

# EBS 289-NATURE OF MATHEMATICS

## SELF-ASSESSMENT QUESTIONS FOR REVISION

♥ The following questions comprise of UCC quizzes and examination past questions, college based quizzes past questions and likely examination questions set by the compilers. We have carefully categorized the questions under their respective units. This uncompleted material is an initiative of the compilers to aid you in your revision and self-assessment. It is our hope that it serves the purpose for which it is intended. We therefore entreat you to take advantage of it. ♥

~ Thank You. ~

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# UNIT ONE

## DEFINITION OF MATHEMATICS

### INSTRUCTION

For questions 1 to 26, each stem is followed by four options lettered A to D. Read carefully and choose the correct or best option.

1. Which of the three divisions of Mathematics involves continuity and limits?

- A. Calculus.
- B. Algebra
- C. Geometry
- D. Analysis

5. Mathematics uses one of the following as a means of discovering truth.

- A. experimentation
- B. proofs
- C. theories
- D. axioms

2. In whose view is Mathematics considered as a servant of many fields?

- A. Galileo
- B. Morris Kline
- C. T. J. Robinson
- D. Bertrand Russell.

6. One of these is not among the highest values of Mathematics and Science.

- A. honesty
- B. openness
- C. preciseness
- D. simplicity

3. Quantity refers to \_\_\_\_\_ and computations.

- A. space.
- B. arithmetic.
- C. pattern.
- D. calculations.

7. Mathematics relies on \_\_\_\_\_ and creativity.

- A. Logic
- B. patterns
- C. observations
- D. conclusions

4. \_\_\_\_\_ defines Mathematics as the logical study of shape, arrangement, quantity and many related concepts.

- A. James Rees
- B. Euclid
- C. Richard Skemp
- D. James and James  
Dictionary of Mathematics.

8. All the following philosophers view Mathematics as real except

- A. Bertrand Russell
- B. Morris Kline
- C. James Rees
- D. J. W. N. Sullivan.

9. Mathematics relies predominantly on \_\_\_\_\_ as its standard of truth.

- A. analysis
- B. experimentation
- C. logic
- D. observation

10. Who defined Mathematics as a "science of quantity"?

- A. Aristotle
- B. Comte
- C. Pierce
- D. Sawyer

11. Mathematics is regarded as the "queen" of the sciences because it

- A. has some features of science
- B. gives ideas for extension in science.
- C. is used by all physicists
- D. is older than all sciences.

12. Mathematics is divided into three fields namely

- A. Algebra, Geometry and Calculus.
- B. Algebra, Logic and Patterns
- C. Algebra, Geometry and Analysis
- D. Algebra, Trigonometry and Geometry.

13. The cycle of Mathematical investigation involves representation, manipulation and \_\_\_\_\_

- A. factorization
- B. simplification
- C. validation
- D. verification.

14. Modern view of Mathematics is that Mathematics is a science of pattern and \_\_\_\_\_

- A. facts
- B. numbers
- C. order
- D. theorems

15. Who claims that "Mathematics is a creative and inventive process"?

- A. Darwin
- B. Kline
- C. Russel
- D. Skemp

16. In a cycle of investigation that is intended to lead to the development of valid mathematical ideas, the component of the cycle that deals with how good the solutions are is termed as

- A. Representation
- B. Validation
- C. Manipulation
- D. Set of rules

17. Who claims "A mathematician is a blind man in a dark room looking for a black cat which isn't there"?

- A. Darwin
- B. Hardy
- C. Poincare
- D. Wigner

18. The main problem of mathematics, according to Richard Skemp, lies in its great

- A. discovery and invention
- B. abstractness and generality.
- C. theoretical systems
- D. international form.

19. Which of the following were invented by a mathematician?

I:  $\sqrt{2}$

II: Area

III: Perimeter

IV: Negative Numbers

A. I and II

B. III and IV

C. I, II and IV

D. I and IV

20. "Mathematics is like defining objects in terms of undefined terms and consequently making propositions." This is an assertion made by

A. Descartes

B. Morris Kline

C. Bertrand Russell

D. Brahmaputa.

21. At which of the stages of the cycle of mathematical investigation does one strictly adhere to a set of rules?

A. Manipulation

B. Validation

C. Algorithm

D. Representation.

22. 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 which we never know what we are talking about nor whether what we are saying is true.

23. 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 axioms

D. Algorithm, numerals and language.

24. 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, Aristotle and Morris Kline

D. Richard Skemp, Sullivan and Darwin.

25. The three components of the cycle of mathematical investigation are

- A. Addition, subtraction and division.
- B. Representation, manipulation and multiplication.
- C. Representation, manipulation and validation.
- D. Calculation and creativity.

26. One of the highest values in mathematics is its

- A. abstractness
- B. openness
- C. preciseness
- D. proofs.

Items 27 to 40 are statements followed by True and False options. Read each statement carefully and indicate whether it is True or False.

27. The domain of mathematics is numbers, logic, form, algorithm and change.

- A. False
- B. True

28. Mathematics is the study of only patterns that are relevant to the observable world.

- A. True
- B. False

29. There is no general agreement on precisely what mathematics is.

- A. False
- B. True

30. Validation in mathematics is a matter of authority, not judgement.

- A. True
- B. False

31. Mathematics is perceived as an art because of its imaginative nature.

A. False

B. True

32. Galileo asserted that God is a mathematician.

A. False

B. True

33. Numbers and numerals are creations of the human mind.

A. True

B. False

34. The usefulness of mathematics in science and technology will be clear to students if they experience it often in sophisticated forms and later simple forms.

A. False

B. True

35. Mathematics has distinct features from science.

A. True

B. False

36. Making multiple representations of the same idea and translating from one to another makes it easy for students to grasp its meaning.

A. True

B. False

37. Mathematics is a many-sided science.

A. False

B. True

38. The main focus of teaching mathematics should be to let students know the idea of connectedness in mathematics.

A. False

B. True.

39. Mathematics is abstract in the sense that it does not deal with actual objects.

- A. True
- B. False.

40. Mathematics can describe and explain but it cannot predict what might happen.

- A. True
- B. False.

### Self-Assessment Questions 1

1. Discuss the assertion that mathematics is an abstract subject.
2. What is mathematics? Include ideas related to (a) its definition; (b) its being a creation or a discovery. Illustrate your answer with specific mathematical ideas and symbols.
3. Identify and explain three features that mathematics shares with other sciences.
4. Explain how other disciplines like music, home economics, driver education, and social sciences also create contexts for students to learn the value of mathematics.
5. Identify and explain three components of the cycle of investigation.
6. Why should teachers engage students in the routine use of concrete materials?
7. Explain why mathematics is regarded as (a) a creation of the human mind; (b) a discovery.

END OF UNIT ONE

PLEASE REFER ANSWERS FROM THE NEXT PAGE.

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## ANSWERS TO THE OBJECTIVE QUESTIONS.

1	D	6	(No ans)	11	B	16	C	21	A	26	C	31	B
2	C	7	A	12	C	17	A	22	C	27	A	32	A
3	B	8	A	13	C	18	B	23	A	28	B	33	B
4	D	9	C	14	C	19	D	24	A	29	B	34	A
5	A	10	A	15	B	20	C	25	C	30	B	35	B

36	A
37	B
38	B
39	A
40	B

### NOTE TO READERS

Dear reader, kindly send your recommendations, corrections (if any), and constructive criticisms to any of the compilers to make the successive units that are yet to be done more dependable.

We are in this together.

Thank You.

PROF. S. MEEKBEN'S

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# UNIT TWO

## SOME MATHEMATICS EDUCATION TERMS

### INSTRUCTION

For questions 1 to 45, each stem is followed by four options lettered A to D. Read carefully and choose the correct or best option.

- |  |  |
|--|--|
| 1. A statement that seems to defy logic is a/an _____<br>A. theorem<br>B. conjecture<br>C. antinomy<br>D. axiom  | 5. Who authored the book titled "Elements"?<br>A. Euclid<br>B. Games<br>C. Thompson<br>D. Darwin   |
| 2. Which of the following set of primes can be expressed as the sum of two integral squares?<br>A. {5, 13, 19, 29}<br>B. {3, 7, 11, 19}<br>C. {5, 13, 17, 29}<br>D. {3, 5, 11, 17} | 6. "Cretans are always liars," says a Cretan. This is a paradox of _____<br>A. place<br>B. motion<br>C. self-reference<br>D. lazy bones                                  |
| 3. The square root of a number is one of _____ of the given number.<br>A. the factors<br>B. the three equal factors<br>C. the two equal factors<br>D. the two factors.             | 7. A pair of consecutive odd numbers that are primes and differ by 2 are termed as _____<br>A. Prime factors<br>B. Prime numbers<br>C. Prime twins<br>D. Prime triplets. |
| 4. These are universally true and need no proof.<br>A. Conjectures<br>B. Algorithms<br>C. Paradox<br>D. Axioms   | 8. The symbol used to indicate an operation is termed as a/an _____<br>A. operand<br>B. operation<br>C. operator<br>D. divisor   |

9. Kofi had seven oranges and later found out that two were missing. What method of subtraction is this?

- A. Missing addends
- B. Comparison
- C. Take away
- D. Matching

10. Which of the following forms the basis for mathematical theorems?

- A. axioms
- B. patterns
- C. conjectures
- D. principles

11. In mathematics, the process that involves a change or transformation is \_\_\_\_\_

- A. algorithm
- B. antinomy
- C. conjecture
- D. operation

12. The function  $f(n) = n^2 - n + 41$  is used to generate primes for natural numbers less than

- A. 40
- B. 41
- C. 42
- D. 43

13. Who conjectured that any even number greater than 2 is the sum of two primes?

- A. Fermat
- B. Euclid
- C. Goldbach
- D. Leonhard

14. A finite set of precise instruction for solving a problem is termed as a/an \_\_\_\_\_

- A. Antinomy
- B. Algorithm
- C. Conjecture
- D. Operation

15. Which approach can best be used to solve  $71 - (6-1)^2 - 24 \div 8$ ?

- A. BEDMAS
- B. FOIL
- C. BODMAS
- D. HMMDIA

16. The common notions which must be accepted due to the nature of logic of human thought are called

- A. theorems
- B. conjectures
- C. axioms
- D. paradox

17. A pupil is required to pack 20 tins of milk into 4 similar boxes. Which aspect of division will the child apply?

- A. Cartesian Product
- B. Partitioning
- C. Measurement

## D. Comparison

18. Counting all principle involves:

- A. counting objects for the first addend, counting objects for the second addend, and then counting all combined.
- B. counting real objects for the first addend and then finger count for the second addend.
- C. just mentioning one of the addends and then finger counting for the second addend.
- D. counting one of the larger addend and then just counting on.

19. Which of the following algorithms is used in multiplying polynomials in algebra?

- A. BODMAS
- B. FOIL
- C. HMMDIA
- D. PEDMAS

20. "If everything has a place, place too will have a place, and so on ad infinitum." Who made this contradictory statement?

- A. Galileo
- B. Russel
- C. Epimenides

## D. Aristotle.

21. Which of the following concepts formalizes the intuitive idea that primes become less common as they become larger?

- A. Euclid Infinity of Primes
- B. Fermat's Last Theorem
- C. The Twin Prime Conjecture.
- D. Prime Number Theorem (PNT)

22. The equation  $x^n + y^n = z^n$  where  $x, y$  and  $z$  are integers is impossible when  $n$  is an integer greater than 2. This is popularly known as

- A. Pythagoras Theorem
- B. Fermat's Last Theorem
- C. Fermat's "two square" theorem.
- D. Fermat's Numbers

23. A pupil counted two items in groups from a set of ten items. She then counted the number of groups formed. Which division approach did she use?

- A. Partitioning
- B. Missing Addend
- C. Mixing Set
- D. Measurement

24. Missing Addend is an interpretation of \_\_\_\_\_
- A. Addition
  - B. Subtraction
  - C. Multiplication
  - D. Division

25. Describe this Notion of Euclid:  $3+2 = 2+3$ .

- A. If equals be subtracted from equals, the remainders are equal.
- B. Things which are equal to the same things are equal to one another.
- C. If equal things should be added to equal things, the wholes are equal.
- D. Things which coincide with one another, are equal to one another.

26. FOIL is a multiplication algorithm which stands for \_\_\_\_\_

- A. First Only, Inside Out
- B. Factors Outside, Inside Last
- C. First Outside, Inside Last
- D. First Order, Inside Out

27. The process by which a pupil compares two sets by matching them on one-to-one correspondence basis and finds out how many items are left over in the bigger set is called

- A. Comparison
- B. Separation
- C. Missing Addend
- D. Take Away

28. Which of the following is a binary operation in that it combines only two quantities at a time?

- A. Subtraction
- B. Addition
- C. Multiplication
- D. Division

29. Why was Euclid's name associated with truth? Because

- A. the name Euclid means truth.
- B. he dominated the world of mathematics, science and other fields of study.
- C. he made several reasoned statements that were accepted without argument.
- D. he debunked all the postulations of other mathematicians and scientists.

30. Using the PEDMAS algorithm, simplify  $2\{1+[4(5+3)-6]\}$

- A. 28
- B. 54
- C. 14
- D. 18

31. What is meant by a minuend?  
A. The number to be subtracted  
B. The number to be divided  
C. The product of an operation  
D. The number from which we are subtracting.

32. A proposition that cannot be proved is a/an \_\_\_\_\_  
A. axiom  
B. conjecture  
C. theorem  
D. paradox

33. The formula  $2^n - 1$  for determining Mersenne Primes works if only  $n$  is \_\_\_\_\_  
A. any positive natural number.  
B. less than or equal to 4.  
C. prime  
D. greater than 2.

34. Which of the following is associated with Kurt Gödel?  
A. Even Numbers Conjecture  
B. Odd Perfect Number Conjecture.  
C. Paradox  
D. Prime Number Theorem

35. Pick the odd one out.  
A. Binomial Theorem  
B. Pythagoras Theorem  
C. Fermat's Last Theorem.

D. Prime Number Theorem.  
36. \_\_\_\_\_ is a universally accepted rule or principle in mathematics.

A. Axiom  
B. Theorem  
C. Paradox  
D. Algorithm.

37. Prince is supposed to submit seven (7) reports for approval. However he has submitted only four (4) reports to his supervisor. What interpretation of subtraction will be used in finding out the number of reports left for him to submit?

A. Counting up  
B. Matching  
C. Take Away  
D. Missing Addend

38. According to the Five Common Notions of Euclid, things which coincide with one another \_\_\_\_\_

A. are greater than any of its parts.  
B. are equal to one another.  
C. are equal to the same thing.  
D. are the addends of one another.

39. Which operation involves the take one I take principle?

- A. Addition
- B. Multiplication
- C. Division
- D. Subtraction.

40. What is considered as "general truths"?

- A. Algorithm
- B. Axiom
- C. Theorem
- D. Validation.

41. Which of the following is an algorithm for subtraction and uses an additive component?

- A. BEDMAS
- B. FOIL
- C. HMMDIA
- D. PEDMAS

42. An unproved proposition in mathematics that is believed to be true is termed as a/an \_\_\_\_\_

- A. Antinomy
- B. Algorithm
- C. Axiom
- D. Conjecture

43. Which of the following is among the "Five Common Notions" in the Element?

- A. An equal can be added to an equal.

B. An equal can be subtracted from an equal.

C. The whole is greater than any of its parts.

D. Things which coincide with one another are divisible.

44. All the following prime exponents when substituted into the formula  $2^p - 1$  give a Mersenne Prime except \_\_\_\_\_

- A. 11
- B. 7
- C. 5
- D. 3

45. If the cost of 1 pen is the same as the cost of 3 candies, which of Euclid's axioms simplifies this scenario?

- A. Things, which coincide with one another, are equal to one another.
- B. If equals be subtracted from equals, the remainders are equal.
- C. Things which are equal to the same thing are equal to one another.
- D. If equal things should be added to equal things, the wholes are equal.

## INSTRUCTION

Items 46 to are statements followed by True and false options. Read each statement carefully and indicate whether it is true or false.

46. In every  $n < p < 2n$  where  $n$  is any positive integer, there is a guarantee to find a prime  $p$ .

A. False

B. True

47. Measurement problem as an approach in division is basically finding the number of groups that can be made from the larger collection.

A. True

B. False

48. The cube root of a given number is one of the three factors of the number.

A. True

B. False

49. The equation  $x^n + y^n = z^n$  has no solution in integers for  $n \geq 3$ .

A. False

B. True

50. The function  $f(n) = n^2 - n + 41$  does not produce prime if  $n = 40$ .

A. True

B. False

51. Odd perfect numbers exist but they are very few.

A. True

B. False

52. The expression  $2^{2^n} + 1$  for generating primes does not satisfy the range  $1 \leq n \leq 4$ .

A. False  
B. True

53. The Cartesian product is used in the concept of addition.

A. False  
B. True

54. Using algorithms and other several ways to solve mathematical problems portray the creative nature of mathematics.

A. False  
B. True

55. Multiplication is regarded as repeated addition thus "5 lots of 6" or " $5 \times 6$ " means  $6 + 6 + 6 + 6 + 6$ .

A. False  
B. True

56. When working with multiplication and division, you do whichever comes first.

A. True  
B. False

57. Pythagorean Theorem is used even in objects that are not right angle triangles.

A. True  
B. False

58. Galileo Paradox concludes that ideas of less, equal, and greater apply to infinite sets, but not finite sets.

A. False  
B. True



## INSTRUCTION

Fill in the blanks with the appropriate responses.

59. A theorem is a/an \_\_\_\_\_ that has been proved.
60. A mathematical \_\_\_\_\_ is also called a paradox.
61. \_\_\_\_\_ and \_\_\_\_\_ are two distinct primes that sum up to 156.
62. Primes that can be written in the form  $2^n - 1$  are called \_\_\_\_\_ primes.
63. \_\_\_\_\_ contradicts basic truths about what mathematics is supposed to model.

## Self - Assessment Questions.

1. Identify and explain the five common notions propounded by Euclid.
2. Explain each of the following basic operations:  
a) addition                      c) multiplication  
b) subtraction                d) division
3. Explain how you would guide your students to find the:  
a) square root of 225            b) cube root of 1000.
4. Explain how you would use HMMDIA algorithm to work out the following:  
a)  $\begin{array}{r} 176 \\ - 57 \\ \hline \end{array}$                       b)  $\begin{array}{r} 153 \\ - 34 \\ \hline \end{array}$
5. Explain how you would use the FOIL approach to find the following products:  
a)  $(2x-3)(x+2)$             b)  $(3x-1)(2x+5)$

6. Explain how you would use the BEDMAS algorithm in solving  $71 - (6+1)^3 + 24 \div 8$ .
7. Explain how you would use long division to find:  
 a)  $153 \div 6 = ?$       b)  $472 \div 5 = ?$
8. Use the Mersenne prime formula,  $2^p - 1$  to verify which of these numbers are primes: 3, 7, 31, 641, and 2047.
9. Explain the proof of Euclid's conjecture of infinity of primes.
10. State the quadratic function conjecture and disprove it.
11. State each of the following theorems:  
 a) The Pythagorean Theorem  
 b) The Binomial Theorem
12. Identify and explain three mathematical paradoxes.
13. Express 97 as the sum of two integral squares.
14. Using the Binomial Theorem, expand  $(1+x)^4$ . Using your expansion, find the value of  $\left(\frac{5}{4}\right)^4$  correct to three decimal places.
15. Use the Binomial Theorem to expand  $(1+x)^{\frac{1}{2}}$  in ascending powers of  $x$  to as far as  $x^3$ .  
 Using your expression, evaluate  $\sqrt{1.08}$ , correct to four significant figures. (UCC END OF SEM.-2021)

END OF UNIT TWO

PLEASE REFER ANSWERS FROM THE NEXT PAGE.

## ANSWERS TO THE OBJECTIVE QUESTIONS

1	C	11	D	21	D	31	D	41	C	51	B	59	Conjecture.
2	C	12	B	22	B	32	B	42	D	52	A	60	antinomy.
3	C	13	C	23	D	33	C	43	C	53	A	61	83 and 73.
4	D	14	B	24	B	34	C	44	A	54	B	62	Mersenne.
5	A	15	A	25	D	35	C	45	C	55	A	63	Phenomenological
6	C	16	C	26	C	36	B	46	B	56	A		Paradox.
7	C	17	B	27	A	37	D	47	A	57	A		
8	C	18	A	28	B	38	B	48	B	58	A		
9	C	19	B	29	C	39	C	49	B				
10	A	20	D	30	B	40	B	50	B				

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To be continued...