NPUA YEREVAN HIGH SCHOOL

INTERNATIONAL BACCALAUREATE

DIPLOMA PROGRAMME

ADMISSION TEST

MATHEMATICS

SAMPLE

YEREVAN 2024

NPUA YEREVAN HIGH SCHOOL

INTERNATIONAL BACCALAUREATE DIPLOMA PROGRAMME

DURATION: 90 minutes

TOTAL GRADES: 7 points

SECTION 1 - *The score for tasks ranging from 1 to 25 is 0.14 points.*

Choose the correct answers

1. Factorize: $3x^2 - 9x + 6$.

   1) (x +1) (x - 2) 2) (3x -3) (x - 2) 3) (3x + 1) (x + 2) 4) there is no right answer

2. What is the 6th term of the geometric progression: 9, 3, 1, 1/3, ...

   1) there is no right answer 2) $\frac{1}{9}$ 3) $\frac{1}{81}$ 4) $\frac{1}{27}$

3. Solve the equation: $\sqrt{7-x} - 1 = 2$.

   1) -2 2) 5 3) there is no right answer 4) -1

4. Simplify the expression $\frac{x^3-81x}{x^3+9x^2}$.

   1) $\frac{x}{x+9}$ 2) there is no right answer 3) x+9 4) $\frac{x-9}{x}$

5. If $f(x) = 4x^3 + 3x^2 - 5x - 8$, find $f(-1)$.

   1) 5 2) -5 3)- 4 4) there is no right answer

6. Solve the inequality $|2x - 7| \geq 5$.

   1) [1; 6] 2) there is no right answer 3) $x \in (-\infty; 1] \cup [6; \infty)$ 4) $[6; \infty)$

7. In an isosceles trapezoid with bases 9 and 15, a circle is inscribed. Find the length of its legs.

   1) 6 2) 12 3) 24 4) there is no right answer

8. Calculate the circumference of a circle with a diameter of 11 units.

1) 22π 2) 6π 3) 10π 4) there is no right answer

9. Find the value: $\sqrt{21}-\sqrt{(4-\sqrt{21})^2}$.

1) there is no right answer 2) 4 3) $2\sqrt{21}$ 4) -4

10. In a right triangle ABC it is known that $\cos A=\frac{15}{17}$. Find tgA .

1) $\frac{8}{15}$ 2) $\frac{8}{17}$ 3) there is no right answer 4) $\frac{15}{17}$

11. Find the length of the longer diagonal of a regular hexagon with side length 4.

1) $4\sqrt{3}$ 2) there is no right answer 3) $8\sqrt{2}$ 4) 8

12. Find the remainder, when a + 8 is divided by 6, if leaves a remainder of 3, when divided by 6.

1) 4 2) 5 3) 0 4) there is no right answer

13. Find the sum of all proper fractions with denominator 6.

1) 3.5 2) there is no right answer 3) 2.5 4) 5

14. Find the coordinates of the point of intersection of the lines: $y=2x-5$ and $x-2y=1$.

1) there is no right answer 2) (3, 1) 3) (1, 3) 4) (-3, 1)

15. Find the value $\frac{m}{n}$, if $\frac{5n+2m}{3m-2n}=\frac{3}{2}$.

1) $\frac{16}{5}$ 2) there is no right answer 3) $\frac{8}{5}$ 4) $\frac{7}{5}$

16. Find the square of the distance between the points (4, -3) and (2, -1).

1) 4 2) 2 3) 8 4) there is no right answer

17. Solve the system of equations: $\begin{cases}3x+2y=24\\2x-y=-5\end{cases}$.

1) (-2, 9) 2) (2, -9) 3) there is no right answer 4) (2, 9)

18. Solve the inequality: $\frac{6-3x}{x+4}\geq 0$.

1) $(-4;-2]$ 2) $(-4;2]$ 3) there is no right answer 4) $(-\infty;-4)\cup[2;\infty)$

19. Given a function $f(x) = 2x^3 + 3x^2 - 5x - 8$. Find $f\big(f(-1)\big)$.

    1) 46 2) there is no right answer 3) -2 4) 2

20. Find the radius of the circle inscribed in a square with an area of 64.

    1) $8\sqrt{2}$ 2) $4\sqrt{2}$ 3) 4 4) there is no right answer

21. Divide the polynomial $P(x) = x^3 - 3x^2 - 11x - 2$ by $Q(x) = x + 2$.

    1) there is no right answer 2) $x^2 - 4x - 3$ 3) $x^2 - 5x - 1$ 4) $x^2 - x + 3$

22. Find the sum of the first 20 terms of an arithmetic progression, if its first term is -15, and the difference is 3.

    1) 270 2) 620 3) there is no right answer 4) 540

23. An operation \$ is defined on any three real numbers by $a \$ b \$ c = a - 3(c + 2b)$.
    Find x if $6 \$ 2 \$ x = 12$.

    1) 4 2) there is no right answer 3) 6 4) -6

24. Find $5a + c$, if $x^2 - 12x + 7 = (x + a)^2 - c$.

    1) -1 2) -2 3) 1 4) there is no right answer

25. Find k, if the lines $5x + 2y = 10$ and $15x + ky = 18$ are parallel .

    1) there is no right answer 2) -6 3) 6 4) 1

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SECTION 2 - *The score for tasks ranging from 1 to 20 is 0.175 points.*

1. All numbers from 1 to 1000 are written one after the other. What digit is written in the 2016 position?
2. How many integer values can the expression (2a-b) take, if 1<a<4, -2<b<3?.
3. Find the square of the diagonal of a rectangle, if after tripling its length and reducing its width four times, the area of the new rectangle is 60 square meters, the perimeter is 64 meters.
4. If 40% of x is equal to 60% of y, and $x + y = 120$, find $x - y$.
5. AB is the diameter of the circle, AC = 8, BC = 6. Find the radius of the circle.
6. Find the largest natural number belonging to the domain of the function: $f(x) = \sqrt{x(4 - x^2)}$.
7. In a group of 20 students, 15 like pizza, 12 like burgers, and 8 like both pizza and burgers. How many students in the group like:
    1) burgers but not pizza,
    2) pizza but not burgers,
    3) neither pizza nor burgers,
    4) either pizza or burgers?
8. The 13 foot ladder rests against the wall. The base of the ladder is 5 feet from the wall. At what height does the ladder rest against the wall?
9. Find the sum of the coordinates of the midpoint of the segment with endpoints. (4, -2) and (-3, 1) .
10. Find the value of the expression: $\dfrac{\sin^3\alpha\cdot(1+ctg\alpha)+\cos^3\alpha\cdot(1+tg\alpha)}{\sin\alpha+\cos\alpha}$.
11. For three bags, A, B, and C, bag A contains one-fourth the number of apples as bag B, and bag B contains one-fifth the number of apples as bag C. If bag A has 20 apples, then how many apples are in the three bags?

12. The cafe has 8 types of cakes and 5 types of drinks. How many different orders can be made if the customer has to choose three cakes and two drinks?
13. Simplify an expression: $\frac{1-sin^4\alpha}{sin^2\alpha\cdot(1+sin^2\alpha)} - ctg^2\alpha$.
14. Find the largest integer solution to the inequality: $\frac{x^2-36}{\sqrt{-x-3}} \le 0$.
15. In the basket, there are 6 apples, of which 3 are red, 2 are green, and 1 is yellow. You randomly pull out 2 apples one after the other without returning them to the basket. Find the probability that both apples will be red. Multiply the answer by 100.
16. Find the number of solutions of the equation $x^2+2xy-3y^2-13=0$, where x and y are natural numbers.
17. The vertex of the parabola $y = ax^2 - bx + 3$ is the point $A(1;2)$. Find $a+b$.
18. The side of the base of a regular triangular pyramid is 12, and the angle formed by the side and the base is 30°. Find
    1) the height of the pyramid,
    2)) the $\frac{1}{\sqrt{7}}$ part of the surface area of a pyramid's lateral surface.
19. How many five-digit even numbers can be formed with 0, 1, 2, 3, 4, 5 digits (without repetition of digits)?
20. For what values of a does the equation $a^2x - 5 = 25x + a$ have no solution?