Answers
for Grade 7 Group Assignments - Quarter #2

Notes for Parents:

- Answers for group assignment problems that are out of the workbook can be found in the "G7 Workbook Answer Key".
- It is probably best not to give this document to the students, as it might spoil it for them.
- This answer key doesn't include all answers.

Week 9

for Thursday:

Puzzle #1: 8½ and 16

Puzzle #2: Frank weighs 42kg

Week 10

for Tuesday: A Row of Houses:

Facts #1, 2, 6, 10, 15 tell us that the South African lives in the left-most house (house #1), and, most importantly, that his house must be yellow. We now know that the red house must be either house #3 or house #5. If we try assigning house #5 to red, and follow all of the other facts, we end up with a contradiction, so we know that house #3 must be red. From this point onwards there is a fair bit of trial and error. But eventually we get our answer: The South African drinks water, and the Nepali has a zebra.

for Thursday:

1) Tim is 21.

2) The youngest three are girls, and the oldest is a boy. Therefore, the youngest child has two sisters.

3) 62 and 11

Week 11 No answers needed

Week 12

for Thursday:

1) A Handful of Coins: 15 dimes

2) Chessboard Squares:

64 squares are 1 by 1,
49 squares are 2 by 2,
36 squares are 3 by 3,
25 squares are 4 by 4,
16 squares are 5 by 5,
9 squares are 6 by 6,
4 squares are 7 by 7,
1 square is 8 by 8.

Altogether, we get a total of **204 squares**.

Week 13

1) Number Riddle: Mary has $14.50.

2) Three Schools:

One way to do it is to work with ratios. We can quickly see that the ratio of the number of students of Bob's school to Alex's school is 2:1. And, since one-quarter the number of students at Bob's school is equal to one-third the number of students at Chris's school, then that ratio must be 4:3. Therefore, the ratio of the three schools is 4:3:2, which means that Bob's school is $^4/_9$ of the total, Alex's school is $^3/_9$ of the total, and Chris's school is $^2/_9$ of the total. This leads to our desired result that the number of students at the three schools is 236, 177, and 118.

Week 14

1) Two Jugs:

It appears that there are two solutions to each case. You may either pour each time from the large jug into the small one, or each time from the small one into the large one. (See solutions on the next page.) It is interesting to see that if you simply keep pouring from one into the other, all of the numbers will eventually appear. Also, if you switch which jug is pouring into which, the numbers appear in reverse order. Additional solutions may be found that are a mix of these two approaches.

Pouring from the small jug (4l) into the large one (9l) (otherwise known as the hard way to get to 5 liters.)

8 liters : Fill the small jug twice and pour it into the large one. This gives you 8 liters in the large jug.
3 liters : Now refill the small jug and pour it into the large one until it is full (1l will fit). This leaves 3 liters in the small jug.
7 liters : Empty the large jug onto the ground, and then pour the 3 liters from the small jug into the large one. Refill the small jug and pour the small jug into the large jug (adding 4l). You now have 7 liters in the large jug.
2 liters : Now refill the small jug and pour it into the large one until it is full (2l will fit). This leaves 2 liters in the small jug.
6 liters : Empty the large jug onto the ground, and then pour the 2 liters from the small jug into the large one. Refill the small jug and pour the small jug into the large jug (adding 4l). You now have 6 liters in the large jug.
1 liters : Now refill the small jug and pour it into the large one until it is full (3l will fit). This leaves 1 liter in the small jug.
5 liters : Empty the large jug onto the ground, and then pour the 1 liter from the small jug into the large one. Refill the small jug and pour the small jug into the large jug (adding 4l). You now have 5 liters in the large jug.

Pouring from the large jug (9l) into the small one (4l) (otherwise known as the hard way to get to 8 liters).

5 liters : Fill the large jug and pour it into the small jug until it is full. This leaves 5 liters in the large jug.
1 liter : Empty the small jug and pour the large jug into the small jug (subtracting 4l). You now have 1 liter in the large jug.
6 liters : Empty the small jug onto the ground, and then pour the 1 liter from the large jug into the small one. Now refill the large jug and pour it into the small one until it is full (3l will fit). This leaves 6 liters in the large jug.
2 liters : Empty the small jug and pour the large jug into the small jug (subtracting 4l). You now have 2 liters in the large jug.
7 liters : Empty the small jug onto the ground, and then pour the 2 liters from the large jug into the small one. Now refill the large jug and pour it into the small one until it is full (2l will fit). This leaves 7 liters in the large jug.
3 liters : Empty the small jug and pour the large jug into the small jug (subtracting 4l). You now have 3 liters in the large jug.
8 liters : Empty the small jug onto the ground, and then pour the 3 liters from the large jug into the small one. Now refill the large jug and pour it into the small one until it is full (1l will fit). This leaves 8 liters in the large jug.

2) More Pets:

In total, they have 32 pets. One possible way to arrive at the solution is to realize that (because of the second and third sentences) Charlie has 7 more pets than Ben. We also know that Ben and Charlie have 15 pets combined, so we can figure out (with a bit of thinking) that Ben must have 4 pets, and Charlie must have 11 pets. The rest is easy!

3) Concert Tickets: 1600 section B tickets and 2900 section A tickets.

4) The Money Wizard: Peggy started with $5.25.

Week 15

1) The ages are 5, 5, and 8.

2) The numbers are 9, ⅓, ⅔.

Practice Test Answers:

1) a) $B = \frac{4}{3}G$
$G = \frac{3}{4}B$
$4G = 3B$
b) 16

2) B:H = 20:11
H:B = 11:20
B:H = $1.\overline{81}$:1
H:B = 0.55:1

3) a) G:J = 3:7
b) C:B = $0.\overline{83}$:1

4) J:K = 1.6:1

5) B:C = 3:4

6) a) $B = 1.5H$
$H = B \div 1.5$
b) 60 cm

7) 1¼ cups

Week 16

1) The Towers of Hanoi - Part I:

For a stack of 2 disks it takes 3 moves; 3 disks take 7 moves; 4 disks take 15 moves; 5 disks take 31 moves, etc. We can base each answer on the previous answer. For example, with 4 disks, we know that it takes 7 moves to transfer the top three disks to another peg, then one move to move the largest disk to the empty peg, and finally, 7 more moves to get the stack of three disks back on top of the largest disk. Therefore, moving the whole stack of 4 disks takes 7+1+7 = 15 moves. Similarly, moving 5 disks would take 15+1+15 = 31 moves.

Now we can notice that all the number of moves (3, 7, 15, 31, etc.) are one less than a power of two (4, 8, 16, 32, etc.). From this, we can make a formula that calculates the number of moves needed (M) based on the number of disks (D). The formula is**:** $M = 2^D - 1$. Therefore, the number of moves needed to move an entire stack of 64 disks is $2^{64} - 1$. This can be estimated by ignoring the minus 1, and realizing that $2^{64} = 2^4 \cdot 2^{10} \cdot 2^{10} \cdot 2^{10} \cdot 2^{10} \cdot 2^{10}$. And since $2^4 = 16$ and $2^{10} = 1024$ (which is approximately 1000) we can say that $2^{64} \approx$ **16,000,000,000,000,000,000**. This is approximately the total number of moves needed to move the whole stack of 64 disks.

2) The Towers of Hanoi - Part II:

From Part I, we know that the total number of moves is approximately 16,000,000,000,000,000,000. It is also the total number of seconds needed to move the whole stack, given that each move takes one second. So now the question is: *how many years is this*? We first calculate the number of seconds in a year. There are 60 seconds in a minute, 60·60 = 3600 seconds in an hour, 3600·24 = 86400 seconds in day, and, finally, 86400·365 = 31536000 seconds in a year, which we can approximate as 32,000,000. The number of years is therefore 16,000,000,000,000,000,000 ÷ 32,000,000, which, when looked at as a fraction, reduces nicely to 1,000,000,000,000 ÷ 2, which equals 500,000,000,000 years, or half a trillion years. The exact number of years is 584,942,417,335, which shows that our quick estimation is quite accurate.

Do you have a sense of how long a trillion years actually is? Modern science estimates that the universe is approximately 14 billion years old. This would mean that moving the whole stack of 64 disks would take about 35 times longer than the age of the universe. Hard to imagine, indeed!

3) *Factors*

a) Here are some numbers with 10 factors: 48, 567, 162, etc.

b) Here are some numbers with 7 factors: 646, 729, etc.

c) Here are some numbers with 14 factors: 192, 1458, 8192, etc.