UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF PURE AND APPLIED MATHEMATICS

MODULE: **BASIC MATHEMATICS AND APPLICATIONS IN ECONOMICS AND BUSINESS B – MAEB322 AND MAEB0B1**

CAMPUS: **APK**

ASSESSMENT: **SUPPLEMENTARY EXAMINATION**

DATE: **JANUARY 2018**

ASSESSORS: **MR W VAN REENEN**
MS M NOUKO

INTERNAL MODERATOR: **MS S RICHARDSON**

DURATION: **2 HOURS**

80

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 ALLOWED
NO TIPEX ALLOWED
STATE ALL FORMULAS USED - MARKS ARE GIVEN FOR FORMULAS
SHOW ALL THE NECCESARY CALCULATIONS
IF NECESSARY, ROUND OFF TO TWO DECIMAL PLACES
IF NECESSARY, INTEREST RATES ARE TO BE ROUNDED TO TWO DECIMAL PLACES AS A PERCENTAGE
SCIENTIFIC CALCULATORS ARE ALLOWED
FINANCIAL CALCULATORS ARE NOT ALLOWED

QUESTION 1 **[14]**

Given ;

Contraints: $\begin{cases} 0 \leq x \leq 20 \\ 0 \leq y \leq 30 \\ 10x + 30y \geq 360 \\ 40x + 10y \geq 400 \\ 45x + 50y \leq 2250 \end{cases}$ Objective Function: $Z = 300x + 150y$

1.1 Sketch the Feasible Region described by the constraints. [7]

1.2 Find all the corner points of the Feasible Region. [5]

1.3 Maximise the Objective Function. [2]

QUESTION 2 **[10]**

Differentiate the following functions. You do **NOT** have to simplify your answers.

2.1 $y = (8x^2 - 16)(20x + 4x^5)$ [2]

2.2 $y = \ln(4x^2 - 8x)^8$ [3]

2.3 $y = e^{5x^3+25x}$ [2]

2.4 $y = \frac{2-2x}{2x^2+4}$ [3]

QUESTION 3 [7]

Tanya and Rachel are B.Com Accounting graduates from UJ. Upon graduating, they started a business specialising in the design and manufacturing of a charm-bracelet, *The Jem*, especially for the student market. Tanya and Rachel have decided to employ a business analyst in order to aid them in optimising their business. The analyst determined the following economic functions:

$$Total\ Cost\ (TC) = 2q^2 + \sqrt[4]{q^6} + 5000 \qquad Price\ (P) = \frac{6}{q} + 6\sqrt{q}$$

Determine the:

3.1 Marginal Cost (MC) function. [1]	3.2 MC at $q = 100$. [1]
3.3 Average Cost (AC) function. [1]	3.4 AC at $q = 100$. [1]
3.5 Total Revenue (TR) function. [1]	3.6 Marginal Revenue (MR) function. [1]
3.7 MR at $q = 100$. [1]	

QUESTION 4 [9]

Rorisang purchased her first business for R2,500,000.00. Rorisang took out a loan for R2,500,000.00 at a good interest rate of 7.8% per year, compounded monthly, for a 20 year period. (Refer to Annexure A)

Determine:

4.1 The monthly payment. [2]

4.2 The interest contained in the 135^{th} payment. [2]

4.3 The principle outstanding after the 92^{nd} payment. [2]

4.4 The finance charge. [2]

4.5 The 100^{th} payment. [1]

QUESTION 5 [10]

The following data consists of the test scores out of 60 for a group of MAEB322-0B1 students:

19	5	15	10	10	11	13	15	17	18
20	4	26	27	30	5	31	34	36	37
40	20	5	5	46					

5.1 Complete the following class-based frequency table: [3]

Class	Count	Frequency	Relative Frequency
0-10			
11-20			
21-30			
31-40			
41-50			
51-60			
TOTAL			

5.2 Complete the following table: [3]

Mean	
Mode	
Median	

5.3 Construct a histogram using the frequency table from Question 5.1. [4]

Question 6 [4]

You have one coin and one die. You first throw the coin and then roll the die.

- Coin: H = Heads, T = Tails
- Die: 1, 2, 3, 4, 5, 6

6.1 Determine the sample space. [1]

6.2 Construct a Tree Diagram which represents the situation. Clearly indicate all outcomes and probabilities. [3]

Question 7 [10]

Given the following sample space S with events A, B and C:

$S = \{1, 2, 3, 4, 5, 6\}$ $A = \{1, 2, 3\}$ $B = \{4, 5, 6\}$ $C = \{1, 2, 3, 5\}$

7.1 Construct the Venn-Diagram which represents this situation. [4]

7.2 Determine:

a) $P(A)$ [1]

b) $P(C^{|})$ [1]

c) $P(A \cap B)$ [1]

d) $P(A) \cdot P(B)$ [1]

7.3 Are *A* and *C* are independent events? Motivate your answer. [2]

QUESTION 8 [6]

William wants to open a coffee bar. He approaches Noxi as a potential investor. If Noxi will provide an initial investment of R35,000.00, William will pay Noxi the following:

YEAR	CASH FLOW
2	R5,500.00
4	R10,000.00
6	R15,000.00

Assume an interest rate of 7.3%, compounded semi-annually.

8.1 Determine the net present value (NPV) of the cash flows. [5]

8.2 Is the investment profitable for Noxi? (**YES** OR **NO**) [1]

QUESTION 9 [10]

9.1 Thandeka is 25 and graduated from UJ. She has started her own company which trades in glass beads used for traditional embroidery. She wants to start a retirement fund and estimates that she will need R 9,000,000.00 when she retires at the age of 62. An investment firm offers her an interest rate of 6.5% per year on her capital. If the retirement fund pays out as a perpetuity, what would the first payment be? **[2]**

9.2 Peter's investment of R5,000.00 grew to R10,500.00. The interest rate for this investment, compounded monthly, was 8.5%. How many years did it take for Peter's investment to mature? (Ignore leap years and round your answer to the nearest year). **[3]**

9.3 *Truck-X* wants to replace their light vehicle fleet in 4 years' time with new electric vehicles at an estimated R10,000,000.00. They want to set up a sinking fund for the new purchase. *ABC Bank* offers *Truck-X* a savings option, where they will make payments at the start of each quarter and will earn interest at a rate of 6%, compounded quarterly. Determine the required quarterly payment into this savings option. **[3]**

9.4 Convert a nominal interest rate of 9%, continuously compounded, to an effective rate. **[2]**

End of Assessment – Total Marks: 80

ANNEXURE A

$R\frac{r}{m}\left[\frac{1-\left(1+\frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}}\right]$	$R\left[1-\frac{r}{m}\times\frac{1-\left(1+\frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}}\right]$	
$nmR-A$	$R\left[\frac{1-\left(1+\frac{r}{m}\right)^{-nm}}{\frac{r}{m}}\right]$	$R\left[\frac{1-\left(1+\frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}}\right]$

Use this page if you want to redo a question. Please indicate clearly at the question that the answer is here.