Candidate's Index Number:
Signature:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B.ED)
SECOND YEAR, FIRST SEMESTER MID SEMESTER QUIZ, FEBRUARY 2021

FEBRUARY 19, 2021   NATURE OF MATHEMATICS   3:00 PM – 3:40 PM

This paper consists of two sections, A and B. Answer ALL the questions in both Sections A and B.

SECTION A
(20 Marks)

Answer ALL the questions in this Section.

Items 1 to 10 are stems followed by four options lettered A to D. Read each item carefully and circle the letter of the correct or best option.

1. Written symbols we use to represent numbers are called ………………....
   A. counting numbers
   B. numbers
   C. numerals
   D. real numbers.

2. The Egyptians used different images to represent different units of 10. The Egyptian symbol
   ⟲ represents …………………....
   A. 10
   B. 100
   C. 1000
   D. 10000

3. The Roman number MMXXI represents the numeral ……………....
   A. 2019
   B. 2020
   C. 2021
   D. 2029

4. The number $(53e)_{twelve}$ expressed in base ten is ……………………………
   A. 10137
   B. 10129
   C. 10127
   D. 10126

5. Which of the following individuals used numbers in coordinate geometry to formulate the concept of coordinates.
   A. Descartes.
   B. Euclid.
   C. Pythagoras.
   D. Thales.

6. In transformation, if the object and its image have the same shape, though size may be different, then the object and its image are said to be ....
   A. congruent.
   B. equal.
   C. isometries.
   D. similar.

7. If the area of an object is 8cm² and that this object is enlarged with a scale factor 3, what would be the area of the enlarged figure?
   A. $24cm^2$
   B. $72cm^2$
   C. $216cm^2$
   D. $432cm^2$

8. The Roman numeral MCMXLIV represents .... in Hindu Arabic.
   number system.
   A. 1946
   B. 1994
   C. 1944
   D. 1934

9. The Pythagoreans studied numbers as a way to find certain mystical properties in the numbers. They called the odd numbers as .... numbers.
   A. abundant
   B. feminine
   C. masculine
   D. prime

10. When an object is repositioned and reflected but not resized, the resulting image is congruent to the original object. This statement is ....
    A. always false.
    B. always true.
    C. neither true nor false.
    D. sometimes true.

SECTION B
(20 Marks)

Answer ALL questions in this section. In each question, show all the necessary details of working.

1. Suppose there are 6 families each having 4 males and 7 females. Find the total number of people in all the six families. **(5 Marks)**

2. For each of the following,
   - a. perfect number
   - b. abundant number
   - c. deficient number

   i. Explain what it is. **(5 Marks)**
   ii. Give an example of each. **(5 Marks)**
   iii. Give a reason for your answer. **(5 Marks)**

---

1. Method I

   Total number of males = 6×4 = 24 males   M1
   Total number of females = 6×7 = 42 females   M1
   Total number of people = 24+42 = 66   M1A1
   Therefore, there are 66 people in the six families. A1

   Method II   M1A1
   Total of males and females in each family = 4+7 = 11 people
   Total in all six families = 6×11 = 66 people A1 A1
                                      M1

2. (a)(i) A perfect number is a counting number that is equal to the sum of all its divisors that are less than the number itself. 2☐ marks

   (b) An abundant numbers is a natural number that has the sum of its proper divisors greater than the number itself. 2

   (c) Deficient number is a number whose sum of its proper divisors less than the number itself. 1

   (ii) Perfect number example 6 ie proper divisors of 6 are
   6 = {1, 2, 3} Sum = 1+2+3 = 6 2
   Abundant number eg. 8 ̶1̶+̶2̶+̶4̶ 24 = 1+2+3+4+6+8+12 = 36
                                12 = 1+2+3+4+6 = 16
   Deficient ⇒ 8 = 1+2+4 = 7 2

(iii) For the abundant number 12, the sum of its proper divisors is 16 which is greater than the number 12. 2

– For the perfect number 6, the sum of the proper divisors ie $1+2+3=6 \Rightarrow 6=6$. 2

– The deficient number 8 has sum of proper divisors ie $1+2+4=7$ but $7<8$.

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COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B. ED)
FIRST YEAR, END-OF-FIRST SEMESTER EXAMINATION, FEBRUARY 2020

FEBRUARY 6, 2020   NATURE OF MATHEMATICS   2:00 PM – 2:40 PM

This paper consists of two sections, A and B. Answer all the questions in Sections A and THREE questions in Sections B. Section A will be collected after the **first 40 minutes**.

SECTION A
Answer all the questions in this section

For items 1 to 9, each stem is followed by four options lettered A to D. Read each item carefully and circle the letter that corresponds to the correct or best option. Each question carries 2 marks

1. Mathematicians resolve the truth or falsity of conjectures by mathematical ....
   A. models.
   B. patterns.
   C. proofs.
   D. structures.

2. According to James and James Dictionary of Mathematics, Mathematics is divided into three fields. These are Algebra, ...
   A. Analysis and Geometry.
   B. Analysis and Shapes.
   C. Trigonometry and Geometry.
   D. Geometry and Vectors.

3. One of the highest values in mathematics, like science is its................
   A. abstractness.
   B. openness.
   C. preciseness.
   D. proofs.

4. When an object is repositioned and reflected but not resized, the resulting image is congruent to the original object. This statement is ....
   A. always false.
   B. always true.
   C. neither true nor false.
   D. sometimes true.

5. Richard Skemp describes mathematics as the most ....
    A. abstract and so the most powerful of all theoretical systems.
    B. applied and so most indispensable tool in all theoretical systems.
    C. used entity and so most applicable in all theoretical systems.
    D. useful and so most important entity in all theoretical systems.

6. Mathematics relies predominantly on .... as its standard of truth.
    A. analysis
    B. experimentation
    C. logic
    D. observation

7. Which one of the following is not true about *successor* in Peano's Postulates?
    A. Distinct numbers have distinct successors.
    B. No number has one as a successor.
    C. One is the successor of two.
    D. The successor of n is $n+1$.

8. Which one of the following mathematics philosophers described a mathematician as *a blind man in a dark room looking for a black cat which isn't there?*
    A. B. Russell
    B. C. Darwin
    C. G. Hardy
    D. H. Poincaré

9. Which one of the following is true about a square root of a number as one of the ....
    of the given number.
    A. factors
    B. two factors
    C. two equal factors
    D. three equal factors

Item 10 is a statement followed by true and false. Read the statement carefully and indicate whether it is True or False by circling the letter of the correct option.

10. There is no general agreement on precisely what mathematics is.
    A. False
    B. True

For questions 11 to 15 write your solution in the space provided under each question. Each question carries 4 marks. Show working clearly.

11. Use the Binomial theorem to expand $(1 + x)^{1/2}$ in ascending powers of x to as far as x^3.

12. Use your expansion in question 11 above to find the value of $\sqrt{1.08}$, correct to four significant figures.

13. State the first four axioms of Peano in your own words

14. Consider the following statements

$P: x = 4$ and

$Q: x^2 = 16$.

State whether each of these is true or false

(a) $P \Rightarrow Q: x = 4 \Rightarrow x^2 = 16$ is _____.

(b) $Q \Rightarrow P: x^2 = 16 \Rightarrow x = 4$ is _____.

(c) $-P \Rightarrow -Q: x \neq 4 \Rightarrow x^2 \neq 16$ is _____.

(d) $-Q \Rightarrow -P: x^2 \neq 16 \Rightarrow x \neq 4$ is _____.

15. Explain why this argument is valid but **not sound.**

- All my friends are girls.
- Atiptoe is my friend.
- Therefore, Atiptoe is a girl.

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COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B. ED)
FIRST YEAR, END-OF-FIRST SEMESTER EXAMINATION, FEBRUARY 2020

FEBRUARY 6, 2020   NATURE OF MATHEMATICS   2:00 PM – 2:40 PM

SECTION B
(60 Marks)
Answer only THREE questions from this section
Each question carries 20 marks. Show working clearly.

1. (a) Explain how you would use mathematical algorithm (BEDMAS) to evaluate

    $(7-3)^2 - 2 \times 5 + 9$ (6 Marks)

    (b) Explain how you would use the Sieve of Eratosthenes to find all prime
    numbers from 1 to 100.   (14 Marks)

2. (a) State the principle of mathematical induction.   (6 Marks)
    (b) Use the principle of mathematical induction to prove that

    $\sum_{r=1}^{n} r^2 = 1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{1}{6}n(n+1)(2n+1)$ (14 Marks)

3. (a) (i) Explain the difference between a *conjecture* and a *theorem*.   (6 Marks)

       (ii) Give an example of each   (4 Marks)

    (b) Explain how you would use prime factorization to find the highest
    common factor (HCF) of 108 and 300.   (10 Marks)

4. (a) Distinguish between a **perfect** number and an **abundant** number giving
        an example of each and justifying each answer given example.   (10 Marks)

    (b) What is a deficient number? Give an example of a deficient number.   (5 Marks)

    (c) Explain each of the following mathematical terms giving an example of each.
        (i) Mathematical Axioms

        (ii) Mathematical Algorithms   (5 Marks)

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INSTITUTE OF EDUCATION

FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
FIRST YEAR, END-OF-FIRST SEMESTER EXAMINATION, SEPTEMBER 2019

SEPTEMBER 5, 2019   NATURE OF MATHEMATICS   2:00 PM - 2:40 PM

This paper consists of two sections, A and B. Answer all the questions in Section A and TWO questions in Section B. Section A will be collected after the **first 40 minutes**.

SECTION A
(40 MARKS)

Answer all the questions in this Section.

For items 1 to 24, each stem is followed by four options lettered A to D. Read each statement carefully and circle the letter that corresponds to the correct or best option.

1. Which one of the following statements is always true about *natural* numbers?
    A. Even are exactly divisible by odd numbers.
    B. Even numbers leave no remainder when divided by 2.
    C. The sum of two odd numbers is a perfect number.
    D. The sum of two odd numbers is an even number.

2. The sum of any two consecutive triangular numbers gives a square number. This statement is
    _____.
    A. a paradox
    B. always false
    C. always true
    D. neither true nor false

3. A polite number is a natural number that _____.
    A. has the sum of its proper divisors equal to the number itself
    B. has the sum of its proper divisors greater than the number itself
    C. has the sum of its proper divisors less than the number itself
    D. is the sum of two or more consecutive natural numbers

4. *Counting all* principle involves _____.
   A. counting objects for the first addend, counting objects for the second addend, and then counting the combined collection.
   B. counting the real objects representing the first addend, and then finger counting for the second addend.
   C. just mentioning one of the addends and then finger counting for the second addend.
   D. making collections of objects for the first addend, and another collection for the second addend, and then combining.

5. In Mathematics, " *a logical argument that establishes, beyond any doubt, that something is true*" is a suitable description of a/an _____ .
   A. generalization
   B. operation
   C. proof
   D. theorem

6. The greatest number that can divide two or more given natural numbers is known as the

   _____.
   A. greatest common factor
   B. greatest common multiple
   C. highest common denominator
   D. lowest common multiple

7. A mathematics *postulate* is a _____.
   A. deduction which demonstrates the validity of a statement
   B. self-evident truth with its basis in geometrical ideas
   C. statement which holds for an underlying number concept
   D. statement whose truth value is not yet established

8. Which of the following represents the sequence of the four *conceptual* stages in the development of algebra?
   A. Geometric → Rhetorical → Dynamic function → Symbolic stages
   B. Geometric → Rhetorical → Syncopated → Symbolic stages
   C. Geometric → Static equation-solving → Dynamic function → Abstract stages
   D. Geometric → Static equation-solving → Rhetorical → Syncopated stages

9. Which of the following statements are true?

   I.   ∩𝟃∣∣∣ = 𝖳⥷⥷⥷⥷⥷ 𝖳𝖳𝖳

   II. ∩𝟃∣∣∣ = 𝖳⥷⥷⥷⥷⥷ 𝖳𝖳𝖳

   III. 113 = 𝖳⥷⥷⥷⥷⥷ 𝖳𝖳𝖳

   A. I & II only
   B. I & III only
   C. II & III only
   D. I, II & III

10. The belief that *truths in mathematics appear to be necessary and certain and almost independent of humankind* is attributed to the _____.
    A. Absolutists
    B. Constructivists
    C. Fallibilists
    D. Formalists

11. The statement that "*there is no authoritative source of knowledge and that we are all not perfect and so mathematical knowledge should be open to revision*" best describes the _____ view.
    A. Absolutists'
    B. Fallibilists'
    C. Formalists'
    D. Platonists'

12. The central idea of Constructivism is that human learning is constructed and that learners _____.
    A. are tabula rasa on which new knowledge is etched
    B. build knowledge upon established formalized teacher given rules
    C. build new knowledge upon the foundation of previous learning
    D. passively receive information transmitted to them by the teacher

13. Any geometric figure that has a *point symmetry* about a turn centre is described as having _____.
    A. both rotational and folding symmetry
    B. rotational symmetry of order 3 .
    C. 120° rotational symmetry
    D. 180° rotational symmetry

14. The first main step involved in the proof by mathematical induction for infinity of cases is the _____.
    A. checking for the induction hypothesis
    B. establishment of basis for the induction
    C. establishment of core of the induction proof .
    D. testing for induction hypothesis

15. Which of the following descriptions best fits a *sound* argument? It is _____
    A. a deduction from two or more premises
    B. plausible and comes from probable premises
    C. valid and has premises that are true
    D. valid and has premises that may be possible

16. Which of the following forms of adaptation has taken place when an individual incorporates a new experience into an already existing framework without changing that framework?
    A. Accommodation
    B. Assimilation
    C. Generalization
    D. Operation

15. Scaling uniformly in all directions, as used in scale drawing, always results in _____ figures.
    A. congruent
    B. enlarged
    C. similar
    D. translated

16. The mathematician who is known to have demonstrated that there are propositions that are *undecidable* is called _____.
    A. Epimenides
    B. Kurt Gódel
    C. Betrand Russell
    D. Richard Skemp

17. When an object is repositioned and reflected but not resized, the resulting image is congruent to the original object. This statement is _____.
    A. always true
    B. always false
    C. sometimes true
    D. undecidable

18. The form of adaptation which involves the process of reframing one's mental representation of the external world to fit new experiences is known as _____.
    A. abstraction
    B. accommodation
    C. generalization
    D. reinforcement

19. Which one of the following philosophers of mathematics was regarded as the "*Maker of Mathematicians*"?
    A. Archimedes
    B. Aristotle
    C. Euclid
    D. Plato

20. Which of the following statements are true about a *perfect* number?
    I.   The sum of its proper divisors is equal to the number itself.
    II.   The sum of all its divisors is twice the number itself.
    III. It is less than the sum of all its proper divisors.
    IV.   The sum of its proper divisors is greater than the number itself.

    A. I & II
    B. I & III
    C. I & IV
    D. II & III

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FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
FIRST YEAR, END-OF-FIRST SEMESTER EXAMINATION, SEPTEMBER 2019

SEPTEMBER 5, 2019   NATURE OF MATHEMATICS   2:40 PM – 4:00 PM

SECTION B
(60 MARKS)

Answer ONLY TWO questions from this section
Each question carries 30 marks

1. a) Explain two main beliefs held by each of the following philosophers of Mathematics.
   (i)   Fallibilists;   [6 marks]
   (ii) Platonists.   [6 marks]

   b) (i) What is meant by lowest common multiple of two or more natural numbers?
      (ii) Explain how you would use *prime factorization* to find *the least natural
           number that is divisible by 144 and 96.*   [18 marks]

2. a) Explain two definitions of mathematics.   [6 marks]

   b) Explain, step by step, how to use HMMDIA algorithm to solve the subtraction

      problem:

$$
\begin{array}{r}
5\ 4\ 1 \\
-\ \ 8\ 5 \\
\hline
\end{array}
$$
                                                                          [12 marks]

   c) (i) Give two definitions of a proof in mathematics.   [4 marks]
      (ii) What are the main conditions for the complete proof by mathematical
           Induction?   [8 marks]

3. a) (i) What are *proper factors* of a natural number? Illustrate with a suitable example. [4 marks]

   (ii) Explain each of the following mathematics education terms, illustrating with two examples each: *deficient*, *abundant* and *perfect* natural numbers. [12 marks]

b) Explain, with illustrative examples, the difference between *congruent* and *similar* geometric figures. [6 marks]

c) Consider the pattern:

$$2 + 1 \times 9 = 11$$

$$3 + 12 \times 9 = 111$$

$$4 + 123 \times 9 = 1111$$

... ...

... ...

  i. Predict the next two rows in the sequence. [4 marks]

  ii. Use pattern observed to complete the 9th row in the sequence and explain. [4 marks]

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FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
LEVEL 300, FIRST SEMESTER QUIZ, SEPTEMBER, 2021

SEPTEMBER 8, 2021   NATURE OF MATHEMATICS   1:30 PM - 2:00 PM

Answer ALL the questions.

Items 1 to 20 are stems followed by four options lettered A to D. Read each item carefully and circle the letter which corresponds to the correct or best option.

1. The Greek word 'axios' from which axiom is derived means ……………..
   A. anything used.
   B. anything proposed.
   C. something worthy.
   D. worthy proposal.

2. Which one of the following terms fits the description *'a number which has exactly two factors, the number itself and one'*?
   A. Composite number.
   B. Odd number.
   C. Perfect number.
   D. Prime number.

3. Who authored the book titled "Elements"?
   A. Aristotle.
   B. Euclid.
   C. Fermat.
   D. Goldbach.

4. The proposition that *any even number greater than 2 is the sum of two primes* is often referred to as ……………………………..
   A. Goldbach's even number conjecture.
   B. Fermat's Last Theorem.
   C. Fermat's even prime number conjecture.
   D. Euclid's infinity of even primes.

5. Which one of the following is among the "Five Common Notions" in the Elements?
   A. An equal can be added to an equal.
   B. An equal can be subtracted from an equal.
   Ⓒ The whole is greater than any of its parts.
   D. Things which coincide with one another are divisible.

6. The components of the *cycle of investigation* in mathematics are sequentially arranged as
   ....
   Ⓐ representation, manipulation and validation.
   B. representation, manipulation and variation.
   C. representation, validation and manipulation.
   D. representation, variation and manipulation .

7. Which one of the following statements is a correct definition of *square root* of a given natural number?
   A. One of the factors of the given natural number.
   Ⓑ One of the two equal factors of the given number.
   C. The product of two equal factors.
   D. The result of multiplying a number by itself.

8. *The process that starts with an input in a particular state of affairs, goes through a transformation which results with an output in a final state of affairs,* is referred to as a/an
   .... in mathematics.
   A. algorithm
   B. antinomy
   C. conjecture
   Ⓓ operation

9. Which one of the following is an example of a mathematical algorithm?
   A. AXIOM.
   B. CONJECTURE.
   C. FOID.
   Ⓓ HMMDIA.

10. A mathematical statement whose *truth value is yet to be established* is known as
    ....
    A. axiom.
    Ⓑ conjecture.
    C. paradox.
    D. theorem.

11. Which of the earliest numeration systems was known to have employed only two wedge-shaped characters called *cuneiform*?
    A. Babylonians.
    B. Egyptians.
    C. Hindu-Arabic.
    D. Romans.

12. Which one of the following descriptions fits the mathematics term "theorem"?
    A. A proposition whose truth value has been established.
    B. A proposition whose truth value is yet to be established.
    C. A self- contradictory mathematics statement.
    D. A self- evident truth or common notion.

13. The conjecture *"Any even number greater than 2 is the sum two of primes"* is attributed to the mathematician called ....
    A. euclid.
    B. fermat.
    C. goldbach.
    D. skemp.

14. Which of the following paradoxes concerns a Cretan philosopher asserting that "*All Cretans are liars*"?
    A. Epimenides' Libel.
    B. Lazy bones Paradox.
    C. Russell's Paradox.
    D. Tortoise and Archilles Paradox.

15. Any proposition, *which offhand appears to be true but is actually false, or which appears to be false, but is actually true* is referred to as ....
    A. algorithm.
    B. axiom.
    C. conjecture.
    D. paradox.

16. Which one of the following mathematicians is claimed to make the statement "*God is a Mathematician*"?
    A. Galileo.
    B. Plato.
    C. R. Skemp.
    D. Sir James Jeans.

17. The name of the mathematician associated with the demonstration that there are propositions that are *undecidable* is ....
    A. Richard Skemp.
    (B) Kurt Gödel.
    C. Epimenides .
    D. Betrand Russell.

18. The *counting on* principle stipulates that the learner ....
    A. counts all objects for the first addend, and then finger counts for the second addend.
    B. counts objects for the first and the second addends and then counts all combined.
    C. makes all objects for the first addend, and all the objects for the second addend.
    D. states one of the addends and then "finger" counts to represent the second addend.

19. Richard Skemp's definition of Mathematics is ....
    A. A way of thinking, and the thinking is about numbers
    B. An abstract subject made up of symbols and other arbitrary elements
    (C) The most abstract and so the most powerful of all theoretical systems.
    D. 'The subject in which we never know what we are talking about nor whether what we are saying is true'

20. The statement that *the square of the hypotenuse is equal to the sum of the squares of the other two sides in any right-angled triangle*, is known as the ....
    (A) Pythagorean Theorem.
    B. Fermat's Last Theorem.
    C. Euclidian Theorem.
    D. Binomial Theorem.

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FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
FIRST YEAR, FIRST SEMESTER QUIZ I, AUGUST 2019

AUGUST 24, 2019   NATURE OF MATHEMATICS   1:30 PM – 2:00 PM

Answer ALL questions on the question paper

For items 1 to 16, each stem is followed by four options lettered A to D. Read each statement carefully and circle the letter that corresponds to the correct or best option.

1. Which of the following mathematicians is associated with the definition of mathematics as *a way of thinking, the thinking is about number and about space and the things that are in space?*
    A. Kline
    B. Russell
    C. Skemp
    D. Thompson

2. Which one of the following is an example of a mathematical algorithm?
    A. AXIOM
    B. CONJECTURE
    C. HDMAA
    D. PEDMAS

3. Which one of the following is among the "Five Common Notions" in the Elements?
    A. An equal can be added to or subtracted from an equal.
    B. An equal can be subtracted from an equal or multiplied by an equal.
    C. Any of the parts of a whole is greater than the whole.
    D. Things which coincide with one another are equal to one another.

4. The book titled "Elements" was written by _____
    A. Euclid.
    B. Fermat.
    C. Goldbach.
    D. Russell.

5. Which one of the following statements is a correct definition of *cube root* of a given natural number?
   A. One of the three equal factors of the given number.
   B. One of the two equal factors of the given number.
   C. The product of three equal factors.
   D. The result of multiplying a number by itself thrice.

6. Which one of the following is the definition of mathematics attributed to Richard Skemp?
   A. A very powerful subject in which we never know what we are talking about.
   B. The most abstract and most powerful of all theoretical systems.
   C. The most abstract subject which plays a critical role in modern culture and scientific literacy.
   D. The subject in which we never know what we are talking about nor whether what we are saying is true.

7. Propositions that are often considered as *general truths* are referred to in mathematics as a/an
   _____.
   A. algorithm.
   B. axiom.
   C. conjecture.
   D. paradox.

8. Any proposition, *which offhand appears to be true but is actually false, or which appears to be false, but is actually true* is referred to as _____
   A. algorithm.
   B. antinomy.
   C. axiom.
   D. conjecture.

9. Any procedure carried out on one or more original values to generate a new value is generally referred to in mathematics as _____
   A. Algorithm.
   B. axiom.
   C. conjecture.
   D. operation.

10. The conjecture *"Any even number greater than 2 is the sum two of primes"* is attributed to the mathematician called _____
    A. Euclid.
    B. Fermat.
    C. Goldbach.
    D. Skemp.

11. A mathematical statement whose *truth value is yet to be established* is known as _____
    A. axiom.
    B. conjecture.
    C. paradox.
    D. theorem.

12. Which one of the following descriptions fits the mathematics education term "theorem"?
    A. A proposition whose truth value has been established.
    B. A proposition whose truth value is yet to be established.
    C. A self- contradictory mathematics statement.
    D. A self- evident truth or common notion.

13. Which one of the following mathematicians is claimed to make the statement "*God is a Mathematician*"?
    A. Galileo
    B. Plato
    C. R. Skemp
    D. Sir James Jeans

14. Bertrand Russell's definition of Mathematics is _____
    A. A way of thinking, and the thinking is about numbers.
    B. An abstract subject made up of symbols and other arbitrary elements.
    C. The most abstract and so the most powerful of all theoretical systems.
    D. 'The subject in which we never know what we are talking about nor whether what we are saying is true'.

15. The term used for propositions regarding the undefined terms assumed to be self- evidently true was derived from the Greek word 'axios' which means _____
    A. anything used.
    B. anything proposed.
    C. something worthy.
    D. worthy proposal.

16. Which one of the following terms fits the description "*a number which has additional factors other than itself and one (1)*"?
    A. Antinomy.
    B. Composite number.
    C. Odd number.
    D. Prime number.

17. Distinguish between *prime number* and *composite number* using one example each to illustrate.

[4 marks]

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NATURE OF MATHEMATICS
QUIZ I

1. D
2. D
3. D
4. A
5. A
6. B
7. B
8. B
9. D
10. C

11. B
12. A
13. D
14. D
15. C
16. B

1 mark each

156   164

①

17. A prime number has exactly two distinct factors, one and the number itself. 1 mark

Example: 5, prime with the only two factors being 1 and 5 1 mark

A composite number has more than two distinct factors. 1 mark

Example: 8 with factors 1, 2, 4, 8. etc 1 mark

②

Candidate's Index Number

Signature:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

FIVE SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
FIRST YEAR END-OF-FIRST SEMESTER EXAMINATION SEPTEMBER 2017

SEPTEMBER 5, 2017   NATURE OF MATHEMATICS   12:00 PM - 2:00 PM

THE PAPER CONSISTS OF TWO SECTIONS A AND B.   ANSWER ALL QUESTIONS IN SECTION A AND THREE QUESTIONS FROM SECTION B.

SECTION A (40 MARKS)

ANSWER ALL QUESTIONS ON THE QUESTION PAPER
FOR QUESTIONS 1 – 20, CIRCLE THE LETTER FOR THE CORRECT OR BEST OPTION

1. Which one of the following solids is composed of 20 triangular faces?
   - A. Dodecahedron
   - B. Icosahedron ✓
   - C. Octagon
   - D. Tetrahedron

2. An argument is valid if _____.
   - A. it is impossible for the conclusion to be true when the premises are true
   - B. it is impossible for the premises to be true and the conclusion false
   - C. the premises succeed in guaranteeing the conclusion ✓
   - D. true premises are likely to give conclusions that may be true

3. Who are the authors of the book "*Principia Mathematica*"?
   - A. Bertrand Russell and Alfred N. Whitehead ✓
   - B. Bertrand Russell and Richard Skemp
   - C. Gottfried Leibniz and Aristotle
   - D. Gottfried Leibniz and George Boole

4. Which one of the following is a major belief held by the Absolutist philosophers of mathematics? ✓
   - A. Mathematics is a body of knowledge where truths appear to everyone as necessary and certain.
   - B. Mathematics is essentially a human pursuit, invented by humans, and therefore prey to human errors.
   - C. Mathematics is a game, concerned solely with algorithmic manipulations of symbols.
   - D. Mathematics is a languageless creation of the mind and time is only a priori notion.

5. The statement " *a logical argument that establishes, beyond any doubt, that something is true*" describes a/an _____ in mathematics
   - A. algorithm
   - B. operation
   - C. proof ✓
   - D. theorem

6. Which of the following statements are true about a *perfect* number?
   - I. The sum of its proper divisors is equal to the number itself.
   - II. The sum of all its divisors is twice the number itself. ✓
   - III. It is less than the sum of all its proper divisors.
   - IV. The sum of its proper divisors is greater than the number itself.
      - A. I & II ✓
      - B. I & III
      - C. I & IV
      - D. II & III

7. Which one of the following is true about transformations?
   - A. The unchanged properties in a transformation are called variants.
   - B. Symmetry refers to turning a figure about a central point to match the original.
   - C. Reflection is any change of the position of a shape.
   - D. Direct isometry preserves orientation or order. ✓

8. When an object is repositioned and reflected but not resized, the resulting image is congruent to the original object. This statement is _____.
   - A. Always true ✓
   - B. Never true
   - C. Sometimes true

9. If two rectangles have the same diagonals, they are said to be _____.
   - A. variants
   - B. strecthes
   - C. dilation
   - D. congruent ✓

10. The belief that "*mathematical objects exist and their existence is an objective fact quite independent of our knowledge of them*" is held mainly by _____.
    - A. Constructivists
    - B. Fallibilists
    - C. Formalists
    - D. Platonists ✓

11. Which one of the following statements is true about the natural number 15?
    - A. It is a deficient and a feminine number.
    - B. It is a deficient and polite number. ✓
    - C. It is an abundant number.
    - D. It is an abundant and a polite number.

12. The stage in the proof by mathematical induction whereby we test for the truth of the proposition for $n = 1$ (or any first integer for which the proposition holds) before making an assumption for $n = k$ is referred to as _____.
    A. Induction hypothesis
    B. Core of the induction proof
    C. Confirmation induction
    D. Basis for induction ✓

13. When a figure has $180°$ rotational symmetry, it is described as having _____.
    A. folding symmetry about the line of fold
    B. plane geometric symmetry of order
    C. point symmetry about the turn centre ✓
    D. translational symmetry by a vector

14. Which one of the following is the correct definition of mathematics by Richard Skemp?
    A. The most abstract and most powerful of all theoretical systems. ✓
    B. The most powerful subject in which we never know what we are talking about.
    C. The most abstract subject which plays a critical role in modern culture and scientific literacy.
    D. The subject in which we never know what we are talking about nor whether what we are saying is true.

15. A mathematical paradox is also known as a/an _____.
    A. theorem
    B. proof
    C. libel
    D. antinomy ✓

16. The least number that is divisible by two given natural numbers is the _____ of the given numbers.
    A. greatest common divisor
    B. highest common factor
    C. lowest common divisor
    D. lowest common multiple ✓

17. *Counting on* principle involves _____.
    A. stating one of the given addends and then "finger counting" for the second addend. ✓
    B. making collections of the first addend, and the second addend, and then combining.
    C. counting the objects for the first addend, and also for the second addend and then counting all combined.
    D. counting all objects for the first addend, and then "finger count" for the second addend.

18. Which one of the following best describes an *axiom* in mathematics?
    A. A deduction that demonstrates that a process is true.
    B. A proposition whose truth value has been established.
    C. A statement which holds for an underlying concept. ✓
    D. A statement whose truth value cannot be established.

19. An unproved proposition in mathematics that is believed to be true is termed _____.
    A. algorithm
    B. antinomy
    C. axiom
    •D. conjecture

20. The sum of any two consecutive triangular numbers gives a square number. This statement is _____.
    A. Never true
    B. Sometimes true
    • C. Always true

For questions 21 – 22, write your response in the space provided under the question.

21. a) Write 536 as:
    (i)   an Egyptian numeral;   [2 marks]

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    (ii)   a Babylonian numeral.   [2 marks]

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    b) Explain how to convert 536 as a base five numeral.   [5 marks]

$$5\,|\,536$$
$$5\,|\,107 \; r \; 1$$
$$5\,|\,21 \; r \; 2$$
$$5\,|\,4 \; r \; 1$$
$$D \quad 4$$

    $$\therefore 536 = 4121_{five}.$$

22. Show that 1184 and 1210 are amicable numbers.   [11 marks]

    Factors of 1184 and 1210

    $1184 = 1, 2, 592, 4, 296, 8, 148, 74, 16, 32, 37,$ ~~74~~ (11)

    Sum = 1210

    $1210 = 1, 2, 605, 5, 242, 10, 121, 11, 110, 55, 22, = 1184$

    (1) 5 chks

ANSWER ANY THREE QUESTIONS FROM THIS SECTION

1. a) (i) Explain TWO definitions of Mathematics.   [6 marks]

    (ii) Identify THREE examples to illustrate mathematics as an invention.   [6 marks]

    b) State Goldbach's even number conjecture and illustrate with THREE numbers selected from numbers between 50 and 100.   [8 marks]

2. a) (i) Explain how you would solve the subtraction problem $\begin{array}{r} 2\ 7\ 6 \\ -\ \ 8\ 9 \\ \hline \end{array}$ using the

    HMMDIA algorithm.   [10 marks]

    b) (i) What does the acronym FOIL stand for?   [2 marks]
        (ii) Use the FOIL algorithm, step by step, to expand and simplify $(3x-2)(2x+3)$.
                                                                            [8 marks]

3. a) Describe the steps involved in using prime factorization to find the least natural number divisible by 144 and 108.   [12 marks]

    b) (i) Explain TWO definitions of proof in mathematics.   [4 marks]
    . (ii) Identify TWO reasons why we need proof in mathematics.   [4 marks]

4. a) Distinguish clearly between *abundant* and *polite* numbers.   [6 marks]

    b) Explain clearly how you would determine whether each of the numbers, 8, 20 and 27 is *polite*, or *abundant* or both.   [14 marks]

5. a) Explain THREE main beliefs held by each of the following philosophies of mathematics:
        (i)   Absolutism;   [6 marks]
        (ii)   Fallibilism.   [6 marks]

    b) Distinguish between *congruent* and *similar* figures, illustrating with diagrams.

                                                                            [8 marks]

CANDIDAT'S INDEX NUMBER

SIGNATURE:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
FIRST YEAR, FIRST SEMETER QUIZ 1, AUGUST 2017

AUGUST 22, 2017   NATURE OF MATHEMATICS   10:30 AM - 11:00 AM

Answer ALL the questions on the question paper.

For questions 1 – 14, circle the letter for the correct or best option.

1. Which of the following personalities made the assertion that "*God is a Mathematician*"?
    A. G. Galileo
    B. Sir James Jeans
    C. D. Paling
    D. J.W.N. Sullivan

2. The definition of mathematics as "*the subject in which we never know what we are talking about nor whether what we are saying is true*" is attributed to...................
    A. Morris Kline.
    B. James Rees.
    C. Bertrand Russell.
    D. Richard Skemp.

3. Which one of the following is a group of people who view mathematics as *real*?
    A. Morris Kline, J.W.N. Sullivan and James Rees
    B. Richard Skemp, Bertrand Russell and Max Black
    C. Bertrand Russell, Marshall Stone and Max Black
    D. Richard Skemp, Max Black and Sullivan

4. Mathematics as a science of patterns and order has its domain to include...................
    A. numbers, chance and algorithm.
    B. numbers, sound and predicate.
    C. change, games and verbs.
    D. algorithm, language and verbs.

5. The term "axiom" is derived from the Greek word "*axios*" which means...................
    A. something worthy.
    B. something proved.
    C. something derived.
    D. something established. *proved.*

6. A primary proposition assumed to be self- evidently true is referred to in mathematics as a/ an..........................
    A. algorithm.
    B. axiom.
    C. conjecture.
    D. paradox.

7. The author of the book titled "*Elements*" is..........................
    A. Euclid
    B. Russell
    C. Hardy
    D. Galileo

8. Any procedure carried out on one or more original values to generate a new value is termed in mathematics education as..........................
    A. algorithm.
    B. antinomy.
    C. operation.
    D. squaring.

9. Which mathematics education term fits the description "*a finite set of precise instruction for performing a computation including all definite procedures for solving the problem*"?
    A. Algorithm
    B. Antinomy
    C. Conjecture
    D. Operation

10. An unproved proposition in mathematics that is believed to be true is termed..............
    A. algorithm.
    B. antinomy.
    C. axiom.
    D. conjecture.

11. What is the name of the mathematician who created the theory of "*Ideal Number*" in his failed attempt to prove the famous Fermat's Last Theorem?
    A. Professor Andrew
    B. Euclid
    C. Eduard Kummer
    D. David Slowinski

12. A proposition that has been demonstrated that it can neither be proved to be true nor false is termed..........................
    A. Algorithm.
    B. Antinomy.
    C. Conjecture.
    D. Theorem.

13. In mathematics education, a self-contradictory statement is referred to as................
    A. Axiom.
    B. Conjecture.
    - C. Paradox.
    D. Theorem.

14. Which one of the following mathematician philosophers proved that every mathematical system has propositions that are *undecidable*?
    A. Euclid
    , B. Kurt Gödel
    C. Goldbach
    D. Bertrand Russell

For each of questions 15 – 18, show your working in the space provided under the question.

15. What does the acronym HMMDIA stand for?   [1 mark]

16. a) Identify the components of the cycle of mathematical investigations for developing valid mathematical ideas.   [3 marks]

b) Which of the components deals with how good the solutions obtained are? [1 mark]

17. Explain the *"counting on"* principle of addition using $3 + 5 = ?$ to illustrate. [5 marks]

18. Use Goldbach's even number conjecture to write 84 as the *sum of two prime numbers* in THREE different ways. [6 marks]

EMA 201S: NATURE OF MATHEMATICS   2017   QUIZ 1

1. **B**   Sir James Jeans
2. **C**   Bertrand Russell
3. **A**   Morris Kline, J.W.N. Sullivan and James Rees
4. **A**   Numbers, chance and algorithm
5. **A**   something worthy
6. **B**   axiom
7. **A**   Euclid
8. **C**   operation
9. **A**   Algorithm
10. **D**   ocnjecture
11. **C**   Eduard Kummer
12. **B**   Antinomy
13. **C**   Paradox   — 14 marks
14. **B**   Kurt Gödel

15. HMMDIA stand for   How Much More Do I Add   [1 mark]

16. a) Components of the cycle of mathematical investigations:
    Representation – Manipulation – Validation   [1 mark each = 3 marks]

b) The components deals with how good are the solutions obtained, is Validation   [1 mark]

17. *Counting on* principle involves starting with one of the addends   —— [1 mark]
    (often the larger number) say 5, and   —— [1 mark]
    then just counting on 3 more from 5 using some objects or fingers or just mentally, [1 mark] —

    saying 5: 6, 7, 8, and giving the last count, 8 as the answer for $3 + 5 = 8$. [1 mark] [1 mark]

18. Goldbach's even number conjecture: 84 as the *sum of two prime numbers*

    84 = (11+73), (71+13), (17+67), (23+61), (31+53), (37+47), (41+43):
        (5 + 79)
                                                    [2 marks each for any 3 = 6 marks]

                                            80 marks

Candidate's Index Number

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INSTITUTE OF EDUCATION

FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
FIRST YEAR FIRST SEMESTER QUIZ II, AUGUST 2017

AUGUST 31, 2017   NATURE OF MATHEMATICS   10:30 AM – 11:00 AM

Answer ALL the questions on the question paper

1. A set of basic symbols and some rules for deriving other symbols from them is referred to as
....
   A. cuneiform
   B. hieroglyphics
   C. number and numerals
   D. numeration system ✓

2. What is the name of the ancient Egyptian writing system?
   A. Algorist
   B. Cuneiform
   C. Hieroglyphics ✓
   D. Vigesimal

3. The two primary sources of Egyptian mathematics are ....
   A. Ahmes papyrus and Leather roll papyrus
   B. Berlin papyrus and Golenischev papyrus
   C. Rhind papyrus and Berlin papyrus
   D. Rhind papyrus and Moscow papyrus ✓

4. Which one of the following numerals represents the Egyptian numeral ？
   A. 100
   B. 1000 ✓
   C. 10000
   D. 1000000

5. Which one of the following statements is TRUE about numeration systems?
   A. ∩𝟗∩ІІІ∩ІІ = ＴＴＹＹＴＴＴＴＴ 1𝟛𝟝
   B. 𝟗𝟗𝟗∩ІІІІІ = ＴＴＹＹＴＴＴＴＴ 15-5
   C. 𝟗∩∩∩ІІІІІ = ＴＴＹＹＹ ＴＴＴＴＴ 1𝟛𝟝
   D. 135 = ＴＴＹＹＹ ＴＴＴＴＴ 1𝟛𝟝

6. The two opposing factions involved in the controversy over the introduction of the Hindu – Arabic numeration system were ....
   - A. Abacists and Rhinds
   - 'B. Algorists and Abacists ✓
   - C. Algorists and Cuneiform
   - D. Cuneiform and Hieroglyphics

7. What is the name of the author of the book titled *Liber Algorisms de Numero Indorum*.
   - A. Rene Descartes
   - B. Euclid
   - C. Aryabhatta
   - D. Al- Khowarizmi ✓

8. Integers were initially regarded as ....
   - A. integrity and fictitious
   - B. fictitious and infinite
   - C. fictitious and absurd ✓
   - D. absurd and obscure

9. Which one of the following statements is true about the Pythagoreans?
   - A. Amicable numbers have the sum of their proper divisors equal
   - B. Deficient number has sum of its proper divisors equal to it
   - C. Even numbers are regarded as feminine numbers ✓
   - D. They refer to odd numbers as feminine

10. The sum of the proper divisors of a "*perfect*" number is ....
   - A. equal to the number itself ✓
   - B. equal to twice the number itself
   - C. greater than the number itself
   - D. less than the number itself

11. The Arabic word "*al-jabr*" from which the word algebra is derived means _____.
   - A. recreation
   - B. reduction
   - C. reservation
   - D. restoration ✓

12. The three distinct stages which the development of symbolic algebra went through are ....
   - A. Rhetorical→syncopated→ symbolic algebra ✓
   - B. Rhetorical→symbolism→dynamic algebra
   - C. Rhetorical→syncopation→geometric algebra
   - D. Rhetorics→verbalism→static equation algebra

13. What geometric term is used to refer to two or more points that lie on one straight line?
    A. Collinear ✓
    B. Curvilean
    C. Plane
    D. Pseudosphere

14. A geometric fact so simple and obvious that its validity may be assumed is termed ....
    A. postulate ✓
    B. element
    C. conjecture
    D. antinomy

15. The mathematician who gave a simpler version of Euclid's 5th Postulate after describing the postulate as a "*merely plausible and an unreasoned statement*" was ....
    A. Lobachevski
    B. Proclus ✓
    C. Saccheri
    D. Thales

16. The flipping of a shape along an axis to produce a symmetrical figure is referred to as ....
    A. Translation
    B. Rotation
    C. Reflection ✓
    D. Isometry

17. Transformations that keep the figure the same size are *generally* referred to as ....
    A. congruencies
    B. folding symmetries
    C. isometries ✓
    D. similarities

18. The form of reasoning in which a general statement is made and logic is used to fit in the specific cases is termed............................ reasoning.
    A. axiomatic
    B. deductive ✓
    C. inductive
    D. intuitive

19. The logic titled "*Universal characteristics*" which attempted to reform and unify all mathematics was associated with ....
    A. Aristotle
    B. Diophantus
    C. Gottfried Leibniz ✓
    D. Socrates

20. Which one of the following philosophers is accredited the title "*Maker of Mathematicians*"?

    A. Aristotle

    B. Gödel

    ✓C. Plato ✓

    D. Thales

21. Write down TWO pairs of *twin primes* between 20 and 50.   [2 marks]

22. With an illustrative example, distinguish between the terms "*number*" and "*numeral*".

                                                    [4 marks]

- Idea of quantity eg. oneness, twoness etc.
- Symbol used to represent number is numeral eg 5 to represent concepts of quantity five

23. State the commutative and associative properties of order for multiplication in algebraic form and explain in words.   [4 marks]

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EMA 201S: NATURE OF MATHEMATICS
QUIZ 2   AUGUST 2017

MARKING SCHEME

[1 mark each]

1. D
2. C
3. D
4. B
5. NO ANSWER
6. B
7. D
8. C
9. C
10. A
11. D
12. A
13. A
14. A
15. B
16. C
17. C
18. B
19. C
20. C
21. $(29, 31)$ and $(41, 43)$ 1 mark, 1 mark

22. Idea of quantity e.g. oneness, twoness etc. is referred to as Number.   [1 mk, 1 mk]
    Symbol used to represent number is numeral e.g. '5' to represent concepts of the quantity five (the number five).   [1 mk, 1 mk]

23. The Commutative property for multiplication states that the order in which two numbers are multiplied makes no difference. [1 mark]

Algebraically, $a \times b = b \times a$; $a, b \in N$, (Or $a, b \in R$) [1 mark]

The Associative Property states that the order of multiplying three or more numbers does not affect the result. [1 mark]

Or, In multiplying three or more numbers, the associative property states that no matter which two numbers are multiplied first, the final result is the same.

Algebraically, $(a \times b) \times c = a \times (b \times c) = a \times b \times c$; $a, b, c \in N$, (Or, $a, b, c, \in R$)[1 mark]