



# Intermediate Math Circles - Ratios

## October 7, 2015 Problem Set

1. The length and width of the Canadian flag are in the ratio  $2 : 1$ . A company buys a flag with area  $10 \text{ m}^2$ . What are the dimensions of the flag?
2. A right triangle with sides in the ratio  $3 : 4 : 5$  has one side of length  $60 \text{ mm}$ . What are the possible lengths of the other sides?
3. Emily's chemistry teacher instructed her class to make a saltwater solution with a  $2 : 3$  ratio of salt to water. Emily misheard her teacher and made a  $100 \text{ mL}$  solution with a  $2 : 3$  ratio of water to salt instead. How much water must she add to have the correct solution?
4. Evan is  $1.8$  metres tall. He walks between two lampposts that are  $5$  metres apart and notices that his shadow from one of the lampposts just touches the base of the other. He also notices that the ratio of his height to the height of the lamppost is  $2$  to  $5$ . How far is he from each lamppost?
5. A wildlife observer captures  $40$  deer from a forest, tags them and lets them go back in the forest. Later, he captures  $60$  deer from the same forest and sees that  $18$  of them are tagged. What is the approximate number of deer living in the forest? We assume that the ratio of tagged deer to untagged deer in the captured group is the same as the ratio in the entire forest.
6. In a room, there are a number of people and a number of dogs. The ratio of heads to legs in the room is  $5 : 13$ . Assuming that there are no amputees present, what is the ratio of humans to dogs in the room?
7. Two schools are getting together for a dance. The first school has a  $3 : 5$  ratio of boys to girls. The second school has a  $4 : 3$  ratio of boys to girls. All of the students attend the dance and during one song each boy is paired up with one girl. What is the ratio of the number of students at the first school to the number of students at the second school?
8. Kaelee wants to make  $75\%$  cocoa chocolate. To do this she mixes together melted  $60\%$  cocoa chocolate and  $85\%$  melted cocoa chocolate. If she uses  $200 \text{ mL}$  of the  $60\%$  cocoa chocolate, how much  $85\%$  chocolate will she need to use?
9. Quick Shipping Co. will only ship boxes that have the sum of their length, width and height at most  $240 \text{ cm}$ . If a box has its length, width and height in the ratio  $3 : 2 : 5$ , and it is small enough to be shipped, what is its maximum possible volume?
10. Kool-Aid is made with flavouring mix, sugar and water. The directions instruct you to mix the flavouring mix, sugar and water in the ratio  $1 : 8 : 32$ . Jackie decides to make Kool-Aid. She adds  $30 \text{ mL}$  of flavouring mix and  $240 \text{ mL}$  of sugar to a  $1000 \text{ mL}$  bottle, then fills the rest with water. She wants to drink some of this extra sugary Kool-Aid, and then re-fill the bottle with water to bring it to the proper ratio. How much will she need to drink?
11. (AMC 12A 2003) Al, Bert and Carl are to divide a pile of Halloween candy in the ratio  $3 : 2 : 1$  because they placed first, second and third, respectively, in a draw at their school. Due to some confusion, they come at different times to claim their prize, and each assumes he is the first person to arrive. If each takes what he believes to be the correct share of candy, what fraction of the candy goes unclaimed?