



FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

MODULE: MATHEMATICS – ADIA004 and S3PACQ4

CAMPUS: APK

ASSESSMENT: SUPPLEMENTARY EXAM

DATE: JULY 2019

ASSESSORS: MR W VAN REENEN

EXTERNAL MODERATOR: DR J MBA

DURATION: 2 HOURS

82

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: 12 (INCLUDING COVER PAGE)

INSTRUCTIONS:

- ANSWER ALL THE QUESTIONS IN PEN
- ALL GRAPHS MUST BE DRAWN IN PEN
- NO PENCIL OR TIPEX ALLOWED
- STATE ALL FORMULAS USED – MARKS ARE GIVEN TO FORMULAS
- SHOW ALL THE NECCESARY CALCULATIONS
- IF NECESSARY ROUND OFF TO TWO DECIMAL PLACES
- SCIENTIFIC CALCULATORS ARE ALLOWED
- FINANCIAL CALCULATORS ARE ALLOWED
- THE QUESTIONS CAN BE ANSWERED IN ANY ORDER

Question 1 *ONLY use a financial calculator for this question.* [7]

- 1.1 An effective rate of 12.57% per year is equivalent to what nominal rate compounded quarterly? [1]

ANSWER	
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- 1.2 In 7 years, Peter's investment of R11,000 grew to R13,250. Determine the interest rate, compounded monthly, for this investment. [1]

ANSWER	
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- 1.3 John and his wife, Jane, is repaying a home loan of R1,350,000 at 11.5% per year, compounded monthly, with monthly payments over 20 years.

- a) Determine the monthly payment. [1]

ANSWER	
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- b) Determine the balance outstanding after the 70th payment. [1]

ANSWER	
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- c) Determine the interest contained in the 205th payment. [1]

ANSWER	
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- d) Determine the total finance charge. [1]

ANSWER	
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- 1.4 *South African Airways (SAA)* wants to replace one of their *Boeing 737-400* aircrafts in 5 years' time with a *Boeing 737-800 MAX*. *SAA* estimate that they will be able to sell off their current machine for R 400,000,000 whilst a new machine is estimated at R 1,000,000,000. They want to set up a sinking fund for the new purchase, by using the scrap value of their current machine as deposit on the new machine. *Pinnacle Industrial Bank* offers *SAA* a savings option, where they will make payments at the start of each month and will earn interest at a rate of 10%, compounded monthly. Determine the required monthly payment into this savings option. [1]

ANSWER	
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Question 2**[9]**

Simplify the following expression completely:

$$\frac{12x^2 - 19x + 4}{6x^2 - 17x + 12} \div \frac{4y - 16xy}{4x^2 - 9}$$

Question**[15]**

Solve for x in the following equations:

3.1 $\frac{x}{x+1} - \frac{2}{6+x} = \frac{4+5x}{x^2+7x+6}$ **[4]**

FINAL ANSWER	
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3.2 $\ln(x + 3) + \ln 4 = 2 \ln x$

[3]

FINAL ANSWER	
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3.3 $x^2 - 2x - \frac{3}{x^2 - 2x} = 2$

[5]

FINAL ANSWER	
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$$3.4 \quad e^{\ln x + \ln 2} = e^{\ln 4}$$

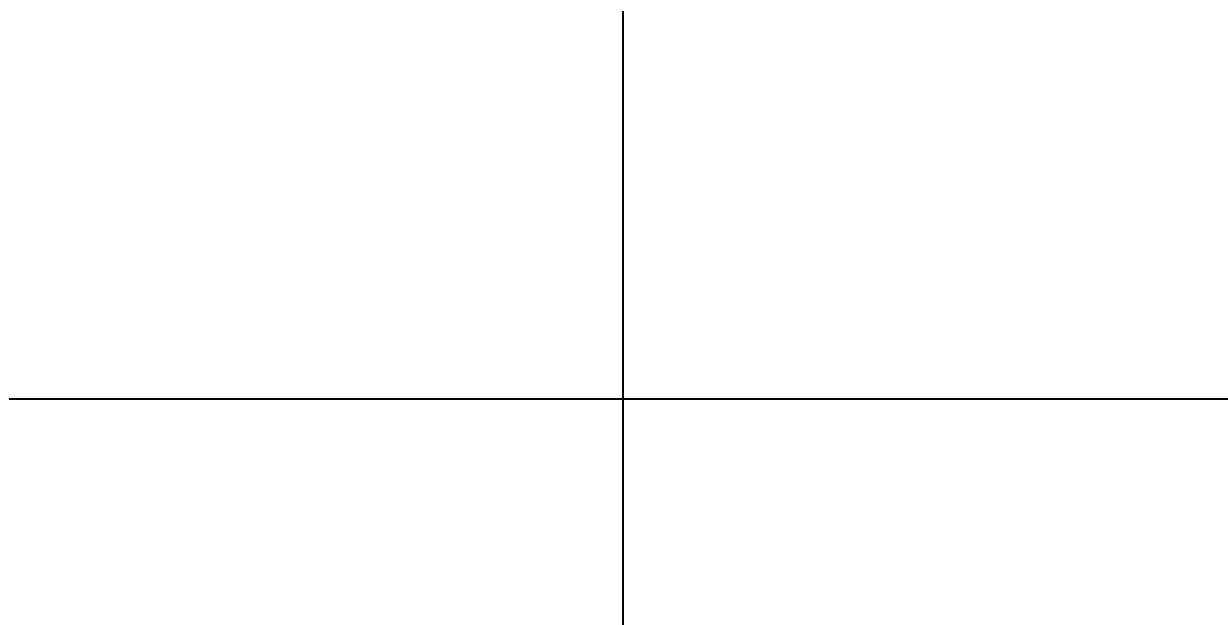
[3]

FINAL ANSWER	
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Question 4**[4]**

Graph the following case-defined function:

$$f(x) = \begin{cases} 1 & \text{if } -4 \leq x < -1 \\ x^2 - 1 & \text{if } -1 \leq x \leq 1 \\ \ln x & \text{if } x > 1 \end{cases}$$



Question 5**[5]**Solve for x and y simultaneously:

$$\begin{cases} x - 2y + 3z = 7 \\ 2x + y + z = 4 \\ -3x + 2y - 2z = -10 \end{cases}$$

FINAL ANSWER	
$x =$	
$y =$	
$z =$	

Question 6**[3]**

Solve the following inequality and represent your answer on a number line:

$$\frac{2 - 8x}{-3} > \frac{4x + 20}{4}$$

Question 7**[12]**

Given the following system of constraints:

$$\begin{aligned} -40x + 20y &\geq -120 \\ -2x + y &\leq 8 \\ y &\leq -2x + 10 \\ x, y &\geq 0 \end{aligned}$$

7.1 Sketch the *Feasible Region* described by the constraints. Clearly label the sketch.
[5]



- 7.2 Find the coordinates of all the corner points of the *Feasible Region* (in any order).
 [Round your answer to **two (2) decimal places** where applicable] [5]

	COORDINATES
CORNER POINT A	
CORNER POINT B	
CORNER POINT C	
CORNER POINT D	
CORNER POINT E	

- 7.3 If possible, determine the value of x and y that will minimize the following function: [2]

$$P = 0.4x - 0.2y.$$

	FINAL ANSWER
CORNER POINT COORDINATES	
MAXIMUM PROFIT	

Question 8**[15]**

Given the following function:

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

8.1 State the domain.

[1]

FINAL ANSWER

8.2 State the y-intercept.

[1]

FINAL ANSWER

8.3 State the x-intercept(s).

[3]

FINAL ANSWER

8.4 State the turning point.

[2]

FINAL ANSWER

8.5 Is the turning point a maximum or minimum?

[1]

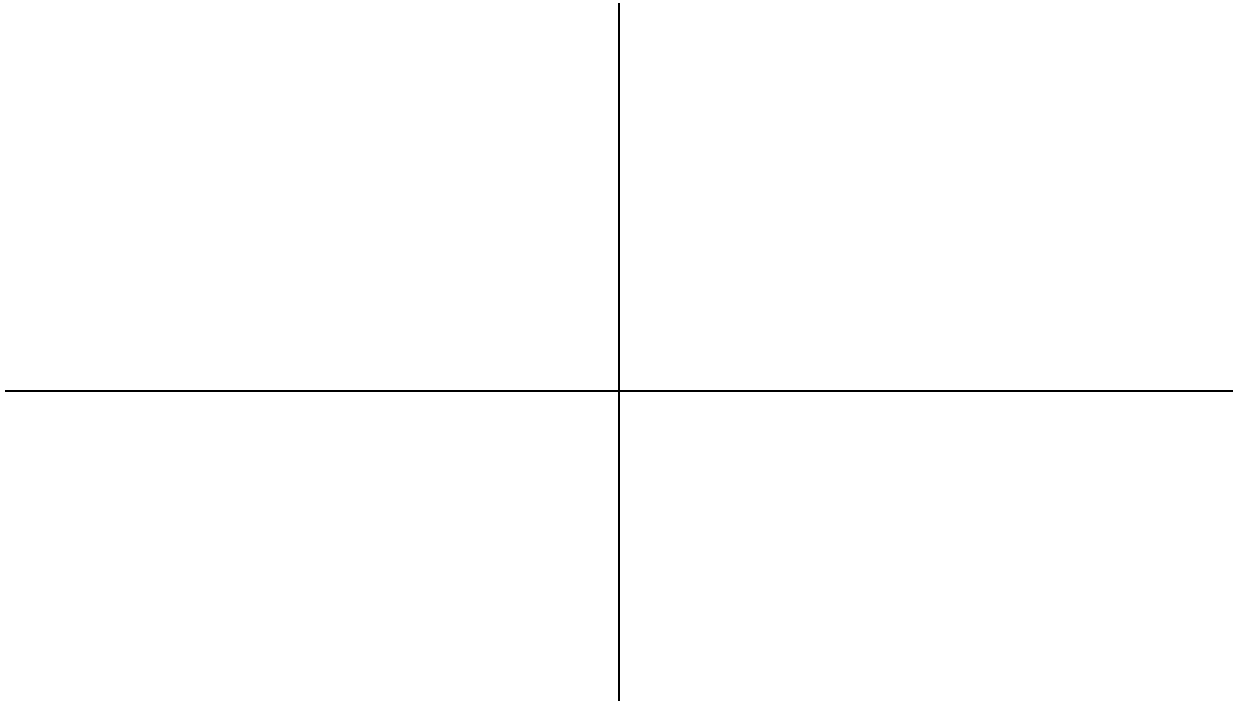
FINAL ANSWER

8.6 State its line of symmetry.

[1]

FINAL ANSWER

- 8.7 Sketch the graph of the function $f(x)$ by making use of the results of 8.1 to 8.6 above. [6]



Question 9 *Use of a financial calculator is NOT allowed.* [5]

Inge wants to open a doggy parlour, *Happy Hounds*. She approaches Benjamin as a potential investor. If Benjamin will provide an initial investment of R30,000, Inge will pay Benjamin the following cash flows:

YEAR	CASH FLOW
3	R 10,000
5	R12,000
7	R14,000

Assume an interest rate of 7%, compounded quarterly.

Determine the net present value (NPV) of the cash flows.

FINAL ANSWER

Question 10**[7]**

A debt of R6,000 due three years from now is to be repaid by a payment of R1,000 in two years, a payment of $\$x$ in four years, and R500 at the end of five years.

10.1 Draw a complete timeline and:

[2]

- a) Clearly indicate all debts and payments separately.
- b) Encircle the year where you are evaluating the problem.

10.2 If the interest rate is 7.5% compounded monthly, determine the value of x .

[5]

End of Assessment – 82 Total Marks

Use this space if you want to redo a question. Clearly indicate at the question that the answer is on Page 12.