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ST ANNE'S DIOCESAN COLLEGE
TRIALS EXAMINATION – 2023
GRADE 12

MATHEMATICS – PAPER 1

Time: 3 hours

Exam no. _____

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 24 pages. Please check that your question paper is complete.
2. Read the questions carefully.
3. Answer all the questions.
4. You may use an approved non-programmable and non-graphical calculator unless otherwise stated. Ensure your calculator is in **DEGREE** mode.
5. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
6. Diagrams are not necessarily drawn to scale.
7. If necessary, round off answers to **ONE** decimal place, unless otherwise stated.
8. It is in your own interest to write legibly and to present your work neatly.
9. Two blank pages (pages 23 and 24) are included at the end of the paper.
If you run out of space for a question, use these pages.
Clearly indicate the question number of your answer should you use this extra space.

For official use only.

	Equations	Calculus	Number patterns	Functions	Financial Maths	Sequences	Probability	Functions	Calculus	Functions
Question	1	2	3	4	5	6	7	8	9	10
Mark										
Total	28	12	14	21	16	12	15	8	20	4
Total										
									150	
Percentage										
									100	

SECTION A
QUESTION 1(a) Given $x^2 = 4x$ 1. Solve for x .

(3)

2. Hence, or otherwise determine the value(s) of y if $(y^2 + 3)^2 - 4(y^2 + 3) = 0$.

(3)

(b) Solve for x :1. $-2x^2 - 3x + 1 = 0$ (correct to TWO decimal places)

(3)

2. $(x + 5)(x - 4) < 10$

(4)

$$2^{x+y} = 8 \quad \text{and} \quad x^2 + y^2 = 5$$
[illegible]

(d) It is given that $\log_p 2 = \frac{1}{a}$; $\log_p 5 = \frac{1}{b}$ and $\log_p 10 = \frac{1}{c}$.

1. Write $\log_p 10$ in terms of $\log_p 2$ and $\log_p 5$.

(1)

2. Hence, or otherwise, prove that $c = \frac{ab}{a+b}$.

(3)

[28]

(4)

(4)

1. $f(x) = \frac{x+x^2}{x}$

(2)

(2)

2. $y = 2\sqrt{x} - \frac{x}{2}$

(3)

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

(3)

[12]

- (3)

- (2)

- [illegible]

3. Write down the coordinates of the turning point.

[14]

QUESTION 4

(a) The graph of $f(x) = a\left(\frac{1}{3}\right)^x + 7$ passes through the point $(-2; 10)$.

1. Calculate the value of a .

(2)

2. Consider: $g(x) = \left(\frac{1}{3}\right)^x$

(a) Determine the equation of h , the inverse of g , in the form $h(x) = \dots$

(2)

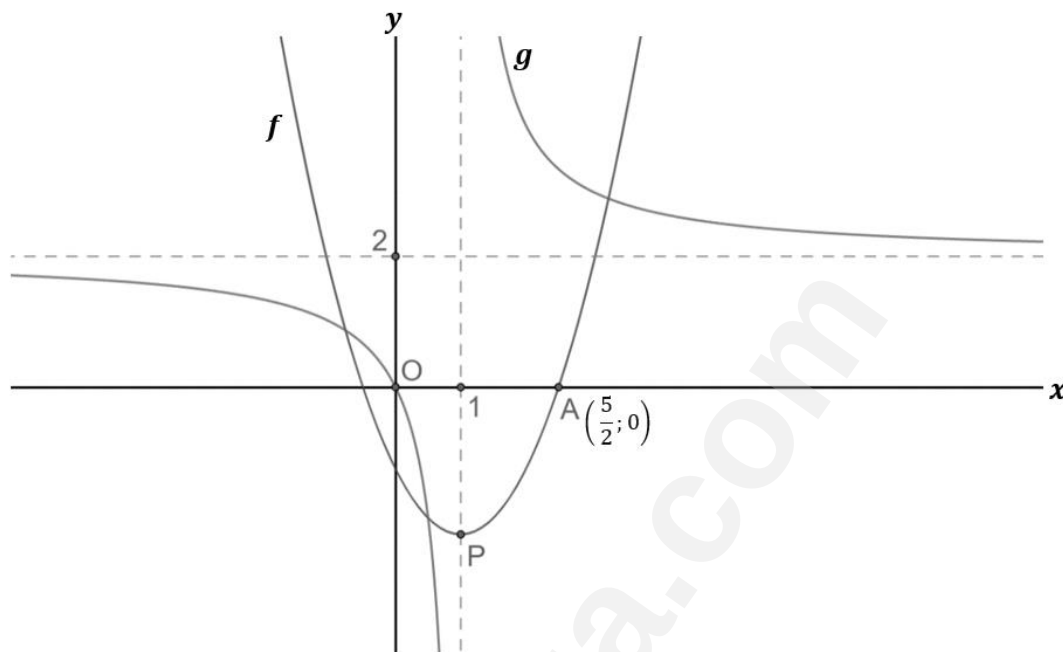
(b) Draw a rough sketch of $h(x)$ in the space below.
Show any intercept with the axes and at least one other point.

(3)

(c) Describe the translation from f to g .

(3)

(b) The graphs of a parabola, f , and a hyperbola, g , are drawn in the sketch below.



It is given that g passes through the origin and has a vertical asymptote passing through $(1; 0)$ and a horizontal asymptote passing through $(0; 2)$.

P is the turning point of f and lies on the vertical asymptote of g . The point $A(\frac{5}{2}; 0)$ is a point on f .

1. Determine the equation of g , the hyperbola, if $g(x) = \frac{2}{x+m} + n$.

_____ (2)

2. If $f(x) = (x + p)^2 + q$ determine the values of p and q .

_____ (3)

3. Write down the equation of s , if $s(x)$ is the reflection of g about the x –axis.

(2)

4. Write down the vertical asymptote of t , if $t(x) = g(x - 2)$.

(1)

5. Determine the equation of the axis of symmetry of g in the form $y = mx + c$, if $m > 0$.

(2)

6. The graph of $p(x) = x + k$ is given. For which value(s) of k will the equation $g(x) = p(x)$ have two real roots of opposite sign?

(1)

[21]

- (b) Thandeka plans to buy a car that costs R300 000. She will pay a cash deposit of 10% and take out a loan for the balance.
The interest on the loan is 13% p.a. compounded monthly.

1. Calculate the value of the loan.

(2)

2. The first repayment is paid 6 months after the loan has been granted.
The loan will be repaid over a period of 5 years.
Calculate the monthly instalments.

(4)

[16]

QUESTION 6

(a) The first **24** terms of an arithmetic series is given: $48 + 56 + 64 + \cdots + 232$.

1. Calculate the sum of this series.

(2)

2. Calculate the sum of all natural numbers from 48 to 232.

resources

(3)

3. Hence, calculate the sum of all natural numbers from 48 to 232 that are NOT divisible by 8.

[illegible]

(5)

(5)
[12]

QUESTION 7

- (a) A group of teenagers took part in a trial to test a new headache tablet.

Half the group received the headache pill and the other half received a sugar pill.

Of the group receiving the headache tablet, $\frac{7}{10}$ were cured.

Of the group receiving the sugar pill $\frac{2}{5}$ were cured.

1. Represent the given information in a tree diagram. Indicate on your diagram the probability of each branch.

(3)

2. Determine the probability, as a percentage, that a person chosen at random from the group will NOT be cured.

(3)

(b) Events A and B are mutually exclusive events.

$$P(A) = x$$

$$P(B) = 2P(A)$$

$$P(A \text{ or } B) = 0,72$$

1. Calculate the value of $P(A)$ to two decimal places.

(2)

2. Are $P(A)$ and $P(B)$ complementary? Justify your answer.

(2)

(c) Events C and D are independent such that $P(C) = y$, $P(D) = y + 0,2$ and $P(C \cap D) = 0,15$.

1. Determine the possible numerical value(s) of y .

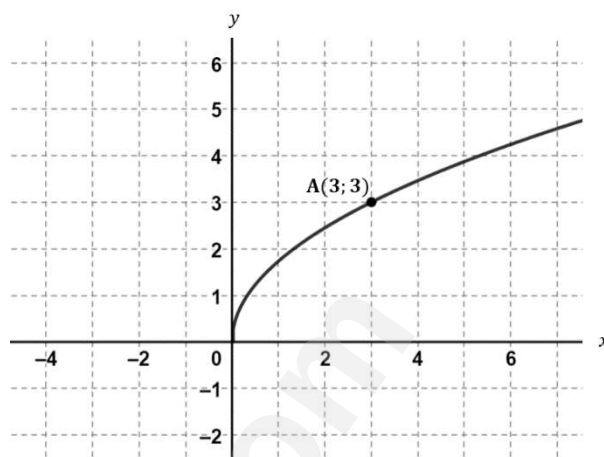
(3)

2. Hence determine the numerical value of $P(C \cup D)$ to two decimal places.

(2)
[15]

QUESTION 8

- (a) The graph of $f(x) = \sqrt{3x}$; $x \geq 0$ is drawn.
 f passes through the point A(3; 3).



1. Determine the equation of f^{-1} , the inverse of f , in the form $y = \dots$.

(3)

2. For which values of x is $f(x) > f^{-1}(x)$?

(1)

- (b) The exponential graph, $g(x) = b^x + q$ has the following properties:

- Range: $y > -4$
- Increasing for $x \in \mathbb{R}$
- Passes through the point (1; -1)

Determine the y -intercept of g .

(4)

[8]

QUESTION 9

(a) The graph of the cubic function f has the following properties:

$$f'(-1) = 0, \quad f'(2) = 0$$

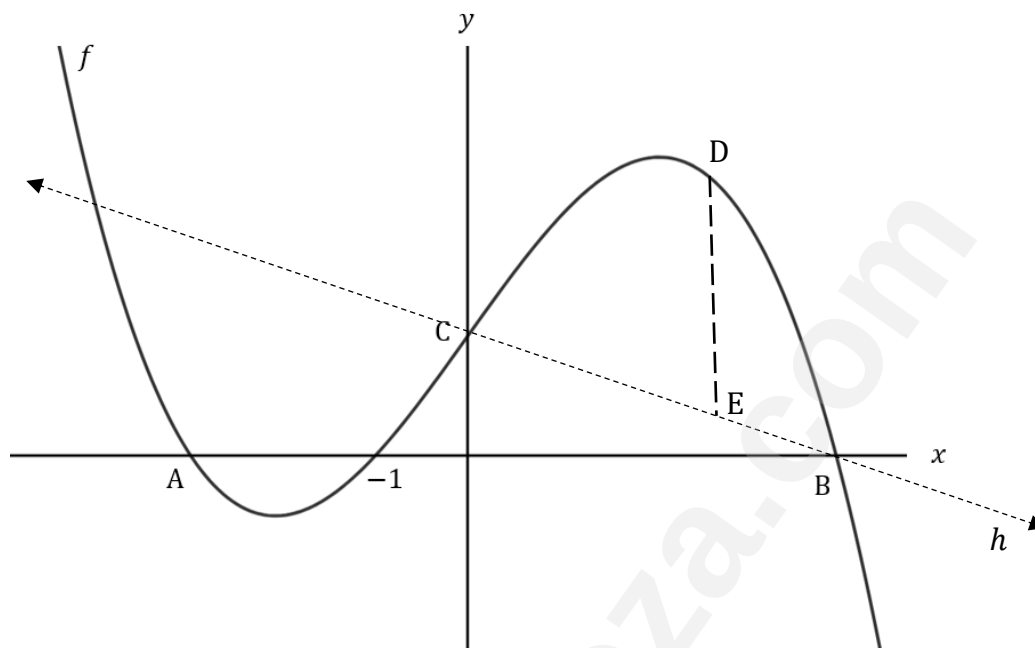
$$f'(x) > 0 \text{ for } x < -1 \text{ and } x > 2$$

$$f'(x) < 0 \text{ for } -1 < x < 2$$

The y - intercept is positive and $f(x)$ has one root.

Draw a possible sketch graph of f using this information.

(4)



1. Calculate the coordinates of A and B, showing all necessary working.

(5)

(5)

2. Calculate the value(s) of x for which the tangent to f is parallel to the line $y = -14x + c$.

(3)

3. Determine the point of inflection of g if it is given that $g(x)$ is a reflection of f about the x -axis.

(4)

4. The equation of the straight line joining BC is $h(x) = -3x + 12$. DE is a vertical line. Determine the value of x for which DE is a maximum length, and $x \geq 0$. Leave your answer in simplified surd form.

(4)

[20]

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