



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2010/2011
FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE (COMPUTER ENGINEERING)

SCE 118: CALCULUS FOR ENGINEERS

DATE: Monday 29th November 2010

TIME: 2.00p.m -4.00p.m

INSTRUCTION: ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER
TWO QUESTIONS

QUESTION ONE (30 MARKS): COMPULSORY

a) Prove the following identities

i. $\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$ (3 marks)

ii. $\tan 3A = \frac{3 \tan A - \tan^3 A}{1 - 3 \tan^2 A}$ (3 marks)

b) Find the area under the curve $y = x^3 + 2x$ over interval $[0, 1]$ (2 marks)

c) Evaluate the limits below

a) $\lim_{x \rightarrow 3} \left(\frac{x+1}{x^2-2} \right)$ (2 marks)

b) $\lim_{x \rightarrow -2} \left(\frac{2x^2-8}{x+2} \right)$ (2 marks)

d) Examine the continuity of the functions below

a) $f(x) = \sin x$ as $x \rightarrow 0$ (2 marks)

b) $f(x) = \frac{x^2-1}{x+1}$ as $x \rightarrow 1$ (2 marks)

e) A manufacturer of canned fruits uses tins with approximate rectangular bases

with sides in the ratio 3 : 2 holding 30 cm^3 each. What height should the tins be to use as little metal as possible? (5 marks)

f) Find $\frac{dy}{dx}$ given $y = \frac{x^5}{\sqrt{x+1}}$ (4 marks)

g) Evaluate the integrals $\int_0^{10} x^3 dx$ using the Simpsons rule, five divisions. (3 marks)

h) Evaluate the following integral $\int \sin^2 x dx$ (3 marks)

QUESTION TWO (20 MARKS): OPTIONAL

a) Evaluate the limits below

i. $\lim_{x \rightarrow -1} \left(\frac{x(x+1)^2}{x} + 4x^3 + 3 \right)$ (3 marks)

ii. $\lim_{x \rightarrow -1} \left(\frac{x(x+1)^2}{x} + \sqrt{x+5} \right)$ (3 marks)

b) Use first principles to prove that if $f(x) = \cos x$, then $f'(x) = -\sin x$ (6 marks)

c) The acceleration of a particle t seconds after the start is $(8-6t^2)\text{m/s}^2$. Find the velocity and displacement of the particle in terms of t given that the particle started with a velocity of 2m/s . How far is the particle from the starting point after 2 seconds and what is its velocity? (8 marks)

QUESTION THREE (20 MARKS): OPTIONAL

a) Find the gradient of the curve $y = 3\sin \theta - \sin^3 \theta$, $x = \cos^3 \theta$ (6 marks)

b) Find the equation of the tangent and normal to the curve

$x^2 + 2xy + 3y^2 = 4$ at $(3,3)$ (6 marks)

c) Evaluate the integrals $\int_0^{10} x^4 dx$ using five divisions by

a) The Simpsons rule (4 marks)

b) The trapezoidal rule (4 marks)

QUESTION FOUR (20 MARKS): OPTIONAL

a) Find $\frac{dp}{dk}$ given that

i. $p = e^{\tan(k^2+1)}$ (5 marks)

ii. $p = \ln \frac{k}{(k^2+1)^{\frac{3}{2}}}$ (7 marks)

b) Given the following inverse trigonometric evaluate their derivatives.

i. $y = \sin^{-1} 3x$ (4 marks)

ii. $y = \tan^{-1} 3x$ (4 marks)

QUESTION FIVE (20 MARKS): OPTIONAL

a) Evaluate the integrals below

i. $\int \frac{dx}{\sqrt{3-x^2}}$ (4 marks)

ii. $\int e^{x-2} dx$ (3 marks)

iii. $\int_{-1}^1 3x^2 + 2 dx$ (3 marks)

b) Find the area enclosed by the curves $y = x^2 - 5x$ and $y = 3x^2 - 6x$ (10 marks)