

Mathematics, 2016 EC, common, entrance exam

Grade 12 · Mathematics · 2016 E.C.

Time allowed: 120 minutes**Questions:** 38**Total marks:** 38

Name _____ Grade _____ ID No. _____ Date _____

1. In the set of natural numbers, which one of the following defines a composite number? (1)
 - A. A number that has only two distinct factors
 - B. A number that is divisible by numbers from 2 to 9
 - C. A number that has two or more different factors
 - D. A number that has three or more different divisors
2. Which of the following is true about rationalizing the denominator? (1)
 - A. Only denominators can be multiplied by an irrational number
 - B. Only numerators can be rationalized when there is a radical
 - C. It is a method of changing the denominator into a rational number
 - D. It is a technique of multiplying a given number by an irrational expression
3. When dividing 142 by 13 and expressed using the division algorithm, which is correct? (1)
 - A. $142 = 10(13) + 12$
 - B. $142 = 11(13) - 1$
 - C. $142 = 11(13) + 1$
 - D. $142 = 10(14) + 2$
4. The solution set of the system $2x - y = 5$ and $3y + 15 = 6x$ is: (1)
 - A. The empty set
 - B. $\{(t, 2t - 15): t \in \mathbb{R}\}$
 - C. $\{(t, 2t - 5): t \in \mathbb{R}\}$
 - D. $\{(0, -5), (1, -3), (2, -2), \dots\}$
5. Which one of the following refers to the definition of similar plane figures? (1)
 - A. Figures whose corresponding angles have the same ratio
 - B. Figures where one is an enlargement of the other
 - C. Figures whose ratios of corresponding sides are different
 - D. Figures that have different shapes but same size
6. In a right triangle where angle A is 30° and side opposite it is 11 cm, what is the hypotenuse? (1)
 - A. 22 cm
 - B. $22\sqrt{3}$ cm
 - C. $11\sqrt{3}$ cm
 - D. 33 cm
7. A circle has diameter 16 cm and a chord 6 cm from the center. What is the chord length? (1)
 - A. $2\sqrt{7}$ cm
 - B. 8 cm
 - C. $4\sqrt{7}$ cm
 - D. 16 cm
8. Which of the following is the approximate surface area of the base of a regular pentagonal prism of radius 6 cm? (1)
 - A. 54 sq. cm
 - B. 85.5 sq. cm
 - C. 27 sq. cm
 - D. 27.5 sq. cm

9. If each observation is multiplied by 0.5, what is the new mean? (1)
- A. $1/2$ B. $1/2 \bar{x}$
C. $2 \bar{x}$ D. $\bar{x} - 0.5$
-
10. A regular triangular pyramid labeled 1, 2, and 3 is thrown twice. What is the probability that the sum of the numbers facing down is less than 5? (1)
- A. $1/3$ B. $2/3$
C. $4/9$ D. $5/9$
-
11. Given vectors u with initial point $(-1, 0)$ and terminal point $(2, 3)$, and v with initial point $(5, -2)$ and terminal point $(2, 3)$, what is $v - u$? (1)
- A. $(-6, 3)$ B. $(2, -6)$
C. $(0, -2)$ D. $(-6, 2)$
-
12. Which one of the following is the definition of a polynomial function? (1)
- A. A function f defined by $f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$, where n is non-negative integer, $a_n \neq 0$ and $a_i \in \mathbb{R}$
B. A function f defined by $f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$, where n is positive integer, $a_n \neq 0$ and $a_i \in \mathbb{R}$
C. A function f defined by $f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$, where n is an integer, $a_n \neq 0$ and $a_i \in \mathbb{R}$
D. A function f defined by $f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$, where n is a rational number, $a_n \neq 0$ and $a_i \in \mathbb{R}$
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13. When $f(x) = 4x + kx - 1$ is divided by $x - 1/2$, the remainder is 3. What is the value of k ? (1)
- A. 14 B. 7
C. 7 D. 9
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14. What is the solution set of $\log_4(x + 1) - 2 \log_4 x = 0.5$? (1)
- A. $\{1, -1/2\}$ B. $\{1/2, -1\}$
C. $\{1/2\}$ D. None
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15. Which of the following is the characteristic of $\log(20 + 1/5)$? (1)
- A. -1 B. 1
C. 2.02 D. 0.2
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16. Which of the following statements about trigonometric values is true? (1)
- A. $\sin 270^\circ = 0$ B. $\cos(-180^\circ) = -1$
C. $\tan(-90^\circ) = 0$ D. $\tan(540^\circ) = -1$
-
17. For $0^\circ \leq \theta \leq 90^\circ$, which relationship describes the co-function of θ ? (1)
- A. $\cos \theta = \sec(90^\circ - \theta)$ B. $\csc \theta = \sin(180^\circ - \theta)$
C. $\cot \theta = \tan(90^\circ - \theta)$ D. $\sec \theta = \sin(180^\circ - \theta)$
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18. For $0^\circ \leq \theta \leq 90^\circ$, which of the following identities is correct? (1)
- A. $\csc^2(90^\circ - \theta) = 1 + \tan^2 \theta$ B. $\sec^2 \theta + \tan^2 \theta = 1$
C. $\cot^2(90^\circ - \theta) = 1 + \csc^2 \theta$ D. $\cot^2 \theta + \csc^2 \theta = 1$

19. Let ABCD be a rhombus and E be the midpoint of diagonal AC. Which of the following is NOT true? (1)

- A. $\triangle ABC$ is isosceles
B. AC is perpendicular to BD
C. $\triangle BEC$ is a right triangle
D. $\angle DAB$ is acute
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20. A regular hexagonal park has radius 12 m. What length of fencing material is needed? (1)

- A. $72\sqrt{3}$
B. 72
C. $36\sqrt{3}$
D. 36
-

21. Given a right circular cylinder has radius 5 cm and lateral surface area 150π cm². What is its volume? (1)

- A. 375π
B. 350π
C. 315.5π
D. 200π
-

22. A spherical container has diameter 3 m. What is the volume of water it holds? (1)

- A. $27/4 \pi$
B. $27/2 \pi$
C. $9/2 \pi$
D. $9/4 \pi$
-

23. The domain and range of $f(x) = 1 + [2x - 4]$ are: (1)

- A. $[2, \infty)$ and $[1, \infty)$
B. $\mathbb{R}$ and $[2, \infty)$
C. $[2, \infty)$ and $\mathbb{R}$
D. $\mathbb{R}$ and $[1, \infty)$
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24. Which of the following is the inverse of $f(x) = \sqrt{x - 3}$? (1)

- A. $f^{-1}(x) = x^2 + 3, x \geq 0$
B. $f^{-1}(x) = x^2 + 3, x \geq 3$
C. $f^{-1}(x) = \sqrt{x + 3}$
D. $f^{-1}(x) = 1/\sqrt{x - 3}$
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25. Which of the following is the simplified form of $[x - (x + 3)/(x - 1)]^2 + (x - 3)/(x^2 - 2x + 1)$? (1)

- A. $(x^2 - 2x + 3)/(x - 1)$
B. $(x - 1)/(x - 3)$
C. $x^2 - 1$
D. $x^2 - 2x + 1$
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26. A data on scores of 32 students is listed as follows: (1)

Score	Number
52	48
76	35
60	45
50	75

If the data is to be grouped in 6 classes, what has to be the class interval (w)?

- A. 6
B. 7
C. 8
D. 9
-

27. Five English books (3 identical) and 3 different Mathematics books are arranged in a row. If one specific Math book is first, how many arrangements are possible? (1)

- A. 240
B. 840
C. 5040
D. 6720

28. Balls numbered 1 to 10 are placed in a box. What is the probability that a randomly selected ball is neither odd nor a multiple of 3? (1)
- A. $\frac{3}{10}$ B. $\frac{2}{5}$
C. $\frac{3}{5}$ D. $\frac{2}{5}$

29. Let A be a 3×3 matrix and k a real number. Which statement is true? (1)
- A. $\det(kA) = 3\det(A)$
B. $\det(-A^T) = \det(A)$
C. Interchanging rows does not change determinant
D. Multiplying one column by k multiplies determinant by k

30. Given the linear system, (1)

$$\begin{cases} a_{1x} + b_{1y} - c_{1z} = 3 \\ a_{2x} + b_{2y} + c_{2z} = -1 \\ a_{3x} + b_{3y} + c_{3z} = 2 \end{cases}$$

such that the determinant of the coefficient matrix is $\frac{1}{3}$. Which of the following is the value of y ?

- A. $\begin{vmatrix} a_1 & b_1 & c_1 \\ -3 & 1 & -2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ B. $\begin{vmatrix} a_1 & 3 & c_1 \\ a_2 & -1 & c_2 \\ a_3 & 2 & c_3 \end{vmatrix}$
C. $\begin{vmatrix} a_1 & b_1 & c_1 \\ -3 & 1 & -2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ D. $\begin{vmatrix} a_1 & -3 & c_1 \\ -3a_3 & 1 & c_2 \\ a_3 & -2 & c_3 \end{vmatrix}$

31. Given the sequence -2, 0, 4, 10, ... what can be the fifth term? (1)
- A. 14 B. 16
C. 18 D. 20

32. Which one of the following gives the definition of integration for a function? (1)
- A. Reversing differentiation B. Derivative at a point
C. Rate of change D. Derivative on an interval

33. What is the mean deviation about the mean of the data: 15, 12, 10, 13, 9, 12, 11, 15, 14, 9? (1)
- A. 1.4 B. 1.5
C. 1.8 D. 2.0

34. Given the following grouped data (1)

| x | 8 - 12 | 13 - 17 | 18 - 22 | 23 - 27 | 28 - 32 |
| ---|---|---|---|---|
| f | 3 | 4 | 5 | 6 | 2 |

Which of the following is the standard deviation of the data?

- A. 6 B. 6.5
C. $\sqrt{37}$ D. $\sqrt{37.5}$

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- 35.** Given two sets of data A and B with ranges 15 and 15 respectively, coefficient of range (CR) of A is 0.2 and CR of B is 0.21. Then which of the following is true? (1)
- A. The dispersion of A is slightly greater than that of B.
 - B. The dispersion of B is slightly greater than of A.
 - C. Data A has the same dispersion as B even if CR varies.
 - D. No enough information to compare dispersion roughly.
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- 36.** in a homogenous population where there is a catagorical difference items are selected randomly in each category Which sampling method selects items randomly within categories? (1)
- A. Simple random
 - B. Systematic
 - C. Stratified
 - D. Cluster
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- 37.** An agent planned to transport fertilizers in barrels and sacks from a port using two types of cars designated by A and B. Each car A can transport 30 barrels and 50 sacks charging Birr 8,000 for a trip, and each car B can transport 45 barrels and 80 sacks charging Birr 12,000. If there are at least 400 barrels and at most 1,500 sacks to be transported from the port, which of the following is a constraint of the linear programming problem to minimize the cost of transportation given by $z = 8,000x + 12,000y$? (1)
- A.
$$\begin{cases} 6x + 9y \geq 80 \\ 5x + 8y \leq 150 \\ x \geq 0, y \geq 0 \end{cases}$$
 - B.
$$\begin{cases} 6x + 9y \leq 80 \\ 5x + 8y \geq 150 \\ x \geq 0, y \geq 0 \end{cases}$$
 - C.
$$\begin{cases} 3x + 5y \leq 40 \\ 9x + 16y \geq 30 \\ x \geq 0, y \geq 0 \end{cases}$$
 - D.
$$\begin{cases} 3x + 5y \geq 40 \\ 9x + 16y \leq 30 \\ x \geq 0, y \geq 0 \end{cases}$$
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- 38.** A college graduate plans to deposit Birr 2000 each year starting from the first day of the year into a saving account that pays 8% interest compounded annually. How much will he/she has just after the first day of the third year? (1)
- A. 4492.2
 - B. 6332.8
 - C. 6492.8
 - D. 7012.2

— END OF EXAMINATION —