

## Solutions.

**Problem 1.** Make the following table:

	Milk	Lemonade	Cola	Water
Cup				
Glass				
Bowl				
Jar				

The cup contains neither milk nor water, so we put "—" in the corresponding boxes of the table.

The vessel with lemonade is standing between the bowl and the vessel with cola, so the bowl doesn't contain lemonade or cola.

It is known, that the jar contains neither lemonade nor water.

Finally, the glass is standing near the jar and the vessel with milk. Therefore, milk is neither in the glass nor in the jar.

Reasoning as above, we obtain the following table

	Milk	Lemonade	Cola	Water
Cup	-			-
Glass	-			
Bowl		-	-	
Jar	-	-		-

Filling in the remaining gaps in the table we get

	Milk	Lemonade	Cola	Water
Cup	-			-
Glass	-			
Bowl	+	-	-	
Jar	-	-	+	-

	Milk	Lemonade	Cola	Water
Cup	-	+	-	-
Glass	-	-	-	+
Bowl	+	-	-	-
Jar	-	-	+	-

Answer: Milk is in the bowl, lemonade is in the cup, cola is in the jar and water is in the glass.

**Problem 2.** Assume the contrary. Then all the women at the stadium support Harlequins and the Wasps supporters are men only. We know that the women spent more money on drinks than the men at the stadium. It means that the Harlequins supporters spent more money on drinks than the Wasps supporters. But it contradicts the formulation of the problem. Therefore, our assumption is incorrect.

**Problem 3.** Denote by  $Ol$ ,  $Z$ ,  $J$  and  $A$  the numbers of points scored by Olivia, Zara, James and Alex respectively. From the formulation of the problem we know that  $A$  is the biggest number,  $J$  is not the smallest, and  $Z$  is not the smallest since  $Z > Ol$ . It means that the only two cases are possible:  $A > Z > J > Ol$  or  $A > J > Z > Ol$ . Then as  $A > Z$  and  $J > Ol$  hold for the both cases, we conclude  $A + J > Z + Ol$ . But it means that the boys outplayed the girls.

Answer: The boys outplayed the girls.

**Problem 4.** The first digit of a "cool" 4-digit number can be 2, 4, 6 or 8 (4 possibilities). On the 2nd, 3rd and 4th positions of "cool" 4-digit number can be 0, 2, 4, 6 or 8 (5 possibilities). Since all the positions don't have effect on each other, the total number of "cool" 4-digit numbers is equal to  $4 \times 5 \times 5 \times 5 = 500$ .

Answer: 500 numbers.

**Problem 5.** It is easy to see that any line passing through the center of the cheese (which is the center of the corresponding circle) divides it into two equal parts. The same holds for the center of the bread, which is the intersection point of the diagonals of the corresponding square. Therefore, the line that goes through the both centres will divide the cheese into two equal parts and the bread into two equal parts simultaneously. If the centres don't coincide, then the solution is unique. If the centre of the bread and the centre of the cheese coincide, then there are infinitely many solutions.

Answer: Yes, you can.

**Problem 6.** Assume the contrary. How many messages can exist in this case? Under our assumption, if A writes on B's timeline, then B can't write on A's timeline. Therefore, the total number of messages which is  $5 \times 10 = 50$  is less or equal to the number of pairs you can make from 10 people. The later is equal to  $\frac{10 \times 9}{2} = 45$ . Thus, we obtain  $50 \leq 45$ , which is a contradiction.