Brush Up on Proportions

I think the dye ratio was slightly off.

Don't be silly. Dogs can't talk.

Hairdresser Josie Nevarez needs scissors, combs, ratios, and proportions!

Cosmetology isn't the study of outer space! It's another word for the work that hairdressers, nail technicians, and other beauty professionals do—and it's a field in which art and math meet.

Josie Nevarez, who works for Trio Salon in Chicago, Illinois, told *MATH* that when she colors hair, she regularly uses *ratios*. What would happen if Josie put too much bleach in a mix? Or too much peroxide in the hair dye? Uh-oh! Light-brown hair could turn platinum blond or dark brown hair might become a shade of orange! Ratios help avoid these hairy situations.

"The reason we use ratios, such as 2 parts *developer* (peroxide, a chemical) to 1 part dye, is so we get the color result we are looking for," Josie told *MATH*. "And we don't want to damage the hair. That's why it is important to use proper ratios."

GOING PRO

Josie Nevarez

THE JOB: Cosmetologist

THE MONEY: Depending on your specialty, experience, location, and other factors, pay can range anywhere from minimum wage to $100,000 a year or more.

NECESSARY SKILLS: Geometry, measurement, and money math; strong people skills; great sense of color; steady hands!

HOW TO GET STARTED: Join a cosmetology club at school (some high schools offer classes). Then, enroll in cosmetology school and take apprentice jobs at salons.

JOSIE'S ADVICE: "A good education is key because you can go anywhere you want with it."

Say Josie is using the ratio she mentioned, and has 30 milliliters (ml) of developer. She can solve a *proportion* to find out how much dye she needs:

$$\frac{\text{2 parts developer}}{\text{1 part dye}} = \frac{\text{30 ml developer}}{x \text{ ml dye}}$$

By cross-multiplying and solving for *x*, Josie knows she needs 15 ml of dye.

We bet you're *dye*-ing to solve some proportion problems. Hairy up!

—by Jessica Perlman

WHAT TO DO

Use the information in the story to answer the questions.

1 Josie wants to make some blond dye using natural products. She ends up using 12 cups of chamomile tea and 4 cups of lemon juice. What is the ratio of tea to lemon juice?

2 Josie wants to make a hot oil treatment to moisturize hair. One recipe recommends that she use an oil-to-honey ratio of 3:2. Josie's treatment has 9 ounces of oil.

a. What proportion would she write to find the amount of honey she needs?

b. How many ounces of honey does she need?

3 A salon customer wants to have her hair dyed. Josie needs to use an isopropyl alcohol-to-ammonia ratio of 8:1 to make the dye. She is using 20 ounces of ammonia. How many ounces of isopropyl alcohol does she need?

4 That isopropyl alcohol comes in handy at the salon! Josie needs to clean her combs and scissors with a mix of isopropyl alcohol and water. The directions say that she must add 5 parts alcohol for every 2 parts of water.

Josie has 17 ounces of water. How many ounces of isopropyl alcohol should she use?

5 Oh no! A new client just arrived with orange hair! Josie has to fix another salon's coloring mistake with a special dark brown dye. First, Josie will use a solution to strip the color from the hair strands, with a ratio of 2 parts ammonia to 3 parts isopropyl alcohol. Then, for the dye, she will use a ratio of 5 parts color to 3 parts developer.

a. Josie uses 9.5 ounces of ammonia. How many ounces of isopropyl alcohol does she use?

b. Josie has 11.4 ounces of developer. How many ounces of color will she use?