



Chapel Hill Math Circle

Intermediate Group

In the Land of Diagramsⁱ, Part 1

September 24, 2016

1. One hundred high school students were asked if they knew about any of the following mythological heroes: Achilles, Gilgamesh, and Hercules.
 - 25 people did not know any of these.
 - 3 people knew all three.
 - 48 people knew who Achilles or Gilgamesh were but did not know who Hercules was.
 - 40 people knew who Gilgamesh was.
 - 21 people knew who at least two of these were.
 - 7 people knew who Hercules and Gilgamesh were but did not know who Achilles was.
 - 8 people knew who Hercules and Achilles were.

How many students knew only about two heroes?

2. A survey among 200 Millennials asked about their movie series preferences among The Lord of the Rings, Harry Potter, and Star Wars.
 - 22 students dislike all movie choices.
 - 73 students like only The Lord of the Rings.
 - 136 students like The Lord of the Rings.
 - 14 students like only Harry Potter and Star Wars.
 - 31 students like only The Lord of the Rings and Star Wars.
 - 63 students like Harry Potter.
 - 135 students do not like Star Wars.

How many like all three series?

3. Peter beats his little brother Paul by 10m in a 100m race. Feeling compassionate, Peter races Paul again, but this time Peter starts 10m behind the starting line. Assuming they both run at the same rate as the first time, who wins?

4. Grandma takes five minutes to climb from the first floor of a building to the fifth. If she climbs at the same speed, how long will it take her to get to the ninth floor from the first?

5. While walking in the park, Nicole and Valerie came to a large round clearing surrounded by a ring of cottonwood trees and decided to count the trees. Nicole walked around the clearing and counted all the trees. Valerie did the same, but started from a different tree. Nicole's 20th tree was Valerie's 7th, while Nicole's 7th tree was Valerie's 94th. How many trees were growing around the clearing?

6. A dot is marked in a circle.
 - a. Cut the circle into at most three parts so that, by rearranging the parts, you get a circle with its center at the dot.
 - b. Is it possible to do so by cutting the circle into at most two parts?

ⁱ Problem 3 is a rewording of a famous puzzle by Martin Gardner (because I couldn't find the original one!). Problems 4, 5, and 6 are taken from Sergey Dorichenko's *A Moscow Math Circle* from MSRI and AMS's Mathematical Circles Library. A copy is in display in the snacks room.