

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN
ECONOMICS AND MATHEMATICS AND BACHELOR
OF COMPUTER SCIENCE**

COURSE CODE: MATH 110

COURSE TITLE: BASIC MATHEMATICS

STREAM: Y1S1

DAY: THURSDAY

TIME: 9.00 – 11.00 A.M.

DATE: 17/03/2011

INSTRUCTIONS:

1. Answer question ONE and any other TWO questions
2. Begin each question on a separate page
3. Show your workings clearly

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

- a) Find the three angles of the triangle whose sides have lengths $a = 8$ cm, $b = 19$ cm and $c = 14$ cm (6 marks)
- b) The number of bacteria in a refrigerated food is given by

$$N(T) = 20T^2 - 80T + 500, \quad 2 \leq T \leq 14$$

Where T is the Celsius temperature of food. When the food is removed from refrigeration, the temperature is given by

$$T(t) = 4t + 2, \quad 0 \leq t \leq 3$$

Where t is the time in hours. Find the following.

- i) The composite $N(T(t))$. What does this represent (3 marks)
- ii) The number of bacteria in the food when $t = 2$ hours (2 marks)
- iii) The time when the bacteria count reaches 2000 (3 marks)
- c) Prove that $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$ (6 marks)
- d) Three numbers are in G.P. Their product is 64 and sum is $124/5$. Find them (6 marks)
- e) In how many ways can 3 boys and 5 girls be arranged in a row so that all the 3 boys are together (4 marks)

QUESTION TWO (20 MARKS)

- a) Given $h(x) = \frac{x+4}{2x-5}$ find $h^{-1}(x)$, $(h^{-1} \circ h)(x)$ and $(h \circ h^{-1})(x)$ (10 marks)
- b) For each of these relations on the set $\{1,2,3,4\}$, decide whether it is reflexive, symmetric, anti-symmetric or transitive (6 marks)
- i) $\{(2,2),(2,3),(2,4),(3,2),(3,3),(3,4)\}$
- ii) $\{(1,1),(1,2),(2,1),(2,2),(3,3),(4,4)\}$
- iii) $\{(2,4),(4,2)\}$
- iv) $\{(1,2),(2,3),(3,4)\}$
- v) $\{(1,1),(2,2),(3,3),(4,4)\}$
- vi) $\{(1,3),(1,4),(2,3),(2,4),(3,1),(3,4)\}$

- c) Show that the functions are inverse of each other

$$f(x) = 2x^3 - 1 \quad \text{and} \quad g(x) = \sqrt[3]{\frac{x+1}{2}} \quad (4 \text{ marks})$$

QUESTION THREE (20 MARKS)

- f) Prove that $\frac{\tan \theta - \cot \theta}{\tan \theta + \cot \theta} = (\sin \theta - \cos \theta)(\sin \theta + \cos \theta)$ (7 marks)

g) Prove the following proposition:

$$p(n) : \frac{1}{1(3)} + \frac{1}{3(5)} + \frac{1}{5(7)} + \dots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1} \quad (7 \text{ marks})$$

h) Mr Kigen arranges to pay off a debt of Kshs 9,600 in 48 annual instalments which form an arithmetic series. When 40 of these instalments are paid, Mr Kigen becomes insolvent and his creditors find that Kshs 2400 still remains unpaid. Find the values of each of the three instalments of Mr Kigen. Ignore interest (6marks)

QUESTION FOUR (20 MARKS)

- a) Expand the following upto y^4 and hence evaluate $(0.92)^{20}$ and $(1.08)^{20}$
 $(1+3y)^{20}$ (7 marks)
- b) Given $f(x) = 2x + 3$ and $g(x) = \frac{1}{2}(x - 3)$ find the following
- i) $(f \circ g)(x)$ (4 marks)
 - ii) $(g \circ f)(x)$ (3 marks)
- c) Find the general solution for the equation $24\sec^2\theta - 26\tan\theta - 18$ (6 marks)

QUESTION FIVE (20 MARKS)

- a) A survey was conducted on a sample of 25 new cars being sold at a local auto dealer was conducted to see which of the three popular options, air conditioning(A), Radio (R) and power window (W), were already installed. The survey found 15 had air conditioning, 12 had radio, 5 had air conditioning and power windows, 9 had air-conditioning and radio, 4 had radio and power windows, 3 had all three options and 2 had no option
Find the number of cars that had
- i) Only power option (2 marks)
 - ii) Only air conditioning (2 marks)
 - iii) Only radio (2 marks)
 - iv) Radio and power windows but not air- conditioning (3 marks)
 - v) Air- conditioning and radio but not power windows (3 marks)
 - vi) Only one of the option (2 marks)
- b) Prove that the following argument is valid using truth tables “If he works hard, he will be successful. He was not successful. Therefore, he did not work hard.” (6 marks)