



MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR SECOND TERM EXAMINATION FOR

CERTIFICATE IN BUILDING TECHNOLOGY ENGINEERING
MATHEMATICS II

DATE: 4/6/2021

TIME: 11.30-2.30 PM

INSTRUCTIONS:

Answer question one and any other four questions

- 1 a) Given the matrices $A = \begin{bmatrix} -1 & 2 \\ 2 & -1 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 & 3 \\ 6 & -1 & 2 \end{bmatrix}$
Determine $(AB)^T$ (6 marks)
- b) Using Pythagorean identities solve $\cos\left(\frac{\pi}{2} - \frac{\pi}{3}\right)$ (4 marks)
- c) use substitution method to solve the following pair of simultaneous equations (4 marks)
- $$3x - y = 11$$
- $$3x - 2y = 4$$
- d) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 2 & 4 \\ 4 & 1 & 3 \\ 2 & 1 & 1 \end{bmatrix}$ (6 marks)
- e) Three forces F_1, F_2 and F_3 forms the simultaneous equations given below.
 $F_1 + F_2 + F_3 = 9$
 $F_1 - 2F_2 + 2F_3 = 7$
 $3F_1 + F_2 + F_3 = 15$
Use crammers' rule to determine the values of forces (10 marks)
2. a) write down the fourth term in the binomial expansion of $(3x + 2y)^4$, and determine its value when $x = \frac{1}{2}$ and $y = \frac{1}{3}$ (5 marks)
- b) i) show that $\sin^2 \alpha + \cos^2 \alpha = 1$ (9 marks)

3. a) Using the matrices $Q = \begin{bmatrix} 5 & -2 & 1 \\ 3 & 9 & 10 \\ -4 & 2 & 3 \end{bmatrix}$ $P = \begin{bmatrix} 7 & 2 \\ 4 & 5 \\ 6 & 1 \end{bmatrix}$ and $R = \begin{bmatrix} 6 & 10 & 2 \\ 0 & -2 & 3 \end{bmatrix}$
- State with reasons whether the following operations are possible or not
- (QXP)
- (PXR)+Q (6 marks)
- b) Using the quotient rule differentiate the following $y = \frac{(x^2+4x)}{(x-4)}$ (5 marks)
- 4 a) Solve by factorization $8x^2 + 9x + 1 = 0$ (6 marks)
- b) By completing the square, determine the constants p,q and r such that
- $$4x^2 + 7x + 6 = p(x + q)^2 + r$$
- (5 marks)
5. a) Perform the following integration
- $$\int (x - 11 + 3/\sqrt{x}) dx$$
- (5 marks)
- b) Let $y = (x + 1)(x^2 + 3)$. find dy/dx (6 marks)
- 6 a) find the angle between the vectors
- $$A = 3i - 2j + 5k \quad \text{and} \quad B = 4i - 7j + 8k$$
- (6 marks)
- b) Determine the value of constant a if the three vectors
- $$A = 2i - j + ak, \quad B = -2i - 2j \quad \text{and} \quad C = 4i + 2j - 3k$$
- are coplanar (5 marks)
7. a) solve the equation
- $$x + 5 - \frac{1}{x+4} = 1$$
- (6 marks)
- b) Given that $u = 2xy - x^2 + y^2$, show that $\frac{d^2u}{dx^2} + \frac{d^2u}{dy^2} = 0$. (5 marks)