



eduresourceza.com

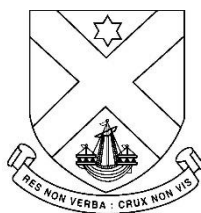
St Anne's Diocesan College

TRIAL EXAMINATION

CORE MATHEMATICS: PAPER I

Form 6

Time: 3 hours



August 2016

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Highlight your teacher's name.

MORGAN	THOMPSON	VD MERWE
--------	----------	----------

2. Fill in your exam number.

--

3. This question paper consists of 8 pages and a double-sided formula sheet.
Please check that your paper is complete.
4. Read the questions carefully.
5. Answer all the questions.
6. Number your answers exactly as the questions are numbered.
7. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
8. Round off your answers to **one decimal digit** where necessary.
9. All the necessary working details must be clearly shown.
10. It is in your best interest to write legibly and to present your work neatly.

FOR OFFICIAL USE ONLY

Question	1	2	3	4	5	6	7	8	9	10	11	Total
Topic	Algebra	Functions	Finance	Calculus	Seq & Series	Functions	Calculus	Finance	Seq & Series	Calculus	General	
Max Mark	17	16	9	14	16	8	22	12	16	16	4	150
Your Mark												

SECTION A

QUESTION 1

(a) Solve for x :

(1) $x - 4x^3 = 0$ (3)

(2) $8^{2x+3} = \frac{1}{2}$ (3)

(3) $2 + \sqrt{5x-4} = x$ (4)

(b) The equation $(k+3)x^2 + 6x + k = 5$, where k is a constant, has 2 distinct (unequal) real solutions for x .

(1) Show that k satisfies $k^2 - 2k - 24 < 0$ (4)

(2) Hence, find the possible value(s) of k . (3)

[17]

QUESTION 2

(a) Given the equation: $f(x) = \frac{2}{x-5} - 1$

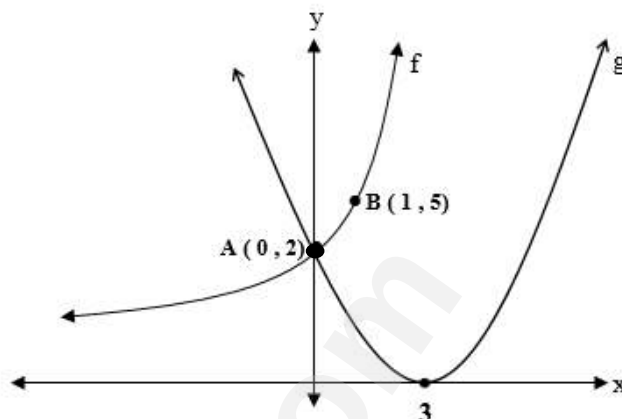
(1) Write down the equations of the asymptotes of f . (2)

(2) Write down the equation of the new graph, $g(x)$, if f is shifted 2 units left and 4 units up. (2)

(3) Describe the transformation which has taken place if the image of f is now

$h(x) = -\frac{2}{x+5} - 1$. (2)

- (b) The sketch below represents the graphs of the functions $f(x) = k^x + q$ and $g(x) = ax^2 + bx + c$.
 $B(1; 5)$ is a point on f .
 $A(0; 2)$ lies on both f and g .



- (1) Determine the value of q and show that the value of $k = 4$. (3)
- (2) Determine the value of a . (3)
- (3) Explain why the inverse of g is not a function? (1)
- (4) Write down ONE way in which the domain of g could be restricted in order that g^{-1} is a function. (1)
- (5) Hence, write down the domain and range of g^{-1} , using your answer from (4) above. (2)

[16]**QUESTION 3**

- (a) Thandi decides to invest R45 000 into a savings account. She is charged $x\%$ interest per annum compounded six-monthly. After 5 years the investment matures and she receives R 66 611. Calculate the interest rate. (3)
- (b) Convert 9,5% interest per annum compounded quarterly into an effective interest rate. (2)
- (c) Neya wants to raise R 80 000 by making equal monthly payments into a savings annuity that pays 12% p.a. compounded monthly. She is able to pay R 2 000 at the end of each month and checks her balance immediately after making each payment. How many payments must she make before reaching her target? (4)

[9]

QUESTION 4

- (a) Given $f(x) = 4x - x^2$.
- (1) Determine $f'(x)$ using first principles. (4)
 - (2) For which value(s) of x is the graph of $f(x)$ decreasing? (3)
- (b) Differentiate with respect to x :
- (1) $(3x - 2)^2$ (3)
 - (2) $\frac{x^2 + \sqrt{x}}{x}$, leave your answer in positive exponents where necessary. (4)
- [14]**

QUESTION 5

- (a) Given the sequence: $2 ; 12 ; x ; y ; \dots$
Determine the possible value of x and y if the sequence is:
- (1) Arithmetic (1)
 - (2) Geometric (1)
 - (3) Quadratic; if the second difference is 2. (2)
- (b) In the year 2000, an IT store sold 1500 computers. Each year the shop sold 100 more computers than the previous year, so that the shop sold 1600 computers in 2001, 1700 computers in 2002, and so on forming an arithmetic sequence.
- (1) Determine T_n . (2)
 - (2) Show that the shop sold 2200 computers in 2007. (2)
 - (3) Using a suitable formula, calculate the total number of computers sold by the shop from the beginning of 2000 until the end of 2013. (3)
 - (4) In the year 2000, in the same IT store, the selling price of each computer was R 9 000. The selling price fell by R200 each year, so that in 2001 the selling price was R 8 800, in 2002 the selling price was R 8 600, and so on forming an arithmetic sequence.

In a particular year, the selling price of each computer in Rands was equal to three times the number of computers the shop sold in that year.
By forming and solving an equation, find the year in which this occurred. (5)
- [16]**

QUESTION 6

(a) Draw a neat sketch of $f(x) = ax^2 + bx + c$ from the following information:

- the roots of f differ by 8 units

- the value of $x = \frac{-b}{2a}$ is 2

- the range of the function is $y \leq 4$

(4)

(b) Hence, or otherwise, determine the y-intercept.

(4)

[8]

80 marks

SECTION B

QUESTION 7

Given $f(x) = 2x^3 + 5x^2 - 4x - 3$.

- (a) If $(x - 1)$ is a factor of $f(x)$, determine all intercepts with the axes. Show ALL working. (4)
- (b) Determine the coordinates of the stationary points and identify the local maximum and minimum. (6)
- (c) Draw a rough sketch of f showing the intercepts and stationary points. (3)
- (d) Use your graph to determine
- (1) for which values of k the equation $2x^3 + 5x^2 - 4x - 3 = k$ has three different roots. (2)
- (2) for which values of $x \leq 0$, $f'(x) \cdot f(x) < 0$. (3)
- (e) How far apart are the x -values of the points of tangency to $f(x)$ whose equations can be given by $g(x) = -4x + q$ (4)

[22]

QUESTION 8

Marli's parents decide to buy her a flat in Pretoria where she is going to study next year. They pay a deposit of R 105 000, which is equivalent to 15% of the selling price of the flat. The bank charges them an interest rate of 9,75%, per annum compounded monthly. The loan is to be repaid within 15 years.

- (a) Determine the selling price of the flat. (1)
- (b) Marli's parents start repaying the loan one month after it was granted. Show that the monthly instalments are R 6 303,21. (3)
- (c) Calculate the outstanding balance of the loan after the 90th payment. (3)
- (d) Calculate how much money Marli had paid to the bank in total after the 90th instalment? (2)
- (e) What percentage of the total amount of money paid at the end of the 90th instalment went towards paying the banks interest charges? (3)

[12]

QUESTION 9

(a) The first term of a geometric series is 20 and the common ratio is $\frac{7}{8}$.

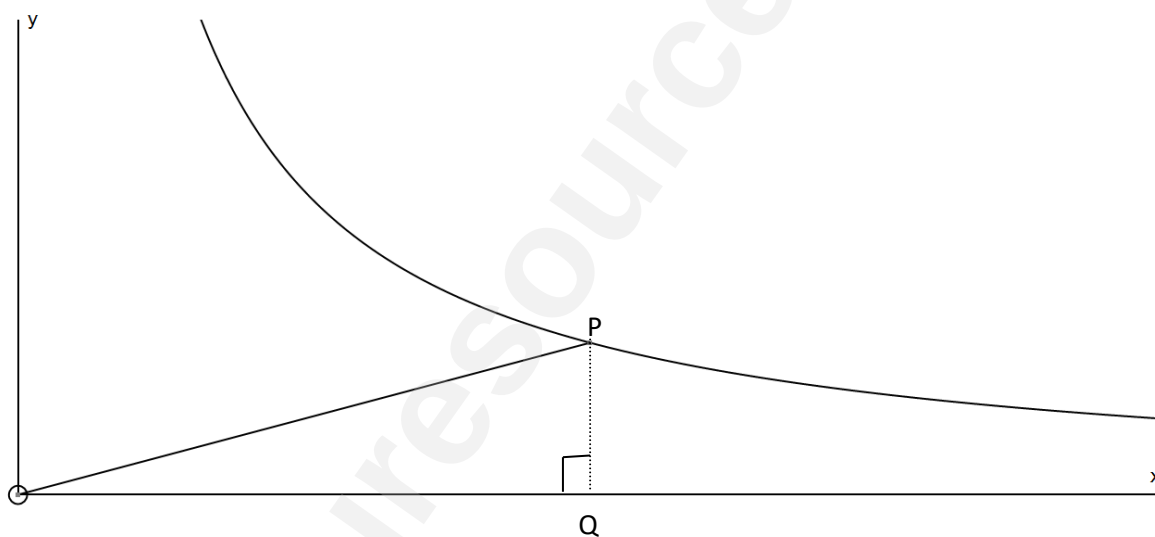
- (1) Find S_{∞} (2)
- (2) Find S_{12} (2)
- (3) Find the smallest value of n such that $S_{\infty} - S_n < 0,5$ (5)

(b) Calculate: $\sum_{t=2}^{22} (2t + 5)$ (4)

(c) Given $S_n = n^2 + n$, determine T_6 . (3)
[16]

QUESTION 10

(a) $P(x; y)$ is any point on the graph of $y = \frac{4}{x}$ for $x > 0$.



A line OP is drawn from the origin to point P on the curve.

A vertical line, PQ , is drawn perpendicular to the x -axis. Let OQ be x units long.

- (1) Write down the coordinates of P in terms of x . (1)
- (2) Show that $OP^2 = x^2 + \frac{16}{x^2}$ (2)
- (3) Show that the coordinates of P are $(2; 2)$ when OP^2 is at a minimum. (4)
- (4) Hence, show that when OP^2 is at its minimum value, OP is perpendicular to the tangent to the curve at P . (4)

(b) A particle moves along a straight line.

The distance, s in metres, of the particle from a fixed point on the line at time t seconds, ($t \geq 0$), is given by $s(t) = 2t^2 - 18t + 45$.

(1) Calculate how far away the particle is from the fixed point, to begin with. (2)

(2) Calculate the particle's acceleration. (3)

[16]

QUESTION 11

Given $f(x + 1) = f(x) + 3$ and $f(1) = 2$, find $f(2016)$.

Show all relevant working.

[4]

70 marks
