



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: EXAMINATION

DATE: 27 NOVEMBER 2017

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

[11]

Given

$$\text{Constraints: } \begin{cases} 0 \leq x \leq 50 \\ 0 \leq y \leq 40 \\ 2x + 2y \geq 120 \\ 3x + 3y \leq 240 \end{cases} \quad \text{Objective Function: } Z = 300x + 150y$$

1.1 Sketch the Feasible Region described by the constraints.

[6]

1.2 Find all the corner points of the Feasible Region.

[4]

1.3 Maximise the Objective Function.

[1]



QUESTION 2

[8]

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

2.1 $y = \log_{10} \pi^e$ [1]

2.2 $y = \sqrt[4]{\sqrt[3]{\sqrt{x}}}$ [2]

2.3 $y = \ln \sqrt{2x^2 + 4x}$ [3]

2.4 $y = e^{3x^3 + 9x}$ [2]



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:

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

$$\text{Price (P)} = \frac{6}{q} + 6\sqrt{q}$$

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

[10]

Lesotho's Consumption Function (C) is determined to be:

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

where C & i are in billions

Determine:

4.1 The Marginal Propensity to Consume (MPC) at an income of $R\ 81$ billion. [7]

4.2 The Marginal Propensity to Save (MPS) at an income of $R\ 81$ billion. [2]

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



QUESTION 5**[10]**

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

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|
| 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 | | | | | |

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 :

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

7.1 Construct the Venn-Diagram which represents this situation.

[4]



7.2 Determine:

a) $P(A)$ [1]

b) $P(C)$ [1]

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

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

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

QUESTION 8

[8]

Tshepo is graduating with his B.Com Investment Management degree from UJ this year. He is starting with a graduate programme in Corporate Finance with *Pinnacle Industrial Bank* on 1 January 2018. *Pinnacle Industrial Bank* has a strict dress code and requires Tshepo to wear formal business clothes on a daily basis. Tshepo determined that he would need 4 pairs of formal trousers, 5 dress shirts, 2 ties, 1 belt, 5 pairs of socks and 2 pairs of formal shoes for his first year of work. He visits *Superb Men's Outfitters* in the Cresta Shopping Centre and received the following quotes per item:

- | | |
|-----------------------------|-------------------------------------|
| • Formal Trousers @ R399.00 | • Belts @ R150.00 |
| • Dress Shirts @ R299.00 | • Socks (pack of 5 pairs) @ R150.00 |
| • Ties @ R75.00 | • Formal Shoes @ R729.50 |



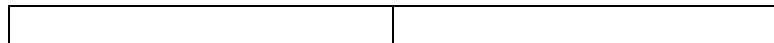
Tshepo approaches his uncle for a loan to purchase all his required clothing from *Superb Men's Outfitters* on 1 December 2017.

8.1 What is the total amount which Tshepo needs to borrow from his uncle? [1]

Tshepo's uncle agrees to loan him the amount required to purchase all his clothing on 1 December 2017, but in return requires a payment of R500.00 on 1 December 2017, R1000.00 by 1 June 2018 and a final payment of R_x by 1 December 2018 (Tshepo expects his bonus to pay out at the beginning of December 2018). The interest rate is quoted as 8%, compounded semi-annually.

8.2 Represent this loan on the following timeline: [2]

Debt/s:



Payment/s:

8.3 Determine the unknown amount R_x that Tshepo needs to pay his uncle on 1 December 2018. [5]



QUESTION 9**[6]**

Ranjit is a B.Com Marketing student at UJ. He has performed some market research and has established that 4 out of 5 students that enter the UJ APK main entrance in the morning would be willing to pay up to R10.00 for a cup of warm oats. Ranjit accordingly decided to open *Pit Stop* next to the pedestrian entrance at UJ's main gate and calculates that he would require R50,000.00 to operate his business for 2018.

Ranjit approaches a well known businessman, Mr. Mohamed Ismail, with a proposition. In exchange for an upfront payment of R50,000.00, he would guarantee Mr. Ismail the following cash flows:

| YEAR | CASH FLOW |
|------|------------|
| 2 | R10,000.00 |
| 4 | R20,000.00 |
| 6 | R30,000.00 |

Assume an interest rate of 4%, compounded semi-annually.

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

9.2 Is the investment profitable for Mr. Ismail? (**YES** OR **NO**) [1]

QUESTION 10**[6]**

Koko is graduating with her B.Com Economics and Econometrics Honours degree from UJ this year. She is starting with a graduate programme in Corporate Finance with *Pinnacle Industrial Bank* on 1 January 2018, situated on Rovonia Road in Sandton. Koko hopes that if she saves money by continuing to stay with her mother in Soweto, she will have sufficient money to purchase a *Toyota Aygo X-Play Black*. Koko visited *Prestige Toyota* on the Westrand for a test drive and received a quote to purchase a new model for R 161,500.00 at the end of December of 2017. As a soon to be staff member of *Pinnacle Industrial Bank*, Koko receives a preferential interest rate of 9%, compounded monthly, should she take up financing. Instalments on the vehicle are payable at the



end of each month. The following additional costs are also involved in purchasing the vehicle:

- Finance Admin Fee @ R1,250.00
- Extended Warranty @ R1,500.00
- Licencing and Registration Fee @ R3,250.00
- Tinted smash and grab windows @ R2,500.00

Koko decides to purchase the vehicle, however, *Pinnacle Industrial Bank* requires a 10% deposit on the quoted sales price (including all additional costs), which she will be paying from her savings.

10.1 What is the total amount which Koko will pay to purchase the vehicle from *Prestige Toyota*? [1]

10.2 What amount does *Pinnacle Industrial Bank* require as a deposit? [1]

10.3 If Koko will be financing the vehicle over 6 years, calculate the total monthly instalment to purchase the vehicle. [2]

10.4 What is the total amount which Koko will be paying back to *Pinnacle Industrial Bank* by the end of her 6 year car loan? [1]

10.5 How much interest, in total, will Koko be paying on her 6 year car loan? [1]



| |
|--|
| End of Assessment – Total Marks: 80 |
|--|

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

