EDUCATIONAL ASSESSMENT AND EXAMINATIONS SERVICE (EAES)
ETHIOPIAN SECONDARY SCHOOL PILOT TEST (ESSPT)
GINBOT, 2016 E.C /MAY, 2024 G.C

Subject Code: 02 **Booklet Code: 010**
Number of Items: 60 **Time Allowed: 3 Hours**

1. Which one of the following numbers is a natural number?

A. -5 C. $\frac{10}{2}$

B. 0 D. $\frac{3}{5}$

2. Which one of the following set of numbers has a one to one correspondence relation with the set of points on a number line?

A. The set of natural numbers C. The set of real numbers
B. The set of rational numbers D. The set of integers

3. For non-zero real numbers x, y and t, what is the simplified form of the expression $\left(\frac{(4x)^{\frac{1}{2}}y^{-2}}{t^2}\right)\left(\frac{x^{\frac{1}{2}}t^5}{9y^{-2}}\right)\div\frac{(2t)^3}{9xy}$?

A. $2x^2y$ C. $\frac{1}{4xy^5t^6}$

B. $\frac{1}{4}x^2y$ D. $2xy^5t^6$

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4. In dividing $a = 54$ by $b = 4$, then what are the quotient and remainder, respectively?

   A. 4 and 13
   B. 13 and 4
   C. 2 and 13
   D. 13 and 2

5. Which one of the following systems of linear equations has unique solution?

   A. $\begin{cases} x - 2y = 4 \\ -2x + 4y = -8 \end{cases}$
   B. $\begin{cases} x + 2y = 3 \\ x - y = 10 \end{cases}$
   C. $\begin{cases} 2x = y \\ 4x - 2y = 0 \end{cases}$
   D. $\begin{cases} 3x + 4y = 5 \\ 6x + 8y = 7 \end{cases}$

6. What is the solution set of the equation $|x + 2| + |x| = 5$?

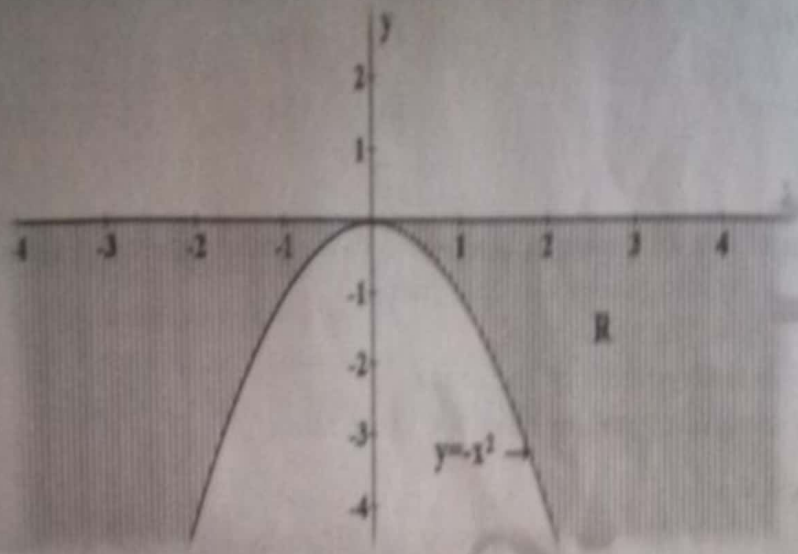
   A. $\left\{-\frac{7}{2}, \frac{3}{2}\right\}$
   B. $\left\{\frac{7}{2}, -\frac{3}{2}\right\}$
   C. $\left\{\frac{7}{2}, \frac{3}{2}\right\}$
   D. $\left\{-\frac{7}{2}, -\frac{3}{2}\right\}$

7. Let U be the set of natural numbers, and let $A = \{x \in U : 2x + 6 = 0\}$. Then what is the absolute complement of A?

   A. ϕ
   B. $\{-3\}$
   C. U
   D. $U \cup \{-3\}$

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8. Consider the relation R whose graph is given by the shaded region below.



Which one of the following is true about the domain and range of the relation R?

A. Domain of R is $(-\infty, \infty)$
B. Range of R is $[0, \infty)$
C. Domain of R is $(-\infty, 0]$
D. Range of R is $(-\infty, \infty)$

9. If $f(x) = 2x^2 + 1$, $g(x) = x^3 - 4$ and $h(x) = \frac{3}{x-1}$, then what is the value of $\left(\frac{fg+h}{h}\right)(2)$?

A. 39
B. 3
C. 12
D. 13

Mathematics

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$\frac{(n-2)180^\circ}{n}$ each measure of exterior angle $= \frac{(18-2)(180^\circ)}{18}$

$\frac{360}{n}$ measure of each exterior angle $= \left(\frac{16}{18}\right)180^\circ =$

$\frac{360}{n}$ " "

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10. What is the measure of each interior angle of a regular 18 sided polygon?

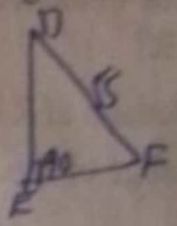
A. 2880° C. 170°

B. 160° D. 180°

11. Which one of the following is true about two similar figures in a plane?

A. Corresponding sides are congruent.
B. They have the same area.
C. One is enlargement of the other.
D. Corresponding angles have the same ratio.

12. In ΔDEF, if $m(< E) = 90^\circ$, $m(< F) = 2m(< D)$, and length of $DF = \sqrt{5}$, then the length of EF is equal to



A. $\frac{1}{\sqrt{5}}$ C. $\frac{\sqrt{15}}{2}$

B. $\frac{\sqrt{5}}{2}$ D. $\frac{\sqrt{10}}{2}$

13. If an equilateral triangle DEF is inscribed in a circle of radius 6cm, then what is the area of the minor segment cut off by the chord $\overline{DE}$?

A. $(12\pi - 9)\ cm^2$ C. $(6\pi - 3\sqrt{3})\ cm^2$

B. $(12\pi - 9\sqrt{3})\ cm^2$ D. $(6\pi - 3)\ cm^2$

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14. The scores of 20 students in their Mathematics Examination (out of 20) is given in the table below:

Score	8	10	15	17	20
Frequency	1	8	4	5	2

Which one of the following is true?

A. 10 students scored 8 out of 20.
B. 18 students scored below 15.
C. There are two students who scored 20 out of 20.
D. 7 students scored above the average.

15. A teacher asked his students the number of hours they studied last week and recorded their response as follows:
10, 12, 27, 11, 8, 15, 19, 21, 13, 10, 9, 17, 18 and 24
What is the median of this data?

A. 13
B. 14
C. 15
D. 20

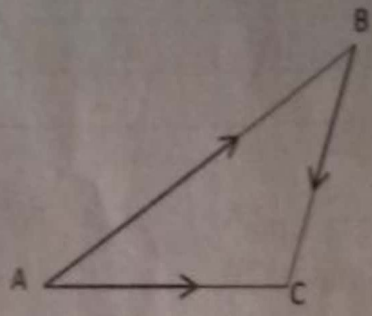
16. A box contains three different bags containing marbles. The first bag contains 2 red and 3 white marbles. The second bag contains 3 red and 2 white marbles, and the third bag contains 1 red and 4 white marbles. If a bag is drawn at random from the box and a marble is drawn at random from the selected bag, what is the probability of getting a red marble?

A. $\frac{1}{5}$
B. $\frac{4}{5}$
C. $\frac{3}{5}$
D. $\frac{2}{5}$

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17. The diagram below is formed by the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{BC}$.



If we use the notation $\overrightarrow{AB} = u$, $\overrightarrow{AC} = v$, then what is $\overrightarrow{BC}$ in terms of u and v?

A. $v - u$
B. $v + u$
C. $u - v$
D. $u - 2v$

18. If $f(x) = 2x^3 + x$ and $(f.g)(x) = 18x^5 + 14x^4 + 17x^3 + 7x^2 + 4x$, then what is $g(x)$?

A. $9x^3 + 7x^2 + 4$
B. $7x^2 + 9x + 4$
C. $9x^2 + 7x + 4$
D. $9x^3 + 4$

19. What are the zeros of $f(x) = x^3 + 4x^2 + x - 6$?

A. $-3, -2$ and 1
B. $-3, 2$ and -1
C. $3, -2$ and -1
D. $3, 2$ and 1

20. What is the mantissa of the common logarithm $\log 4.39$?

A. 4
B. -1
C. $\log 4.39$
D. $\log 0.439$

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21. Which one of the following defines an exponential function f?

A. $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x) = a^x, a \in \mathbb{R} \setminus \{1\}$.

B. $f: \mathbb{R} \to (0, \infty)$ defined by $f(x) = x^a, a \in \mathbb{R} \setminus \{1\}$.

C. $f: (0, \infty) \to \mathbb{R}$ defined by $f(x) = a^x, a \in (0, \infty) \setminus \{1\}$.

D. $f: \mathbb{R} \to (0, \infty)$ defined by $f(x) = a^x, a \in (0, \infty) \setminus \{1\}$.

22. Let $f(x) = \left(\frac{1}{3}\right)^{x+4}$ and $g(x) = \log_{\frac{1}{3}}^{(x+4)}$ be given. Then which one of the following is true about the two functions?

A. f and g have the same domain.

B. f and g have the same range.

C. Domain of f is contained in domain of g.

D. Domain of f is equal to range of g.

23. What is the solution set of the inequality $5x + 2 \leq 2x - 7$?

A. $[3, \infty)$ C. $(-\infty, 3]$

B. $(-\infty, -3]$ D. $(-\infty, -3)$

24. What is the solution set of the quadratic inequality $3x^2 + 10x < 13$?

A. $(-1, \frac{13}{3})$ C. $(-\infty, -1) \cup (\frac{13}{3}, \infty)$

B. $(-\frac{13}{3}, 1)$ D. $(-\infty, -\frac{13}{3}) \cup (1, \infty)$

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25. If two non-adjacent vertices of a square with diagonal of length $5\sqrt{2}$ units are at $(3, 2)$ and $(x, -3)$, then which one of the following is possible value of x?

A. 2
B. 3
C. -3
D. 8

26. What is the equation of the line passing through the point $(2, -3)$ and having the same slope as the line $2x - 3y + 3 = 0$?

A. $2x + 3y + 13 = 0$
B. $2x - 3y - 13 = 0$
C. $-2x + 3y - 13 = 0$
D. $2x - 3y + 13 = 0$

27. If $\cos\theta = -1$, where $0 \le \theta \le 2\pi$, then what is the value of $\sin\left(\frac{3}{2}\theta\right) + \tan(2\theta)$?

A. -1
B. 0
C. 1
D. -2

28. What is the value of $\tan(930^\circ)$?

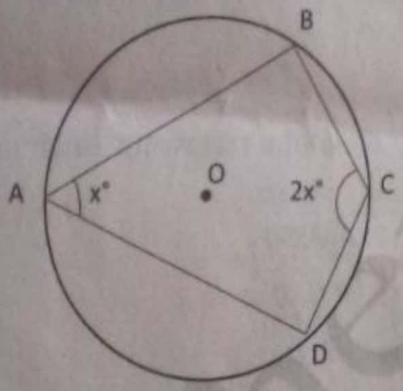
A. $-\sqrt{3}$
B. $-\frac{1}{\sqrt{3}}$
C. $\sqrt{3}$
D. $\frac{1}{\sqrt{3}}$

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29. What are the domain (D), range(R) and period (P) of $f(x) = 3 + 2\cos x$?

A. $D = (-\infty, \infty)\ R = [-5, -1]$ and $p = 2\pi$.
B. $D = [0, \infty), R = [1,5]$ and $p = \pi$.
C. $D = (-\infty, \infty), R = [1,5]$ and $p = 2\pi$.
D. $D = (-\infty, \infty), R = [-1,1]$ and $p = 2\pi$.

30. A quadrilateral ABCD is inscribed in a circle as shown below,



What is the value of x?

A. 120
B. 90
C. 60
D. 45

31. A right circular cylinder of radius 7cm and height 10cm contains some amount of water. When a solid metal cube of side length 5 cm is completely submerged the cylinder becomes full. What is the amount of water in the cylinder in cm^3?

A. $250\pi - 343$
B. $700\pi - 125$
C. $490\pi - 125$
D. $250\pi + 343$

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32. What is the total surface area of a right circular cone with radius 6cm and height 8cm?

A. $132\pi\ \text{cm}^2$
B. $36\pi\ \text{cm}^2$
C. $60\pi\ \text{cm}^2$
D. $96\pi\ \text{cm}^2$

33. Which one of the following is true about a frustum of a regular pyramid?

A. The lateral faces are squares.
B. The lateral faces are congruent isosceles triangles.
C. The slant height is the altitude of any one of the lateral faces.
D. The lateral surface area is half of the lateral surface area of the pyramid.

34. Which one of the following is true about the following functions involving the modulus function?

A. The domain of $f(x) = |x| - x$ is $[0, \infty)$.
B. The range of $f(x) = |x| - x$ is $(-\infty, \infty)$.
C. The range of $f(x) = |x| + 3$ is $[-3, \infty)$.
D. The range of $f(x) = |x| + x$ is $[0, \infty)$.

35. Which one of the following functions is a one-to-one correspondence from $\mathbb{R}$ into $\mathbb{R}$, where $\mathbb{R}$ is the set of real numbers?

A. $f(x) = x^3$
B. $f(x) = |x|$
C. $f(x) = \lfloor x \rfloor$
D. $f(x) = \sqrt{x}$

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36. What is the range of the function $f(x) = \frac{x^2 - 16}{x - 4}$?

A. $R \setminus \{4\}$ C. $R \setminus \{8\}$

B. $[4, \infty)$ D. $[8, \infty)$

37. Which one of the following is true about quantitative and qualitative data?

A. A model of a car is a quantitative data.

B. The eye color of a person is a quantitative data.

C. The life time of a shoe is a qualitative data.

D. The width of a football field is a quantitative data.

38. The following table gives the hourly income of 25 persons (in Birr).

Income	Frequency
20-24	5
25-29	6
30-34	4
35-39	8
40-44	2

What is the modal income (in Birr)?

A. 35.5 C. 37.5

B. 36.5 D. 38

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39. In a class of 40 students, 21 students are taking Physics and 33 students are taking Chemistry. If there are 18 students taking both Physics and Chemistry, then what is the probability that a student is taking Physics or Chemistry?

A. $\frac{40}{54}$ C. $\frac{9}{20}$

B. $\frac{18}{54}$ D. $\frac{9}{10}$

40. If $A = \begin{pmatrix} -2 & 3 \\ 1 & 1 \end{pmatrix}$, then what is the transpose of A?

A. $\begin{pmatrix} 1 & 3 \\ 1 & -2 \end{pmatrix}$ C. $\begin{pmatrix} -2 & 1 \\ 3 & 1 \end{pmatrix}$

B. $\begin{pmatrix} -2 & 3 \\ 1 & 1 \end{pmatrix}$ D. $\begin{pmatrix} 2 & -1 \\ -3 & -1 \end{pmatrix}$

41. Which one of the following is the solution set of the system $\begin{cases} x + 2y = 8 \\ x + y = 5 \end{cases}$?

A. $(-7, 2)$ C. $(1, 4)$

B. $(3, 2)$ D. $(2, 3)$

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42. The 3×3 system of linear equations $AX = B$ has a solution $(1, b, 3)$. If $\det(A) = 16$ and the determinant of the matrix obtained by replacing the second column of A by B is -32, then what is the value of b?

A. -2
C. 2
B. $-\frac{1}{2}$
D. $\frac{1}{2}$

43. Which one of the following defines an arithmetic progression?

A. It is a sequence whose n^{th} term is given by $A_n = A_1 d^{n-1}$, Where d is a constant.

B. It is a sequence where each term is obtained by multiplying the preceding two terms.

C. It is a sequence where each term is obtained by adding the preceding two terms.

D. It is a sequence where the difference of any two consecutive terms is a constant.

44. What is the sigma notation representation of $\frac{1}{3}+\frac{1}{12}+\frac{1}{27}+\frac{1}{48}+\cdots$?

A. $\sum_{k=1}^{\infty}\frac{1}{k^3}$
C. $\sum_{k=1}^{\infty}\frac{1}{3k^2}$
B. $\sum_{k=1}^{\infty}\frac{1}{3k}$
D. $\sum_{k=1}^{\infty}\frac{1}{(3k)^2}$

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45. Which one of the following is convergent geometric series?

A. $\sum_{n=1}^{\infty} \frac{4(-1)^n}{2^{n/2}}$

B. $\sum_{n=1}^{\infty} 5\left(-\sqrt{5}\right)^n$

C. $\sum_{n=1}^{\infty} \frac{4\ 4^{n-1}}{\left(\sqrt[3]{26}\right)^n}$

D. $\sum_{n=1}^{\infty} 3^n \cdot \left(\frac{1}{\sqrt{3}}\right)^n$

46. Due to tax reduction, a person has Birr 600 extra spendable money. If we assume that the person spends 70% of this on consumer goods, that the producers of these goods spend 70% of what they receive on consumer goods, and that this process continue indefinitely, then what is the total amount of money spent on consumer goods?

A. Birr 2000
B. Birr 294
C. Birr 1400
D. Birr 224

47. Each of the following sentences is related to calculation of gradient of the cubic function $f(x)=x^3$. Which one of the following is **NOT** true?

A. If a is a real number and $a \neq x$, then $\frac{x^3 - a^3}{x - a} = x^2 + ax + a^2$.

B. As x approaches a, the expression $x^2 + ax + a^2$ approaches $3a^2$.

C. The gradient of $f(x) = x^3$ at the point $(2, 8)$ is 12.

D. The gradient of $f(x) = x^3$ at the point $(-2, -8)$ is -12.

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52. The price (in Birr) of two items where recorded for seven days as shown below,

Item A: 18, 19, 23, 28, 37, 38, 39

Item B: 5, 6, 7, 5, 12, 20, 25

Which one of the following is true about these two sets of data?

A. The two data sets have the same coefficient of range.
B. Item A has more stable prices than Item B.
C. Item B has more stable prices than Item A.
D. The two items have the same variability of prices.

53. What is the coefficient of quartile deviation for the data set:
13, 12, 10, 15, 18, 21, 8, 32, 27.

A. $\frac{13}{2}$
B. $\frac{24}{35}$
C. $\frac{13}{35}$
D. $\frac{11}{35}$

54. Which one of the following is **NOT** true about random sampling technique?

A. It gives every member of the population equal chance of being selected.
B. It gives us a sample that best represents the population.
C. It gives us a sample in a short period of time and with less cost.
D. It gives us a sample which is free of bias.

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55. What is the maximum value of $Z = 2x + 3y$ subject to the constraints:

$$\begin{cases} 4x - 3y \geq -4 \\ y \leq -2x + 8 \\ x \geq 0, y \geq 0 \end{cases}$$

A. 8
B. 24
C. 4
D. 16

56. A factory manufactures tables and chairs. A table and a chair requires 4 hours and 2 hours, respectively, for assembling and 2 hours and 1 hour ,respectively, for finishing. The maximum labor hour available per day for assembling and finishing are 20 and 15 respectively. If x and y represent the number of tables and chairs produced per day, respectively, then which one of the following systems of inequalities indicate the limitations on x and y?

A. $\begin{cases} 4x + 2y < 15 \\ 2x + y < 20 \\ x \geq 0, y \geq 0 \end{cases}$

C. $\begin{cases} 2x + 4y < 15 \\ x + 2y < 20 \\ x \geq 0, y \geq 0 \end{cases}$

B. $\begin{cases} 4x + 2y < 20 \\ 2x + y < 15 \\ x \geq 0, y \geq 0 \end{cases}$

D. $\begin{cases} 2x + 4y < 20 \\ 2x + y < 15 \\ x \geq 0, y \geq 0 \end{cases}$

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57. If a person drives his car at a speed of 25 km/hr, then he will spend Birr 2 per kilometer for fuel and if he drives faster at a speed of 40 km/hr, then he will spend Birr 5 per kilometer for fuel. If the person has Birr 100 for fuel, then what is the maximum distance he can travel in 1 hour?

A. 20 km
B. 30 km
C. 40 km
D. 45 km

58. Enrollment for the Ethiopian Mathematics Olympiad is increased by 70% this year. If there are 3570 students enrolled for the competition this year, then how many students did participate in the competition last year?

A. 2100
B. 1470
C. 2499
D. 530

59. If you deposit Birr 3000 at 10% interest rate compounded annually, then what is the interest you will earn after 3 years?

A. Birr 900
B. Birr 993
C. Birr 3900
D. Birr 3993

60. What is the monthly payment for a sofa costing Birr 15000 if the loan is amortized over 4 months at an interest rate of 12%?

A. Birr 3765
B. Birr 3750
C. Birr 3900
D. Birr 3850

THE END

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