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ACADEMY

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2024

EDUCATIONAL ASSESSMENT AND EXAMINATION SERVICE (EAES)
ETHIOPIAN SECONDARY SCHOOL PILOT
MATHEMATICS TEST
SENE 2015/ JUNE 2023

BOOKLET CODE: 015
Number of Items: 65

SUBJECT CODE: 02
Time Allowed: 3 hours

1. Which one of the following expressions is equal to $0.66666\ldots$?

A. $\frac{2}{3}$
B. $\frac{7}{9}$
C. $\frac{1}{3}$
D. $\frac{3}{5}$

2. Which one of the following numbers is irrational?

A. $\frac{22}{7}$
B. $0.1222\ldots$
C. $0.1010010001\ldots$
D. $3.1414141414\ldots$

3. Which of the following is equal to $5^{\frac{2}{3}}$?

A. $\sqrt[3]{25}$
B. $\sqrt{125}$
C. $\sqrt[3]{125}$
D. $\sqrt[3]{5}$

4. Which one of the following is the simplified form of $\left(64^{\frac{1}{3}} \times 81^{\frac{1}{2}}\right)^{\frac{1}{2}}$?

A. 18
B. 36
C. 6
D. 12

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5. Which one of the following expressions is equal to $\frac{35}{6}$ using division algorithm ?

A. $5+\frac{5}{6}$

B. $4+\frac{11}{6}$

C. $6+\frac{-1}{6}$

D. $7+\frac{-7}{6}$

6. Let $A = \{3, 5, 8, 12\}$. Which of the following is the number of subsets of A ?

A. 8

B. 15

C. 12

D. 16

7. Let the universal set U be the set of natural numbers and $A = \{x \in U | x \geq 5\}$. Which one of the following is the absolute complement of A ?

A. $\{1, 2, 3\}$

B. $\{1, 2, 3, 4, 5\}$

C. $\{1, 2, 3, 4\}$

D. $\{5, 6, 7, \ldots\}$

8. Which one of the following relations is a function?

A. $\{(1, 3), (2, 3), (3, 3)\}$

B. $\{(3, 5), (3, 6), (4, 8)\}$

C. $\{(1, 2), (2, 2), (2, 3)\}$

D. $\{(1, 3), (2, 3), (2, 4)\}$

9. Which one of the following is true about the graph of $y = -3x + 6$?

A. It is increasing.

B. 3 is its slope.

C. (2, 0) lies on the graph.

D. (1, -3) lies on the graph.

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10. What is the measure of an interior angle of a regular polygon with 6 sides?
    A. 130°
    B. 120°
    C. 110°
    D. 140°

11. Which one of the following is a regular polygon ?
    A. All rectangles.
    B. All Hexagons.
    C. All Rhombuses.
    D. All Equilateral triangles.

12. Suppose $\Delta ABC \cong \Delta DEF$ such that $m(< B) = 70°$ and $m(< E) = (x + 30)°$. What is the value of x?
    A. 30
    B. 50
    C. 40
    D. 70

13. Which of the following is **NOT** true about two similar polygons ?
    A. Their corresponding sides are proportional.
    B. They have the same number of sides.
    C. They have the same number of angles.
    D. Their corresponding angles are not necessarily congruent.

14. Which one of the following is equal to $\frac{\pi}{6}$ radian ?
    A. 60°
    B. 30°
    C. 50°
    D. 180°

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15. It is given from the Table of Trigonometric Function that:
$\sin 40° = 0.6428$, $\cos 40° = 0.7660$ $\tan 40° = 0.8391$.
Which one of the following is true?

A. $\sin 50° = 0.8391$
B. $\cos 50° = 0.7660$
C. $\cot 50° = 0.8391$
D. $\tan 50° = 0.6428$

16. In a circle of radius 5 units, one of its chords is 8 units long. What is the distance of the chord from the center ?

A. 4 units.
B. 3 units.
C. 5 units.
D. 9 units.

17. Which of the following is true about the arithmetic mean of a population?

A. It is not affected by the largest value in the data.
B. It can be obtained even when some of the data values are not known
C. It can be used for qualitative data.
D. It is uniquely determined.

18. Which one of the following is true about the measure of dispersion?

A. It shows how individual values in the data are closer.
B. It locates the center of the data set.
C. It shows how each value is repeated in the data set.
D. It locates the midpoint of the values in the data.

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19. Which of the following is true about the polynomial function $P(x) = 3x^5 + 2x^7 + 5x^2 + 4x + 6$?
   A. Its leading coefficient is 3.
   B. Its constant term is 4.
   C. Its degree is 7.
   D. The coefficient of x^3 is 1.

20. What are the possible set of all positive rational zeros of $P(x) = 2x^6 + 2x^3 + 5x^2 + 4x + 3$?
   A. $\{1, 2, 3\}$
   B. $\{1, 2, \frac{1}{3}, \frac{2}{3}\}$
   C. $\{1, 3, \frac{1}{2}, \frac{3}{2}\}$
   D. $\{1, 2, 3, \frac{1}{2}, \frac{1}{3}, \frac{2}{3}\}$

21. Which of the following is true about the graph of the polynomial function $P(x) = x^4 - 16$?
   A. It is increasing on the interval $[-4, \infty)$.
   B. The graph opens downward.
   C. Its maximum value is -16.
   D. It intersects the *x-axis* only at two points.

22. Given that $\log 3.64 = 0.5611$. Which one of the following is equal to $\log 364$?
   A. 0.5511
   B. 2.5611
   C. 1.4489
   D. 3.5511

23. Which one of the following is true about the graph of $y = e^{-x}$?
   A. It is decreasing .
   B. It has *x-intercept*.
   C. Its *y-intercept* is 0.
   D. It is increasing 0n [0, 5].

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24. Suppose a, x and y are positive numbers with $a \neq 1$ such that $y = a^x$. Which of the following is true?

A. $x = \log_y a$.
B. $x = \log_a y$.
C. $y = \log_a x$.
D. $x = a^{-y}$.

25. Which of the following is true about the functions $f(x) = 2^x$ and $g(x) = \log_2 x$?

A. They have the same domain.
B. They have the same range.
C. Their graphs intersect at the point $(0,1)$.
D. The domain of f and the range of g are equal.

26. Which of the following pairs of lines are parallel ?

A. $2x - y + 3 = 0$ and $2x + y - 3 = 0$
B. $3x - 2y + 1 = 0$ and $6x - 4y + 5 = 0$
C. $y = -2x + 3$ and $x = -2y - 3$
D. $x + y = 0$ and $y - x + 2 = 0$

27. Which of the following pairs of lines are perpendicular ?

A. $2x + y + 3 = 0$ and $2x + y - 3 = 0$
B. $x - y + 1 = 0$ and $6x - 3y + 5 = 0$
C. $y = -2x + 3$ and $x = -2y - 3$
D. $x + y = 0$ and $y - x + 2 = 0$

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28. Suppose θ is an angle in standard position and a point $P(6,8)$ on its terminal side. Which of the following is true?

A. $sin\theta = \frac{3}{5}$

B. $tan\theta = \frac{3}{4}$

C. $sec\theta = \frac{5}{3}$

D. $csc\theta = \frac{1}{5}$

29. Suppose α and β are two co-terminal angles. Which of the following is true about the trigonometric values of α and β?

A. $\sin\alpha = \cos\beta$

B. $\tan\alpha = \cot\beta$

C. $\sin\alpha = \sin\beta$

D. $\sec\alpha = \csc\beta$.

30. Which of the following is true about the sign of trigonometric values of the indicated angles?

A. sin 830° is positive.

B. tan 830° is positive.

C. cos 740° is negative.

D. cot 850° is positive.

31. Suppose θ is an angle in the standard position and a point $P(x,y) \neq (0,0)$ on its terminal side. Which of the following is equal to $\cot\theta$?

A. $\frac{\sqrt{x^2+y^2}}{x}$

B. $\frac{\sqrt{x^2+y^2}}{y}$

C. $\frac{x}{y}$

D. $\frac{y}{x}$

32. A tree which casts a shadow of 10 m when the angle of elevation of the s is 45°. What is the height of the tree ?

A. 8 m

B. $10\sqrt{2}$ m

C. $5\sqrt{2}$ m

D. 10 m

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33. Which of the following is the range of the function $(x) = |x^2 - 4|$?

A. $(-\infty, \infty)$
B. $[-4, \infty)$
C. $[4, \infty)$
D. $[0, \infty)$

34. Which of the following is true about the absolute value of x, where $x \in \mathbb{R}$?

A. $|x| = x$
B. $|x| = -x$
C. $|x| = \sqrt{x^2}$
D. $|-x| = x$

35. Let $p(x)$ and $q(x)$ be two polynomials and $r(x)$ be any real-valued function. Which of the following expression defines a rational function ?

A. $\frac{p(x)}{r(x)}$, where $r(x) \neq 0$
B. $\frac{p(x)r(x)}{q(x)}$, where $q(x) \neq 0$
C. $\frac{r(x)}{p(x)}$, where $p(x) \neq 0$
D. $\frac{p(x)}{q(x)}$, where $q(x) \neq 0$

36. Which of the following is true about the graph of the function $(x) = \frac{x-2}{x^2-4}$?

A. The line $y = 0$ is the horizontal asymptote of f.
B. The line $x = 2$ is the vertical asymptote of f.
C. The lines $x = 2$ and $x = -2$ are the vertical asymptotes of f.
D. It intersects the x-axis at (2, 0).

37. 60 students sat for mathematics exam. The maximum score was 50 and the minimum score was 10 out of 60%. What is the class interval if we group these into 8 classes ?

A. 10
B. 8
C. 5
D. 4

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38. What is the class limit of a continuous grouped data?
A. It is the midpoint of the class interval.
B. It is the frequency of the class interval.
C. It is an endpoint of the class interval.
D. It is the largest endpoint of an interval.

39. What is a bimodal data set?
A. It is a data set with single mode.
B. It is a data set with two modes.
C. It is a data set with three modes.
D. It is a data set with no modes.

For questions 40 and 41 use the following table of grouped frequency distribution..

Mark	10-15	16-21	22-27	28-33	34-39	40-45	46-51	52-57	57-62
F	3	5	7	9	11	5	5	3	2

40. What is the third quartile of the grouped data?
A. 40
B. 48.5
C. 36.5
D. 42.5

41. Which one of the following is the range of the grouped data?
A. 45
B. 50
C. 53
D. 62

42. Given the data 5, 6, 6, 7, 7, 8, 9, 10, 11, 11. Which one of the following is the variance of the data?
A. 4.2
B. 3.2
C. 3.06
D. 2.06

43. In how many different ways can 8 people be seated around a circular table?
A. 720
B. 4050
C. 40320
D. 5040

44. Which of the following describes the number of combination of objects?
A. It is the number of arrangements in a rectangular table.
B. It is the number of ways of choosing certain objects from the total.
C. It is the number of arrangements in which order is important.
D. It is the number of arrangements in a circular table.

45. Which of the following is true in the expansion of $\left(x+\frac{2}{x}\right)^4$?
A. The coefficient of x^4 is 16.
B. The coefficient of x^2 is 32.
C. The constant term is 24.
D. The coefficient of x^3 is 2

46. Which one of the following is true about "Pascal's Triangle"?
A. It determines the coefficients in the binomial expansion.
B. It gives the number of different arrangements in permutation.
C. It compares two numerical expressions.
D. It determines the exponent of an algebraic expression.

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47. A fair die is tossed once. What is the probability that a prime number appears ?

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{3}{4}$

48. Which of the following sets containing the joint event possible outcomes is for tossing a coin twice simultaneously ?

A. {HH, HT, TH, TT}

B. {HH, TH, TT}

C. {HH, HT, TT}

D. {HT, TH}

49. Suppose A, B and C are events. Which of the following is an event connected by or ?

A. At least one of the events occurs.

B. Neither of the events occurs.

C. Three of the events occur.

D. At most one of the events occurs.

50. What is a sample space of a given random experiment ?

A. It is any favorable outcome of the experiment.

B. It is the totality of favorable outcomes of the experiment.

C. It is any favorable outcome except some of the events.

D. It is the intersection of all possible outcomes of the experiment.

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51. Which one of the following is dependent event ?
A. Tossing a coin and rolling a die simultaneously.
B. Tossing a coin twice and getting number one in the second trial.
C. Cheating an exam and getting unpunished.
D. Robbing a bank and getting jailed.

52. What is a matrix?
A. It is set of numbers.
B. It is a rectangular array of numbers.
C. It is set of ordered pairs.
D. It is a triangular array of positive numbers.

53. Which of the following is the application of scalars?
A. Measuring your height and knowing your mass.
B. Knowing the direction of your school from your home.
C. Knowing the direction and distance of your school from your home.
D. Knowing the direction and the speed of your car.

54. Let $u = (3, 4)$, $v = (-2, 1)$ and $w = (5, -8)$ be vectors in a plane. Which one the following is the sum of the three vectors?
A. (6, 5)
B. (6, -3)
C. (10, -3)
D. (8, -4)

55. Given vectors $u = (8, -5)$ and $v = (-9, 4)$. Which one of the following is equal to $u - v$?
A. $(-1, -1)$
B. $(17, -1)$
C. $(1, 1)$
D. $(17, -9)$

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56. Which one of the following is equal to the vector $u = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$?

A. $3\begin{pmatrix} 1 \\ 0 \end{pmatrix} + 4\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

B. $3\begin{pmatrix} 0 \\ 1 \end{pmatrix} + 4\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

C. $3\begin{pmatrix} 0 \\ 1 \end{pmatrix} + 4\begin{pmatrix} 1 \\ 0 \end{pmatrix}$

D. $3\begin{pmatrix} 1 \\ 0 \end{pmatrix} + 4\begin{pmatrix} 1 \\ 0 \end{pmatrix}$

57. Let t be any real number. Which one of the following is a parametric equation of the line passing through the points $(2, 3)$ and $(4, -8)$?

A. $x = 2t$ and $y = -8t$.

B. $x = 2 + 2t$ and $y = 3 + 8t$.

C. $x = 2 + 2t$ and $y = 3 - 11t$.

D. $x = 2 + 2t$ and $y = 3 - 2t$.

58. Which one of the following is true about the transformation of the plane?

A. It is a mapping that shrinks the shape of an object only.

B. It is a mapping and classified as rigid and non-rigid motions.

C. It is a mapping which preserves only the direction.

D. It is a mapping which preserves only the distance.

59. Which one of the following is true about the graph of the function $f(x) = secx$?

A. It is increasing on $\left(\frac{3}{2}\pi, 2\pi\right)$.

B. It has an *x-intercept*.

C. Its domain is $[0, 2\pi]$.

D. It has y-intercept.

60. Which one of the following is true about the graph of $y = \arcsin x$?

A. Its domain is $[-1, 1]$.

B. It has no *y-intercept*.

C. It is a decreasing function.

D. It has no *x-intercept*.

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61. Which of the following is a countable set?
A. The interval [0, 5).
B. The set of real numbers.
C. The set of natural numbers.
D. The set of irrational numbers in [0, 1].

62. Which of the following is true about the graph of the sequence $\{1^2, 2^2, 3^2, 4^2, 5^2\}$?
A. It is increasing.
B. Its range is [1, 25].
C. Its domain is [1, 5].
D. Its graph is continuous.

63. Consider the first few terms of the Fibonacci sequence {1, 1, 2, 3, 5, 8, 13, 21, 34, 55,...}. Which one of the following are the next two terms of the sequence respectively?
A. 76 and 89
B. 68 and 89
C. 66 and 76
D. 89 and 144

64. Which one of the following is equal to the series $\sum_{n=1}^{\infty} 2\left(\frac{3}{5}\right)^n$?
A. ∞
B. 3
C. $\frac{2}{3}$
D. $\frac{3}{2}$

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65. Which one of the following forms a geometric progression?
   A. Having some amount of starting an annual salary with guaranteed raise of some amount per year.
   B. Depositing some Birr in a bank account with constant increments at the end of each year.
   C. The amount of money deposited in a bank account which pays annually compounded interest at a fixed rate.
   D. Having some amount of Birr account and withdrawing some fixed amount at the end of each year.

THE END

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