



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATION FOR

CERTIFICATE IN ELECTRICAL ENGINEERING

CERTIFICATE IN MECHANICAL ENGINEERING

CERTIFICATE IN CIVIL ENGINEERING

ECU 00201: MATHEMATICS IV

DATE 23/9/2019

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Use the compound angle formulae to simplify the following

i) $\sin\left(\theta + \frac{\pi}{2}\right)$

ii) $\cos(180 - \theta)$

(6 marks)

b) Given that $8\cos\theta + 25\sin\theta = R\cos(\theta - \alpha)$

i) Find the value of R and α

ii) hence solve the equation $8\cos\theta + 25\sin\theta = 17$

$$\text{For } 0^\circ \leq x \leq 360^\circ$$

(8 marks)

c) Show that

i) $\frac{1}{\cos A + \sin A} + \frac{1}{\cos A - \sin A} = \tan 2A \operatorname{cosec} A$

(5 marks)

d) Given the vectors $a = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $b = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$

Find

i) $|a - b|$

ii) $3a - 5b$ (6 marks)

- e) Kanu bought 8 pencils and 5 rulers at a total cost of Ksh 271 from a bookshop, Deno bought 14 pencils and 21 rulers from the same bookshop at a total cost of Ksh 707 determine the cost of each item (5 marks)

QUESTION TWO (20 MARKS)

- a) i) Using the expansion of $\tan(A + B)$ show that

$$\tan 3\theta = \frac{3\tan\theta - \tan^3\theta}{1 - 3\tan^2\theta} \quad (5 \text{ marks})$$

Hence solve the equation $\tan 3\theta + 2\tan\theta = 0$ for 0° and 180° inclusive

(5 marks)

- ii) Solve the triangle PQR given PQ=5.9cm QR=9.2cm and

$$\text{Angle } Q = 107^\circ \quad (4 \text{ marks})$$

- b) Prove the identity

$$\frac{\sin 2x - \cos 2x + 1}{\sin 2x + \cos 2x + 1} = \tan x \quad (6 \text{ marks})$$

QUESTION THREE (20 MARKS)

- a) If $\sin A = \frac{12}{25}$ and $\cos B = \frac{4}{5}$ where A and B are acute angles determine

i) $\cos(A + B)$

ii) $\tan 2B$ (8 marks)

- b) Show that

$$\sinh^{-1}x = \ln \{x + \sqrt{x^2 + 1}\} \text{ and hence determine } \sinh^{-1}(0.84) \text{ correct to four decimal places} \quad (12 \text{ marks})$$

QUESTION FOUR (20 MARKS)

a) Find the value of $\tan A$ when $\tan(A - 45^\circ) = \frac{1}{3}$ (5 marks)

b) Express $5\sin 2\theta + 8\cos 2\theta$ in the form of $R\sin(2\theta + \alpha)$ Hence solve

$$5\sin 2\theta + 8\cos 2\theta = 9 \text{ for } 0^\circ \leq \theta \leq 360^\circ \quad (10 \text{ marks})$$

c) Wagi deposited Ksh 14237 in a bank offering a compound interest of 8% per annum
Calculate

i) Total savings after 11 years

ii) Time taken for the interest to amount to Ksh 10,140 (5 marks)

QUESTION FIVE (20 MARKS)

a) Show that

$$\frac{\sin \theta}{1 + \cos \theta} + \frac{1 + \cos \theta}{\sin \theta} = \frac{2}{\sin \theta} \quad (5 \text{ marks})$$

b) A worker is paid Ksh 25000 as the starting salary with an annual increment of 2% per annum

Calculate

i) His salary at the end of his 10 year

ii) His total earnings after 30 years of service

number of Years it would take for him to attain a salary of ksh 100000.

(10 marks)

c) Solve the equation $3 \cosh x + 2 \sinh x = 14.31$ correct to four decimal places (5 marks)

Solve for $-180 \leq \theta \leq 180$ the equation $6\sin 2\theta - 4\cos 2\theta = 1$ (5 marks)