

Mathematics, 2018 EC, social science, entrance exam, round 1

Grade 12 · Mathematics · 2018 E.C.

Time allowed: 120 minutes

Questions: 40

Total marks: 40

Name _____ Grade _____ ID No. _____ Date _____

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1. What is the solution set of $\sqrt{5^{x^2}} = 25^x$? (1)
 A. $\emptyset$ B. 0
 C. $\sqrt{2}$ D. 0, 4
2. In an experiment of rolling a die, what is the probability of getting 1 or 5? (1)
 A. $\frac{1}{6}$ B. $\frac{1}{3}$
 C. $\frac{2}{3}$ D. $\frac{1}{4}$
3. Which one of the following pairs of lines are perpendicular to each other? (1)
 A. $l_1 : y = 2x - 1$ and $l_2 : y = \frac{1}{2}x + 1$ B. $l_1 : y = 1$ and $l_2 : y = -2$
 C. $l_1 : y = 3x + 1$ and $l_2 : y = -3x + 4$ D. $l_1 : x = 3$ and $l_2 : y = 1$
4. Suppose that a person has 4 jackets and 5 trousers. In how many different ways can the person dress? (1)
 A. 20 B. 16
 C. 9 D. 25
5. Consider the following grouped data as shown in the table below. Which one of the following is the variance of the above data? Value Frequency 1-5 4 6-10 5 11-15 6 16-20 5 (1)
 A. 60 B. 29.5
 C. 59 D. 28.5
6. Which of the following statements defines a prime number? (1)
 A. It is a natural number that is a product of two distinct numbers.
 B. It is a natural number that has more than two factors.
 C. It is a natural number that is a factor of all numbers.
 D. It is a natural number that has exactly two distinct factors.
7. A rectangular metal sheet of dimension 12 m by 18 m is cut into six congruent rectangular sheets (or pieces). Then what is the area of each piece in m^2 ? (1)
 A. 36 B. 24
 C. 28 D. 32
8. What is the solution set of the inequality $|3 - 2x| - 5 \geq 2$? (1)
 A. $\{x: x \geq -2 \text{ or } x \leq 5\}$ B. $\{x: -2 < x < 5\}$
 C. $\{x: -2 \leq x \leq 5\}$ D. $\{x: x \leq -2 \text{ or } x \geq 5\}$

9. What are the domain and range of the function $f(x) = x + |x|$ respectively? (1)
- A. $\mathbb{R}$ and $[2, \infty)$ B. $\mathbb{R}$ and $\mathbb{R}$
 C. $\mathbb{R}$ and $[0, \infty)$ D. $[0, \infty)$ and $\mathbb{R}$
-
10. Given below the ages of 40 people taken to form five football teams in a certain sport field. Ages 10-18 18-26 26-34 34-42 42-50 No. of Peoples 10 4 8 12 6 What is the class midpoint of the third class? (1)
- A. 34.5 B. 26
 C. 30.5 D. 30
-
11. Let a function, $f(x) = \begin{cases} 2x^2 - 4, & \text{if } x \geq 1 \\ x^3 - 4x + 1, & \text{if } x < 1 \end{cases}$. Then what is the equation of the tangent line to the graph of f , at $x = -2$? (1)
- A. $y = -4x + 14$ B. $y = -8x - 12$
 C. $y = 8x + 17$ D. $y = 4x - 2$
-
12. Let A and B be two sets such that $A = \{1, 4, 9\}$ and $B = \{n \in \mathbb{N} : 3 < n \leq 5\}$. Which of the following sets represents $A \times B$? (1)
- A. $\{(4, 1), (5, 1), (5, 4), (5, 5), (4, 9), (5, 9)\}$ B. $\{(1, 4), (1, 5), (4, 4), (4, 5), (9, 4), (9, 5)\}$
 C. $\{(1, 4), (1, 5), (4, 5), (5, 5), (9, 4), (9, 5)\}$ D. $\{(4, 1), (5, 1), (4, 4), (5, 4), (9, 4), (9, 5)\}$
-
13. Let $p(x) = 4x^3 - x^2 + ax + b$ be a polynomial function such that a and b are constants. If $p(x)$ is divided by $x + 1$ and $x - 2$ the remainders are 0 and 36 respectively, then what are the values of a and b respectively? (1)
- A. 0 and 5 B. -2 and 3
 C. -3 and 4 D. 1 and 6
-
14. If $\cos \theta = -\frac{5}{13}$ and θ is an angle in the second quadrant, then what is the value of $\cot \theta$? (1)
- A. $\frac{12}{13}$ B. $-\frac{5}{12}$
 C. $-\frac{12}{13}$ D. $\frac{5}{12}$
-
15. Let a matrix $A = \begin{pmatrix} 1 & -3 & 2 \\ -3 & 3 & -1 \\ 2 & -1 & 0 \end{pmatrix}$. Then what is the inverse of A? (1)
- A. $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{pmatrix}$ B. $\begin{pmatrix} -1 & 2 & 4 \\ 3 & -3 & 1 \\ -2 & 1 & 0 \end{pmatrix}$
 C. $\begin{pmatrix} 1 & \frac{1}{2} & \frac{1}{3} \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{5} \\ \frac{1}{3} & \frac{1}{5} & \frac{1}{6} \end{pmatrix}$ D. $\begin{pmatrix} 1 & \frac{-1}{3} & \frac{1}{2} \\ \frac{-1}{3} & \frac{1}{3} & -1 \\ \frac{1}{2} & -1 & 0 \end{pmatrix}$
-
16. In an arithmetic sequence, the 4 th and 8 th terms are 0 and 12 respectively. What is the sum of the first thirteen terms of the sequence? (1)
- A. 234 B. 18
 C. 117 D. 27
-
17. A line is passing through the points $(-2, 5)$ and $(3, -5)$. What is the gradient of the line? (1)
- A. 0 B. $-\frac{1}{2}$
 C. -2 D. $\frac{2}{3}$

18. Let $p(x)$ and $q(x)$ be polynomials with $q(x) \neq 0$. Which one of the following defines a rational expression? (1)

A. $\sqrt{\frac{p(x)}{q(x)}}$
C. $\frac{p(x)}{\sqrt{q(x)}}$

B. $\frac{p(x)}{q(x)}$
D. $\frac{\sqrt{p(x)}}{q(x)}$

19. Consider the following data: 6, 11, 4, 15, 26, 11, 4, 10, 2, 9. Which of the following is true about the mode of the given data? (1)

- A. Multimodal
C. No mode

- B. Unimodal
D. Bimodal

20. Given the data: 10, 4, 2, 8, 2, 4. What is the standard deviation of the given data? (1)

A. $\sqrt{3}$
C. 5

B. 3
D. $2\sqrt{5}$

21. Consider the following system of linear equations.
$$\begin{cases} x - y = 2 \\ 3x + y = 4 \\ 2x - 2y = 3 \end{cases}$$
 Then which one of the following matrices is the reduced form of the augmented matrix into triangular matrix? (1)

A. $\begin{pmatrix} 1 & -1 & 2 \\ 0 & -2 & -2 \\ 0 & 0 & -1 \end{pmatrix}$
C. $\begin{pmatrix} -1 & 0 & 0 \\ -2 & -2 & 0 \\ 1 & -1 & 2 \end{pmatrix}$

B. $\begin{pmatrix} -1 & 0 & 0 \\ -2 & 4 & 0 \\ 1 & -1 & 2 \end{pmatrix}$
D. $\begin{pmatrix} 1 & -1 & 2 \\ 0 & 4 & -2 \\ 0 & 0 & -1 \end{pmatrix}$

22. Let MD refers to the mean deviation from the mean and $\bar{x}$ denotes the mean of a data set. Which of the following formula represents the coefficient of Mean deviation (CMD) from the mean of the data? (1)

A. $CMD = \frac{MD + \bar{x}}{MD - \bar{x}}$
C. $CMD = \frac{MD - \bar{x}}{MD + \bar{x}}$

B. $CMD = \frac{\bar{x}}{MD}$
D. $CMD = \frac{MD}{\bar{x}}$

23. Which one of the following statements is NOT true about regular polygon? (1)

- A. A circle can be circumscribed about the regular polygon.
B. It has n lines of symmetries.
C. Its apothem is equal to the side of the polygon.
D. A circle can be inscribed in the regular polygon.

24. Let $a > 0$ and $a \neq 1$. Consider $f(x) = a^x$ and $g(x) = \log_a x$. Then which one of the following statements is true about their domains and ranges? (1)

- A. The domain of $f(x)$ is equal to the range of $g(x)$.
B. The domain of $f(x)$ is equal to the domain of $g(x)$.
C. The domain of $f(x)$ is a subset of the domain of $g(x)$.
D. The range of $f(x)$ is equal to the range of $g(x)$.

25. What is the solution set of $\log_2 x + \log_2(x + 3) = 2$? (1)

A. $\{1\}$
C. $\{-4, 1\}$

B. $\{2\}$
D. $\{4\}$

26. If $A = \begin{pmatrix} 3 & 1 & 1 \\ 2 & -1 & 1 \\ 0 & 1 & 3 \end{pmatrix}$, then what is the value of $\det(A)$? (1)
- A. -4
B. -16
C. 14
D. 2

27. Consider the rhombus ABCD as shown in the figure below, where $AC = 6$ units and $BD = 8$ units. Then which one of the following statements is true about the above rhombus? (1)
- A. $m(\angle DAB) = m(\angle OBA) + m(\angle ODA)$
B. The side of the rhombus is 10 units.
C. The perimeter of the rhombus is 20 units.
D. $m(\angle OAB) = m(\angle OBA)$

28. What is the fraction form of the decimal 0.343434...? (1)
- A. $\frac{17}{50}$
B. $\frac{34}{99}$
C. $\frac{5}{9}$
D. $\frac{34}{90}$

29. Let $P(a, b)$ be a point, other than the origin $(0, 0)$, on the terminal side of an angle θ in standard position. Then what is the value of $\cos \theta$? (1)
- A. $\frac{a}{\sqrt{a^2+b^2}}$
B. $\frac{b}{a^2+b^2}$
C. $\frac{b}{\sqrt{a^2+b^2}}$
D. $\frac{a}{a^2+b^2}$

30. Which one of the following is a skew symmetric matrix? (1)
- A. $\begin{pmatrix} 0 & -2 & 3 \\ 2 & 0 & 4 \\ -3 & 4 & 0 \end{pmatrix}$
B. $\begin{pmatrix} -1 & 0 & 0 \\ 2 & 2 & 0 \\ 1 & -3 & 1 \end{pmatrix}$
C. $\begin{pmatrix} 0 & -2 & 1 \\ 2 & 0 & -3 \\ -1 & 3 & 0 \end{pmatrix}$
D. $\begin{pmatrix} 1 & -5 & 4 \\ -5 & 2 & 0 \\ 4 & 0 & 3 \end{pmatrix}$

31. In a bank, there are 10 customers waiting for service. In how many different ways can an officer choose six customers in all, if three older customers are given priority? (1)
- A. 120
B. 35
C. 72
D. 210

32. Given below the amount of time (in minutes) spent on running each day by a group of 16 students. Time spent on running 1-4 5-8 9-12 13-16 17-20 No. of students 3 2 4 4 3 What is the coefficient of quartile deviation of the given data? (1)
- A. $\frac{9}{22}$
B. $\frac{9}{2}$
C. 9
D. 11

33. A mobile seller sells Samsung(S) and Motorola(M) mobile phones. The seller has Birr 10,000,000 to invest and has a storage space of at most 600 mobile phones. Samsung costs Birr 18,000 and Motorola costs Birr 16,000. The shop owner can make a profit of Birr 1,500 from the sale of Samsung and Birr 1,200 from the sale of Motorola. Which one of the following represents the linear objective function and constraints of the profit? (let S and M be the numbers of Samsung and Motorola mobile respectively) (1)

A. $Z = 1,200S + 1,500M$

B. $Z = 1,500S + 1,200M$

subject to:
$$\begin{cases} 16,000S + 18,000M \leq 10,000,000 \\ S + M \leq 600 \\ S, M \geq 0 \end{cases}$$

subject to:
$$\begin{cases} 18,000S + 16,000M \leq 10,000,000 \\ S + M \leq 600 \\ S, M \geq 0 \end{cases}$$

C. $Z = 1,200S + 1,500M$

D. $Z = 1,500S + 1,200M$

subject to:
$$\begin{cases} 18,000S + 16,000M \leq 10,000,000 \\ S + M \geq 600 \\ S, M \geq 0 \end{cases}$$

subject to:
$$\begin{cases} 18,000S + 16,000M \geq 10,000,000 \\ S + M \leq 600 \\ S, M \geq 0 \end{cases}$$

34. The two consecutive sides of a parallelogram are 3 m and 4 m long and the angle between them is 30° . Then what is the area of the parallelogram? (1)

A. 7.5 m^2

B. 12 m^2

C. 6 m^2

D. 24 m^2

35. What is the solution set of the quadratic inequality $3x^2 - 3x - 6 < 0$? (1)

A. $(-3, 6)$

B. $(-\infty, -1) \cup (2, \infty)$

C. $(-1, 2)$

D. $(-\infty, -3) \cup (6, \infty)$

36. There are three red, four yellow and three green balls in a bag. If two balls are picked randomly from the bag at a time, what is the probability of getting at least one green ball? (1)

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

B. $\frac{7}{15}$

C. $\frac{8}{15}$

D. $\frac{7}{45}$

37. A shop sale a shoe at a price of Birr 1225 with a 30% discount notice. How much was the original price of the shoe in Birr? (1)

A. 1432.50

B. 1750

C. 3675

D. 1592.50

38. Two six face dice are thrown at a time. What is the probability of getting the sum of the outcome is a prime number? (1)

A. $\frac{5}{12}$

B. $\frac{5}{8}$

C. $\frac{7}{12}$

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

39. A person is given the colors blue, red and green and asked to paint six houses in a row. The rules are: R1: No two neighboring houses can have the same color. R2: The second and the last houses must have same color. R3: The third and fifth houses cannot have the same color. Then which houses will always have the same color? (1)

A. The second and the fifth

B. The first and the fourth

C. The first and the sixth

D. The fourth and the sixth

40. In a household, there are three mothers, six daughters and four granddaughters living together. What is the smallest possible number of females in the house?

(1)

A. 13

B. 12

C. 7

D. 9

END OF THE EXAMINATION

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