UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED MATHEMATICS

MODULE: **MATHEMATICAL ANALYSIS B – MAA00B1**

CAMPUS: **APK**

ASSESSMENT: **EXAM – PART B**

DATE: **5 DECEMBER 2016**

ASSESSORS: **MR RJ MAARTENS**
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INTERNAL MODERATOR: **DR UA KOUMBA**

DURATION: **50 MINUTES FOR PART B** **MARKS:** **27**

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: 8 (INCLUDING COVER PAGE)

INSTRUCTIONS:

- **ANSWER ALL THE QUESTIONS IN PEN**
- **NO REMARK ON PENCIL, NO TIPEX ALLOWED**
- **STATE ALL FORMULAS USED, MARKS ARE GIVEN TO FORMULAS**
- **SHOW ALL THE NECESSARY CALCULATIONS**
- **IF NECESSARY ROUND OFF TO TWO DECIMAL PLACES**
- **SCIENTIFIC CALCULATORS ARE ALLOWED**
- **PROGRAMMABLE CALCULATORS ARE NOT ALLOWED**
- **QUESTIONS CAN BE ANSWERED IN ANY ORDER**

Part B

Question 1 **[4]**

Prove the following differentiation rule using first principles:

If $f(x) = m(x)n(x)$, then $f'(x) = n(x)m'(x) + m(x)n'(x)$.

Question 2 **[4]**

Differentiate the following function using first principles:

$$f(x) = \sqrt{x-1}$$

Question 3 **[6]**

Differentiate the following functions. You do not need to simplify your answer.

3.1 $y = 3^{x^2+6x}$ [3]

3.2 $y = \ln\left(\sqrt{\frac{x^2+1}{x-1}}\right)$ [3]

Question 4 **[3]**

Given

$$f(x) = \frac{x}{x^3 - 1}$$

4.1 If possible, determine the vertical asymptote(s) of f. [1]

4.2 If possible, determine the horizontal asymptote(s) of f. [1]

4.3 If possible, determine the oblique asymptote(s) of f. [1]

Question 5 **[4]**

For which values of x is the following function concave up:

$$f(x) = 5 - 3x^3 + x^4$$

Question 6 **[6]**

Given the function:

$$f(x) = \sqrt[3]{x^2}(2x - 1)$$

6.1 Determine the critical point(s) of $f(x)$. [3]

6.2 Determine, by making use of the second derivative test, whether the critical point(s) determined in Question 9.1 are maximum, minimum or a possible point of inflection. [3]

End of Part B – Total 27 marks

Use this page if you want to redo a question.
Clearly indicate at the question that the answer is on Page 8.