Answers
for Grade 9 Group Assignments - Quarter #1

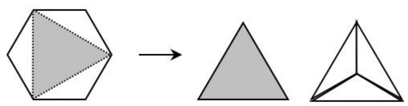
Notes for Parents:

- Answers for group assignment problems that are out of the workbook can be found in the "G9 Workbook Answer Key".
- This answer key doesn't include all answers.

Week 1

2) The donut costs $2.10.

3) **Slicing a Hexagon**



4) Some possible solutions are:

- $(8888-888)\div 8$
- $888+8(8+8)-8-8$
- $888+88+8+8+8$
- $8[8(8+8)-(8+8+8)\div 8]$
- $((88-8)\div 8)^{((8+8+8)\div 8)}$

Week 2

1) Two hourglasses solution: We first need to prepare for the 9-minute interval. To do this, we begin by starting both hourglasses at the same time. Once the 4-minute hourglass runs out, we immediately flip it. Once the 7-minute hourglass runs out, we stop the 4-minute hourglass (which has 1-minute's worth of sand left in it) by putting it on its side. We are now prepared for the 9-minute interval. To begin the 9-minute interval, we restart the 4-minute hourglass, which will finish in one minute. After it finishes, we complete the 9-minute interval by simply running the 4-minute hourglass two more times. (There are other possible solutions, as well.)

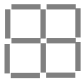
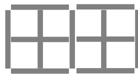
2) There are five teenagers in the group. There are an 18-year-old, a 14-year-old, a 13-year-old, and two 15-year-olds.

3) There are infinitely many starting places for which this is possible – or "infinity times infinity plus one". The North Pole is one such place. There are no other places in the northern hemisphere. However, in the southern hemisphere you could start at a place (very close to the South Pole), such that the second leg of your trip (heading east) exactly circumnavigates a latitude line, which happens to be exactly 1 mile long. In that case, the last leg of your trip (heading north) retraces in reverse the first leg of your trip (heading south). You could have started your journey from any point that is one mile to the north of that latitude line. Furthermore, additional starting places are possible even closer to the South Pole. For example, the one-mile long eastward leg of the trip could have circled twice around a half-mile long latitudinal line. In fact, this would work as long as we choose a length (in miles) for the latitudinal line that is equal to the reciprocal of a whole number (⅓, ¼, 1/5,…). If we choose such a length for a latitudinal line, then we will we go around this latitudinal line (which is really a circle) a number of times in order to complete the one-mile long eastward leg of the trip. Now we see that there are an infinite number of latitude lines to use, and each one has an infinite number of points from which the journey could start. Thus, our answer is: "infinity times infinity, plus one (the North Pole)!"

Week 3

1) There are 13 children in the family (10 girls and 3 boys).

2) Stick Puzzles

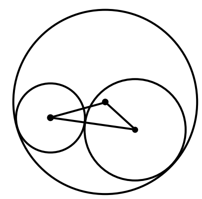
a)  b)  c) 

3) Assume that Bob is a crook. Then his statement would have to be true. But then he wouldn't be lying, so our assumption is wrong; he can't be a crook. Since Bob is a saint, what he says must be true. Therefore, Bill is a crook.

4) Socks in the Dark

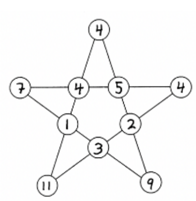
a) You must pull out at least 5 (single) socks.
b) You must pull out at least 7 (single) socks.
c) You must pull out at least 9 (single) socks.

Week 4

1. <u>Three Circles and a Triangle</u>.
   
   Of course, this open-ended problem lends itself to some great explorations. I'm sure that there are some other relationships to be discovered here, but I will focus on this one: the perimeter of the triangle is equal always equal to the diameter of the largest circle. Amazing and somehow quite unexpected! I can think of two very different approaches to prove this. My first approach is algebraic.
   Let the three sides of the triangle (from shortest to longest) be x, y, z, and the three radii (from shortest to longest) be R_1, R_2, R_3. We can then see that:
   $$x = R_3 - R_2 \qquad y = R_3 - R_1 \qquad z = R_2 + R_1$$
   If we now add the three equations together, we get $x + y + z = 2R_3$.
   A second, more visual approach is to break the longest side (at the tangent point of the two smaller circles) into two pieces, which are radii of the circles. Now we simply rotate these two pieces about the centers of their respective circles until they reach the points of tangency of the large circle. Can you see it now? (It may take a minute of concentration.)

2. Dominoes on a chessboard: The squares on a chessboard alternate between black and white. The two squares that were removed were both black. Each domino must cover one white square and one black square. After 30 dominoes have been placed, there must be two white squares left to be covered. Therefore, it is impossible to cover all of the squares with the 31 dominoes.

3) Magic Star



Week 5

- Tuesday's Puzzle: 15 dimes
- Thursday's Puzzle: 100 goldfish need to be removed.

Weeks #6-8. No answers needed for the Group Assignments in these weeks.