



eduresourceza.com



ST STITHIANS GIRLS' COLLEGE

Departments of Mathematics

GRADE 12	
PRELIMINARY EXAMINATION – PAPER 1	
DATE: September 2020	TIME: 3 hours
TOTAL MARKS: 150	
EXAMINER: Boys' College	MODERATOR: Girls' College

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. This question paper consists of 13 questions and 20 pages.
2. A separate information (formula) sheet will be provided to you.
3. Answer ALL the questions and clearly show the calculations you have used to determine your answers.
4. You may use an approved scientific calculator (non-programmable and non-graphical) unless specified otherwise.
5. If necessary, round off answers to TWO decimal places, unless stated otherwise.
6. Please note that diagrams are not drawn to scale.
7. It is in your own interest to write legibly and to present your work neatly.
8. PLEASE FILL IN YOUR NAME AND CIRCLE YOUR TEACHER'S NAME ON THE BACK PAGE.

Question 1:

(a) Solve for x , leaving answers in surd form where appropriate

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

(ii) $5x^2 + 1 = 5x$ (4)

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

(i) Give the domain of $f(x)$ (1)

(ii) If $g(x) = 2x - 1$, Solve for $f(x) = g(x)$, (5)

[12]

Question 2:

- (a) Solve for x , in the following inequality $2x^2 - 7x + 3 \leq 0$ (4)

- (b) For which value(s) of q , will the equation $3x^2 - 6qx + 3q^2 = 0$ have real roots? (3)

[7]

Question 3:

- (a) If Thato encountered someone who was positive for the corona virus, the probability they were wearing a mask is 82%. If they were wearing a mask, the probability that she would contract the virus is 8%. If they were not wearing a mask, the probability that she would not contract the virus is 27%. What is the probability that Thato will test positive for the virus? (Disclaimer: These probabilities have not been verified) (4)
-
-

- (b) For two events, A and B, in the Sample space S, it is given that:

$$P(A) = 0,55 \quad P(B) = 0,6 \quad P(A \text{ and } B) = 0,25$$

- (i) Draw a Venn Diagram to represent the information. (4)



Determine:

- (ii) $P(A \text{ and } B')$ (1)
-
-

(iii)

P(A and B)'

(1)

- (c) The table below summarises the results of all the driving tests taken in a certain town during the first week of January.

	Took test in the Morning	Took test in the Afternoon	Totals
Pass	43	32	75
Fail	15	8	23
Totals	58	40	98

A person is chosen at random from those who took their test during the first week of January.

- (i) Find the probability that the person took the test in the afternoon and failed. (2)

- (ii) The person chosen took the test in the morning. Find the probability that they passed the test. (2)

- (iii) Was the time of day the test was taken independent from outcome? (4)

[18]

Question 4:

- (a) The first three terms of a geometric sequence are 6 ; x ; 54 .

Determine the value(s) of x .

(3)

- (b) Evaluate, by showing all your working: $\sum_{k=4}^{179} (3k - 1)$.

(4)

- (c) The sum of the first n terms of a series is given by the formula $S_n = 3n^2 - 2n$.

Determine T_{10} the tenth term of this series.

(3)

[10]

Question 5:

(a) Given the series $(m-3) + (m-3)^2 + (m-3)^3 + \dots$

(i) For which value(s) of m will the series converge? (3)

(ii) If $m = \frac{5}{2}$ determine S_{∞} of the series. (2)

(b) Consider the sequence of numbers: 41 ; 43 ; 47 ; 53 ; 61 ; 71 ; 83 ;

(i) Determine a formula for T_n (4)

(ii) An interesting property of this sequence is that the first 40 terms are all prime numbers.

Calculate the 41st term and show that it is **not** a prime number (3)

[12]

Question 6:

(a) Given $f(x) = 1 - 3x^2$.

(i) Determine $f'(x)$ from first principles. (5)

(ii) Determine the equation of the tangent for $f(-2)$. (4)

(b) Evaluate the following derivatives:

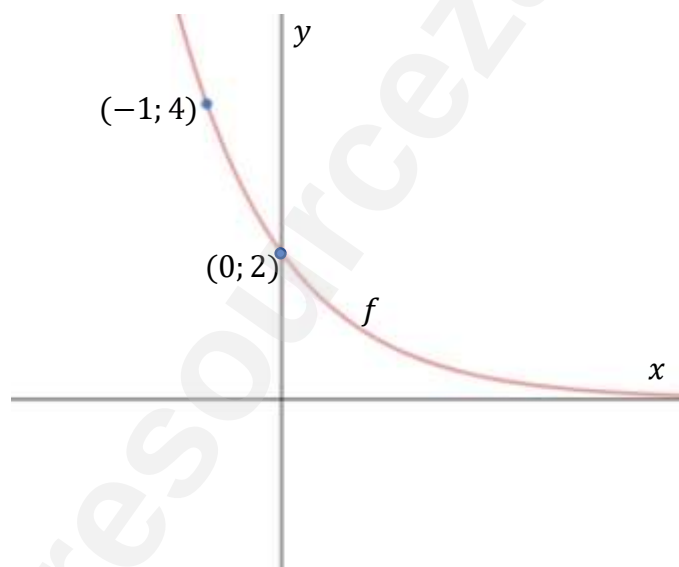
(i) $D_x \left[\left(1 - x^{\frac{1}{2}} \right) \left(1 - \frac{2}{x^{\frac{1}{2}}} \right) \right]$ (4)

(ii) $\frac{dy}{dx}$ if $y = \frac{x^2 - 1}{x + 1}$ (3)

[16]

Question 7:

Shown below the graph of $f(x) = a \cdot b^x$



(a) Show that $a = 2$ and $b = \frac{1}{2}$ (2)

- (b) What is the equation of $g(x)$, the reflection of $f(x)$ in the y -axis? (2)

- (c) What is the equation of $f^{-1}(x)$? (3)

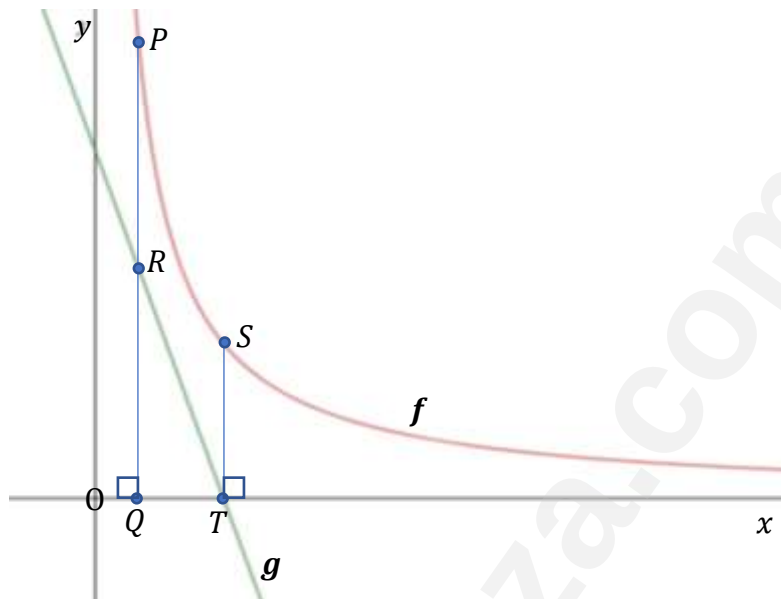
- (d) What is the domain of $f^{-1}(x)$? (2)

- (e) If $f(x)$ and $f^{-1}(x)$ intersect at point $(1; 1)$,
Determine the value(s) of x for which $f(x) \leq f^{-1}(x)$? (2)

[11]

Question 8:

Shown below the graphs of $f(x) = \frac{12}{x}$ for all $x \geq 0$ and $g(x) = -3x + 9$



- (a) Determine the co-ordinates of S. (2)

- (b) Write down the axis of symmetry for $f(x)$. (1)

- (c) The following three scenarios require you to visualise specific situations in order to answer the questions. So read the unique scenarios carefully before answering.

- (i) If $OQ = 1,5$ units determine the length of PR . (3)

- (ii) If $PR = 6$ units determine possible length(s) of OQ .

(4)

- (iii) If Q is a variable point on the x-axis for all $x \geq 0$,
determine the minimum distance of PR .

(5)

[15]

Question 9:

You take out a home loan of R1,2 million in order to purchase an apartment. You have to pay off the loan over a period of 20 years at 8% *p.a* compounded monthly.

- (a) Determine the size of the monthly instalments if the first payment is made one month after you take out the loan. (4)

- (b) Determine the outstanding balance on the loan after 12 years. (4)

- (c) After a period of 12 years you inherit R50000 and decide to pay it into your bond. Determine the size of your new monthly instalment assuming that you will continue to pay off your loan for a further 5 years at the same rate of interest. (5)

- (d) How much money will you have saved by making the deposit of R50000 after 12 years and restructuring the loan? (4)

[17]

Question 10:Solve for x :

(a) $3^{4x} - 27 \cdot 3^x = 0$ (5)

(b) By completing the square and leaving your answers in terms of b
 $2x^2 + 5x - 2b = 3$ (4)

[9]

Question 11:

Airlines have various restrictions on the size of bags that can be taken into the cabin of a plane. Some require that the largest rectangular box shape has sum of the length, breath and height equal to 115 cm with length 55 cm.

Determine the maximum volume of the bag you can take on the plane that satisfies these criteria.

[illegible]

[6]

Question 12:

Given $f(x) = ax^3 + bx^2 + cx$ with $f'\left(\frac{-3}{2}\right) = f'(5) = 0$ and $f(x)$ increasing for $\frac{-3}{2} < x < 5$

- (a) Use this information to draw a rough sketch of $y = f(x)$ (5)

- (b) Determine the value(s) of x for which:

- (i) $f'(x) < 0$ (2)

- (ii) $f(x)$ is concave upwards (3)

[10]

Question 13:

Projectiles, like cannon balls, travel through the air along the path of a parabola, as shown in the sketch below. The information in the sketch can be modelled as follows:

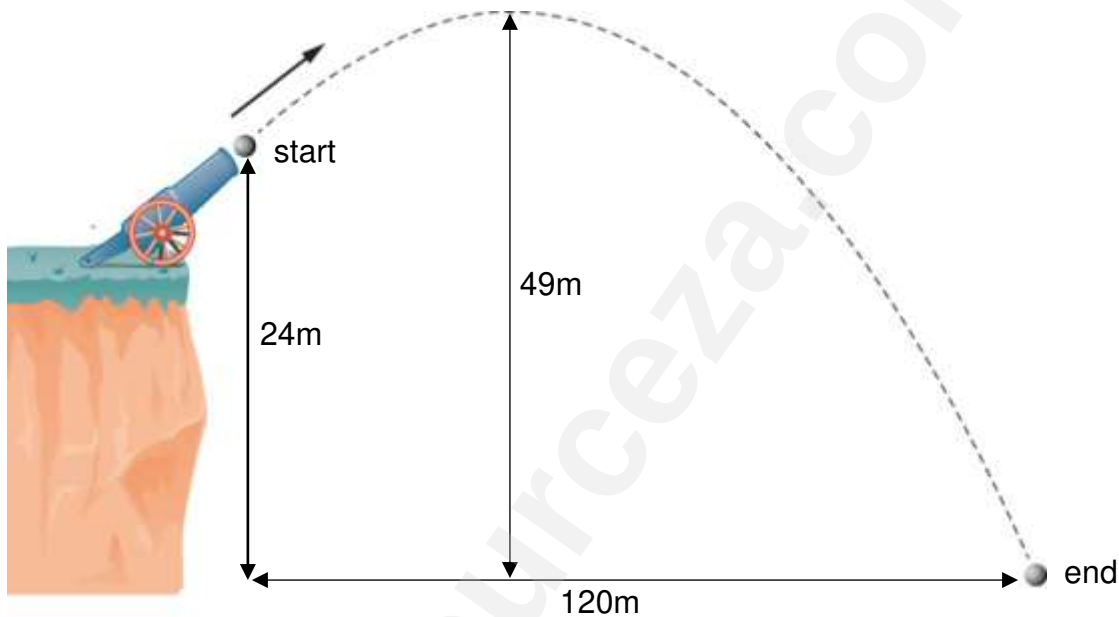
A cannon is placed on the edge of a small vertical cliff, 24 metres above the ground.

Let the point where the cannon ball leaves the cannon be point (0;0). The cannon ball will reach a highest point 49 metres above the ground. When it lands it is 120m away from the foot of the cliff.

Find an equation that will match the path of the cannon ball in the form:

$$y = ax^2 + bx + c$$

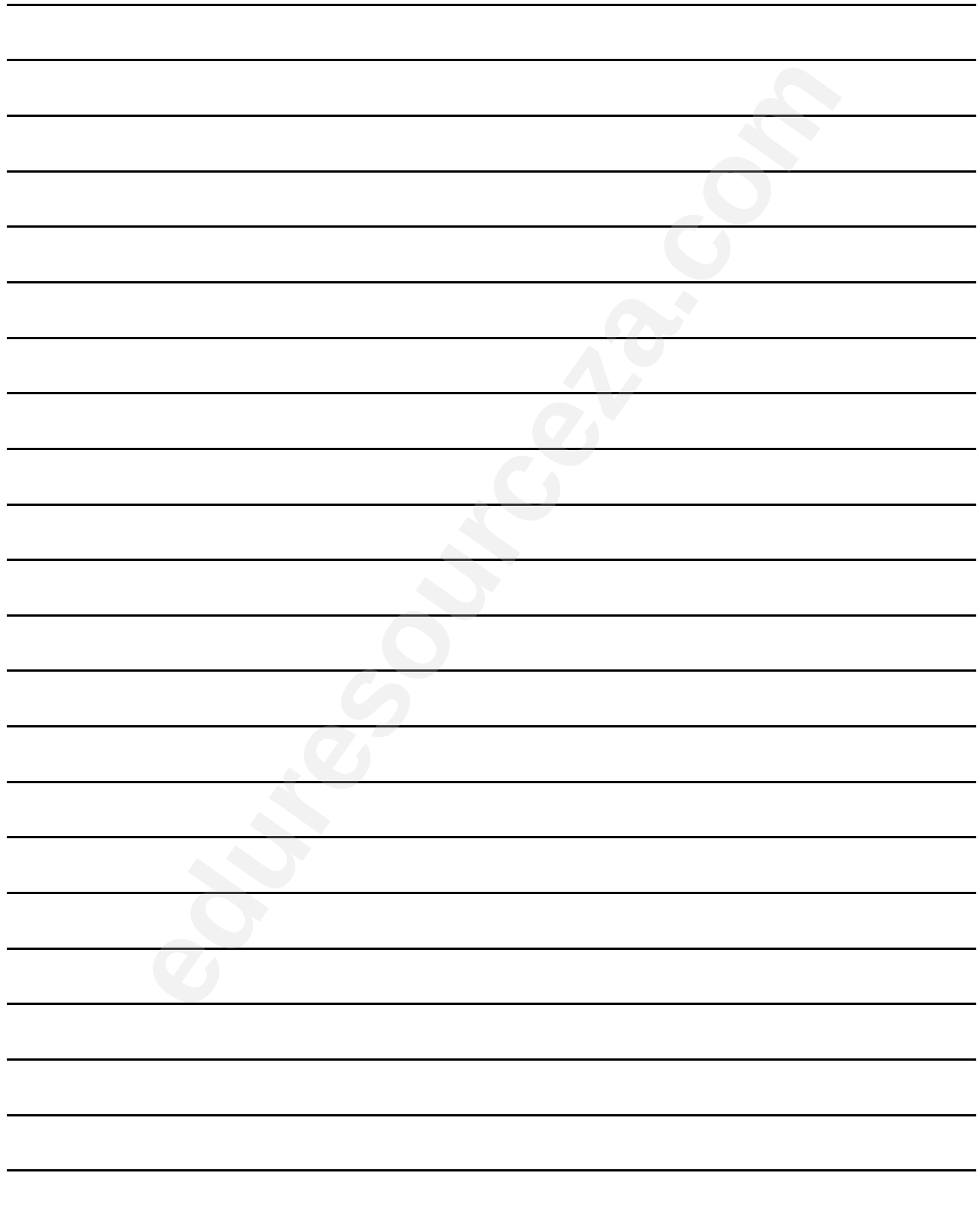
(7)



END OF PAPER 1

[7]

ADDITIONAL LINED SPACE FOR EXTRA WORKING.
LABEL YOUR QUESTIONS CLEARLY



FOR OFFICIAL USE ONLY

MARK RECORD SHEET**Full Name:** _____**Teacher (mark with a x):**☐

Mrs Marais

☐

Mr Nonyane

☐

Mr Schaerer

☐

Mrs Smith

Question	Algebra	Patterns	Finance	Functions	Calculus	Probability
1	/ 12					
2	/ 7					
3						/ 18
4		/ 10				
5		/ 12				
6					/ 16	
7				/ 11		
8				/ 15		
9			/ 17			
10	/ 9					
11					/ 6	
12				/ 7	/ 10	
13				/ 7		
TOTAL	/ 28	/ 22	/ 17	/ 33	/ 32	/ 18
TOTAL	/ 150					%