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MUEO

MOI UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR
(ACADEMICS, RESEARCH & EXTENSION)

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION

FOR THE DEGREE OF
BACHELOR OF SCIENCE
AND
BACHELOR OF SCIENCE WITH EDUCATION

COURSE CODE: MAT 113

COURSE TITLE: DIFFERENTIAL CALCULUS

DATE: 6TH FEBRUARY, 2018 **TIME:** 8.00 A.M. – 11.00 A.M.

INSTRUCTION TO CANDIDATES

- SEE INSIDE.

THIS PAPER CONSISTS OF (3) PRINTED PAGES

PLEASE TURN OVER

Main Examination December 2017 2017/2018

FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION, BACHELOR OF ARTS WITH EDUCATION AND BACHELOR OF SCIENCE WITH EDUCATION.

MATHEMATIC & PHYSICS DEPARTMENT.
COURSE CODE: MAT 113.
COURSE TITLE: Differential Calculus
CAMPUS: Main Campus.

Instructions
Answer **all** questions in **SECTION A.**
Answer **any** three questions in **SECTION B.**
Do not write anything on this question paper.
Cell phones **must** be switched off.
Duration of the examination: **3 hours.**

SECTION A (31 Marks)

QUESTION ONE: (16 marks)
Answer all questions

(a) Given that $f(x) = 5x^2 + x - 7$. Determine $f(2)$. **(2 marks)**
(b) Find the range of the following function $y = x^2 + 2$. **(3 marks)**
(c) Let $f(x) = x^2$ and $g(x) = 2x + 1$. Find $(f \circ g)(x)$. **(3 marks)**
(d) Differentiate from first principles $f(x) = x^3$. **(5 marks)**
(e) Find the domain of the function $f(x) = \sqrt{1 + 5x}$. **(3 marks)**

QUESTION TWO: (15 marks)

(a) Find $\lim_{n\to\infty}\left(\frac{2n^3-3n^2+n}{6n^3}\right)$. **(4 marks)**
(b) Find the differential coefficient of $y = 4x^2 + 5x - 3$ and hence determine the gradient of the curve at $x = -3$. **(4 marks)**
(c) A rectangular plate has a perimeter of 28 cm. Determine the dimensions of the plate that give the maximum area. **(4 marks)**
(d) Find the derivative $\frac{dy}{dx}$ of $y = 7\sin 2x - 3\cos 4x$. **(3 marks)**

SECTION B

Answer three questions from this section

QUESTION THREE: (13 marks)

(a) Use logarithmic differentiation to differentiate: **(4 marks)**

$$y = \frac{x^3 \ln 2x}{e^x \sin x}$$

(b) The distance x metres moved by a car in a time t seconds is given by: $x = 3t^3 - 2t^2 + 4t - 1$. Determine the velocity and acceleration when $t = 1.5\ s$. **(5 marks)**
(c) Find the derivative of the function $y = (4t^3 - 3t)^6$. **(4 marks)**

QUESTION FOUR: (13 marks)

(a) Use implicit differentiation to find the gradient of the tangent drawn to the circle $x^2 + y^2 - 2x - 2y = 3$ when $x = 2$ and $y = 3$. **(5 marks)**

(b) A parabola has parametric equations: $x = t^2, y = 2t$. Evaluate $\frac{dy}{dx}$ when $t = 0.5$. **(4 marks)**

(c) Find the equation of the tangent to the curve $y = x^3 - 2x^2 + x - 2$ when $x = 2$. **(4 marks)**

QUESTION FIVE: (13 marks)

(a) Determine the co-ordinates of the maximum and minimum values of the function $y = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 6x + \frac{5}{3}$ and distinguish between them. **(6 marks)**

(b) Find the derivative of the function: **(4 marks)**

$$y = \frac{4\sin 5x}{5x^4}$$

(c) Find the equation of the normal to the curve $y = x^2 - x - 2$ at the point $(1, -2)$. **(3 marks)**

QUESTION SIX: (13 marks)

(a) Find the co-ordinates of the turning points on the curve $y = 3x^3 + 6x^2 + 3x - 1$ and distinguish between them. **(6 marks)**

(b) Find the derivative of the function $y = (x + 2)^x$. **(4 marks)**

(c) Find the derivative of the function $y = 4\sinh 2x - \frac{3}{7}\cosh 7x$. **(3 marks)**

QUESTION SEVEN: (13 marks)

(a) (i) State the *Rolle's theorem*. **(2 marks)**

(ii) Determine the value c so that the *Rolle's Theorem* is satisfied for the function $f(x) = x^2 - 5x + 4$ on $[1, 4]$. **(4 marks)**

(b) By Using the *L'Hospital's Rule* evaluate: $\lim_{x \to 0} \frac{\sin x}{x}$ **(3 marks)**

(c) By using the rules for limits evaluate: $\lim_{x \to -2} \frac{x^2+x-2}{2x^2+7x+6}$ **(4 marks)**

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