Test no. VZOR01

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1. The set of all solutions of the equation $2^{|x+3|} < 2$ with the unknown $x \in \mathsf{R}$ is (1 b.)

a) $(-\infty,\ -3)$, b) $\emptyset$, c) $(-4,\ -2)$,
d) $(-\infty,\ -4) \cup (2,\ 8)$, e) $\langle -4,\ -2\rangle$.

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2. The domain of the function $f(x) = \dfrac{x}{\sin x}$ is (1 b.)

a) $(-\infty,\ \infty)$, b) the same as the domain of $g(x) = \tan x$,
c) $\bigcup_{k\in\mathsf{Z}} [k\pi,\ (k+1)\pi)$, d) $\bigcup_{k\in\mathsf{Z}} [2k\pi,\ (2k+1)\pi)$,
e) the same as the domain of $g(x) = \cot x$.

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3. Assuming that $\sin\alpha \cdot \cos\alpha = \frac{1}{2}$ and $\alpha \in (\pi,\ 2\pi)$, the value of $\tan(\pi - \alpha)$ (1 b.)

a) is not defined, b) is positive, c) is 0, d) is -1, e) is $\frac{3}{4}\pi$.

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4. In the interval $[0,\ 2\pi]$, the equation $\sin x = \cos x - 1$ has (1 b.)

a) exactly two solutions, b) exactly one solution, c) infinitely many solution,
d) exactly three solution, e) no solution.

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5. The algebraic form of the complex number $z = \dfrac{1+i}{1+2i}$ is (1 b.)

a) $\dfrac{2}{5}$, b) $\dfrac{3}{5} - \dfrac{1}{5}\mathrm{i}$, c) $1 + \dfrac{1}{2}\mathrm{i}$, d) $\dfrac{2}{3}\mathrm{i}$, e) $1 + \mathrm{i}$.

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6. The number y determined by the equation $\log_2 y = 3\log_2 \dfrac{x-2}{2} - 2\log_2 \dfrac{x^2-4}{2}$ is equal to (1 b.)

a) $\dfrac{x-2}{2(x+2)^2}$, b) $3\dfrac{x-2}{2} - 2\dfrac{x^2-4}{2}$, c) $-x^2 + 3x + 2$,
d) $x + 2$, e) $\dfrac{x-2}{6} + \dfrac{x^2-4}{4}$.

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7. Consider two recurrent sequences $(a_n)_{n=1}^{\infty}$ and $(b_n)_{n=1}^{\infty}$ given by the following formulas: $a_1 = 3$, $b_1 = 0$, and $a_n = 2 \cdot a_{n-1}$, $b_n = b_{n-1} + a_n$ for $n \geqq 2$. Determine b_{11}. (1 b.)

a) 2^{11}, b) $3 \cdot 2^{10}$, c) 6138, d) 2048, e) 0.

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8. Four numbers were inserted between numbers 7 and 22 so that these six numbers form the first six successive terms of a certain arithmetic sequence. The sum of its first eight terms is (1 b.)

a) 140, b) 56, c) 29, d) 116, e) 150.

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9. The expression $\dfrac{6x^3b^3}{25y^4} \cdot \dfrac{15y}{b^2}$ simplifies to (1 b.)

a) $\dfrac{2x^3b^5}{75y^5}$, pokud $y \neq 0 \wedge b \neq 0 \wedge x \neq 0$, b) $\dfrac{18bx^3}{5y^3}$, pokud $y \neq 0 \wedge b \neq 0$,
c) $\dfrac{2x^3b^5}{75y^2}$, pokud $y \neq 0 \wedge b \neq 0$, d) $\dfrac{5bx^3}{18y^3}$, pokud $y \neq 0$,
e) $\dfrac{18bx^3}{5y^3}$, pokud $y \neq 0$.

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10. The graph of the function $y = \left(\dfrac{1-\sqrt{x}}{\sqrt{x}-x}\right)^2$ is a part of (1 b.)

a) a straight line,
b) a hyperbola,
c) a parabola,
d) two non-parallel lines,
e) two parallel lines.

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11. The set of all solutions of the inequality $|x+5| \geqq 4 + |3-2x|$ with the unknown $x \in \mathsf{R}$ is (2 b.)

a) $(-\infty,\, 8)$,
b) $[-5,\, 8]$,
c) $(-\infty,\, \infty)$,
d) $\emptyset$,
e) $\left[\frac{2}{3},\, 4\right]$.

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12. Consider the straight lines that pass through the point $A = (0,\, -5)$ and whose distance from the origin is $\sqrt{5}$. Their slopes are (2 b.)

a) $2;\ \dfrac{1}{2}$,
b) $-3;\ 2$,
c) $0;\ 3$,
d) $-2;\ 2$,
e) $-1;\ 1$.

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13. Consider the following sets: $A = \{1, 2, \dots, 1000\}$, $B = \{x \in A : \dfrac{x}{6} \in \mathsf{Z}\}$, $C = \{x \in A : \dfrac{x}{8} \in \mathsf{Z}\}$, $D = \{x \in A : 237 \leqq x \leqq 356\}$ (here Z denotes the set of integers). How many elements does the set $(B \cap C) \cup D$ have? (2 b.)

a) 160,
b) 125,
c) 159,
d) 154,
e) 156.

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14. The solutions of the equation $x^2 - (p+1)x + 4 = 0$ (with unknown x) are not real exactly if (2 b.)

a) $p = -1$,
b) $p \in \mathsf{R}$,
c) $p \in (-5,\, 3)$,
d) $p \in (-1,\, 4)$,
e) $p \in (3,\, 5)$.

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15. How many characters of the Morse code can be created assuming that characters are created by joining dots and dashes into groups of one, two, three, four or five? (2 b.)

a) 62,
b) 64,
c) 32,
d) 66,
e) 26.
