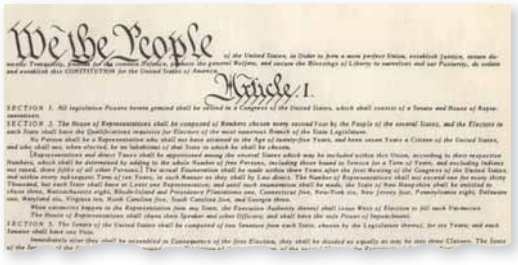
English Spanish

4.5 Percents and Estimation

Essential Question How can you use mental math and estimation to help solve real-life problems?

1 ACTIVITY: Estimating a Percent

Work with a partner. In the U.S. Constitution, the nation's capitol, Washington, D.C., was not allowed to exceed 10 miles square. After the capitol was built, it ended up having less than the maximum allowed area.


We the People
Article I.

a. What was the maximum area allowed by the Constitution?

b. Use the grid to estimate the area of Washington, D.C. Explain your reasoning.

c. What percent of the maximum allowed area did the capitol use?

$$\frac{\text{Actual Area}}{\text{Maximum Area Allowed}}$$

English Spanish

2 EXAMPLE: Using Mental Math

Use mental math to estimate each percent of a number.

a. 10% of $38.57

Round $38.57 to $40.

10% of $40 is $4.

∴ So, 10% of $38.57 is about $4.

b. 19% of $71.33

Round 19% up to 20%.

Round $71.33 down to $70.

20% of $70 is $14.

∴ So, 19% of $71.33 is about $14.

3 ACTIVITY: Using Mental Math

Work with a partner. Use mental math to estimate each percent of a number. Use a calculator to check your estimate.

a. 20% tip for a $29.45 meal

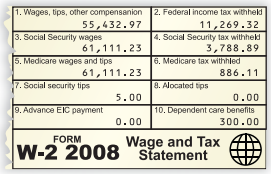
b. 18% tip for a $29.45 meal

c. 6% sales tax on a $21.89 shirt

d. 9% sales tax on a $21.89 shirt

e. 6% commission on selling a $195,000 house

f. 2% property tax on a $208,900 house



1. Wages, tips, other compensation	2. Federal income tax withheld
55,432.97	11,269.32
3. Social Security wages	4. Social Security tax withheld
61,111.23	3,788.89
5. Medicare wages and tips	6. Medicare tax withheld
61,111.23	886.11
7. Social security tips	8. Allocated tips
5.00	0.00
9. Advance EIC payment	10. Dependent care benefits
0.00	300.00

FORM W-2 2008 Wage and Tax Statement

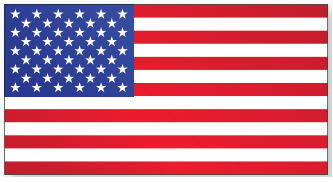
g. 21% income tax on an income of $41,893.56

h. 38% income tax on an income of $78,894.24

What Is Your Answer?

4. IN YOUR OWN WORDS How can you use mental math and estimation to help solve real-life problems? Give two examples with your answer.

5. Estimate the percent of the U.S. flag that is (a) red, (b) white, and (c) blue. Explain your reasoning and include a diagram.



Practice Use what you learned about percents and estimation to complete Exercises 7–12 on page 178.

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4.5 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

In many real-life problems, you do not need an exact answer. To estimate a percent of a number, use common percents that are easy to work with.

Common Percent-to-Fraction Conversions

$10\% = \frac{1}{10}$	$20\% = \frac{1}{5}$	$30\% = \frac{3}{10}$	$40\% = \frac{2}{5}$	$50\% = \frac{1}{2}$	$60\% = \frac{3}{5}$
$70\% = \frac{7}{10}$	$80\% = \frac{4}{5}$	$90\% = \frac{9}{10}$	$100\% = 1$	$25\% = \frac{1}{4}$	$75\% = \frac{3}{4}$

EXAMPLE 1 Estimating the Percent of a Number

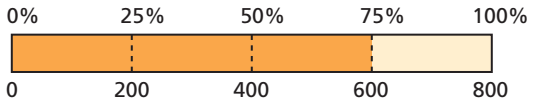
An inflatable pool contains 800 gallons of water. The pool loses 74% of its water through a leak. Estimate the amount of water lost.

74% is close to 75%, or $\frac{3}{4}$. So, find 75% of 800.

$$75\% \text{ of } 800 = \frac{3}{4} \times 800$$

$$= \frac{3 \times \overset{200}{\cancel{800}}}{\underset{1}{\cancel{4}}}$$

$$= 600$$



∴ So, about 600 gallons of water are lost.

On Your Own

Now You're Ready
Exercises 7–18

Estimate the percent of the number.

1. 27% of 40
2. 8% of 50
3. 61% of 125
4. 99% of 230

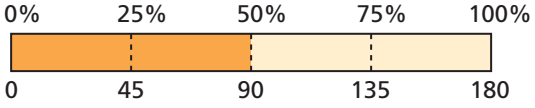
EXAMPLE 2 Using Compatible Numbers

a. Estimate 46% of 177.

46% is close to 50%, or $\frac{1}{2}$. For 177, use the compatible number 180.

$$46\% \text{ of } 177$$
$$\downarrow \quad \downarrow$$
$$50\% \text{ of } 180 = \frac{1}{2} \times 180$$

$$= 90$$



∴ So, 46% of 177 is about 90.

Remember

Compatible numbers are numbers that are easy to compute mentally.

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b. Estimate 81% of 36.

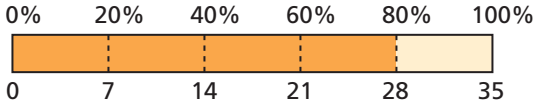
81% is close to 80%, or $\frac{4}{5}$. For 36, use the compatible number 35.

81% of 36

↓ ↓

$80\% \text{ of } 35 = \frac{4}{5} \times 35$

$= 28$



∴ So, 81% of 36 is about 28.

On Your Own

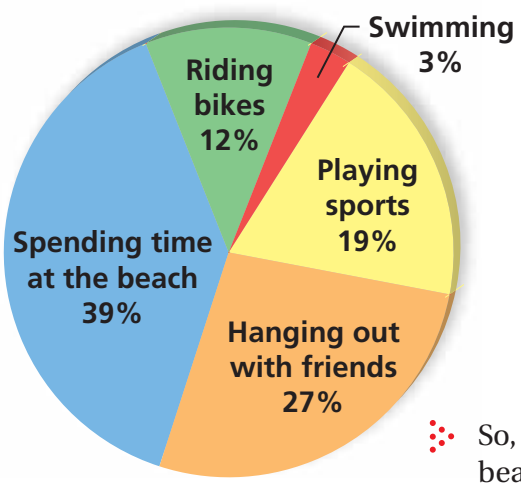
Now You're Ready
Exercises 22–25

Use compatible numbers to estimate the percent of the number.

5. 24% of 63 **6.** 17% of 49 **7.** 76% of 297 **8.** 52% of 91

EXAMPLE 3 Real-Life Application

The circle graph shows the results of a survey of several students at a school. The school has 913 students. How many of them are likely to say spending time at the beach is their favorite summer activity?



From the circle graph, 39% chose spending time at the beach. Use this percent to estimate the number from the school.

39% is close to 40%, or $\frac{2}{5}$. For 913, use the compatible number 900.

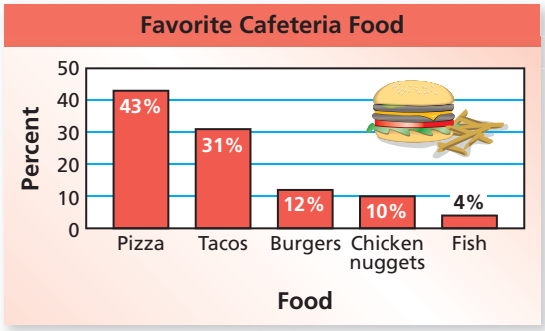
$40\% \text{ of } 900 = \frac{2}{5} \times 900$ Write 40% as a fraction.

$= 360$ Multiply.

∴ So, about 360 students would say spending time at the beach is their favorite summer activity.

On Your Own

9. The bar graph shows the results of a survey of several students at a school. The school has 1038 students. How many of them are likely to say pizza is their favorite cafeteria food?



English Spanish

4.5 Exercises

Check It Out
Help with Homework
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Vocabulary and Concept Check

Round to a common percent.

1. 27% **2.** 63% **3.** 38% **4.** 93%

5. WHICH ONE DOESN'T BELONG? Which one does *not* belong with the other three? Explain your reasoning.

48% of 16	64% of 37	22% of 39	9% of 83

6. OPEN-ENDED Write a real-world problem that can be solved by estimating 22% of 60.

Practice and Problem Solving

Estimate the percent of the number.

1

7. 28% of 52 **8.** 71% of 126 **9.** 17% of 23

10. 12% of 47 **11.** 87% of 233 **12.** 74% of 31

13. 22% of 60 **14.** 33% of 200 **15.** 24% of 180

16. 96% of 66 **17.** 4% of 20 **18.** 6% of 120

19. RESTAURANT The daily special at a restaurant costs $10. About how much more does the daily special cost when the restaurant increases its prices 17%?

20. GOLF About 6% of the golf courses in the United States are in Florida. In 2008, there were 17,151 golf courses in the United States. About how many of them were in Florida?

21. SCHOOL CLUBS A middle school has 722 students.

a. About how many students are not members of a club?

b. About how many students are members of at least two clubs?

Number of Clubs	Percent
0	22
1	42
2	29
3	7

Use compatible numbers to estimate the percent of the number.

22. 70% of 38 **23.** 43% of 202 **24.** 13% of 80 **25.** 24% of 120

2 **Estimate the percent of the number.**

26. 142% of 50 **27.** 223% of 80 **28.** 296% of 33 **29.** 114% of 67

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Determine whether the statement is *sometimes*, *always*, or *never* true. Explain your reasoning.

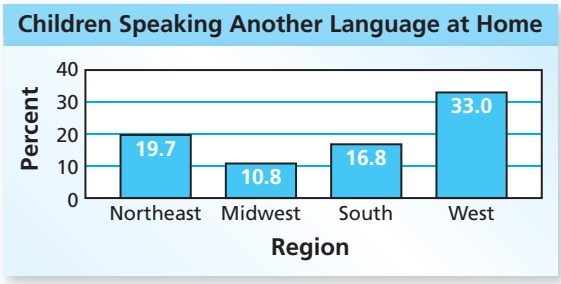
30. If both the percent and the number are rounded down, then the estimate will be less than the actual answer.

31. If the percent is rounded down and the number is rounded up, then the estimate will be less than the actual answer.

32. TRAIL MIX A company increases the size of a bag of trail mix.

a. About how many ounces are in the new bag?

b. The new bag costs $1.80 more. Did the cost increase by the same percent as the size? Does the new cost seem *fair*? Explain.



33. LANGUAGE The bar graph gives information about different regions of the United States. Out of 500 children from each region, estimate the number of children that speak another language at home.

34. SPORTS The circle graph shows the results of a survey of 388 students.

a. Estimate how many more students preferred soccer than baseball and tennis combined.

b. Estimate how many students chose *other*. Explain how you found your answer.

35. Reasoning A pair of shoes that costs $90 is discounted by 33%. To estimate the amount of the discount, you multiply the price by 0.3. Your friend multiplies by $\frac{1}{3}$. Which estimate is closer to the actual amount of the discount? Explain.

Fair Game Review What you learned in previous grades & lessons

Write the fraction in simplest form. SKILLS REVIEW HANDBOOK

36. $\frac{20}{25}$ **37.** $\frac{15}{18}$ **38.** $\frac{42}{48}$ **39.** $\frac{8}{28}$

40. MULTIPLE CHOICE Which number is not equal to $\frac{36}{100}$? SECTION 4.1 SECTION 4.2

(A) $\frac{18}{50}$ (B) 0.36% (C) $\frac{9}{25}$ (D) 0.36