



# MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE BIOLOGY

SMA 100: MATHEMATICS FOR SCIENCE

DATE: 1/2/2022

TIME: 2:00 – 4:00 PM

---

## INSTRUCTIONS TO CANDIDATES

Answer ALL the questions in Section A and ANY TWO Questions in Section B

### SECTION A (COMPULSORY)

#### QUESTION ONE (30 MARKS)

- a) Define the following terms
- i) Function
  - ii) Geometric progression
  - iii) permutation
  - iv) Conditional equation
  - v) Combination (5 marks)
- b) Solve for y  $\frac{6y-4}{10y+2} = \frac{3y-18}{5y+6}$  (4 marks)
- c) The 6<sup>th</sup> term of a Geometric Progression is 27, and the common ratio is 3. Write the first five terms of the progression. (4 marks)
- d) Solve the inequality  $|3x - 18| \leq 12$  and plot the graph (4 marks)
- e) Solve the following quadratic equation by quadratic formula.
- $$3x^2 - 9x - 10 = 0 \quad (3 \text{ marks})$$
- f) How many terms of the progression -1, 1, 3, 5, ..... must be used if we want the sum to be 360. (4 marks)
- g) Solve the equation  $2\tan \theta = 4\sin \theta$ , for value of  $\theta$  from  $0^\circ$  to  $360^\circ$  (3 marks)

- h) suppose a die was tossed 2 times what is the probability of getting
- i) 6 in two occasions
  - ii) A sum of 9
  - iii) A sum of 7 or 8
- (3 marks)

## SECTION B (ANSWER ANY OTHER TWO QUESTIONS)

### QUESTION TWO 20 MARKS

- a) Simplify  $\frac{1}{\sqrt{x^2-a^2}}$  when  $x = a \operatorname{cosec} \theta$  (5 marks)
- b) Solve the equation  $1 + \cos \theta = 2 \sin^2 \theta$ , for the values of  $\theta$  from  $0^\circ$  to  $360^\circ$  (5 marks)
- c) Sketch the graph of  $y = 3 \sin 2(x - \frac{\pi}{4})$  for  $0 \leq x \leq 2\pi$ . Find its wavelength and amplitude (5 marks)
- d) A man who works five days a week can travel to work on foot, by bicycle or by bus. In how many ways can he arrange a week's travelling to work? (5 marks)

### QUESTION THREE 20 MARKS

- a) Solve for  $x$ ,  $5^{2x} - 3 = 1.2$  (5 marks)
- b) If  $\log_3(2x + 4) = \log_3 4 + 2$  solve for  $x$  (5 marks)
- c) Simplify  $\frac{11!}{9!7!} + \frac{12!}{10!6!} + \frac{13!}{11!5!}$  (3 marks)
- d) Determine the value of  $x$  for which the following form an AP.  
 $2x + 1, x + 4, 4x + 5$  (3 marks)
- e) The first term of A.P is 4, the last term is 36 and the sum is 500. Find the number of terms and the common difference. (4 marks)

### QUESTION FOUR 20 MARKS

- a) In a class of 200 students ,80 students study statistics ,60 study chemistry and 30 study both chemistry and statistics. If a student is selected at random, find the probability that he studies
  - i) chemistry and not statistics
  - ii) statistics and not chemistry
  - iii) statistics or chemistry
  - iv) neither chemistry nor statistics

(8 marks)

b) For the following grouped data find the

i) Median

ii) Mode

iii) Mean

(12 marks)

| class | frequency |
|-------|-----------|
| 20-30 | 8         |
| 30-40 | 7         |
| 40-50 | 10        |
| 50-60 | 5         |

### QUESTION FIVE 20 MARKS

a) Solve the following equation by quadratic formula.

$$px^2 - (2p + q) + (p + q) = 0$$

(4 marks)

b) Solve the inequality and represent it graphically  $|6x - 14| \geq 12$

(4 marks)

c) Solve for  $x$ ,  $8^{2x} - 2 = 6.2$

(4 marks)

d) i) Solve each of the following logarithmic equation

$$\log_2(x - 1) + \log_2 x = 5$$

(3 marks)

ii) Evaluate

$$5\sqrt{\frac{12.6 \times 2.14}{13.62 + 657}}$$

(5 marks)