

### **Golden Apples**

A prince picked a basketful of golden apples in the enchanted orchard. On his way home, he was stopped by a troll who guarded the orchard. The troll demanded payment of one-half of the apples plus two more. The prince gave him the apples and set off again. A little further on, he was stopped by a second troll guard. This troll demanded payment of one-half of the apples the prince now had plus two more. The prince paid him and set off again. Just before leaving the enchanted orchard, a third troll stopped him and demanded one-half of his remaining apples plus two more. The prince paid him and sadly went home. He had only two golden apples left. How many apples had he picked?

### **Lockers**

There are 20 lockers in the hallway of a school, numbered from 1 to 20. At the beginning of math class they are all closed. A math teacher wants her students to work off some energy before class, so she gives them the following task: the first student in her class had to go open every locker. The second student then goes and closes every second locker. The third student goes to every third locker and closes it if it's open or opens it if it's closed. The fourth student does the same to every fourth locker, the fifth to every fifth locker, and so on, until all 20 students have made their way down the row of lockers. Which lockers will be open at the end of this exercise?

Suppose you repeat this with 200 lockers and 200 students? Which lockers will be open at the end? Why? Which locker(s) will have changed the most?

### **Age**

If my age is divided by 3, the remainder is 2. If my age is divided by 5, the remainder is also 2. If my age is divided by 7, the remainder is 5. How old am I? Is there only one possibility?

### **Geometry**

Describe an algorithm for cutting up a parallelogram into a rectangle – that is, cutting a parallelogram so that the pieces can be reassembled to form a rectangle. What is the algorithm for cutting up a triangle to form a rectangle?

### **Alien Planet**

Grook, a farmer on an alien planet, has two kinds of animals on her farm: beedels and gerkuns. Beedels have 7 legs each and only one head. Gerkuns have 5 legs each, but also only have one head. Grook's laser counting device can only count heads or legs. After letting the beeduls and gerkuns graze in the same field, Grook used her device to find that her herd had 190 legs and 32 heads. How many beedels does Grook have?