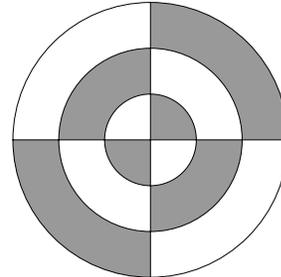


Katenary Timed Sprint

College of Charleston Math Meet
February 22, 2014

Instructions: Katenary Evenmean (no relation to Katniss Everdeen, of course) is competing in The Number Games. Write the exact answer to each question about her in the corresponding box. All answers should be written either as whole numbers or as fractions in simplified form.

1. Katenary Evenmean is training for this year's Number Games by firing arrows at a target like the one shown in the figure. It is formed by three concentric circles of radius 1, 2 and 3 respectively, each divided into fourths. The area of the dark shaded region is $x\pi$. What is x ?



1:

2. Katenary's train bound for the Number Games travels at a constant speed of 100 kilometers per hour. Her teammate takes the next train which leaves the same station an hour later on a parallel track, but travels at 160 kilometers per hour. After how many hours will the faster train catch up with the earlier train? (Give your answer as a reduced fraction.)

2:

3. Three blue birds are guarding the entrance to the arena where the Number Games are to be held. Aside from the number painted on their left wings, they look identical. Katenary knows that each of them is either a LiarJay which only say things that are *false* or a TrueBlue which only makes *true* statements, but she does not know how many there are of each type.
- Bird #1 says "Believe me, little lady. Bird #10 is a LiarJay."
 - Bird #4 says "I'm the TrueBlue, both of the other birds are liars!"
 - Bird #10 says "Don't listen to him, Katenary. Bird #4 is lying to you."

To gain entrance to the arena, Katenary must identify which of them are lying. Put the sum of the numbers of the LiarJays in the box.

3:

4. Four cards numbered 2, 3, 6, and 7 are put into a bag and Katenary randomly selects two of them. She wins extra batteries for her calculator if the two numbers she draws are relatively prime (that is, if they have no common prime factors). What is the probability that she wins? (Give your answer as a fraction in simplified form.)

4:

5. A giant analog clock hangs over the arena. In the center of the clock is a red light which is sometimes on and sometimes off. The contestants have to figure out how often it is on. Katenary's allies realize that the light is on whenever the hour hand is in the bottom half of the clock (between three and nine o'clock). The light is *also* on whenever the minute hand is in the top right quarter of the face (the first fifteen minutes of every hour). The light is off at all other times. During a 3 day period, for what *fraction* of the time will the red light be on? (Give your answer as a simplified fraction.)

5:

6. To finally win The Number Games, Katenary must run up a ramp, stop at just the right point, and raise a flaming torch. Because the curve is (coincidentally) in the shape of a *catenary*, running forward on it a distance of $\sqrt{h^2 + 303h}$ meters takes her up a height of exactly h meters. She has to stop at the highest point where the length she has run on the ramp is twice the height. How high will she be (in meters) at that point?

6:

COLLEGE *of* CHARLESTON

Math Meet February 22, 2014 Timed Sprint

Name (please print): _____

School Name: _____

Grade: _____

The grading for the Timed Sprints is unusual! Your grade will be the number of questions answered correctly, starting with the first question, before you make a mistake. For example, if you only answer questions 1-4 correctly and questions 7-13 correctly, your grade will be a "4" since you did not get question 5 right. You will have a limited amount of time to work on the sprint. Your paper will be collected at the end of this period.

By my signature below I certify that all of the work completed on this sprint is my own.
