

**ST. DAVID'S MARIST INANDA**



**MATHEMATICS  
PAPER 1 PRELIMINARY EXAMINATION  
GRADE 12  
4 SEPTEMBER 2020**

**EXAMINER: MR L VICENTE  
MODERATOR: MRS S RICHARD**

**MARKS: 150  
TIME: 3 hrs**

**NAME:** \_\_\_\_\_

**PLEASE PUT A CROSS NEXT TO YOUR TEACHER'S NAME:**

Mrs Kennedy	Ms Vazzana	Mrs Nagy	Mr Vicente	Mrs Richard	Mrs Black
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**INSTRUCTIONS:**

- ✓ This paper consists of 27 pages and a separate two-page information sheet with formulae is included. Please check that your paper is complete.
- ✓ Please answer all questions on the Question Paper.
- ✓ You may use an approved non-programmable, non-graphics calculator unless otherwise stated.
- ✓ Answers must be rounded off to two decimal places, unless otherwise stated.
- ✓ Answers only will NOT necessarily be awarded full marks.
- ✓ It is in your interest to show all your working details.
- ✓ Work neatly. Do NOT answer in pencil.
- ✓ Diagrams are not drawn to scale.

<b>SECTION A</b>	<b>Q1</b> [11]	<b>Q2</b> [16]	<b>Q3</b> [12]	<b>Q4</b> [13]	<b>Q5</b> [18]	<b>Q6</b> [9]	<b>TOTAL</b> [79]
<b>LEARNER'S MARKS</b>							
<b>SECTION B</b>	<b>Q7</b> [5]	<b>Q8</b> [24]	<b>Q9</b> [16]	<b>Q10</b> [14]	<b>Q11</b> [8]	<b>Q12</b> [4]	<b>TOTAL</b> [71]
<b>LEARNER'S MARKS</b>							

**TOTAL:            /150**

**SECTION A**

**QUESTION 1**

**[11 marks]**

a) Solve for  $x$ :

1)  $x^2 - 28 > -3x$  (4)

2)  $(x+2) - \sqrt{x+8} = 0$  (4)

b) Given:  $-2x^2 + 3x - 3 = -p$ , determine the value(s) of  $p$  for which the equation will have two unequal, real roots. (3)

**QUESTION 2**

**[16 marks]**

- a) Given  $g(x) = 6x^2 + x$ , determine  $g'(x)$  by first principles. (4)

b) Determine  $f'(x)$ , given  $f(x) = \frac{6x^4 - 7x^2 + 2\sqrt{x}}{3x^2}$ .

Leave your answer with positive exponents.

(4)

c) Given:  $h(x) = x^3 - 8x^2 + 8x + 14$

Determine the average gradient of the curve between the points where  $x = -1$  and  $x = 1$

(3)

- d) The tangent to  $g(x) = x^3 + \frac{1}{x^3}$  at  $x = a$  is parallel to the x-axis. Determine the value(s) of a. (5)

**QUESTION 3****[12 marks]**

a) Given:  $f(x) = \frac{2}{x-2} + 3$

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

2) Determine the x and y intercepts of the graph of  $f$ . (3)

b) Given:  $g(x) = 3 \cdot 2^x - 2$

1) Determine the intercepts with the axes, round off to 2 decimal places if necessary. (4)

2) Sketch the graph of  $g$ , label all intercepts with axes and asymptotes. (3)



**QUESTION 4****[13 marks]**

- a) Joe meets with his financial advisor who says he urgently needs to start saving extra money for his retirement. He makes equal monthly payments at the beginning of every month starting on 1 January 2021 of R5 600, he makes his last payment on the day he retires (1 April 2030). The account he saves his money in has an interest rate of 11.39% p.a compounded monthly.

How much money will he have in his retirement annuity on the day he retires (1 April 2030)? (5)

b) Now that Joe has retired he deposits a lump sum of R1 110 000 into an account that has an interest rate of **10% p.a. compounded monthly**. Using this account he plans to pay himself a salary of R10 907,84 a month.

1) For how many months will his money last? (5)

2) How much money will he have left in his account after 4 years? (balance outstanding) (3)



**QUESTION 5****[18 marks]**

- a) The  $n$ th term of a quadratic sequence is given by  $T_n = an^2 + bn + c$ .  
The third and seventh terms of the quadratic sequence are  $-4$  and  $4$   
respectively,

The common second difference is  $1$ .

Determine  $b$  and  $c$ .

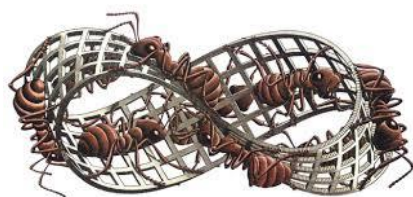
(5)

b) The first 3 terms of an infinite geometric series are 45 ; 15 ; 5; ...

1) Write the series with  $\Sigma$ -notation (3)

2) Why is the sum finite? (1)

3) What is the sum of the series? (2)



c) The sum to  $n$  terms of an arithmetic sequence is given by  $S_n = \frac{n}{2}(4n - 195)$

1) How many terms of the series must be added up to give a total of 1350?  
(4)

2) Determine the 10<sup>th</sup> term of the sequence. (3)

**QUESTION 6****[9 marks]**

a) 1) Solve for k :

$$2k = \frac{6}{k} - 1$$

(3)

2) Hence or otherwise, solve for x, without using a calculator and using the fact that  $\sqrt{10} \approx 3,2$ :

$$2\log(x+1) = \frac{6}{\log(x+1)} - 1$$

(6)

**SECTION B**

**QUESTION 7**

**[5 marks]**

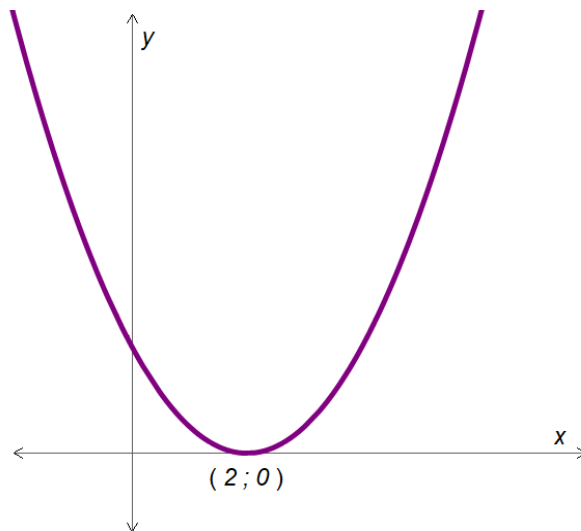
Solve for x:

$$4^x = 64(\sqrt[3]{2}) \quad [\text{round off to 2 decimal places}]$$



**QUESTION 8****[24 marks]**

a) The graph of  $h(x) = ax^2 + bx + c$  is shown:



1) Complete the following statements by filling in a  $<$  ;  $>$  or  $=$  as appropriate:

i)  $a$    $0$  (1)

ii)  $b$    $0$  (1)

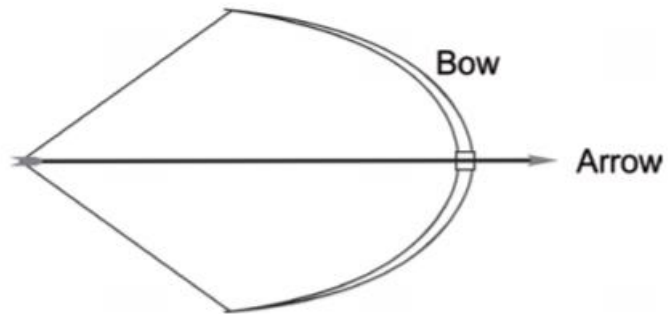
iii)  $c$    $0$  (1)

iv)  $b^2$    $4ac$  (1)

2) State, with reason, whether the y-intercept of the graph of  $y = h'(x)$  is positive or negative. (2)

3) State the turning point of  $j(x)$  if  $j(x) = h(x-2) - 3$  (2)

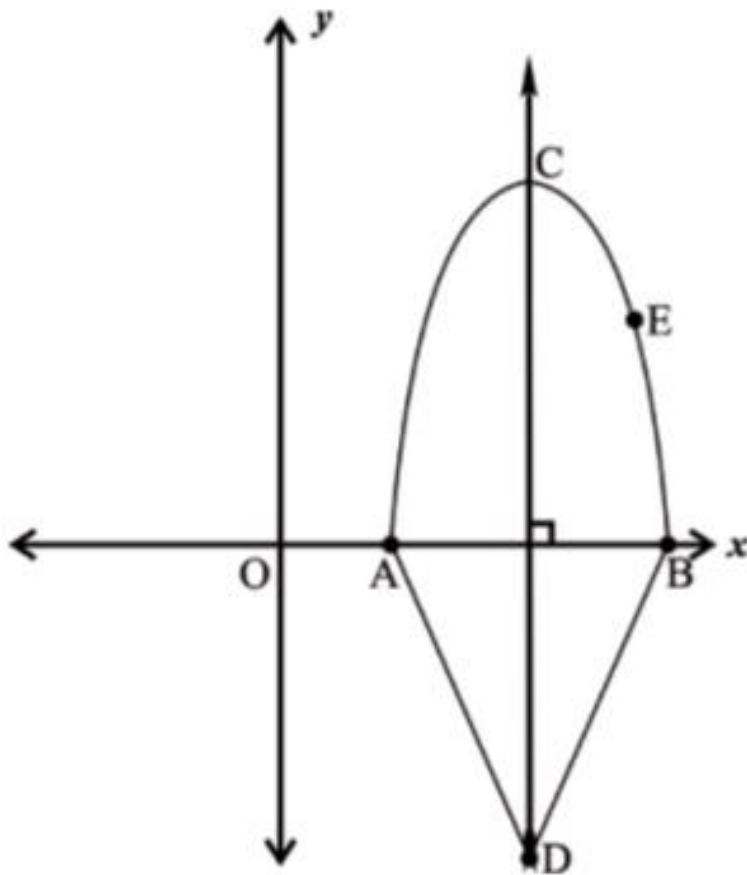
b) The diagram below shows a picture of a bow and arrow.



This picture is represented on the set of axes below.

Points A (1; 0) , B(9;0) and E (6; 30) are given.

CD is perpendicular to AB.

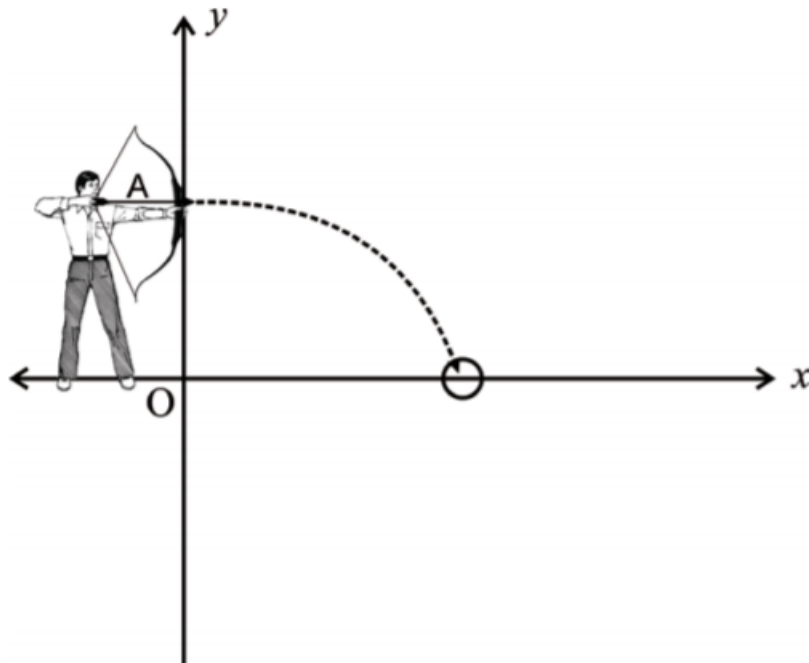


1) Determine the equation of the parabola in the form  $y = ax^2 + bx + c$ . (4)

2) Determine the equation of the line AD if the gradient of  $AD = -\frac{5}{2}$  (3)

3) Hence, determine the length of CD. (4)

- c) The arrow will follow a parabolic path, with maximum at the point of release.  
It is given that the equation of its path is  $f(x) = -\frac{1}{72}(x^2 - 144)$  ;  $0 \leq x \leq 12$



- 1) Write down the equation of the inverse function  $f^{-1}(x)$  (3)

2) Hence state the domain of  $f^{-1}(x)$ .

(2)

**QUESTION 9**

**[16 marks]**

a) Given:  $P(A \text{ or } B) = 0.8$ ,  $P(\text{not } (A \text{ and } B)) = 0.7$  and  $P(\text{not } A) = 0.4$

Are the events A and B independent? Justify.

(6)

b) Consider the word YELLOWWOOD

1) How many unique “words” can be made using the letters YELLOWWOOD  
(these words need not have any English meaning) (3)

2) How many unique words will have the letters D and Y apart? (3)

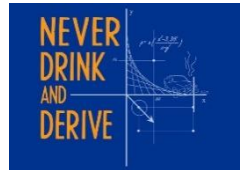
3) What is the probability that a word selected at random will have the two  
W's together? (4)



**QUESTION 10****[14 marks]**

a) Writing your answer with positive exponents, determine  $\frac{dy}{dx}$  if:

$$3xy - 6y = x^2 - 8x + 12 \quad \text{for } x \neq 2 \quad (4)$$



b) If  $f(x) = ax^3 + bx^2 + 42x - 5$  and the gradient at any point on the curve is given by  $2x^2 - 20x + 42$

1) Show that the values of  $a$  and  $b$  are  $\frac{2}{3}$  and  $-10$  respectively (3)

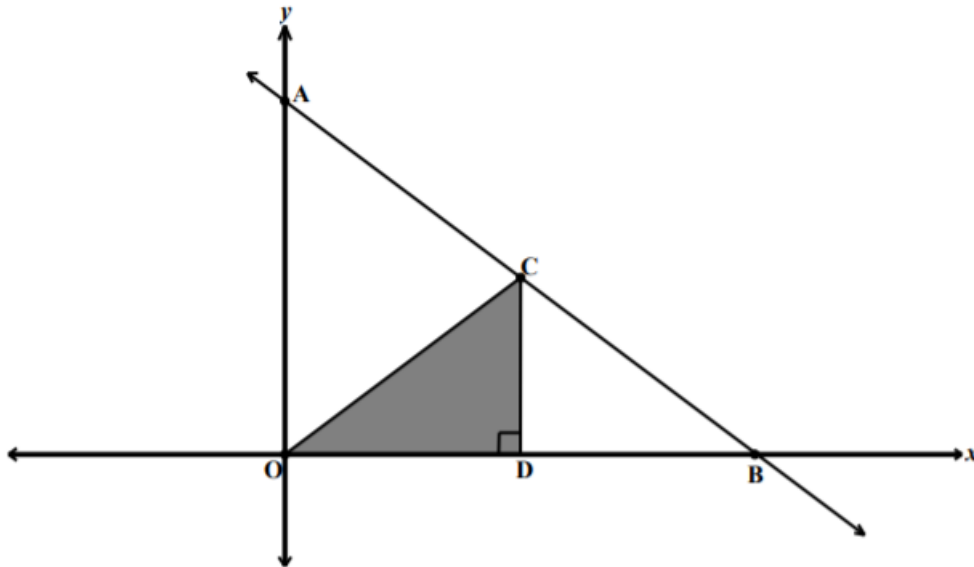


2) Determine co-ordinates of the point of inflection of the graph of  $f$ . (3)

3) If  $h(x) = f(x-3)$ , determine where the graph of  $h$  is decreasing. (4)

**QUESTION 11****[8 marks]**

In the diagram,  $C(x; y)$  is a variable point on the line segment  $AB$ , where  $A$  and  $B$  are the points  $(0; 7)$  and  $(15; 0)$  respectively.  $COD$  is a right angled triangle with  $D$  on the  $x$ -axis.



Determine the value of  $x$  for which  $COD$  will have a maximum area.

**QUESTION 12**

**[4 marks]**

A convergent geometric series is such that every term is twice the sum of all the terms that follow it. Determine the common ratio.