FYS PRE-ASSESSMENT TEST

Welcome to the RBS Intro Week! This test covers reading, reasoning and quantitative skills that may appear in the First Year Seminar (FYS) and other classes. It is a preliminary activity to estimate the progress you have made during the study year. This test does not entail any obligations and will not affect your grades.

The total time for this test is **45 minutes**. You may use Internet and calculators, but should not communicate with other people during this test.

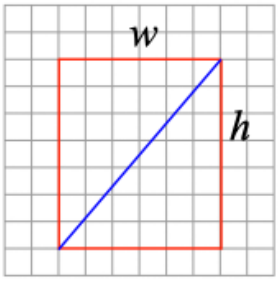
For each question enter a short answer (typically, a number) or select an answer variant (A,B,C,D). The topics covered by this test include algorithmic procedures, spatial reasoning, integer arithmetic, combinatorics and counting, probabilities and statistics.

Question 1

There is a rectangle consisting of 5×7 little squares. How many little squares are cut by its diagonal? (A little square is cut by a line, iff the square is separated in two parts; touching a square's vertex does not count.)

Write an integer: _____.

Question 2 There is a rectangle consisting of $w \times h$ little squares, where w is the width and h is the height. Let N denote the number of squares cut by its diagonal? Which of the following statements is always true?



(A) $N = w + h - 1$

(B) $N \le w + h - 1$

(C) $N \ge w + h - 1$

(D) Either $N = w + h - 1$ or $N = w + h + 1$

Select an answer (A,B,C,D): _____.

Question 3 What digit should be written instead of y so that the resulting number $\overline{5783y1y0}$ is divisible by 90?

(The number has eight digits, and two of them are equal to some unknown digit y.)

Write a digit (0 - 9): _____.

Question 4

Which statement expresses exactly the same property as this one: "A positive integer N is divisible by 144"?

(A) N is divisible by both 4 and 36.

(B) N is divisible by both 6 and 24.

(C) N is divisible by both 8 and 18.

(D) N is divisible by both 9 and 16.

Select an answer (A,B,C,D): _____.

Question 5: What is the least number of candies Joe needs, if he wants to distribute them to his 10 friends so that every friend gets some candy and no two friends should get equal number of candies. (Only whole candies are handed out – they cannot be cut into pieces.)

Write a positive integer: _____.

Quesiton 6: In order to feed his pet rats, Joe needs either x apples, or y bananas or z peaches. (Combining different types of fruit is not allowed.) Somebody brought Joe a random collection of N fruit; every fruit in the collection is either an apple, a banana or a peach. What is the least value of N to guarantee that Joe's rats can be fed (no matter what are the counts of apples, bananas and peaches).

(A) $N = x + y + z - 3$,

(B) $N = x + y + z - 2$,

(C) $N = x + y + z - 1$,

(D) $N = x + y + z$.

Select an answer (A,B,C,D): _____.

Quesiton 7: Consider the following inequalities between rational numbers:

$$\frac{2}{5} < \frac{5}{12} < \frac{3}{7} < \frac{4}{9} < \frac{1}{2}.$$

Find a fraction $\frac{p}{q}$ that is in-between the following two of these fractions: $\frac{3}{7} < \frac{p}{q} < \frac{4}{9}$. Since there are many such fractions, try to find one with the smallest denominator q.

Write your answer as a fraction p/q: _____.

Question 8: You have two positive fractions $\frac{a}{b} < \frac{c}{d}$ (where all the integers a, b, c, d are positive). How to estimate the smallest possible difference Δ between these fractions: $\Delta = \frac{c}{d} - \frac{a}{b}$?

(A) Δ may equal $\frac{1}{ac}$, but is never smaller than that.

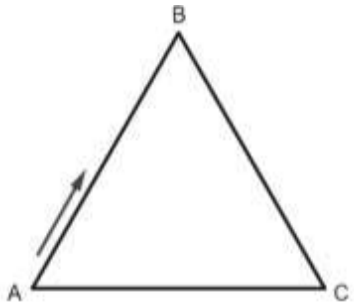
(B) Δ may equal $\frac{1}{bd}$, but is never smaller than that.

(C) Δ may equal $\frac{1}{a^2 + c^2}$, but is never smaller than that.

(D) Δ may equal $\frac{1}{b^2 + d^2}$, but is never smaller than that.

Select an answer (A,B,C,D): _____.

Question 9: A robot moves along the perimeter ABC (see image), the length of each side is 2 cm. The robot starts at the vertex A and travels exactly 2023 centimeters. (Every time the robot reaches a vertex, it makes a $120°$ turn to the right.) How many full rotations around the vertical axis were completed by the robot during this travel? (If robot completes some fractional number of rotations, then keep the integer part only.)



Write your answer as an integer: _____.

Question 10: In a factory there are boxes with screws.

- The first box contains 160 thousand screws.
- The number of screws in the second box are fewer by one fifth compared to the first box.
- The number of screws in the third box are fewer by one fifth compared to the second box.
- The number of screws in the fourth box are fewer by one fifth compared to the third box.

Estimate the difference of the number of screws in the first and the fourth box.

(A) less than 10000,

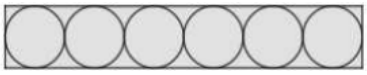
(B) from 10000 to 99999

(C) from 100000 to 999999

(D) At least 1000000.

Select an answer (A,B,C,D): _____.

Question 11: What is the area of the surrounding rectangle, if the perimeter of the shape made of six circles is 18π?



Write your answer as a positive number: _____.

Question 12: On a remote planet each month lasts exactly 42 days; and each month starts on a Friday. Find a date (a number from 1 to 42) which is simultaneously satisfies three properties: (A) It is odd, (B) it is divisible by 3, (C) it is on Tuesday.

Su	Mo	Tu	We	Th	Fr	Sa
38	39	40	41	42	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Write the date (as an integer number): _____.