



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR, FIRST SEMESTER EXAMINATIONS FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

MATHEMATICS III

DATE: 5/12/2017

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer question **ONE** and any other **TWO** questions.

Show all your working.

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Differentiate

i) $\sin(2x + 5)$ (6 marks)

ii) $\frac{x^2 \cos 2x}{\sin x}$ (4 marks)

iii) $x = \frac{3t}{1+t}$ $y = \frac{t^2}{1+t}$ (6 marks)

iv) $y = \sin^2(3x^2 + 2)$ (4 marks)

v) $y = \frac{(3x+1)\cos 2x}{e^{2x}}$ (4 marks)

- b) Find $\frac{dy}{dx}$ given that $y = x^2 \sin x$ Hence show that $\frac{d^2y}{dx^2} + y = 2 \sin x = 4x \cos x$ (6 marks)

QUESTION TWO (20 MARKS)

- a) i) if $y = (x^2 - 3x)^2$ find $\frac{dy}{dx}$ when $x=2$ given that $\frac{dx}{dt} = 2$ (6 marks)
- ii) The area of a circle is increasing at the rate of $2\text{cm}^2/\text{s}$ Find the rate of change of the circumference when the radius is 4cm (6 marks)
- b) use implicit differentiation to find the equation of the tangent to the curve $x^2 + y^2 + 2xy + x = 6$ at point $(-1,2)$ (8 marks)

QUESTION THREE (20 MARKS)

- a) The parametric equation of a curve are $y = 3\sin\theta - \sin^3\theta$ $x = \cos^3\theta$
- Find i) $\frac{dy}{dx}$
- ii) $\frac{d^2y}{dx^2}$ at $x = \frac{\pi}{6}$ (10 marks)
- b) Locate the stationary points of the function $z = 2x^2 - xy - 3y^2 - 3x + 7y$ and determine their nature (10 marks)

QUESTION FOUR (20 MARKS)

- a) Given $v = \ln(x^2 + y^2)$ show that $\frac{d^2v}{dx^2} + \frac{d^2v}{dy^2} = 0$ (10 marks)
- b) Find the equation of the Tangent and the normal to the curve $y = 3x^3 - 2x^2 + 3x - 1$ at the point $(2,5)$ (10 marks)