



UNIVERSITY OF EDUCATION, WINNEBA

SUBJECT AREA TEST (SAT)

BSC. MATHEMATICS

MATURE ENTRANCE EXAMINATION, NOVEMBER 10, 2023

INDEX NUMBER: ..... TIME ALLOWED: 60 MINUTES

**Instruction:** This paper consists of 50 multiple choice questions. Choose the most appropriate answer from the list of options provided for each question.

1. A binary operation  $*$  is defined by  $a*b = \frac{1}{2}ab$  on the set of real numbers. Find the value of  $m$  for which  $m*3 = 6$

- A) 2
- B) 3
- C) 4.
- D) 5

2. A body of mass 2 kg travelling at  $10 \text{ ms}^{-1}$  encounters a constant frictional force of 5 N. How long does it take for the body to come to rest?

- A) 3 s
- B) 4 s
- C) 5 s
- D) 6 s

3. A classroom characterized by activities that allow students to develop strategies that are personally meaningful and tolerates a range of responses best depicts a ..... classroom.

- A) Behaviourist
- B) Constructivist
- C) Cognitivist
- D) Developmentalist
- E) None of the above

4. A duck waddles from coordinate  $P(-3, 2)$  to  $Q(6, 5)$ . Find the vector that models the duck's motion.

- A)  $\hat{i} - 3\hat{j} + 7\hat{k}$
- B)  $\hat{i} - 9\hat{j} + 7\hat{k}$
- C)  $\hat{i} - 3\hat{j} + 9\hat{k}$
- D)  $\hat{i} + 9\hat{j} + 3\hat{k}$

5. A number is selected at random from the set  $B = \{1, 2, 3, 4, \dots, 40\}$ . Find the probability that it is a prime number.

- A)  $\frac{3}{8}$
- B)  $\frac{7}{20}$
- C)  $\frac{13}{40}$
- D)  $\frac{3}{10}$
- E) None of the above

6. A sequence is given as  $-5, -2, 2, 4, \dots$ . Find the 23rd term.

- A) 58
- B) 61
- C) 64
- D) 81
- E) 81

7. A set  $X$  has 32 subsets. How many elements are in  $X$ ?

- A) 4
- B) 5
- C) 6
- D) 8

8. All the following except one are factors to consider in deciding whether to use an inductive or deductive discovery strategy.

- A) Nature of the generalisation
- B) Complexity of the generalization
- C) Students ability to abstract patterns
- D) Students ability to draw inferences
- E) Students ability of practice generalised rules

9. An exponential sequence with a positive common ratio has second term as 6 and its

fourth term as 54. Find the value of the common ratio.

- A)  $\frac{1}{3}$
- B) 2
- C) 3
- D) 4

10. Behavioural learning theories apply best to ...

- A) Young children
- B) Observable behaviours
- C) Behaviours that cannot be observed
- D) Adult

11. Calculate  $2c+d$  if  $c=-5i+4j$  and  $d=8i$ .

- A)  $6i$
- B)  $6i+8j$
- C)  $-2i+8j$
- D)  $-2i$

12. Calculate the mean score.

- A) 6.9
- B) 6.4
- C) 5.9
- D) 5.4
- E) None of the above

13. Determine the value of  $p$  for which  $4x^2-px+1$  has a repeated root.

- A) 2
- B) 4
- C) 6
- D) 8

14. Differentiate  $-x^{-1}$  with respect to  $x$

- A)  $-x^{-2}$
- B)  $\frac{1}{x^2}$
- C)  $x^2$
- D)  $-\frac{1}{x^2}$

15. Evaluate  $\frac{1}{2} + (\frac{1}{2} \cdot \frac{1}{2}) - \frac{1}{4}$

- A)  $\frac{1}{4}$
- B) 1
- C)  $\frac{5}{4}$
- D) 4

16. Express  $(3x-2y)/(2y-3x)$  in its lowest form.

- A)  $(x-y)/(y-x)$
- B) 1
- C) -1
- D)  $(x-2y)/(y-2x)$

17. Factorize  $2x^2-3x+1$

- A)  $(x-1)(2x+2)$
- B)  $(x-1)(2x-1)$
- C)  $(x+2)(2x-1)$
- D)  $(x+2)(2x-2)$

18. Find the derivative of the function  $f(x)=x^2$  from the first principle

- A)  $\frac{x^3}{3}$
- B)  $-x^2$
- C)  $-2x$
- D)  $2x$

19. Find the direction of the vector  $a=-3i-5j$ .

- A)  $\tan^{-1} \frac{5}{3}$
- B)  $\tan^{-1} \frac{3}{5}$
- C)  $\tan^{-1} \frac{5}{3}$
- D)  $\tan^{-1} \frac{3}{5}$

20. Find the distance travelled in 3 minutes by a body moving with a constant speed of  $15 \text{ kmh}^{-1}$ .

- A)  $\frac{1}{2} \text{ km}$
- B)  $\frac{2}{3} \text{ km}$
- C)  $\frac{1}{4} \text{ km}$
- D)  $\frac{3}{4} \text{ km}$

21. Find the magnitude of the acceleration produced in a body of mass 5 kg subject to forces  $(4i+j) \text{ N}$  and  $(-i+j) \text{ N}$ .

- A)  $0.92 \text{ ms}^{-2}$
- B)  $0.84 \text{ ms}^{-2}$
- C)  $0.82 \text{ ms}^{-2}$
- D)  $0.72 \text{ ms}^{-2}$

22. Find the median of the distribution.

- A) 4.5
- B) 5.5
- C) 6.5
- D) 8.5
- E) None of the above

23. Find the median of the numbers 34, 47, 46, 68, 76, 81.

- A) 47
- B) 57
- C) 68
- D)  $57\frac{1}{2}$

24. Find the modal score.

- A) 2
- B) 4
- C) 5
- D) 8
- E) 9

25. Find the second derivative of  $y=3x^4+2x^3-4x+3$  with respect to  $x$

- A)  $12x^3+6x^2-4$
- B)  $12x^3-6x^2+4$
- C)  $36x^2+12x+0$
- D)  $36x^2-12x$

26. Find the sum of odd integers from 1 to 49 inclusive.

- A) 525
- B) 600
- C) 625
- D) 1225
- E) None of the above

27. Find the truth set of the equation  $3+10p=8$ ,  $x:\hat{x}^I$ , (where  $I$  denotes integers)

- A)  $\{x:x=1/2\}$
- B)  $\{x:x=-1/2\}$
- C)  $\{x:x=11/10\}$
- D)  $\{x:x=\hat{a} \dots\}$

28. How far an object travels in a given time interval regardless of direction is referred to as

- A) speed
- B) distance
- C) velocity
- D) acceleration

29. If  $a = 4i + 2j - k$  and  $b = 2i - 6i - 3k$  then calculate a vector that is perpendicular to both  $a$  and  $b$

- A)  $-12i + 10j - 28k$
- B)  $12i - 10j + 28k$
- C)  $10i + 12j + k$
- D)  $28i - 3j + 12k$

30. If  $\text{LOG}_x 8=2$  find  $x$ .

- A) 5
- B) 4
- C) 3
- D)  $2\sqrt{2}$
- E) None of the above

31. If the direction of a body is changing then the body's velocity is

- A) uniform
- B) not uniform
- C) zero
- D) unknown

32. If the number  $1/x$  is subtracted from the number  $1/y$ , assuming  $x$  and  $y$  are real numbers, the result is...

- A)  $(x-y)/xy$
- B)  $(y-x)/xy$
- C)  $1/(x-y)$
- D)  $1/(y-x)$

33. If  $u$  is a unit vector, what is the modulus of  $5u$ ?

- A) 5
- B) 25
- C) 0
- D) 1

34. If vector  $u=4i-2j$  and  $v=6i+12j$ , then the vectors are said to be

- A) perpendicular
- B) parallel
- C) collinear
- D) scalar multiples

35. In a group of 72 students, 47 have background is electronics, 59 have

background in Mathematics and 42 have background in both the subjects. How many subjects do not have background in any of the subjects?

- A) 8
- B) 13
- C) 25
- D) 34

36. In a translation in the plane, the image of  $P(5,2)$  is  $P(7,3)$ . Find the image of  $Q(-3,0)$  under the translation.

- A)  $(-1,1)$
- B)  $(2,1)$
- C)  $(1,3)$
- D)  $0,3$
- E) None of the above

37. Individual work in the mathematics classroom is to encourage

- A) Individual thinking
- B) Diversity
- C) Participation
- D) Individual research

38. Mathematical definitions that give a non-singular set of objects are called?

- A) Prescriptions
- B) Generalisations
- C) Concepts
- D) Value judgments

39. Mathematical definitions that give a non-singular set of objects are called?

- A) Prescriptions
- B) Generalizations
- C) Concepts
- D) Values
- E) Skills

40. Mental drill and practice of mathematical facts and procedures is based on

- A) Cognitive development theory
- B) Meaning theory
- C) Constructivism
- D) S-R theory
- E) None of the above

41. Rote learning is the same as ...

- A) Relational understanding
- B) Intuitive understanding
- C) Formal understanding
- D) Instrumental understanding

42. Simplify  $3x - \{5 - 3[x - x(3 - x)]\}$

- A)  $2x^2 + 7x$
- B)  $3x^2 + 3x + 5$
- C)  $3x^2 - 3x + 5$
- D)  $3x^2 - 3x - 5$

43. Solve:  $x + 4 < 4x - 3$

- A)  $x < 7$
- B)  $x > 7$
- C)  $x < -7$
- D)  $x > -7$

44. term and the common ratio.

- A)  $a=2, r=-2$
- B)  $a=-3, r=2$
- C)  $a=-2, r=2$
- D)  $a=2, r=3$

45. The complement of the set A is ....

- A)  $A \notin B$
- B)  $U \notin A$
- C)  $A \notin U$
- D)  $B \notin A$

46. The earliest point at which students' background knowledge should be activated is:

- A) At the beginning of the lesson
- B) In the body of the lesson
- C) In the middle of the lesson
- D) During the evaluation of the lesson

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- E) None of the above

48. The forces  $(3i+5j)N$ ,  $(ai+bj)N$ ,  $(8i-6j)N$  and  $(-4i-3j)N$  are in equilibrium. Find the values of  $a$  and  $b$ .

- A)  $a=7$  and  $b=4$
- B)  $a=-7$  and  $b=4$
- C)  $a=7$  and  $b=-4$
- D)  $a=-7$  and  $b=-4$

49. The line of best fit in a scatter diagram passes through the points  $(2,-3)$  and  $(10,9)$  in the  $x - y$  plane. What will be the predicted  $y$  value for when  $x = 4$  ?

- A) -3
- B) 0
- C) 3
- D) 6
- E) None of the above

50. The rate of change of momentum of a body is referred to as

- A) Force
- B) Impulse
- C) Kinetic energy
- D) Work done

51. The ratio of ages of Adam and Farida is 4:3. After 6 years, Adam's age will be

26. What is the age of Farida at present?

- A) 15 years
- B) 16 years
- C) 17 years
- D) 18 years

52. Two unbiased dice are tossed once. How many elements are in the sample space?

- A) 6
- B) 12
- C) 36
- D) 72
- E) None of the above

53. What is the coefficient of  $y^2$  in the expansion  $(x-y)^3$ .

- A)  $-3x$
- B)  $-3x^2$
- C)  $3x$
- D)  $3x^2$

54. What is the image of  $-1$  under the mapping  $z \mapsto -z^3+3z+5$ ?

- A) -2
- B) -3
- C) 2
- D) 3

55. What is the speed of the car at point A?

- A) 25m/s
- B) 21m/s
- C) 20m/s
- D) 15m/s
- E) None of the above

56. When we make use of many experiences and examples for arriving at a generalised principle or conclusion, it is known as ...

- A) Deductive reasoning
- B) Convergent thinking
- C) Divergent thinking
- D) Inductive reasoning

57. Which of the following is a vector quantity?

- A) Speed
- B) Displacement
- C) Mass
- D) Temperature

58. Which of the following is not true about relational understanding?

- A) It is intrinsically rewarding
- B) There is less to remember
- C) May produce mathematics anxiety
- D) Improves problem solving abilities
- E) None of the above

59. Which of the following points does not satisfy  $3x-y > 1$ ?

- A)  $(2,1)$
- B)  $(1,2)$
- C)  $(-1,1)$
- D)  $(1,-1)$
- E) None of the above

60. Which of the following statements is not true about inductive discovery in teaching mathematics?  
A) It motivates learning.  
B) It is a natural method of making discoveries  
C) It requires the teachers ability to induce patterns  
D) The teacher presents students with many examples  
E) None of the above

61. Which of the following verbs in an instructional plan signals a non-behavioural objective?  
A) Complete  
B) Demonstrate  
C) Comprehend  
D) Compute

62. Which of the following verbs is not suitable for stating specific objectives of a mathematics lesson?  
A) State  
B) Solve problems  
C) Plan  
D) Construct  
E) None of the above

63. Which of the following will not influence the instructional effectiveness of a mathematics lesson?  
A) Teacher's knowledge base  
B) Availability of appropriate instructional materials  
C) Time of the day  
D) Teacher orientation

64. Which one of the following is unlikely to cause conceptual gaps in learning mathematics?  
A) Absenteeism  
B) Inattention  
C) Inability to question  
D) Visual impairment  
E) None of the above

65. Kofi can say the number sequence "one, two, three" correctly and use objects to illustrate the numbers mentioned systematically. Kofi is in which stage of the concept formation process.  
A) Abstraction  
B) Generalization  
C) Mental image  
D) Visualisation  
E) None of the above