

This mathematics test contains 15 questions. In all questions only one answer is correct and brings 2 points. Wrong answer, as well as the case of more than one answer, brings 0 points.

1. The value of the expression

$$\left(\frac{2^{-4} + 3^{-2}}{2^{-1} - 3^{-1}} : (0,5)^3 - 3^{-1} \right)^{\frac{1}{3}}$$

is equal to:

1) 8; 2) 2; 3) $\sqrt[3]{\frac{4}{3}}$; 4) $\sqrt[3]{2}$; 5) $-\frac{1}{2}$.

2. The amount of water that should be added to 140ml of alcohol solution of concentration 96%, in order to get alcohol solution of concentration 70%, is:

1) 75ml of water; 2) 70ml of water; 3) 48ml of water;
4) 52ml of water; 5) 62ml of water.

3. If α and β are real solutions of the equation $x^2 - (a - 2)x + 2a - 7 = 0$, then $\alpha + \beta > 0$, if and only if:

1) $\frac{7}{2} < a \leq 4$ or $a \geq 8$; 2) $a \leq 4$ or $a \geq 8$; 3) $2 < a \leq 4$ or $a \geq 8$;
4) $a < 2$; 5) $2 < a \leq 8$.

4. The product of all solutions of the equation $\sqrt{7x^2 + 1} = x^2 - 1$ is equal to:

1) -9; 2) -3; 3) 0; 4) 3; 5) 9.

5. The solution of the equation

$$9^{x+3} + 27 \cdot 6^{x+3} = 6^{x+5} - 27 \cdot 9^{x+2}$$

belongs to the interval:

1) $(-\infty, -3]$; 2) $(-3, -2]$; 3) $(-2, 0]$; 4) $(0, 2]$; 5) $(2, +\infty)$.

6. The value of the expression

$$\sqrt{\left(\log_3 \frac{1}{9}\right)^2} \cdot \sqrt[3]{\log_2 \frac{1}{256}}$$

is equal to:

1) 32; 2) 16; 3) -4; 4) 4; 5) -16.

7. The value of the expression $\operatorname{tg} 15^\circ - \operatorname{ctg} 15^\circ$ is equal to:

1) $\sqrt{3}$; 2) $-\frac{2\sqrt{3}}{3}$; 3) 1; 4) $-\frac{\sqrt{3}}{2}$; 5) $-2\sqrt{3}$.

8. The equation $\sin^2 \frac{x}{2} - \cos^2 x = 0$ in interval $[0, 2\pi]$:
- 1) has exactly one solution; 2) has exactly two solutions; 3) has exactly three solutions;
 4) has exactly four solutions; 5) has exactly five solutions.
9. The triangle ABC is determined by its vertices $A = (2, 2)$, $B = (5, -1)$ and $C = (2, -4)$. If the point $O = (x, y)$ is the center of the circle that passes through all the vertices (circumcenter), then $x + y$ is equal to:
- 1) 1; 2) -1; 3) 2; 4) 0; 5) 3.
10. Tangent line t of the parabola $y^2 = 18x$ is parallel to the line $3x - y + 4 = 0$. The equation of tangent line t is:
- 1) $3x - y = 0$; 2) $3x - y - 3 = 0$; 3) $3x - y + 3 = 0$;
 4) $6x - 2y + 3 = 0$; 5) $6x - 2y + 1 = 0$.
11. If $f(x) = \frac{x}{x+1}$, then $\underbrace{f(f(\dots(f(x))))}_{2021 \text{ times}}$ is equal to:
- 1) $\frac{x}{x+1}$; 2) $\frac{x}{x+2021}$; 3) $\frac{x}{2021x+1}$; 4) $\frac{2021x}{2021x+1}$; 5) x .
12. If $f(x) = \frac{1}{x}$ and $g(x) = \sqrt{x-1}$, then $f(g^{-1}(2)) \cdot g^{-1}(f(2))$ is equal to:
- 1) $\frac{1}{3}$; 2) -1; 3) $\frac{1}{2}$; 4) $\frac{4}{3}$; 5) $\frac{1}{4}$.
13. In arithmetic sequence (a_n) term a_{1011} is equal to 1. The sum of the first 2021 terms of this sequence is:
- 1) 2020; 2) 2021; 3) 4042; 4) $\frac{2021}{2}$; 5) 4040.
14. In ascending geometric sequence the first and the third term are in relation 4 : 9, and the subtract between the fourth and the second term is 15. The second term of this sequence is equal to:
- 1) 18; 2) 8; 3) $\frac{81}{2}$; 4) 12; 5) 27.
15. If the polynomial $P(x) = x^3 + ax + b$ is divisible by polynomials $x - 1$ and $x - 2$, then the remainder in the division of polynomial $P(x)$ by $x - 3$ is equal to:
- 1) 12; 2) 0; 3) 8; 4) 40; 5) 54.