



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR
CERTIFICATE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE IN BUILDING AND CIVIL ENGINEERING

SUPPLEMENTARY EXAMINATION

EPC 210: MATHEMATICS IV

Date: 31/8/2017

Time: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question ONE and Any Other TWO Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) A ladder 10 m long leans against a wall and makes an angle of 63° with the horizontal.
- i) How high up the wall does the ladder reach?
 - ii) How far from the wall is the foot of the ladder? (6 marks)
- b) Solve the following equations (for x from 0° to 360°)
- i) $\tan x = -2$
 - ii) $\cos 2x = 0.5$
 - iii) $\sin (x+10^\circ) = 0.342$ (8 marks)
- c) Convert the following;
- i) 210° to radians
 - ii) $\frac{5\pi}{6}$ to degrees (4 marks)

- d) A is (1,9) and B is (5,7). M is the mid-point of AB.
- Find the coordinates of M
 - Express $\mathbf{OM}$ as a column vector
 - Determine $|\mathbf{AB}|$ (6 marks)
- e) i) From point O, a man walks 320m west and then 140m south, what is now the man's bearing from O.
- ii) Evaluate $4\cos(5x - 20^\circ)$ when $x = 60^\circ$ (6 marks)

QUESTION TWO (20 MARKS)

- a) Simply the following
- $\tan^2 x - \sec^2 x$
 - $\frac{\sqrt{1 - \cos^2 x}}{\tan x}$ (6 marks)
- b) A triangular field has an area of $1.4 \times 10^3 \text{ m}^2$, two sides of the field enclose an obtuse angle, Θ , and are of length 80m and 70m. determine:
- The value of angle Θ
 - The perimeter of the field. (8 marks)
- c) P is the point (20,7) and Q is (6,2). Determine
- The coordinates of point M, the midpoint of P and Q
 - The length of the vector $\mathbf{PQ}$ (6 marks)

QUESTION THREE (20 MARKS)

- a) If $\mathbf{a} = \begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ and $2\mathbf{a} + h\mathbf{b} = \begin{bmatrix} 6 \\ -5 \end{bmatrix}$ determine the value of h (4 marks)
- b) Given that Y is an acute angle and $\cos Y = \frac{1}{\sqrt{5}}$, find without using tables or calculator;
- Sin Y
 - Tan $(90 - Y)$ (4 marks)
- c) An aeroplane takes off from P and flies to Q. It then flies to R. the bearing of Q from P is 057° and that of R from Q is 127° . If $PQ = 240 \text{ km}$ and $QR = 320 \text{ km}$, find;
- Angle PQR
 - The distance PR

- iii) The bearing of P from R (12 marks)

QUESTION FOUR (20 MARKS)

- a) A triangle has sides 5cm, 9 cm and 10cm, calculate
- Its area
 - The largest angle of the triangle (6 marks)
- b) (i) If $\sin A = \frac{5}{13}$ and $\sin B = \frac{8}{17}$, where A and B are acute angles, find $\sin(A - B)$
- ii) Given that $\sec x = \sqrt{2}$ and angle x is acute, find $\cot x$ and $\sin x$. (8 marks)
- c) Find the value of θ between 0° to 360° in the equation $\cos 2\theta + 5 \cos \theta = 2$ (6 marks)

QUESTION FIVE (20 MARKS)

- a) Show that;
- $\tan^2 x (\operatorname{cosec}^2 x - 1) = 1$
 - $\frac{1}{1 + \sin x} + \frac{1}{1 - \sin x} = \frac{2}{\cos^2 x}$ (6 marks)
- b) Given that $\mathbf{r} = \mathbf{i} + 2\mathbf{j}$ and $\mathbf{s} = -2\mathbf{i} + \mathbf{j}$. Determine the column vectors for points A, B and C where A is $\mathbf{r} + 2\mathbf{s}$, B is $\frac{1}{2}(\mathbf{r} + \mathbf{s})$ and $\mathbf{C} = -\mathbf{s}$ (6 marks)
- c) i) Draw the graph of $y = \cos x$ for the domain $90^\circ \leq x \leq 270^\circ$ (use 30° interval).
- ii) Use the graph in c, (i) above to solve the equation $\cos x = -0.5$ (8 marks)