**Percent Problems**

***Interpret each of the following statements.***

*A mortgage interest rate is 6.3%.*

*A CD earns 2.85%.*

*Many people tip 15%.*

Each of the problems involves percentages, which are a very common method for stating ratios involving monetary values. The mortgage interest rate means that a person must pay $6.30 for every $100 borrowed, which is a ratio of 6.3 to 100. The CD earns $2.85 for every $100 put into the CD, which is a ratio of 2.85 to 100. A tip of 15% means that the people tip $15 for every $100 paid for a meal, which is a ratio of 15 to 100 or 3 to 20.

Remember, in our last lesson, we stated that a *ratio* is a comparison of the relative size of two numerical quantities. A percent is a special type of ratio where the second value is always 100.

***Definition:*** A *percent* is ratio where *n* percent, denoted as *n*%, is the ratio *n* : 100. That is, a ratio compares numerical quantities in terms of the number of parts out of 100.

Examples: Rewrite  and  as common fractions.

Again we use the definition of percent and write the ratio in fraction form, but note that the numerator contains common fractions or mixed numbers. We use an appropriate multiplier and then simplify.





***Note.*** Here are some basic percent-fraction equivalences that should be memorized for use with mental estimation.

     

     

   

  100% = 1  Especially .

1. Write the percentage represented by each or the following diagrams:

(a) (b) (c)

percent5 percent6 percent7

(d) (e) (f)

percent2 percent3 percent4

2. Solve each percent problem

(a) What is 10% of 250? (b) 15 is what percent of 90?

(c) 18% of what is 900? (d) How much is 25% of 120?

(e) 86% of what is 215? (e) What percent of 70 is 5?

(g) 8% of 30 is how much? (h) 54 is 90% of what?

(i) What is 110% of 50? (j) 10 is 10% of what?

(k) 30% of 93 is how much? (l) 85% of what is 340?

(m) 30 out of 40 is what percent? (n) What percent of 50 is 23?

(o) How much is 28% of 50? (p) 25 is what percent of 80?

3. Forty percent of all television programs include scenes of excessive violence in at least one episode per season. If 500 television shows were examined in researching this statistic, how many of them were found to have at least one episode of excessive violence in the season?

4. Of the 500 people on the cruise 429 said that if they were to book another cruise, they would book with the same cruise company. What percent is this?

5. For a child, the proper dosage of a medicine is 25% of the adult-strength dosage. This means that a child gets 5 mg of the active ingredient. How many mg of the active ingredient are in an adult-strength dosage?

6. A quality control study found that 0.05% of the gizmos being manufactured were defective. That means that out of 10,000 gizmos, how many are expected to be defective?

7. Forty-five of the cats in the animal shelter this week were adopted. This represented 75% of all the cats in the shelter. How many cats were in the shelter this week?

8. Crystal missed 12 out of 88 problems on her final exam. What was her percent score?

9. An orthopedic surgeon estimates that 70% of all of the patients referred to her actually need back surgery. If she saw 300 cases this month, how many would she expect to actually need surgery?

10. A charitable organization spent $2940 on administrative expenses last year. This amount is 12% of the total funds it collected. Find the total amount of money the organization collected last year.

11. Suppose that you used to make $8 an hour at your part time job. Find your new hourly wage after getting a 7% pay raise.

12. Twelve marbles are placed in a paper bag: 4 are red, 6 are blue, and 2 are yellow. One marble is drawn from the bag at random. What is the probability that the marble is yellow? Give your final answer as a percent.

13. Mary went panning for gold during a visit to Colorado last summer. It is estimated that about 0.5% of all the silt in the stream she panned in is gold. How many grams of silt would she need to pan in order to obtain one gram of gold?

14 . In the 2009 U.S. Senate, there were 58 Democrats, 40 Republican, and 2 independent senators. Consider the 2 independent senators as Democrats for this problem, since they caucus and usually vote with the Democrats. Suppose that a bill needs a simple majority (51 votes) to pass. Thirty percent of all Democrat senators and 85% of all Republican senators vote for the bill. (a) How many voted for the bill? (b) Did the bill pass?

15. In a time management project, Hector discovers that he spends 9 hours each day playing computer games. What percent of each day is spent playing computer games?

16. After a severe car wreck, the disability insurance company concludes that Avery is 30% disabled and will pay 30% of his regular monthly salary to him as his monthly benefit. The company pays him $450 each month as his disability benefit. What was his monthly income before the accident?

17. (a) Suppose you and four of your friends decide to split an extra large pizza. What percentage of the pizza do you each get if you divide it evenly?

(b) You discover a pizza parlor that has a manager’s special that gives a free order of breadsticks with the purchase of an extra large pizza. One order consists of twelve breadsticks. If one of your friends only wants two breadsticks and the rest are divided evenly, what percentage of the breadsticks do you get?

18. Last week, 137 people took their driver’s test for the first time. Of these, 110 passed the test and received their license. What percentage of the people who took the test received their license? What percentage did not receive their license?

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| --- | --- | --- | --- | --- | --- | --- |
| **Monthly Budgeted Expenses** | | | | | | |
| *Housing* | *Food* | *Transportation* | *Utilities* | *Taxes* | *Entertainment* | *Total* |
| $500 | $300 | $600 | $150 | $200 | $250 | $2000 |

19. Use the table above to find the following percentages:

(a) The percentage of your monthly budget that is spent on housing.

(b) The percentage of your monthly budget that is spent on Entertainment.

(c) The percentage of your monthly budget that is spent on taxes and utilities.

20. Use the “percent of” short cut to find the following.

(a) 10% of 250 (b) 20% of 470 (c) 15% of 80

(d) 18% of 60 (e) 28% of 50 (f) 16% of 25

(g) 67% of 200 (h) 6% of 50 (j) 59% of 100

(k) 16% of 25 (l) 67% of 200 (m) 6% of 50

21. Solve each problem.

(a) 12% of 50 (b) 20 is what percent of 400?

(c) 18% of what is 900? (d) What percent of 400 is 12?

(e) 15% of 80 is how much? (f) 400 is 25% of how much?

22. A recent survey found that 44 million people in the U.S. do not have health insurance. Of those, 30% are between the ages of 18 and 24. Find the number of people in the U.S. between 18 and 24 who do not have health insurance.

23. Recently SCE laid off 11% of its workers. What percent of the workers were not laid off?

24. Raina received a 7% raise. Her new salary is what percent of her previous salary?

25. Fergie discovers that she is spending a total of $760 per month on room and board, and this is 95% of her monthly income.

(a) What is her monthly income?

(b) How much does she have left to spend on other things each month?

26. The month of June has 30 days. It rained 40% of the days in the month of June. It rained 12 days in June.

27. Mountain Gorillas in Africa are an endangered species. According to the Census Report published by the Bwindi Impenetrable National Park in Uganda (one of only two places mountain gorillas are still found living in the wild), the population of mountain gorillas in the park at the 2002 census was 320. In the 2006 census the population was 380. By what percent has the population increased between 2002 and 2006?

28. The price on a brand new GoldWing Motorcycle is reduced 18% because it is a 2008 model and still has not sold. What percent of the original price will Peter pay if he buys this motorcycle on sale?

29. PeeWee is earning $5.60 per hour stocking shelves at his father’s store. He has done such a good job that his father gives him a 5% raise. Now how much is PeeWee earning per hour?

30. Research shows that a certain migraine medicine has a rare but serious (often fatal) side effect in 0.0035% of those who take the medication. If 200,000 people are currently taking this medicine, how many would we expect to suffer from this complication?

31. I have a coupon for one “Magnificent Seven” breakfast at Perkins. With the coupon the breakfast costs $2.00 less than the regular price of the breakfast, which is $4.99. I also have a 20% off entire purchase coupon.

(a) If I am only purchasing one “Magnificent Seven” breakfast, which coupon should I use to get the better price? (Only one coupon can be used per visit). Show any computation and explain your reasoning.

(b) If I am having breakfast with my sister and we each have a “Magnificient Seven” breakfast and we each also have coffee ($1.89 each). How much will I save by using the 20% off coupon instead of the $2.00 off coupon in this situation?

32. Ehu buys a scooter that normally costs $5,600. He only pays $5,040 for the scooter.  
(a) How much, in dollars, did he save?

(b) What percent off the normal price does this represent?

33. Anya purchased a new sofa for 22% off the original price. What percent of the original price did she pay?

34. Marian bought a blender on sale for 10% off. The original price of the blender was $31.20. The sales tax on the purchase is 6%.

(a) How much did the 10% off save her on the blender (before tax)?

(b) How much did the blender cost her, before tax ?

(c) She also bought a bedspread for $50 (not on sale). If she only bought these two items, what is the subtotal of her purchase?

(d) How much did her purchase cost, with tax?

35. Approximately one person out of 3000 will be struck by lightning sometime during their lifetime. What percent of people are struck by lightning sometime during their lifetime?

36. About 10% of all people who are struck by lightning die due to the experience. Another 70% suffer serious, permanent injury. What percent of the people who are hit by lightning live with no serious, permanent injury after being hit by lightning?

37. Marla budgets 20% of her monthly net income for groceries and household items. Her net income for the month is $3000 and she spends $750 on groceries and household items.

(a) How much had Marla budgeted to spend on groceries and household items?

(b) By how much, in dollars, did she exceed her budget?

(c) By what percent did she exceed her budgeted amount for groceries and household items?

38. Harry’s new job pays 140% of what his previous job’s paid. He is now making $72,280. What was his previous salary?

39. A 37 gram granola bar contains 130 calories. The bar contains 30 calories from fat and 3 grams of fat.

(a) Approximately what percent of the calories in the bar are from fat?

(b) Approximately what percent fat content is the bar by weight?