



# MERU UNIVERSITY COLLEGE OF SCIENCE & TECHNOLOGY

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## University Examinations 2010/2011

### SECOND YEAR, FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR SCIENCE IN INFORMATION TECHNOLOGY

#### SMA 2104: MATHEMATICS FOR SCIENCE

DATE: DECEMBER 2010

TIME: 2 HOURS

INSTRUCTIONS: Answer Questions One and any other Two Questions

#### QUESTION ONE – (30 MARKS)

- (a) Solve for x in the equation by completing square method.  $ax^2 + bx + c = 0$  (3 Marks)
- (b) Expand  $(1 + 2x)^{15}$  up to the fifth term, hence using your expansion estimate the value of  $(1.02)^{15}$ . (4 Marks)
- (c) Find the remainder when  $f(x) = 2x^3 + 5x^2 + 4x + 1$  is divided by  $(x + 3)$  (3 Marks)
- (d) Evaluate the value of x given that  $2^{2x+2} - 3(2^{x+1}) + 1 = 0$  (3 Marks)
- (e) Solve the equation  $\log(2x + 1) + \log(2x - 4) = 1$  (3 Marks)
- (f) In how many ways can a customer at a hardware shop select 3 different types of Bolts from 10 available types and 8 different screws from 12 different types? (3 Marks)
- (g) Solve the triangle ABC given that  $A = 43^\circ$ ,  $B = 27$  cm and  $C = 14$  cm. (4 Marks)
- (h) Find the sum of the series:

$$\sum_{r=2}^{18} \left(5 - \frac{r}{4}\right)$$

(4 Marks)

- (i) Prove that  $\frac{\cos^2 \theta (1 - \sec^2 \theta) \sin \theta}{\cos \theta \tan^2 \theta (1 - \sin^2 \theta)} = -\tan \theta$  (3 marks)

**QUESTION TWO – (20 MARKS)**

(a) The table below shows the distribution of children’s waists in a class of 195 children.

Waist size (cm)	Number of children
38 – 41	4
42 – 45	20
46 – 49	30
50 – 53	70
54 – 57	52
58 – 61	16
62 - 65	3

Find:

- (i) The modal class. (1 Mark)
  - (ii) The median (3 Marks)
  - (iii) The mean (3 Marks)
  - (iv) The standard deviation (3 Marks)
  - (v) The coefficient of variation (2 Marks)
  - (vi) The coefficient of Skewness (2 Marks)
- (b) What is the smallest number of terms the Geometric progression  $8 + 24 + 72 + \dots$  that will give a sum greater than 1 million. (6 Marks)

**QUESTION THREE – (20 MARKS)**

- (a) (i) Prove that:  $\sin^2\theta + \cos^2\theta = 1$  where  $\theta$  is an acute angle in a right angled triangle. (4 Marks)
- (ii) Simplify  $\frac{3+\sqrt{5}}{3\sqrt{5}-1}$  (2 Marks)
- (b) Sketch the graph of the function  $f(x) = 8 - 2x - x^2$  by writing it in the form of  $f(x) = a(x - h) + k$  (8 Marks)
- (c) A polynomial  $f(x)$  has a remainder of 9 when divided by  $(x-3)$  and remainder of -5 when divided by  $(2x - 1)$ . Find the remainder when  $f(x)$  is divided by  $(x-3)(2x + 1)$  (6 Marks)

**QUESTION FOUR – (20 MARKS)**

(a) Solve the following quadratic equations using the indicated method:

(i)  $\frac{x-1}{2} + \frac{x+3}{4} = \frac{1}{x-1}$  ; completing square method. (4 Marks)

(ii)  $6x^2 + 7x + 1 = 0$  ; formula method. ( 3 Marks)

(b) Express  $\frac{\tan x \sin x}{\sec^2 x - 1}$  as a single trigono metric function and hence solve  $\frac{\tan x \sin x}{\sec^2 x - 1} = \frac{1}{2}$  for  $0 \leq x \leq 360$ . (5 Marks)

(c) In a large city, 10% of the population has green eyes.

(i) What is the probability that 2 of the three people chosen at random will have green eyes? (2 Marks)

(ii) What is the probability that exactly two of a group of 20 randomly chosen people will have green eyes? (3 Marks)

(iii) What is the probability that more than two of a group of 20 randomly chosen people have green eyes? (3 Marks)

**QUESTION FIVE – (20 MARKS)**

(a) The curve  $y = \sin x$  is translated through the vector  $\pi/6$  on to the curve  $y'$ . State the amplitude and the period. What does  $\pi/6$  represent? (7 Marks)

(b) A sample of 300 grams of plutonium 241 decays according to the function.

$$A(t) = A_0 e^{-0.053t}$$
 where t is time in years.

(i) Find the amount of the sample remaining after, 8 years. (2 Marks)

(ii) Find the half – life. (5 Marks)

(c) (i) Evaluate  $[\binom{16}{12}]$  (2 Marks)

(ii) Use the formula for the sum of an infinite geometric series to write  $0.\overline{727272} \dots = 0.\overline{72}$  as a fraction. (4 Marks)