

## CHAPTER 6. RATIOS AND PERCENTS

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**Problem 6.2:** Nine out of every eleven dentists in my city say you shouldn't eat candy and the rest say it's OK to eat candy. Eighteen dentists in my city say that it's OK to eat candy. How many dentists are in my city?

6.1.3 Washington, D.C., has a land area of 68 square miles and a population of 570,000 people. What is the number of people per square mile in Washington, D.C., rounded to the nearest hundred? (Source: *MATHCOUNTS*)

**Problem 6.4:** Vlatko has a bag that holds only green marbles and red marbles. The ratio of green marbles to the total number of marbles in the bag is  $\frac{2}{5}$ . If Vlatko adds 4 green marbles and takes out 10 red marbles, there will be twice as many green marbles in the bag as red marbles. How many marbles were in the original bag?

6.2.2 My piggy bank has only pennies and nickels in it, and  $\frac{2}{7}$  of the coins are nickels. If I remove all the pennies, then  $\frac{1}{3}$  of the remaining coins are pennies.

(c) How many nickels are in the piggy bank?

6.2.4 If  $a/b = 3/4$  and  $a/c = 5$ , what is  $b/c$ ?

6.2.5 Joe and JoAnn each bought 12 ounces of coffee in a 16-ounce cup. Joe drank 2 ounces of his coffee and then added 2 ounces of cream. JoAnn added 2 ounces of cream, stirred the coffee well, and then drank 2 ounces. What is the resulting ratio of the amount of cream in Joe's coffee to that in JoAnn's coffee? (Source: AMC 12)

6.2.6★ What is the first time after 1 PM at which the minute hand and hour hand of a clock point in exactly opposite directions? F

6.3.1 There are approximately 0.4536 kilograms in a pound. To the nearest whole pound, how many pounds does a steer that weighs 200 kg weigh?

6.3.4 I'm visiting Germany, but forgot to exchange dollars for euros. My meal costs 17 euros. I give the cashier 40 dollars. If 1 euro is worth \$1.32, then how much change in euros should I receive?

6.3.5 In a far-off land three fish can be traded for two loaves of bread, and a loaf of bread can be traded for four bags of rice. How many bags of rice is one fish worth? (Source: AMC 8)

6.3.6 Clint's Cowboy Shop buys horse feed for \$10 per cubic meter ( $\text{m}^3$ ). Clint's customers don't like the metric system, so they'll only buy horse feed by the cubic foot. How much should Clint charge for a cubic foot ( $\text{ft}^3$ ) in order to double his money? (Assume 1 meter equals 3.28 feet.)

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**Problem 6.19:** Suppose that 6% of the eighth graders and 3% of the seventh graders at Washington Junior High participate in MATHCOUNTS. There are 1.5 times as many 8th graders as 7th graders at the school. What percentage of the 7th and 8th graders, taken together, participate in MATHCOUNTS?

6.5.2 Every day, 20% of the fish in a fish store are sold. There are 2000 fish left in the store at the end of the day on Tuesday. How many were there when the store opened on Monday?

6.5.5 Twenty percent of Poe M.S. students walk to school. If the number of “walkers” doubles, and there is no change in the number of non-walkers, what fraction of the students are now walkers? (Source: *MATHCOUNTS*)

6.5.6 Heavy cream is 36% butterfat, while whole milk contains only 4% butterfat. In order to make a delicious pint of ice cream, a recipe calls for 2 cups of a mixture that is 24% butterfat. How many cups of heavy cream should be used to produce the correct butterfat percentage? (Source: *Mandelbrot*)

6.5.7 The state income tax where Kristin lives is charged at the rate of  $p\%$  of the first \$28000 of annual income plus  $(p + 2)\%$  of any amount above \$28000. Kristin noticed that the state income tax she paid amounted to  $(p + 0.25)\%$  of her annual income. What was her annual income? (Source: *AMC 12*)

**6.30** If 1 ounce is equivalent to approximately 28.35 grams, how many ounces are in 541 grams? (Answer to the nearest tenth of an ounce.)

**6.32** I have 2 cartons of eggs. 20% of the eggs in the first carton are red, while 25% of the eggs in the second carton are red. If the second carton has 3 times as many eggs as the first, what percentage of my eggs are red?

6.34 On Tuesday, a radio store reduces all its Monday prices by 20%. On Wednesday, by what percent must the store reduce the Tuesday prices such that each radio costs half its Monday price?

6.37 If  $p$  is 50% of  $q$  and  $r$  is 40% of  $q$ , then what percent of  $r$  is  $p$ ? (Source: Mandelbrot)

6.39 The Red Lamp Brigade patrols the 3600 sectors of the galaxy along with their better known counterparts, the Green Lantern Corps. Each sector has either one Corps member or one Brigadier. In the first 2400 sectors, the ratio of Corps members to Brigadiers is 3 : 1. If there are an equal number of Brigadiers and Corps members in the galaxy, what is the ratio of Corps members to Brigadiers in the other sectors?

6.41 Some marbles in a bag are red and the rest are blue. If one red marble is removed, then one-seventh of the remaining marbles are red. If two blue marbles are removed instead of one red, then one-fifth of the remaining marbles are red. How many marbles were in the bag originally? (Source: AHSME)

6.43 Calvin and Susie are running for class president. Of the first 80% of the ballots that are counted, Susie receives 53% of the votes and Calvin receives 47%. At least what percentage of the remaining votes must Calvin receive to catch up to Susie in the election?



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**6.45** 40% of one spig is a spoog. 25% of a speeg is a spoog. 70% of a speeg is a spug. What percent of 1 spig is 5 spugs? **Hints:** 114

**6.47** Each 25 square inch thermal tile on the space shuttle costs \$130. How much does it cost to cover the entire 2000 square foot bottom surface of the shuttle? (There are 12 inches in a foot.)

**6.48** Given that  $yz : zx : xy = 1 : 2 : 3$  and  $\frac{x}{yz} : \frac{y}{zx} = 1 : k$ , find  $k$ . (Source: AHSME) **Hints:** 40

**6.49** 99% of the trees in our neighborhood are eucalyptus trees. The town planning commission wants to get rid of some of these trees because they spread too quickly. However, the people in my neighborhood like the trees. The commission argues that their new eucalyptus tree removal plan will cut down so few eucalyptus trees that 98% of the trees in our neighborhood will be eucalyptus trees. If the plan only involves removing eucalyptus trees, what percent of the existing trees in my neighborhood would the plan remove? **Hints:** 56

**6.51** The acceleration caused by gravity is about  $32.2 \text{ ft/s}^2$ . There are approximately 3.28 feet in a meter, and there are 60 seconds in a minute. Determine the acceleration caused by gravity in meters per minute squared ( $\text{m/min}^2$ ). Answer to the nearest 100  $\text{m/min}^2$ .

**6.52★** Cassandra sets her watch to the correct time at noon. At the actual time of 1:00 PM, she notices that her watch reads 12:57 and 36 seconds. Assuming that her watch loses time at a constant rate, what will be the actual time when her watch first reads 10:00 PM? (Source: AMC 12) **Hints:** 61

**6.53★** Al, Bert, and Carl are the winners of a school drawing for a pile of Halloween candy, which they are to divide in a ratio of  $3 : 2 : 1$ , respectively. Due to some confusion they come at different times to claim their prizes, and each assumes he is the first to arrive. If each takes what he believes to be his correct share of candy, what fraction of the candy goes unclaimed? (Source: AMC 12) **Hints:** 22

**6.55★** It is now between 10:00 and 11:00 o'clock, and six minutes from now, the minute hand of a watch will be exactly opposite the place where the hour hand was three minutes ago. What is the exact time now? (Source: AHSME) **Hints:** 102