formula sheet has been provided.
7. Diagrams are not drawn to scale.
8. Give all answers correct to 2 decimal places unless otherwise indicated
9. Read all the questions carefully.
10. An approved non-programmable and non-graphical calculator may be used, unless otherwise specified.
11. Make sure that your calculator is in degree mode.

**SECTION A**      **START ON A NEW FOLIO SHEET**

[57]

**Question 1**a) Solve for  $x$ 

1)  $3^x = 10$  (2)

2)  $(x - 3)(x + 5) = 9$  (4)

3)  $9 \cdot 2^{x-1} = 2 \cdot 3^x$  (3)

4)  $2x^2 - 2 \leq 3x$  (4)

b) Determine the following limits:

1)  $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$  (2)

2)  $\lim_{x \rightarrow 3} \frac{x + 3}{x^2 - 3x}$  (2)

c) Find the derivative of  $f(x) = -4x^2$  using first principles. (5)d) Differentiate the following with respect to  $t$ .

1)  $g(t) = t^2 - 3t + 2$  (2)

2)  $k(t) = \frac{t+2}{\sqrt{t}}$  (4)

[28]

**Question 2**

- a) Jonathan buys a car for R150 000 with the intention of replacing it with a similar one in 5 years' time. The value of the car depreciates at 22% per annum on a reducing balance while the price of a similar car is expected to increase by 19% each year.
- 1) Calculate the resale value of Jonathan's car in 5 years' time. (3)
  - 2) What should be the value of a sinking fund that needs to be set up to pay for the new car if the old car is used as a trade-in? (4)
- b) An investor makes monthly investments of R1200 into an annuity at a rate of 12% per annum compounded monthly in order to buy a car for R200 000 cash. Assume that his first payment is immediate and that his last payment is made on the day the investment matures.
- 1) Determine the monthly interest rate. (2)
  - 2) How long will the investor continue to make payments for? (5)
- [14]

**Question 3**

- a) A box contains coloured blocks. The number of blocks of each colour is given in the following table.

Colour	Purple	Orange	White	Pink
Number of blocks	24	32	41	19

A block is selected randomly. What is the probability that the block will be:

- 1) Purple (1)
  - 2) Purple or white (2)
  - 3) Pink and orange (2)
  - 4) Not orange (2)
- b) Take the word 'POSSIBILITY'.
- 1) In how many ways can the letters be arranged if repeated letters are considered identical? (4)
  - 2) What is the probability that a randomly generated arrangement of letters will begin with three I's? Write your answer as a simplified fraction. (4)

[15]

**SECTION B      START ON A NEW FOLIO SHEET**

[45]

**Question 4**a) The first three terms of an arithmetic sequence are 7;  $9\frac{1}{2}$ ; 12.1) What is the 41<sup>st</sup> term of the sequence? (2)

2) What is the sum of the first 101 terms of the sequence? (2)

b) Find the sum to infinity of the series

$$1 + \frac{3}{4} + \frac{9}{16} + \frac{27}{64} \dots \quad (2)$$

c) Expand and evaluate:

$$\sum_{n=4}^7 (-1)^{n+1} n^2 \quad (5)$$

[11]

**Question 5**a) Let  $S_n$  be the sum of the first  $n$  terms of an arithmetic sequence, whose first three terms are  $T_1$ ;  $T_2$  and  $T_3$ . It is known that  $S_1 = 7$ , and  $S_2 = 18$ .1) Write down  $T_1$ .

2) Calculate the common difference of the sequence.

3) Calculate  $T_4$ . (6)

b) In a geometric sequence, the first term is 5 and the fourth term is 40. Find the second term. (4)

[10]

**Question 6**

$$\text{Given } f(x) = \left(\frac{1}{5}\right)^x$$

Sketch the graphs of  $f$  and  $f^{-1}$  on the same system of axes, **on the diagram sheet provided**. Label both graphs clearly, showing any intercepts and asymptotes. (4)

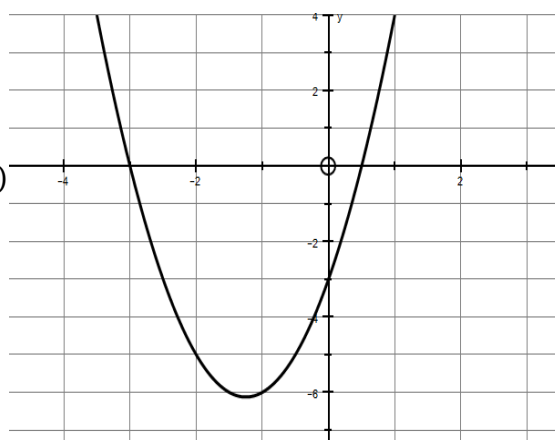
**Question 7**

Choose the correct answer for each multiple choice below/ answer questions; working may be shown:

- a) The quadratic function with equation  $y = 3(x-2)^2 - 3$  has
- A. Turning point at  $(-2; -3)$
  - B. X-intercepts at  $(3; 0)$  and  $(1; 0)$
  - C. Y-intercept at  $(0; -3)$
  - D. Y-intercept at  $(0; -9)$
  - E. X-intercepts at  $(-3; 0)$  and  $(-1; 0)$
- (3)

b) i) The equation of the function shown below is:

- A.  $f(x) = x^2 + \frac{1}{2}x - 3$
- B.  $f(x) = 3x^2 - x - 6$
- C.  $f(x) = 2x^2 + 5x - 3$
- D.  $f(x) = (2x + 1)(x - 3)$
- E.  $f(x) = x^2 - 6$



(3)

- ii) Give a domain of the function  $f(x)$  above which would make its inverse a function. (2)
- iii) In the function above, for which values of  $x$  is  $f'(x) > 0$ ? (2)
- iv) In the function above, for which values of  $x$  is  $f''(x) > 0$ ? (2)

c) The formula  $s = 5t^2 + vt$  can be used to determine the distance that the object has fallen after  $t$  seconds if it has an initial velocity of  $v$  m/s. Calculate the time,  $t$ , taken for an object to fall 40 m if the initial velocity was 10 m/s.

- A. 10 sec
- B. 8 sec
- C. 6 sec
- D. 4 sec
- E. 2 sec

(3)

[15]

**Question 8**

Given that  $(x - 2)$  and  $(x + 3)$  are factors of  $f(x)$  where  
 $f(x) = 3x^3 + 2x^2 + cx + d$ , find the values of  $c$  and  $d$ .

[5]

**SECTION C****START ON A NEW FOLIO SHEET**

[47]

**Question 9**

The intensity of sound  $D$  is measured in decibels (dB) and is given by the formula  
 $D = 10 \log \left( \frac{L}{10^{-16}} \right)$ .

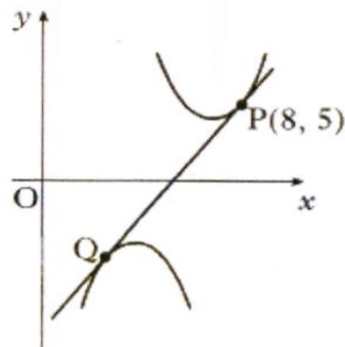
$L$  is the power of the sound experienced and  $10^{-16} \text{w/cm}^2$  is the power of the sound just below the threshold of hearing.

Find the power of the sound  $L$  experienced by the audience seated in the front row of an orchestral performance if the intensity of the sound is 107dB.

[4]

**Question 10**

The parabola with equation  $y = x^2 - 14x + 53$  has a tangent at the point  $P(8; 5)$ .



1) Find the equation of this tangent

(4)

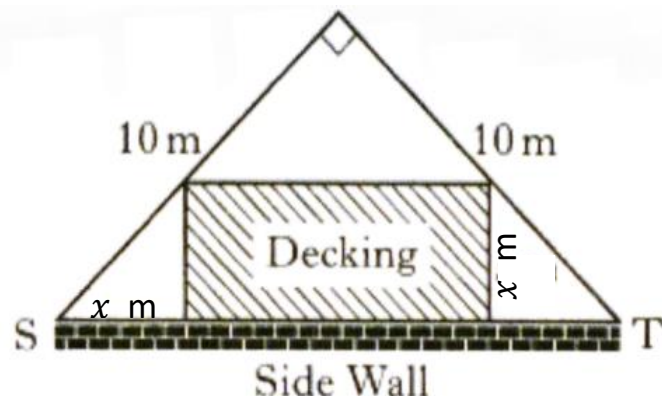
2) Show that the tangent found in (1) is also a tangent to the parabola with equation  $y = -x^2 + 10x - 27$  **and** find the coordinates of the point of contact Q.

(5)

[9]

**Question 11**

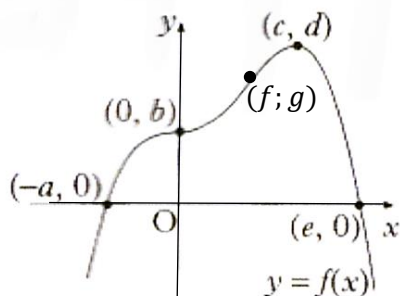
- a) There is a garden, at the side of a house, in the shape of a right-angled isosceles triangle. A rectangular wooden deck is to be installed above the garden at the side of the house, as shown in the diagram.



Answers for this question may be left in surd form.

- 1) Find the exact value of  $ST$ . (2)
- 2) Given that the breadth of the decking is  $x$  meters and that the decking will start  $x$  meters from  $S$  and  $T$ , show that the area of the decking,  $A$ , will be given by
 
$$A = (10\sqrt{2})x - 2x^2$$
 (2)
- 3) Find the dimensions of the decking which maximise its area. (4)

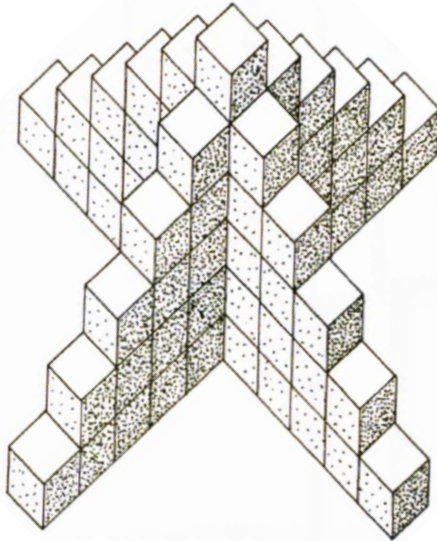
- b) The graph of a function  $f$  intersects the  $x$ -axis at  $(-a; 0)$  and  $(e; 0)$  as shown. There are points of inflexion at  $(0; b)$  and  $(f; g)$  and a maximum turning point at  $(c; d)$ . Sketch the graph of the derived function  $f'(x)$  showing any critical values.



(4)

**Question 12**

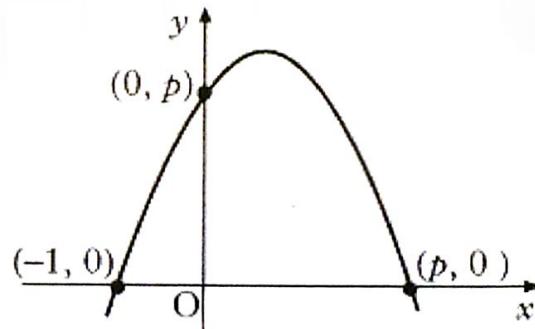
- a) A tower of cubes is built with a central column and four support sections, as shown.



- 1) How many cubes are needed to build this tower? (2)
  - 2) How many cubes are needed to build a tower like this, but 12 cubes high? (2)
  - 3) How many cubes are needed to build a tower like this one but  $x$  cubes high? (4)
- b) Functions  $f(x)$ ,  $g(x)$  and  $h(x)$  are defined as follows:
- $$f(x) = x^2 - x + 10, \quad g(x) = 5 - x \quad \text{and} \quad h(x) = \log_2 x.$$
- 1) Find  $h(f(x))$
  - 2) Find  $h(g(x))$  (3)
  - 3) If  $\log_a m - \log_a n = \log_a \frac{m}{n}$  then solve  $h(f(x)) - h(g(x)) = 3$ . (5)



- c) The diagram shows a sketch of a parabola passing through  $(-1; 0)$ ,  $(0; p)$  and  $(p; 0)$ .



- 1) Show that the equation of the parabola is  $y = p + (p - 1)x - x^2$ . (3)
- 2) For what value of  $p$  will the line  $y = x + p$  be a tangent to this curve? (4)

[23]

EXAM NUMBER: \_\_\_\_\_

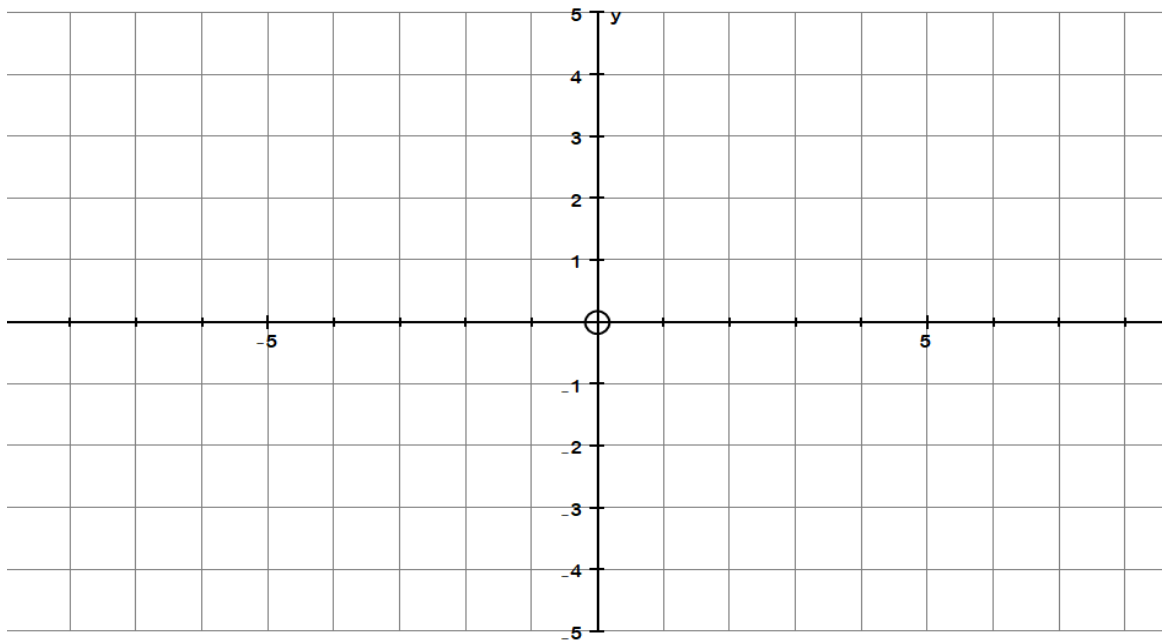
MATHS TEACHER: \_\_\_\_\_

**HAND IN WITH SECTION B****Question 6**

Given  $f(x) = \left(\frac{1}{5}\right)^x$

Sketch the graphs of  $f$  and  $f^{-1}$  on the same system of axes. Label both graphs clearly.

[4]



## MATHEMATICS TEST: PAPER 1 TRIALS 2017

SET BY: J KINSEY

GRADE: 12

TEST DATE: AUGUST 2017

## SUMMARY

QUESTION NO.	LEVEL (K / RP / CP / PS)				MARKS
	K	RP	CP	PS	
1	11	8	9		28
2	3	6	5		14
3		11	4		15
4	2	4	5easy		11
5	2	8			10
6	4				4
7		11	4		15
8			5		5
9			5		5
10		4	5		9
11			7	4	11
12			3	20	23
Total	22	52	52	24	150
Breakdown		49%	35%	16%	

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	TOTAL
Series & Patterns				11	10							8	29
Finance		14											14
Functions						4	8			9		8	29
Algebra	13						3		5			7	28
Calculus	15						4	5			11		35
Probability			15										15
	28	14	15	11	10	4	15	5	5	9	11	23	150