2020 Wits Mathematics Competition
Final Round
Grade 6-7
Name:
School:

Instructions

This paper is 90 minutes long and consists of ten single answer questions (to be answered in the below table) and two proofs (to be answered on the pages they're written on). If needed, additional sheets of blank paper may be used to finish your solutions. Geometric equipment and language dictionaries are allowed but calculators and other computing devices are not.

"The really unusual day would be one where nothing unusual happens.". — Persi Diaconis

SHARP

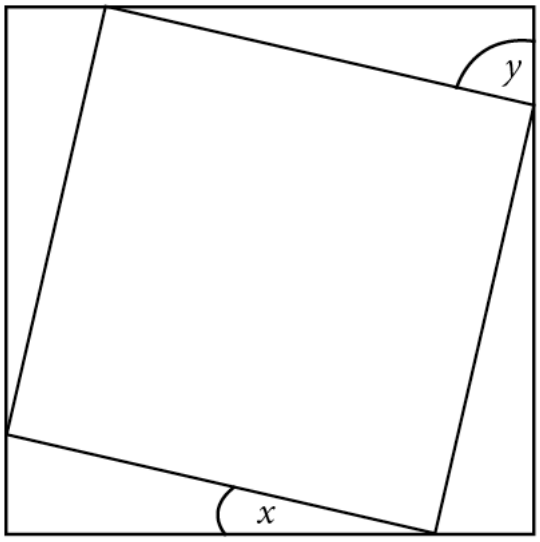
Question	Answer
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

A. Single Answer Questions

2 Marks

1. All even numbers between 1 and 101 are added together. From the total, all the odd numbers between 0 and 100 are subtracted. What is the result?

2. One square is drawn inside another square, creating angles of x° and y° as show in the picture. What is the sum of x° and y°?



3. Sihle picks a number. He tells Ofentse to double the number and add 10. He tells Tina to triple the number. Both Ofentse and Tina get the same solution. What is Sihle's number?

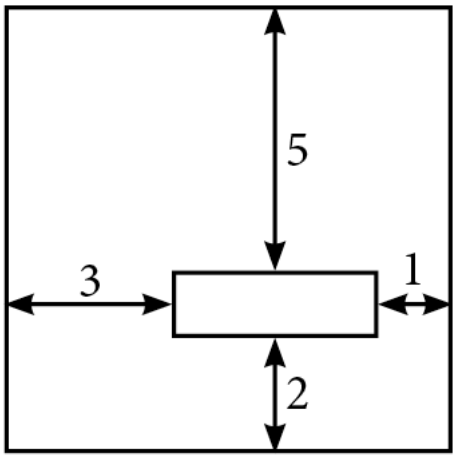
3 Marks

4. Five friends go to the movies for Oti's birthday. She sits in the middle, with two friends on each side. In how many ways can the group be arranged?

5. At a school, the ratio of boys to girls is $4 : 5$, while the ratio of girls to teachers is $7 : 3$. What is the ratio of students to teachers at the school?

6. The mean of four numbers is 5. The median of the four numbers is 6. What is the mean of the largest and smallest of the numbers?

7. A rectangle is drawn inside a square so that their sides are parallel. What is the difference between the perimeter of the square and the perimeter of the rectangle?



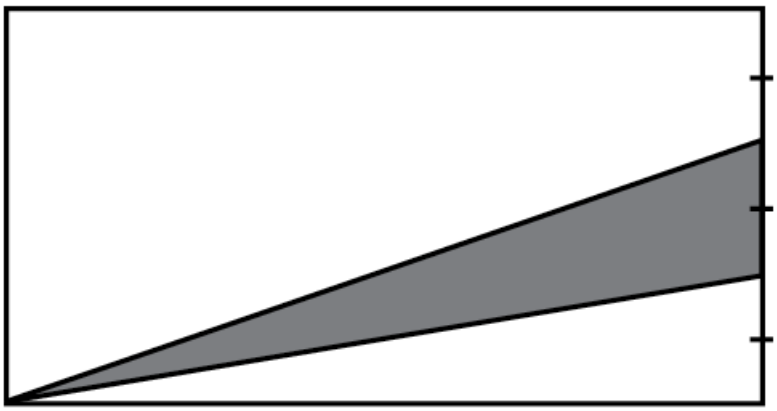
4 Marks

8. We have a deck of $n > 1$ cards and a collection of symbols such that the following conditions are satisfied:

   1. Three distinct symbols are drawn on each card.
   2. Any two cards have exactly one symbol in common.
   3. Any two symbols appear together on exactly one card.

   What is the value of n?

9. A side of a rectangle is split into 3 equal parts, and a triangle is created from the middle part to an opposite corner as shown. What fraction of the rectangle is shaded?



10. What is the smallest natural number W so that $204 \times W$ is a perfect square?

B. Proof Questions

11. An autobiographical number is a number whose first digit is the number of zeros in the number, whose second digit is the number of ones, and so on. For example 1210 is autobiographical because it has 1 zero, 2 ones, 1 two and 0 threes. It just so happens that there is exactly one 10 digit autobiographical number. Find it and explain your working.

12. In the diagram below, $ABCD$ is a square. Triangles AFB and AED are equilateral. Prove that triangle EFC is equilateral.