Mathematics Entrance Exam

1. **Please, classify the following numbers to the right group of numbers. Which ones of the following numbers are integer, rational, irrational real numbers?**

   a) 3.14, b) -2, c) 3^6, d) $\frac{16}{5}$, e) $\sqrt{2}$, f) $\frac{\sqrt{3}}{4}$, g) $\frac{\frac{120}{8}}{\frac{15}{24}}$ h) $\sqrt{-4}$

   Taking into account your solution, what is the correct answer from the followings:

   A.) integers: b), c), h); rationals: b), d) irrational real numbers: a), e), f)
   B.) integers: b), c); rationals: a), b), c), d), g) irrational real numbers: e), f)
   C.) integers: b), c), g); rationals: a), b), c), d), g) irrational real numbers: e), f)
   D.) integers: b), c), g); rationals: a), b), c), d), g) irrational real numbers: e), f), h)

2. **Please, simplify the following mathematical algebraic sentence, and give the final result!**

$$\frac{(7\cdot a^2\cdot b^6)^2}{(2\cdot a^3\cdot b^4)^3} \div \frac{49\cdot a^3\cdot b^4}{(4\cdot a^4\cdot b^2)^2} \quad , a \neq 0,\ b \neq 0.$$

   What is the result? Choose the correct answer from the following possibilities!

   A.) Result is: $\frac{2}{7}\cdot a\cdot b$
   B.) Result is: $\frac{2}{7}$
   C.) Result is: 2
   D.) Result is: $a\cdot b$

3. **Solve the following algebraic equation if x is an integer number!**

$$\frac{x}{x-2} - \frac{x+2}{1-x} = \frac{-3}{x^2-3x+2}$$

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   A.) Result is: $x = 1$
   B.) Results are: $x = 1$ and $x = -\frac{1}{2}$
   C.) Result is: $x = -\frac{1}{2}$
   D.) Result is: there is no solution for this problem

4. **Solve the following algebraic system of equation if x, y are both positive real numbers!**

$$\left.\begin{array}{l} \boldsymbol{x - y = 7^0} \\ \boldsymbol{4^x \cdot 2^{x-y} = 32} \end{array}\right\}$$

Checking your solution, which is the correct answer from the followings:

A.) there is no solution for this problem
B.) Results are: $x = 2$ and $y = 1$
C.) Results are: $x = \frac{5}{2}$ and $y = \frac{5}{2}$
D.) Results are: $x = \sqrt{5}$ and $y = \sqrt{5}$

5. **If the universal set $U = \{x \mid x\ \textit{is an integer and}\ 5 \le x \le 21\}$ and A, B, C are subsets of U such that $A = \{x \mid x\ \textit{is an odd real number}\}$, $B = \{x \mid x\ \textit{is divisible by}\ 5\}$, $C = \{x \mid x\ \textit{is a solution of}\ x^2 - 21x + 90 < 0\ \textit{inequality}\}$. Please, list the elements of the following sets:**

$A \cap B$, $B \cup C$, $A \cap (B \cup C)$, $U \setminus A$ (difference of sets of U and A)

Choose the correct answer from the followings:

A.) $A \cap B = \{5; 7; 9; 10; 11; 13; 15; 17; 19; 20; 21\}$, $B \cup C = \{10\}$,
$A \cap (B \cup C) = \{5; 7; 9; 10; 11; 13; 15; 17; 19; 21\}$, $U \setminus A = \{6; 8; 10; 12; 14; 16; 18; 20\}$

B.) $A \cap B = \{5; 15\}$, $B \cup C = \{5; 7; 8; 9; 10; 11; 12; 13; 14; 15; 20\}$,
$A \cap (B \cup C) = \{5; 7; 9; 11; 13; 15\}$, $U \setminus A = \emptyset$,where $\emptyset$ means the empty set.

C.) $A \cap B = \{5; 7; 9; 10; 11; 13; 15; 17; 19; 20; 21\}$, $B \cup C = \{10\}$,
$A \cap (B \cup C) = \{5; 7; 9; 10; 11; 13; 15; 17; 19; 21\}$, $U \setminus A = \emptyset$, where $\emptyset$ means the empty set.

D.) $A \cap B = \{5; 15\}$, $B \cup C = \{5; 7; 8; 9; 10; 11; 12; 13; 14; 15; 20\}$,
$A \cap (B \cup C) = \{5; 7; 9; 11; 13; 15\}$, $U \setminus A = \{6; 8; 10; 12; 14; 16; 18; 20\}$

6. **Give the possible widest domain of the real numbers for the following mathematical sentence:**

$$\sqrt{\boldsymbol{\log_2 x}}$$

Using your solution, choose the correct answer from the following possibilities:

A.) Only x is real number and $1 < x$ gives solution for the problem mentioned above.
B.) Only x is real number and $0 < x$ gives solution for the problem mentioned above.
C.) Only x is real number and $1 \le x$ gives solution for the problem mentioned above.
D.) Any x real number gives solution for the problem mentioned above.

7. **Let $\boldsymbol{\mathcal{A}} = \frac{\mathbf{1}}{(\sin x)\cdot(\cos x)-\mathbf{1}}$ given. Which are/is correct sentence(s) from the followings regarding to $\boldsymbol{\mathcal{A}}$.**

A.) In the case of $k \cdot \pi$ if k is any integer real number, the domain of $\mathcal{A}$ is an empty set.
B.) There is x real number, which case $\mathcal{A} = 0$.
C.) There is x integer number, which case $\mathcal{A} = 100$.
D.) There is no any x real number, which case the domain of $\mathcal{A}$ is an empty set.