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TRIALS EXAMINATION 2021

MATHEMATICS PAPER 1

TIME: 3 HOURS

150 MARKS

EXAMINER: Mrs D Bolton

25th August 2021

Moderator: Mr Courau and Mr Raghunandan

Name: _____

Mathematics' teacher: _____

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

- This question paper consists of 10 questions and 20 pages (pages 17 to 20 are blank for you to use if necessary) and an information sheet is given.
- Read the questions carefully.
- **ALL** questions must be answered on the question paper.
- Diagrams are **NOT** necessarily drawn to scale.
- All answers must be given correct to **one decimal place** where necessary, unless stated otherwise.
- Approved calculators may be used, unless stated otherwise.
- All the necessary working details must be clearly shown.

	Section A				Section B							
Question	1	2	3	4	5	6	7	8	9	10	Total	%
	20	14	13	25	13	18	6	22	13	6	150	

Paper 1		
Paper 2		
TOTAL	/300	%

QUESTION 1

- a) Solve for x : [Where necessary solve for x in terms of p in the simplest form, show all working details]

1) $(2^x - 1)(2^x + 4)(2^x - 6) = 0$ (4)

2) $(x - 3)(x + 4) = p$ (3)

3) $\log_x(p - 4) = 2$ (2)

4) $\sqrt{5 - x} + 1 + x = 0$ (5)

b) Solve for x and y : **Downloaded from eduresourceza.com**

$$4 - 2y = x$$

$$2^{x(x-y)} = 4 \quad (6)$$

[20]

QUESTION 2

a) 1) Determine the derivative from first principles of $f(x) = -x + 3x^2$. (4)

2) Hence, determine the gradient of $f(x)$ at $x = 2$. (2)

b) 1) Determine: $D_x \left[\frac{2x+3}{x} - 3\sqrt[3]{x^2} \right], x \neq 0.$ (4)

2) Determine: $f'(-1)$ if $f(x) = \left(\frac{x-2}{x^3-8} \right)^{-1}$ (4)

[14]

QUESTION 3 [Correct answers to 3 decimal places where necessary.]

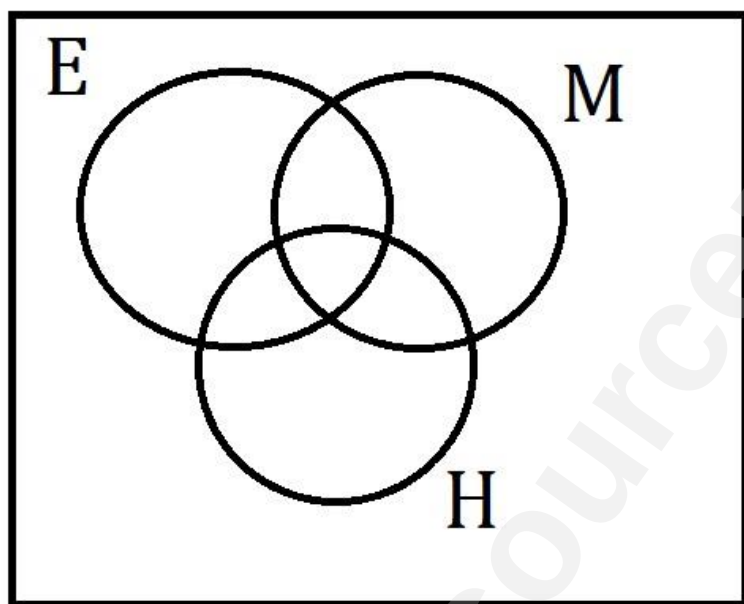
a) The probability that it will rain tomorrow is 0,25 and the probability of strong winds is 0,45. The probability of strong winds or rain is 0,65.

1) What is the probability of strong winds and rain? (2)

2) Are the events mutually exclusive? Give a reason for your answer. (2)

3) Are the events independent? Give a reason for your answer. (2)

- b) A group of 80 students were asked which of the 3 subjects – Mathematics, History and/ or Economics, they intend taking in Grade 10 in 2022.
- 21 Students will not be taking any of the 3 subjects
 - 6 Students will be taking all 3 subjects
 - 10 Students will be taking Mathematics and Economics
 - 11 Students will be taking Mathematics and History
 - Of the 21 students who are taking Economics, 10 students are taking Economics only.
 - 27 Students are taking History.
- 1) Complete the Venn diagram below to represent the above information. (4)

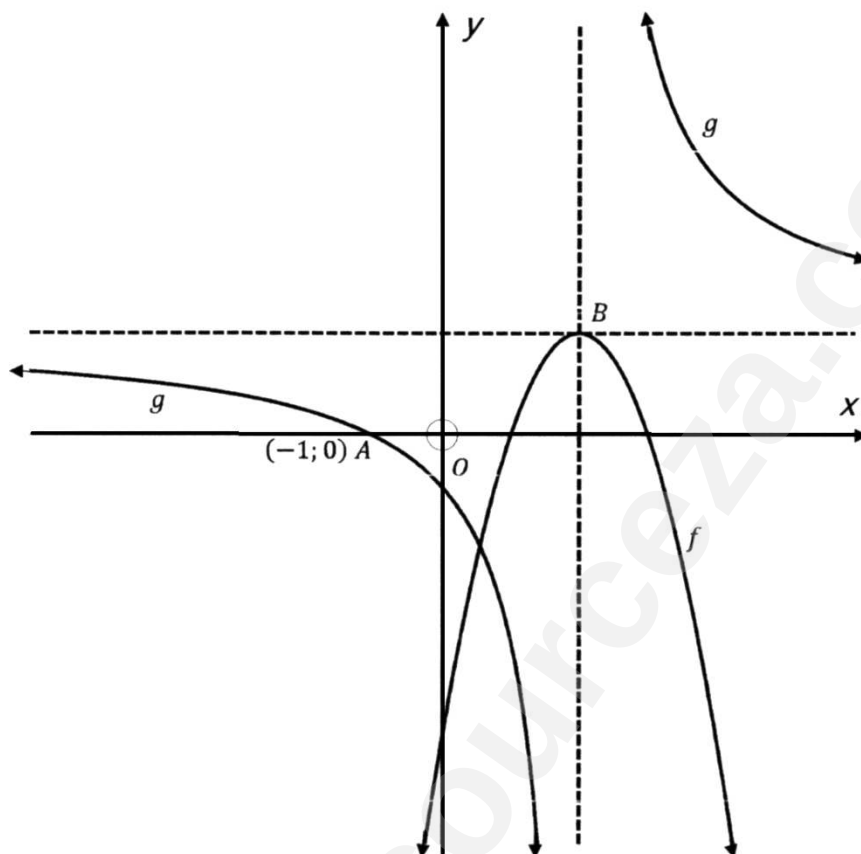


E = Economics
M = Mathematics
H = History

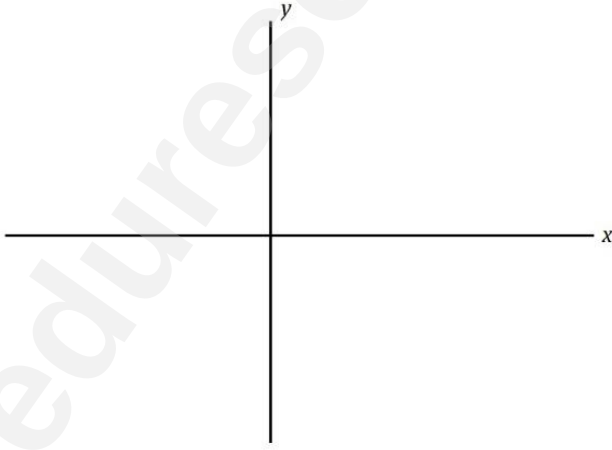
- 2) How many students will be taking Mathematics? (1)
- 3) What is the probability that a student, selected at random, is taking at least 2 of the 3 subjects in Grade 10. (2)

QUESTION 4

- a) The sketch below is a parabola f , with the equation $f(x) = -x^2 + 4x - 3$ and hyperbola g with equation $g(x) = \frac{3}{x+a} + p$.
B, the turning point of f , lies at the point of intersection of the asymptotes of g .
A(-1 ; 0) is the x-intersect of g .



- 1) Show that the co-ordinates of B are (2 ; 1). (2)
- 2) Write down the range of f . (1)
- 3) Determine the values of a and p . (2)

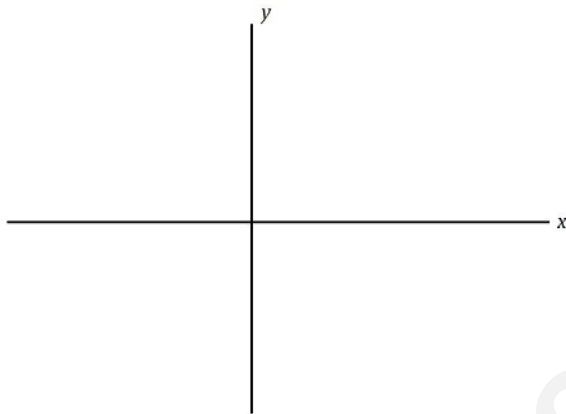
- 4) For which values of x will $g(x) \geq 0$. (2)
- 5) Determine the equation of the vertical asymptote of the graph of h if $h(x) = g(x + 4)$. (2)
- 6) For which values of x will $f(x) \cdot f'(x) \geq 0$. (4)
- 7) Draw a rough graph of $f^{-1}(x)$ on the axes below. Indicate the turning point and any intercepts with the axes. (4)
- 
- 8) How can we restrict the domain of $f(x)$ such that $f^{-1}(x)$ is a function? (2)

b) The function $f(x) = \left(\frac{1}{2}\right)^x + 1$ is given.

1) Write down the range of $f(x)$. (1)

2) Write down $f^{-1}(x) = \dots\dots\dots$ (2)

3) Sketch $f^{-1}(x)$. Show asymptote and x-intercept. (3)



[25]

SECTION B [78 marks]

QUESTION 5

a) Mrs Ndlovu invests R15 500 for exactly k years. She earns interest at a rate of 9% per annum, compounded quarterly. At the end of k years her investment is worth R33 400.

1) Calculate the effective annual rate of Mrs Ndlovu's investment. (2)

2) Determine the value of k . Show all working. Do not use the solve button on your calculator. (4)

- b) Khwezi is planning to buy her first home. The bank will allow her to use a maximum of **30%** of her monthly salary to repay the bond. She earns R18 480 per month. Suppose, at the end of each month, Khwezi repays the maximum amount allowed by the bank. The first payment is made one month after the loan is granted.

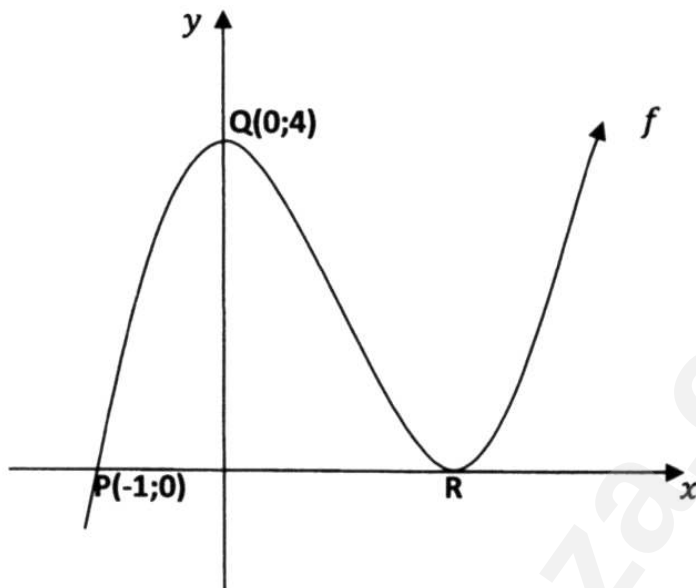
1) How much money does Khwezi borrow if she takes 25 years to repay the loan at a rate of 8%p.a. compounded monthly? (4)

2) Calculate the outstanding balance after 20 years of paying back the loan. (3)

[13]

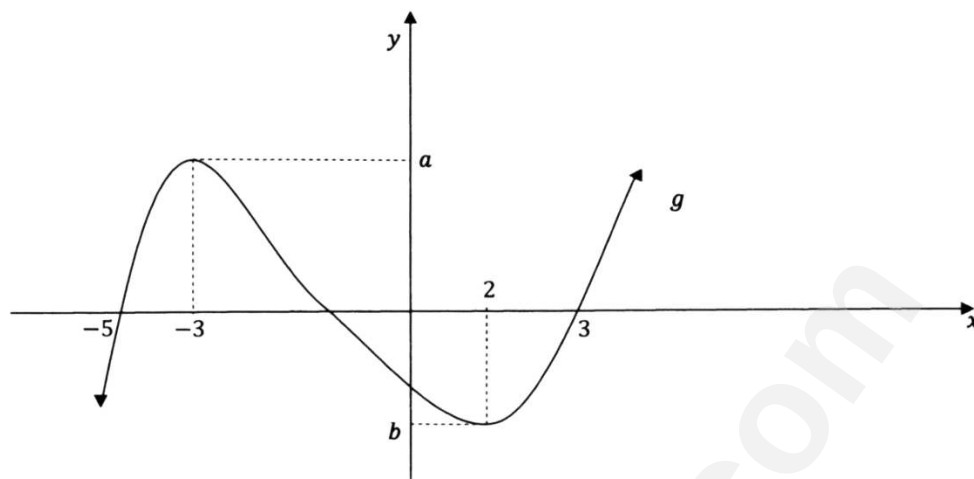
QUESTION 6

- a) The sketch below represents the curve of $f(x) = x^3 + ax^2 + bx + c$. $Q(0; 4)$ is a turning point and a local minimum occurs at R . Study the graph and then the questions that follow.

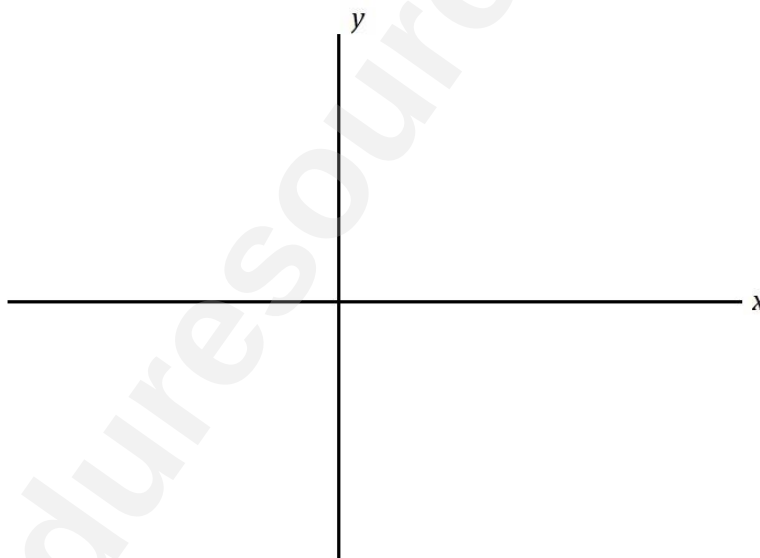


- 1) Write down the value of c . (1)
- 2) Hence, show that $a = -3$ and $b = 0$. (5)
- 3) If $f(x) - k = 0$ has only one real root, use your graph to find the values of k . (2)
- 4) If the equation f was changed to $y = (x + 3)^3 - 3(x + 3)^2 + 4$, what would the new co-ordinates of point Q be? (2)

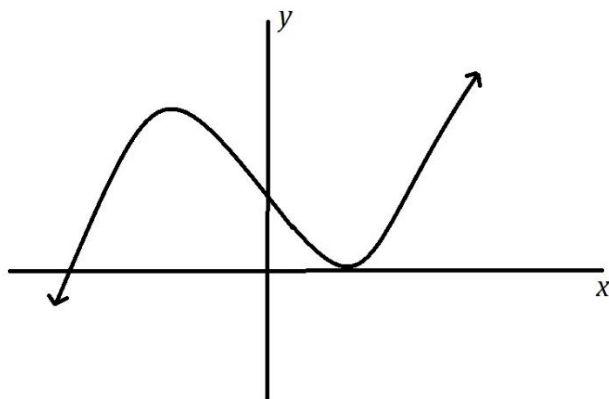
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- b) The graph of a cubic polynomial g is drawn below. Study the graph carefully and then answer the questions that follow.



- 1) For which values of x is $g'(x) > 0$? (2)
- 2) Draw a sketch graph of the derivative $g'(x)$ indicating the x-intercepts on the graph and the axis of symmetry. (3)



- c) The given figure shows the sketch of part of the curve where
 $f(x) = (2x - 5)^2(x + 3)$.



Given that:

- 1) the curve with the equation $y = f(x) + q, x \in R$, passes through the origin, find the value of the constant q . (2)
- 2) the curve with the equation $y = f(x + p), x \in R$, has a local minimum stationary point at the origin, find the value of the constant p . (1)

[18]

QUESTION 7

- a) Find the equation of the tangent to the curve $y = x - \frac{1}{x^2}$ at the point where the curve crosses the x-axis. (6)

[6]

QUESTION 8

- a) Determine the sum of the following series:

$$3 - 6 + 12 - \dots - 1536$$

(5)

- b) A quadratic pattern has a constant second difference of 5. The first two terms are equal. The sum of the first three terms is 14. Find the general term.

(5)

- c) The seventh, eighth and thirteenth terms of an arithmetic sequence are $3x - 1$; x and $-8x + 20$ respectively. Determine the numerical value of x .

(6)

d) Determine the value of x if. Downloaded from eduresourceza.com

(6)

$$\sum_{k=1}^{\infty} 9x^k = \sum_{t=1}^{14} (24 - 3t)$$

[22]

QUESTION 9

a) Given: $y = \log(-x^2 + 2x + 99)$:

1) Determine the values of x for which y is **defined**. Show all working. (5)

2) Showing all your workings, determine the maximum value of y . (4)

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b) Given that $p, q, r, \dots$ form a geometric sequence.

Show that $\log p, \log q, \log r, \dots$ form an arithmetic sequence. (4)

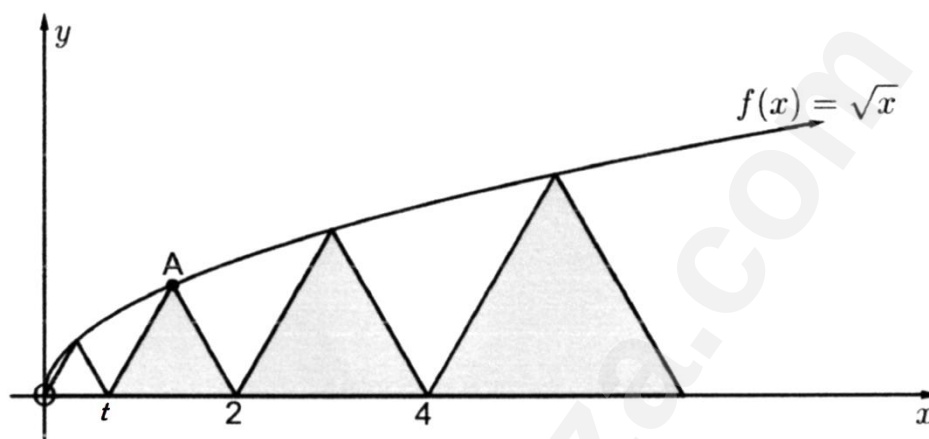
[13]

QUESTION 10

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The graph below shows the graph of the function $f(x) = \sqrt{x}$ and a sequence of points on the x-axis are $\{0, t, 2, 4\}$

The points are drawn such that a sequence of equilateral triangles result. The points on the x-axis form a quadratic sequence.



a) Determine the value of t . (3)

b) Hence, or otherwise, the co-ordinates of the point A. (3)

[6]

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