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ST BENEDICT'S

SUBJECT	MATHEMATICS	PAPER	PAPER 1
GRADE	12	DATE	JULY 2018
EXAMINER NAME	Mrs Serafino	MARKS	150
TEACHER		MODERATOR	Mrs Povall and Gr 12 educators
		DURATION	3 Hrs

QUESTION NO	DESCRIPTION	MAXIMUM MARK	ACTUAL MARK
1	ALGEBRA	36	
2	NUMBER PATTERNS	16	
3	CALCULUS	18	
4	PROBABILITY	16	
5	FINANCIAL MATHS	13	
6	FUNCTIONS	19	
7	CALCULUS	13	
8	NUMBER PATTERNS	9	
9	NUMBER PATTERNS	4	
10	CALCULUS	6	
TOTAL		150	

INSTRUCTIONS

- 1) This exam consists of 9 pages, including the cover page as a formula sheet.
- 2) Approved, non-programmable calculators may be used.
- 3) It is in your own interest to write legibly and to present your work neatly.
- 4) Answer all questions on folio paper.
- 5) Number your answers exactly as the questions are numbered.
- 6) All working must be shown.
- 7) Answers only will not receive marks.
- 8) Round your answers to TWO decimal places unless stated otherwise.
- 9) Diagrams are not necessarily drawn to scale.

QUESTION 1

26 MARKS

a) Simplify

$$1) \quad \frac{18x-2x^3}{x^2+3x} \quad (4)$$

$$2) \quad \frac{6^x \cdot 16^{x+1} \cdot 3^{1-x}}{2^{3x} \cdot 4^{x+2} \cdot 9} \quad (5)$$

b) Solve for x :

$$1) \quad \sqrt{31-10x} = 4-x \quad (5)$$

$$2) \quad x^2 + 5x \geq x + 5 \quad (4)$$

$$3) \quad 3^{9x} = 7 \quad (4)$$

$$4) \quad 3 \cdot 9^x = 4 \cdot 3^x - 1 \quad (4)$$

c) Given the equation: $f(x) = x^2 + 4kx + (3 + 11k)$ where k is a constant.

$$1) \text{ Given that } f(x) = 0 \text{ has no real roots, find the possible values of } k. \quad (4)$$

$$2) \text{ Given that } k = 1 \text{ sketch the graph of } f(x), \text{ showing the points of intersection with all axes as well as the turning point of } f(x). \quad (3)$$

QUESTION 2**16 MARKS**

a) Consider the following series: $4 + 7 + 10 + 13 + \dots + 163$

1) Determine the number of terms in the series. (3)

2) Determine the sum of the series. (3)

3) Express the series in sigma notation (3)

b) The sum of the first two terms of an arithmetic sequence is 30, the 20th term is equal to 89. Write down the first three terms of this sequence. (7)

QUESTION 3**18 MARKS**

a) If $f(x) = 3x^2 + 2x$; find $f'(x)$ by first principles. (5)

b) Find $f'(x)$ if:

1) $f(x) = \frac{(2x^2-5)(3x+2)}{x^2}$ (4)

2) $f(x) = \frac{3x}{\sqrt[6]{x}} - x\sqrt{x}$ (4)

c) $f(x) = ax^3 + bx^2 + cx + d$. If $f'(x) = 6x^2 - 10x + 4$ and $f(0) = 3$; determine the values of a ; b ; c and d . (5)

QUESTION 4**16 MARKS**

a) Consider the word: PICNIC

1) How many distinct different word arrangements can be formed from the word? (2)

2) In how many of these arrangements will the P and the N be next to each other? (3)

- b) A shelf (A) contains 10 books on fiction and 6 on non-fiction. Another shelf (B) has 8 books on fiction and 12 on non-fiction. Lesego selects a bookshelf randomly and then selects a book randomly from that shelf.
- 1) What is the probability that he picks a book on non-fiction? (4)
 - 2) What is the probability that he does not pick a fiction book from shelf B? (3)
- c) The probability that Christopher solves a problem is 0,4 and the probability that James independently solves the same problem is 0,5. Find the probability that neither of them will solve the problem. (4)

SECTION B

QUESTION 5

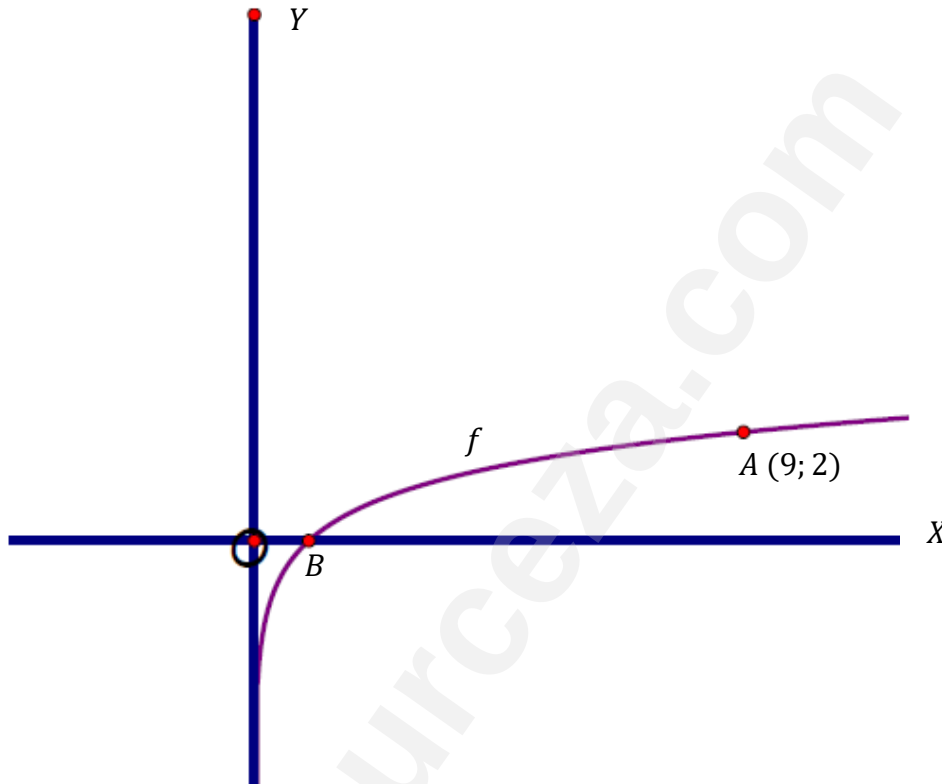
13 MARKS

- a) Luke wants to invest money at a bank that offers interest on investments at a rate of 7,5% per annum compounded monthly.
- 1) Calculate the annual effective interest rate equivalent to this nominal interest rate (2)
 - 2) Russel invests R8 557,00 at this bank at the same interest rate. After how many years will his investment be worth R12 450,84? (4)
- b) Mos opens a savings account by making an initial deposit of R5 850,00. After two years, he deposits a further R4 700,00 into the account. Five years after opening the account, he withdraws R3 600,00 from the account. Interest is paid at 6,3% per annum, compounded monthly, for the first 2 years and 8% per annum, compounded quarterly, thereafter. Determine the value of Mos's investment after seven years. (7)

QUESTION 6

19 MARKS

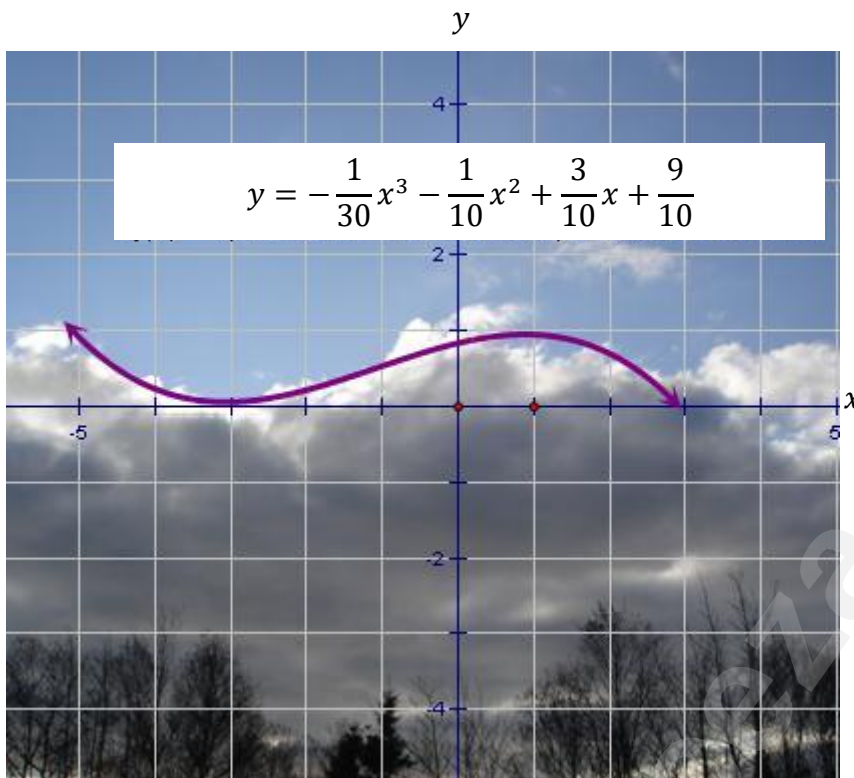
- a) The function $f(x) = \log_a x$ is represented in the diagram with $A(9; 2)$ a point on $f(x)$.



- 1) Determine the value of a . (2)
 - 2) Write down the equation of f^{-1} the inverse of $f(x)$ in the form of $y = \dots$ (2)
 - 3) Write down the range of f^{-1} . (2)
 - 4) For which value(s) of x will $f(x) < -1$? (3)
- b) Consider a linear function with equation $(x) = ax + b$, where $a > 0$ and $b > 0$, and a function with equation $g(x) = dx^2 + c$, where $d < 0$ and $c < 0$.
- 1) Draw a sketch of possible graphs of f and g on the same set of axes. (5)
 - 2) If the vertical distance between the functions is defined by the equation $= x^2 + \frac{2}{3}x + 7$, determine the minimum distance between f and g . (5)

QUESTION 7

13 MARKS



A cubic function is drawn on a picture taken of a cloud formation. The function is modelled by the equation :

$$y = -\frac{1}{30}x^3 - \frac{1}{10}x^2 + \frac{3}{10}x + \frac{9}{10}$$

- Find the coordinates of the turning points of the function. (4)
- Find the equation of the tangent to the function at $x = 0$. (3)
- Find the coordinates of the point where the tangent in (b) cuts the function again. (3)
- Find the values of x for which the function is concaved up. (3)

QUESTION 8**9 MARKS**

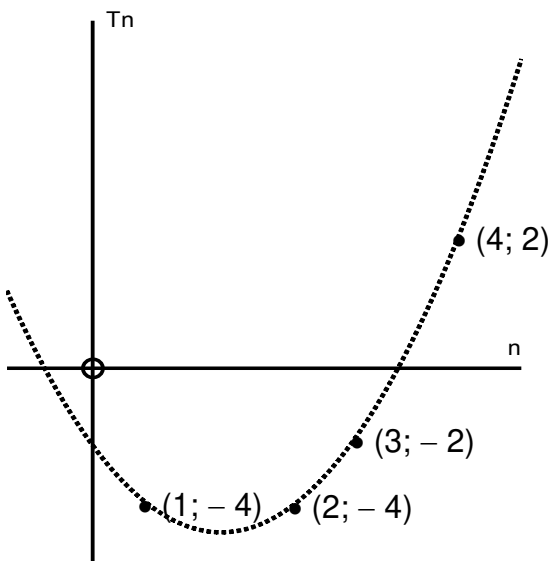
A man bungee jumps off a bridge near Magaliesburg. On the initial jump the bungee cord stretches by 120 meters. On the first bounce the stretch is 60% of the original jump and each additional bounce the rope stretches by 60% of the previous stretch.

- a) What will the rope stretch be on the first bounce? (2)
- b) What will the rope stretch be on the sixth bounce? (3)
- c) Approximate the total distance both downward and upward that the bungee jumper travels before coming to rest. (4)



QUESTION 9

4 MARKS



Points on the graph sketched above can be modelled using the formula $T_n = an^2 + bn + c$, where $n \geq 1$ and $n \in \{\text{integers}\}$. Four points on the graph are given. Use the points to determine the general formula for the **sequence** represented.

(4)

QUESTION 10

6 MARKS

There are 50 apple trees in an orchard. Each tree produces 800 apples. For each additional tree planted in the orchard, the output per tree drops by 10 apples. How many trees should be added to the existing orchard in order to maximise the total output of trees?

(6)

