UNIVERSITY
OF
JOHANNESBURG

FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED MATHEMATICS

MODULE: **MATHEMATICS – ADIA004 and S3PACQ4**

CAMPUS: **APK**

ASSESSMENT: **EXAM**

DATE: **30 MAY 2016**

ASSESSORS: **MR RJ MAARTENS**

INTERNAL MODERATOR: **MR W VAN REENEN**

DURATION: **2 HOURS**

72

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: **4 (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 AND FINANCIAL CALCULATORS ARE ALLOWED**
- **THE QUESTIONS CAN BE ANSWERED IN ANY ORDER**

Question 1   ONLY WITH A FINANCIAL CALCULATOR   [10]

1.1   How much money must an investor invest now to receive a lump sum payment of R20,000 over 10 years at 7.5% per year, compounded quarterly?   [2]

1.2   How long will it take for £200 to amount to £750 at an effective rate of 6% per year?   [2]

1.3   What is the nominal rate compounded semi-annually for an effective rate of 15.5%?   [2]

1.4   If you invest R12,000 now in a pyramid scheme, you can receive the following monthly cash inflows:

Month	1	2	3	4	6
Cash flow	R500	R1,500	R2,500	R3,500	R6,000

If the discount rate is 10.5% per year, compounded monthly, determine the net present value.   [2]

1.5   In 7 years' time, a machine that seals SKOOB cans will have a salvage value of R30,500. A new machine at that time is expected to sell for R125,000. In order for SKOOB to provide funds for the difference between the replacement cost and the salvage value, a sinking fund is set up into which equal yearly payments are placed at the beginning of each year. If the fund earns an effective rate of 6.25% per year, determine what the yearly payments must be into the sinking fund.
                                                                                          [2]

Question 2   WITHOUT A FINANCIAL CALCULATOR   [7]

A debt of R7,500 due in four years and R5,500 due in six years is to be repaid in advance by a single payment of R2,500 now and a final payment at the end of year two.

2.1   Draw a complete timeline indicating all debts and payments.   [2]

2.2   Determine the final payment if the discount rate is 11.5% per year, compounded continuously.   [5]

Question 3   ANY METHOD   [8]

Coco's company is struggling in debts. She approached her bank recently and they recommended that she takes out a revolving credit loan of R75,000 to consolidate all of her debts. In order to assist Coco with her current financial situation, the bank adds to the terms and conditions of this loan that the loan must be paid back monthly over 10 years at a nominal rate of 8.5% compounded monthly. Determine the following:

Monthly payment	
Principal contained in the 40th payment	
Interest contained in the 80th payment	
Total interest paid (Finance charge)	

Question 4   [7]

Simplify the following expressions:

4.1 $\dfrac{(ab^2)(a^2b)^3}{\sqrt{ab^3}}$ [4]

4.2 $3\ln(x) + 4\ln(xy) - \ln(x^2y^2)$ [3]

Question 5   [2]

Rationalize the denominator of the following fraction:

$$\frac{3x}{\sqrt{2x-1}}$$

Question 6   [17]

Solve for x in the following equations:

6.1 $2e^{3x+1} = 7$ [2]

6.2 $\log(x) + \log(x + 3) = 1$ [3]

6.3 $\dfrac{2}{x^2-1} - \dfrac{1}{x^2-x} = \dfrac{2}{x^2}$ [4]

6.4 $x^2 + x + \dfrac{18}{x^2+x} = 11$ [8]

Question 7   [3]

Solve for x and y simultaneously in the following system of equations:

$$\begin{cases} 2x + 4y = 4 \\ 5y - 7x + \dfrac{1}{4} = 10 \end{cases}$$

Question 8   [9]

Minimize: $P = 40x + 20y$

Subject to:
$$\begin{cases} x + y \geq 40 \\ 3x + y \geq 60 \\ x + 2y \geq 60 \\ x, y \geq 0 \end{cases}$$

By first drawing the feasible region.

Question 9   [9]

Given the two functions: $f(x) = x^2 - x - 12$ and $g(x) = -2x + 8$

9.1   Determine $f(2) + g(2)$.   [2]

9.2   Graph f and g on the same set of axes, clearly indicating all intercepts and turning point(s).   [5]

9.3   State the domain and range of f and g respectively.   [2]

End of assessment – 72 Total marks