

Domino Servite School



Accreditation Number 13SCH0100008 Registration Number 122581

Mathematics Paper I

Grade 12

2017 Trial Examination

Time: 3 hours

Examiner: H Pretorius

Total: 150

Moderators: B Hlongwane
J Bebb

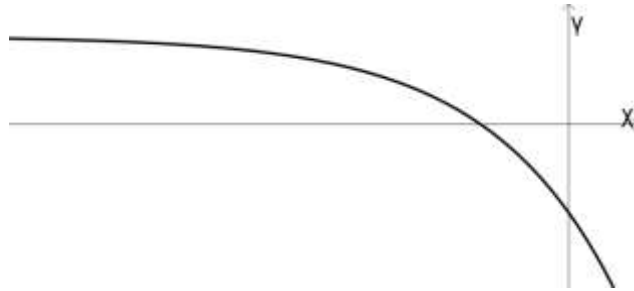
Instructions

1. This question paper consists of **12** questions and **11** pages. Please ensure that your question paper is complete.
2. You may answer the questions in any order, but the following must be adhered to:
 - a) Each answer must be numbered exactly the same as the question.
 - b) You may not separate sub-sections of a question. You have enough paper so leave space open if you do not know how to answer one or more of the sub-sections of a question.
3. Unless otherwise required, round off your final answers to one decimal place.
4. Write in black or blue pen. You may use pencil only for sketches. Any other work done in pencil will be considered rough work and will be marked as such.
5. Follow instructions precisely. Marks can be lost if instructions are not followed.
6. You have been provided with a booklet in which you must write your answers. Only ask for extra paper once you have filled the booklet.

Question 1

All the questions below are multiple choice. Choose the correct answer and write down only the letter of your choice.

- a) The graph of $y = a(2^x) + b$ is shown. Choose the correct descriptions of a and b .



A $0 < a < 1$ and $b < 0$

B $a > 0$ and $-1 < b < 0$

C $a < 0$ and $b < 0$

D $a < 0$ and $b > 0$

(2)

- b) The graph of a polynomial, $f(x)$, is shown, with turning points at $x = -1$ and $x = 2$.

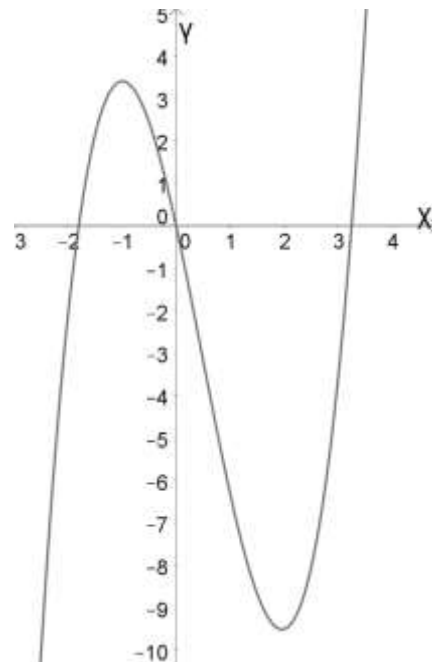
Which statement about $f'(x)$ is **true**?

A $f'(0) = 0$

B $f'(-1) > f'(-2)$

C $f'(2) < 0$

D $(x - 2)$ is a factor of $f'(x)$



(2)

c) Given the expression $\sqrt{-2x^2 + 16x - 24}$, which statement is true?

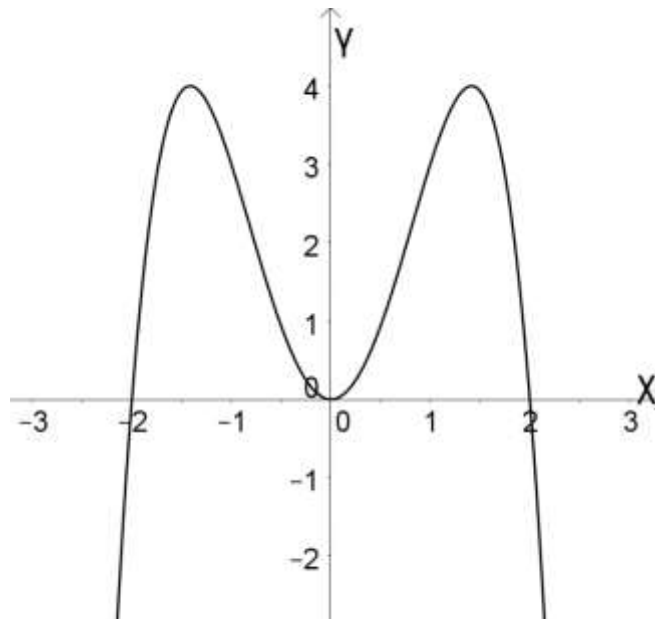
A The expression has a minimum value of 4.

B The expression has a minimum value of $\sqrt{2}$.

C The expression has a maximum value of $2\sqrt{2}$.

D The expression has a maximum value of 2. (2)

d) The graph of $f(x)$ is shown. For how many values of k will $f'(k) = 0$?



A 0 B 1 C 2 D 3 (1)

e) Find the value of ab if $3^a = 2$ and $4^b = 81$.

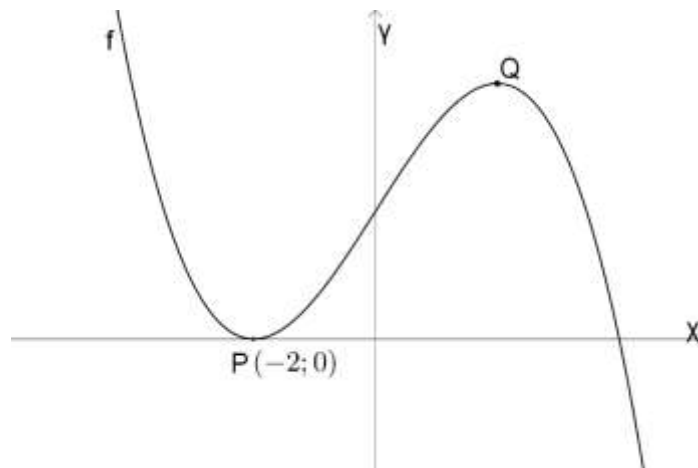
A $\frac{1}{2}$ B 1 C 2 D 2,05 (2)

[9]

Question 2

- a) A graph is translated 2 units to the left and reflected in the x -axis. If the resulting graph has the equation $y = \frac{-4}{x+1}$, find the equation of the graph before these transformations. (2)
- b) A parabola has its turning point at $(-4; 2)$, with its axis of symmetry parallel to the y -axis.
- (1) Find the value of p if the two points $(-7; 5)$ and $(p; 5)$ lie on the graph. (3)
- (2) Find the equation of the graph. (4)
- c) The graph, which is not drawn to scale, represents the function f , where $f(x) = ax^3 + bx + 8$.

$P(-2; 0)$ and Q are turning points.



- (1) Prove that $a = -\frac{1}{2}$ and $b = 6$. (5)
- (2) Determine the coordinates of Q . (5)
- (3) Use the graph to write down the value(s) of t for which the equation

$$-\frac{1}{2}x^3 + 6x + t = 0$$

will have only one real root. (2)

[21]

Question 3

a) The third term of a geometric progression is 8 and the eighth term is $\frac{1}{4}$. Calculate:

(1) the common ratio; (3)

(2) the sum of the first eight terms. (3)

b) Find the value of p if

$$\sum_{n=1}^p 2n = 420$$

(5)

c) Find T_9 if

$$\sum_{n=1}^k T_n = 3k^2 - 1$$

(3)

[14]

Question 4

a) At present there are 3 200 plants of a certain species in a certain area. A variety of factors cause the population to decrease by 13% every year. It is estimated that, if the population drops to below 50, it will not be possible to save the species. After how many years will this happen? Give your answer as a full year. (4)

b) Two brothers are born in January of different years. In the January when the boys turn 4 and 10, their father invests R22 000 at 6% compounded monthly. When each son turns 21, they receive R12 000 from the investment.

(1) How much will be left in the account immediately after the second son receives his money? (4)

(2) If the father wants to ensure that his sons receive an equivalent amount of money, he should take inflation into account. If inflation is calculated at 6,5% p.a., what should the father give the younger brother so that his money would have the same buying power as that of the oldest brother? (2)

- c) A local business man needs to buy 7 industrial knitting machines for his business. The cost of a single machine, manufactured in Europe, is € 13 550,00. The current exchange is R16,50 = €1.00.

The man will have to take out a loan to finance this project.

- (1) Calculate the rand amount required to purchase all 7 machines. (2)
- (2) The bank agrees to give him the loan he requires at an effective rate of 11,8% per annum over a period of six years. However, he would like to repay the loan through equal quarterly payments starting in three months' time. Show that an effective annual rate of 11,8% per annum is converted to a nominal rate of 11,3% per annum compounded quarterly. (2)
- (3) Calculate his quarterly payments to the bank over the period of six years. (3)

[17]

Question 5

- a) Five books are placed on a shelf.



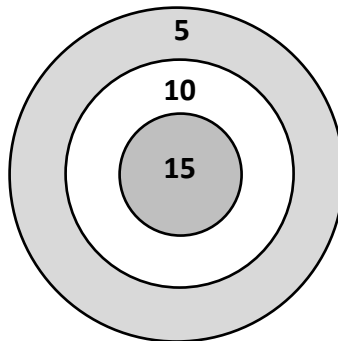
- (1) In how many ways can these books be arranged? (1)
- (2) Two of the books were published before 1920 and have ribbed backings. In how many ways can these five books be placed on the shelf if these two books must be placed next to each other? (2)

- b) A player draws three cards from a standard deck of 52 playing cards. In order to win, the third card must be any number between the first and second cards. If the player draws a 3 and then a 7, what is the probability that he will win the round?



(3)

- c) Some children are playing a game where a dart is thrown at a board with regions as shown. The outcomes of each throw are all independent of each other.



The probabilities of scoring in the different regions are indicated in the table:

15	10	5	0 (miss)
x	0,15	0,3	0,45

- (1) What is the value of x ? (1)
- (2) Two darts are thrown and the scores are added. What is the probability of a total score of 15? (3)
- d) A password consists of 7 characters. The first character must be any consonant. The second letter is a vowel. The next four characters form a four-digit number which must not start with 0 but digits can repeat. The last character is a vowel which must be different from the first vowel. For example:

P E 7 0 4 4 U

How many different passwords are possible?

(4)
[14]

Question 6

a) Determine $f'(x)$ from first principles if $f(x) = \frac{1}{2}x^2$. (5)

b) Determine $\frac{dy}{dx}$ given that:

(1) $y = 4(x - 4)^2$ (3)

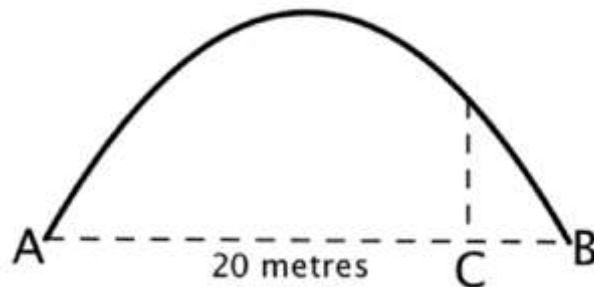
(2) $y = \frac{2x^3 - 16}{x^2 + 2x + 4}$ (4)

c) Find $f'(9)$ if $f(x) = \frac{3}{2\sqrt{x}}$. (5)

[17]

Question 7

- a) A parabolic bridge spans a distance of 20 m across its base AB, and is 10 m above the ground at its highest point. From a 6 metre high point on the bridge arch, a rope hangs vertically, touching the ground at point C. Find the distance from C to B.



(7)

- b) One of the x -intercepts of the graph of a quadratic $y = f(x)$ is $(-6; 0)$. The maximum value of the function is given by $f(p)$. Find the other x -intercept of the graph, in terms of p . (3)

c) Solve for x if $3x^2 < -6x$. (4)

[14]

Question 8

Find the sum of b and c if the equation $x^3 + bx = c$ has solutions $x = 3$ and $x = -1$. [6]

Question 9

a) The line $y = -5x + p$ is a tangent to the graph of $f(x) = kx^3 + x$ at the point where $x = 1$. Find the value of p . (7)

b) In the following table the values of the derivative of a function f are given for different values of x .

x	-4	-3	-2	-1	0	1	2	3	4
$f'(x)$	16	9	4	1	0	1	4	9	16

Sketch a rough graph of f for $-4 \leq x \leq 4$, if it is also given that $f(0) = 1$. (3)

c) A farmer has 80 metres fencing material and he wants to use it to construct a rectangular paddock next to an existing fence. The existing fence will form one side of the paddock. An opening of 2 metres must be left for a gate. What should the dimensions of the paddock be, so that it has the largest possible surface area? (6)

[16]

Question 10

a) Evaluate:

$$\sum_{x=6}^{35} \log \frac{x+1}{x}$$

(4)

b) Solve for x if $199 + 195 + 191 + \dots + 7 + 3 = x + 1 + 5 + \dots + 189 + 193 + 197$. (5)

[9]

Question 11

The sum of an infinite, converging geometrical series is 24. The sum to infinity of the even numbered terms of the same series is 6. Determine the values of the first three terms. [7]

Question 12

A cinema owner noticed that by raising the temperature inside his cinema he could increase the sales of ice cream during the interval. With an audience of 100, the owner made a profit of $\left(200 - \frac{625}{T}\right)$ rands on ice cream sales when the temperature was T degrees Celsius. At the same time he had to pay out $(20 + T)$ rands for heating. Calculate the temperature that leads to the maximum overall profit. [6]