



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL
AND ELECTRONICS ENGINEERING

ECU 0101: APP. GEOMETRY

DATE: 29/8/2017

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer question ONE (Compulsory) and any other TWO questions

QUESTION ONE (COMPULSORY)

- a) A rectangular field of length 36m and 24m wide is surrounded by a path 2m wide, calculate the area of the path (4 marks)
- b) Solve for x , if $0^\circ \leq x \leq 360^\circ$
- i $\sin x = \frac{1}{4}$
 - ii $5 - 8 \cos x = 0$
 - iii $4 \sin x = 5 \cos x$
 - iv $1 + \cos x = 2 \sin^2 x$ (12 marks)
- c) Given the vectors $\mathbf{r} = \begin{bmatrix} 7 \\ 8 \end{bmatrix}$ and $\mathbf{s} = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$, calculate
- i) $\mathbf{r} + 2\mathbf{s}$
 - ii) $|\mathbf{r} - \mathbf{s}|$ (5 marks)

- d) Express i) $(-5, 2)$ as a polar coordinate
 ii) $(5, 60^\circ)$ as a Cartesian co-ordinate (6 marks)
- e) Find the area of a triangle having sides; 8 cm , 10 cm, 12 cm (3 marks)

QUESTION TWO (20 MARKS)

- a) Prove the following identities
- i) $\operatorname{cosec} x + \tan x \sec x = \operatorname{cosec} x \sec^2 x$
- ii) $\frac{\cos x}{\sqrt{1 + \tan^2 x}} + \frac{\sin x}{\sqrt{1 + \cot^2 x}} = 1$ (6 marks)
- b) Find without using tables or calculator the value of:-
- i) $\sin (120^\circ + 45^\circ)$
- ii) $\cos (60^\circ + 60^\circ)$ leaving surds in the answers (8 marks)
- c) Given the vectors $\mathbf{A} = 3\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}$ and $\mathbf{B} = 2\mathbf{i} + 5\mathbf{j} - \mathbf{k}$, determine $\mathbf{A} \times \mathbf{B}$ and the angle between A and B (6 marks)

QUESTION THREE (20 MARKS)

- a) In the triangle PQR, the lengths $PQ = 9.8\text{cm}$, $QR = 12.7\text{cm}$ and the area of the triangle is 53.5cm^2 . calculate ;-
- i) The included acute angle
- ii) The length of the third side (7 marks)
- b) Solve the following equations ($0^\circ \leq \theta \leq 360^\circ$)
- i) $7\tan^2 \theta + \sec \theta = 4$
- ii) $\cos^2 \theta + \cos \theta + 1 = 1$ (9 marks)
- c) If vector $\mathbf{p} = 2\mathbf{i} + 4\mathbf{j} - 3\mathbf{k}$ and $\mathbf{Q} = \mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$, determine their dot product (4 marks)

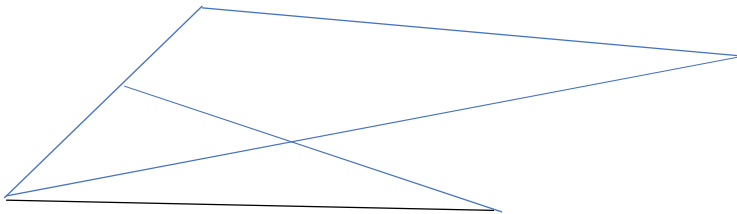
QUESTION FOUR (20 MARKS)

- a) Given that $\sin A = 3/5$ and $\cos B = 5/13$, and that angles A and B are acute. Determine without using tables or calculators.
- i) $\sin (A+B)$ ii) $\sin 2A$ iii) $\cos (A - B)$ (10 marks)

- b) Given that vectors $\vec{AB} = \mathbf{a}$ and $\vec{AC} = \mathbf{b}$ determine in terms of $\mathbf{a}$ and $\mathbf{b}$, vectors
- $\vec{AB}$
 - $\vec{AD}$ if $\vec{CD} = \frac{1}{2}\vec{BC}$ (3 marks)
- c) The triangle XYZ has sides 9 cm, 13cm and 17 cm. Determine the angles of the triangle. (7 marks)

QUESTION FIVE (20 MARKS)

- a) A man walks directly from a point P towards the foot of a tall building which is 300m away. The angle of elevation from point P to the top of the building is 40° . he walks to a point Q towards the building and the angle of elevation of the top of the building from point Q is 55° . Calculate;
- The height of the building
 - The distance of the point Q from the top of the building (10 marks)
- b) In the figure below $\mathbf{p}$ and $\mathbf{q}$ are position vectors of $\mathbf{OP}$ and $\mathbf{OQ}$ respectively.
- $3\mathbf{PR} = 2\mathbf{PQ}$, $\mathbf{OS} = 3\mathbf{OR}$ and $\mathbf{OT} = 2\mathbf{OQ}$



Express in terms of $\mathbf{p}$ and $\mathbf{q}$, vectors

- $\mathbf{PQ}$
- $\mathbf{OR}$
- $\mathbf{TS}$ (10 marks)