Basic Mathematics

Examination

Time allowed: 2 hours

Section A: Objective Section (30 points)

1. Which of the following statement is incorrect? (1 Point)
   a) Set is a well-defined collection of objects.
   b) The set of real numbers is not the largest set of numbers.
   c) The root of a negative 4 is a math error.
   d) Irrational numbers have been mentioned in the bible.
2. Which of the following statement not false?(1 Point)
   a) Irrational numbers have recurring decimal.
   b) Integers are rational numbers.
   c) The real number system is not closed.
   d) Irrational numbers are closed under multiplication.
3. Which statement is incorrect?(1 Point)
   a) Integers are the positive whole numbers.
   b) Cardinality of the set is the number of elements of a set.
   c) The power set is the set of all subsets of a set.
   d) The empty set is a subset of say set A
4. Which statement (s) best describe |x| where x is a set (1 Point)
   a) The order of X
   b) The absolute value of x
   c) The distance from the origin to point x.
   d) the determine of matrix X.
5. Assume one has three interrelated sets A, B, and C. Is the statement: *Members of set A and members of set A only are strictly the same?*(1 Point)
   a) Correct
   b) Somehow correct
   c) Incorrect
   d) Somehow incorrect
6. Which of the following statement is incorrect? (1 Point)
   a) Quadratic equations are polynomials of degree two.
   b) Quadratic equations have at most two roots.
   c) Quadratic functions have at least one turning point.
   d) The constant term in a quadratic equation can assume any value.
7. Identify the correct statement below. (1 Point)
   a) The root of negative 7 does not exist.
   b) The imaginary number i is a complex number.
   c) The roots of a quadratic equation are always real numbers.

d) The coefficient of the first term of the quadratic equation can assume any value.

8. Identify the incorrect statement. (1 Point)
   a) A series is the sum of the terms of a sequence.
   b) A sequence is an ordered arrangement of elements.
   c) The sum to infinity of an arithmetic progression is infinity.
   d) The sum to infinity of a geometric progression is infinity.
9. Three of the definitions are correct except.(1 Point)
   a) A geometric progression proceeds with a common ratio
   b) A finite series is the sum of finite sequence.
   c) The sum to infinity of 0.2+0.02+0.002+...is infinity.
   d) Fibonacci sequences can be found in nature.
10. The following statements are true except (1Point)
   a) The probability of an event occurring ranges from 0 to 1 inclusive.
   b) A spin of a coin is a trial.
   c) The probability theory provides mathematical rules for assigning probabilities to outcomes of random experiments.
   d) A fair coin has more than two possible outcomes
11. Which statement is false? (1 Point)
   a) Measures of central tendency include mean, mode etc.
   b) Measures of variation include variance and standard deviation.
   c) Mean can be used to determine some measures of variation.
   d) Mean and mode can be determined graphically e.g. by use of a histogram.
12. State without proof the De Morgan's laws of set (2 Points)
13. Differentiate between absolute complement and relative complement (2 Points)
14. Differentiate between a series and a sequence. Illustrate with a relevant example in each case. (4 Points)
15. Define the following terms: (5 Points)
   a) Median
   b) Arithmetic series
   c) Absolute value of a real number x
   d) Discrete probability space
   e) A linear equation
16. The ages of boys in a certain class were recorded as follows: 18yrs – 2 boys; 19 years – 8 boys; 20 years – 11 boys; 21 years – 5 boys and 22 years – 2 boys. What is the probability of selecting a boy who is either 19 years or 21 years old? (2 Points)
17. Determine the roots of $3x^2 - 8x - 11 = 0$ (2 Points)
18. Solve for x in the following: $2|2x-5| > 12$ (2 Points)

Section B: Subjective Section (30 points)

1) Determine a quadratic equation whose roots are $3i$ and $2 - i$ (2 Points)

2) Determine the probability of getting a head and an odd number when a fair coin is tossed, and a die rolled once. (2 Points)

3) Two fair dice are tossed.
   (i) Draw a contingency table for the total possible outcomes (1 Point)
   (ii) Find the probability of two number showing up whose product is a factor of 36 (2 Points)

4) Show that $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots = 2$ (2 Points)

5) The following table represents the number of masks sold to motorists by some hawkers along Thika road.

No. of masks	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 - 39	40 – 44	45 – 49	50 – 54
No. of Hawkers	4	5	7	18	28	16	11	8	3

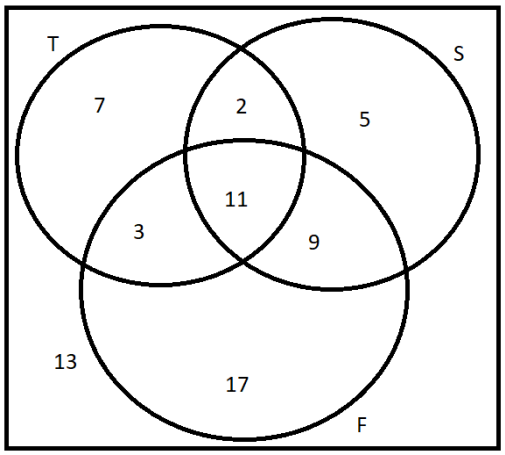
   (i) Calculate the mean number of masks sold (2 Points)
   (ii) Estimate the median mask (2 Points)
   (iii) Calculate the standard deviation (3 Points)

6) The first and the last term of a GP are 3 and 729 respectively and the sum of all terms is 1092. Find the common ratio and the number of terms. (3 Points)

7) Apply the Cramer's rule to solve the linear system (show your working): (4 Points)

$$3x + 2y - z = 12$$
$$5x + 2z = 17$$
$$x - y + 7z = 8$$

8) Study the Venn diagram below that represent the number of people in a party who consumed certain beverages i.e. Tea T, Soda S, Fresh juice F, and others. Use the information to attempt the following questions (Do not draw the Venn diagram).



Supposed 5 people did not honor the invitation to attend the party, find how many people were invited. (1 Point)

(i) How many people drunk all the drinks i.e. tea, soda, and fresh juice (1 Point)

(ii) How many people took at least one of the three drinks i.e. tea, soda, and fresh juice (1 Point)

(iii) How many too exactly one of the drinks i.e. tea, soda, and fresh juice (1 Point)

(iv) $n(T \cup S)$, $|(F \cap S) \cap T^c|$ (2 Points)

(v) How many took both fresh juice and tea but not soda (1 Point)