UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

MODULE: **BASIC MATHEMATICS AND APPLICATIONS IN ECONOMICS AND BUSINESS B – MAEB22 and MAEB0B1**

CAMPUS: **APK**

ASSESSMENT: **EXAM**

DATE: **NOVEMBER 2019**

ASSESSORS: **MR W CHUKWU**
MS T OBERHOLZER

INTERNAL MODERATOR: **MRS M JUGA**

DURATION: **2 HOURS**

70

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: **13 (INCLUDING COVER PAGE)**

INSTRUCTIONS:

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

QUESTION 1 [10]

Multiple Choice Options

For questions 1.1 to 1.10, there is ONLY ONE correct answer per question. Choose the correct answer, and make a cross (X) in the correct block.

QUESTION	A	B	C	D	E	Corrections
1	A	B	C	D	E	
2	A	B	C	D	E	
3	A	B	C	D	E	
4	A	B	C	D	E	
5	A	B	C	D	E	
6	A	B	C	D	E	
7	A	B	C	D	E	
8	A	B	C	D	E	
9	A	B	C	D	E	
10	A	B	C	D	E	

1.1 The yearly interest payable on a deposit of \$250 at 5.5% p.a. simple interest is:

A \$137.50
B \$13.75
C \$12.50
D \$125.00
E None of the above

1.2 An interest rate of 8% compounded semiannually corresponds to an effective rate of

A 8%.
B 8.1600%.
C 8.2031%.
D 9.2456%.
E None of the above

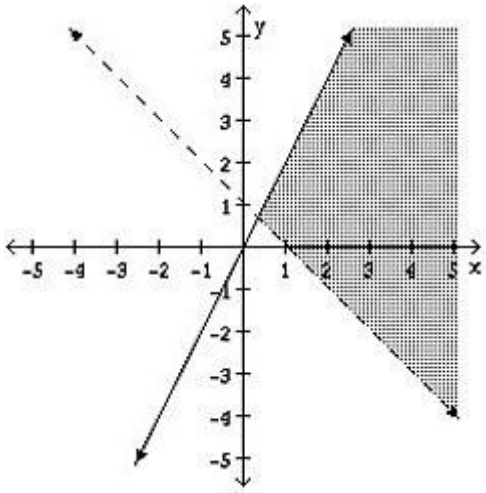
1.3 If an investment of \$20,000 earns interest at an annual rate of 9% compounded continuously, then the value (in dollars) of the investment six years from now is

A $20{,}000(1.09)^{6}$
B $20{,}000(1.09)^{-6}$
C $20{,}000e^{0.54}$
D $20{,}000e^{-0.54}$
E None of the above

1.4 Suppose a person invests $20,000 in a business venture that guarantees the same cash flow at the end of every quarter for four years. If the investment earns interest at the rate of 16% compounded quarterly, then each cash flow is

A $916.40.
B $1527.52.
C $1716.40.
D $1917.39.
E None of the above

1.5 The region indicated in the diagram



is described by

A $\begin{cases} y \geq 2x \\ x + y > 1 \end{cases}$

B $\begin{cases} y \leq 2x \\ x + y \geq 1 \end{cases}$

C $\begin{cases} y < 2x \\ x + y > 1 \end{cases}$

D $\begin{cases} y \leq 2x \\ x + y > 1 \end{cases}$

E None of the above

1.6 Evaluate the derivative of the function

$$y = \sqrt[4]{\sqrt[3]{\sqrt{X^6}}}$$

when $x = -1$.

A. $\frac{1}{4}$
B. 4
C. $\frac{-27}{6}$
D. $\frac{x^2}{4}$
E. None of the above

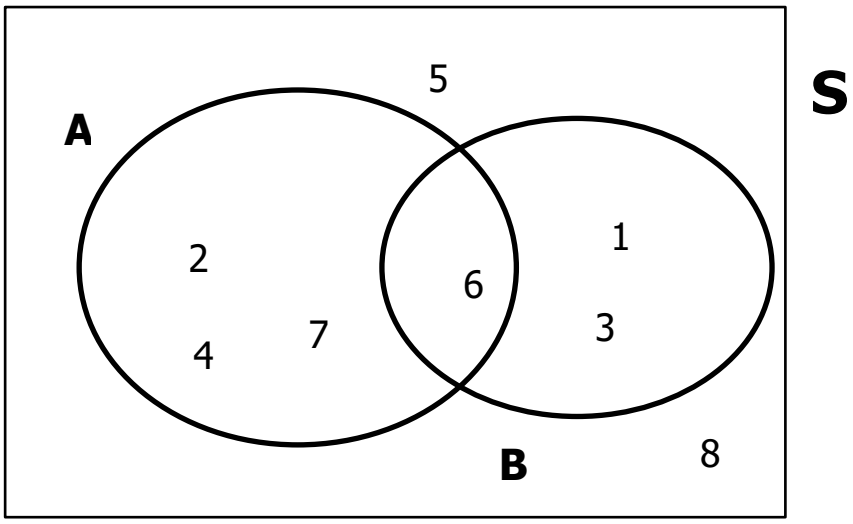
1.7 Differentiate $h(z) = \ln\sqrt{9z^2} + \frac{1}{3\pi - 5}$

A. $\frac{1}{z}$
B. -3
C. $\frac{-1}{3}$
D. $\frac{1}{3z}$
E. None of the above

1.8 In MAEB322 tutorial class there are 12 women and 20 men. What is the probability of choosing a woman?

A. $\frac{5}{8}$
B. $\frac{8}{5}$
C. $\frac{3}{8}$
D. $\frac{8}{3}$
E None of the above

Use the Venn-diagram below to answer questions 1.9 and 1.10.



1.9 Determine $P(A)$

A. $\frac{3}{2}$
B. 8
C. $\frac{4}{7}$
D. $\frac{1}{16}$
E. None of the above

1.10 Determine $P(A^{|})$

A 2
B. $\emptyset$
C. $\frac{1}{2}$
D. $\frac{4}{7}$
E. None of the above

QUESTION 2 [12]

2.1 A house worth $150,000 ten years ago has increased in value at an effective rate of 3% due to inflation. Find the current value of the home. [3]

2.2 A debt of $600 due 3 years from now and $800 due 5 years from now is instead to be paid off by two payments: $500 now and a final payment at the end of 6 years. What would this payment be if an interest rate of 6% compounded quarterly is assumed? [4]
HINT: ***Use a time-line to indicate the information***

2.3 Suppose that you can invest $11,000 in a business that guarantees you the following cash flows: $5500 at the end of 2 years, $4500 at the end of 4 years, and $4000 at the end of 5 years.

2.3.1 Assuming an interest rate of 6.25% compounded annually, find the net present value of the cash flows. [4]

2.3.2 Is the investment profitable? [1]

QUESTION 3 **[4]**

Find the present value of an annuity due with semiannual payments of $350 for 35 years at 6.25% compounded semiannually.

QUESTION 4 **[6]**

Construct an Amortization schedule for the repayment of a loan to the value of R50 000.00 being repaid over a five-year period by equal instalments made at the end of each year. An interest rate of 8% per year is charged on the outstanding balances.

Show your important calculations and use the table provided to set up the Amortization schedule. Supply headings for the columns.

QUESTION 5 **[8]**

Given the following set of constraints:

$$\begin{cases} x + y \geq 3 \\ y \leq 5 \\ x \leq 4 \\ x \geq 0, y \geq 0 \end{cases}$$

5.1 Graphically show the feasible region [4]

5.2 Write down the corner points of the feasible region. [2]

5.3 Maximize: $Z = 4x + 6y$ [2]

QUESTION 6 [9]

Belinda is a graduate from UKZN and has always been passionate about music. He started a company, *Superb Acoustics*, with his friend, Andrew, who is a Civil Engineering student from UJ. *Superb Acoustics* specialises in the design, development and manufacturing of high-end audio amplifiers, specifically geared for the export market of Europe. Belinda and Andrew have decided to employ a business analyst in order to aid them in optimising their company. The analyst determined the following economic functions:

$$Total\ Cost\ (TC) = 2q^2 + \sqrt[4]{q^6} + 5000 \qquad Price\ (P) = \frac{6}{q} + 6\sqrt{q^5}$$

Determine the following:

6.1 Marginal Cost (MC) function. [1]	6.2 MC at $q = 100$. [1]
6.3 Average Cost (AC) function. [1]	6.4 AC at $q = 100$. [1]
6.5 Total Revenue (TR) function. [1]	6.6 Marginal Revenue (MR) function. [1]
6.7 MR at $q = 100$. [1]	
6.8 Find the relative rate of change for the cost function when $q = 1$. [2]	

QUESTION 7 **[10]**

Swaziland's Consumption Function $(C\ (I))$ is determined to be:

$$C(I) = \frac{15 + 10\sqrt{i^3}}{10 + i}$$

where C and I are in millions. Determine:

7.1 The Marginal Propensity to Consume at an income of $R\ 100\ million.$ [5]

7.2 The Marginal Propensity to Save at an income of $R\ 100\ million.$ [2]

7.3 Would you agree with the proposition that the population is more likely to save than to consume (**YES** or **NO**)? [1]

QUESTION 8 **[11]**

The following data consists of the MAEB322-0B1 students test 1 scores out of 60 marks

3	5	5	10	10	11	13	15	17	18
20	20	26	27	30	30	31	34	36	37
40	41	44	45	46	47	48	50	51	52

8.1 Complete the following class-based frequency table **[6]**

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

8.2 Complete the following table **[3]**

Mean	
Mode	
Median	

8.3 Construct a **Histogram** using the completed frequency table in **Question 8.1.** **[4]**

End of Assessment – 70 Total Marks

Use this space to redo a question. Clearly indicate at the question that the solution is on page 13.