LESSON

16 Rounding Whole Numbers • Estimating

WARM-UP

Facts Practice: 64 Multiplication Facts (Test D)

Mental Math: Count by 3's from 3 to 60.

a. 3 × 30 plus 3 × 2

b. 4 × 20 plus 4 × 3

c. 150 + 20

d. 75 + 9

e. 800 − 50

f. 8000 − 500

g. Start with 1. Add 2; multiply by 3; subtract 4; then divide by 5. What is the answer?

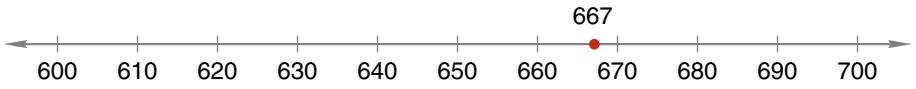
Problem Solving:

Fran has 8 coins that total exactly $1.00. If at least one of the coins is a dime, what are Fran's 8 coins?

NEW CONCEPTS

Rounding whole numbers

When we **round** a whole number, we are finding another whole number, usually ending in zero, that is close to the number we are rounding. The number line can help us visualize rounding.



In order to round 667 to the nearest ten, we recognize that 667 is closer to 670 than it is to 660. In order to round 667 to the nearest hundred, we recognize that 667 is closer to 700 than to 600.

Example 1 Round 6789 to the nearest thousand.

Solution The number we are rounding is between 6000 and 7000. It is closer to **7000.**

Example 2 Round 550 to the nearest hundred.

Solution The number we are to round is halfway between 500 and 600. When the number we are rounding is halfway between two round numbers, we round **up.** So 550 rounds to **600.**

Estimating

Rounding can help us **estimate** the answer to a problem. Estimating is a quick way to "get close" to the answer. It can also help us decide whether an answer is reasonable. To estimate, we round the numbers before we add, subtract, multiply, or divide.

Example 3 Estimate the sum of 467 and 312.

Solution Estimating is a skill we can learn to do "in our head." First we round each number. Since both numbers are in the hundreds, we will round each number to the nearest hundred.

467 rounds to 500

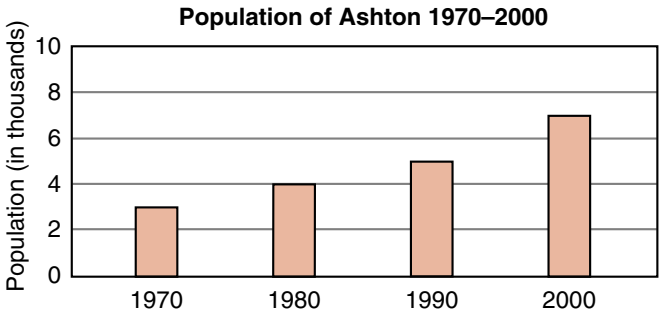
312 rounds to 300

To estimate the sum, we add the rounded numbers.

$$\begin{array}{r} 500 \\ +\ 300 \\ \hline 800 \end{array}$$

We estimate the sum of 467 and 312 to be **800.**

Example 4 According to this graph, about how many more people lived in Ashton in 2000 than in 1980?



Solution We often need to use estimation skills when reading graphs. The numbers along the left side of the graph (the vertical axis) indicate the population in thousands. The bar for the year 2000 is about halfway between the 6000 and 8000 levels, so the population was about 7000. In 1980 the population was about 4000. This problem has a subtraction pattern. We subtract and find that about **3000 more people** lived in Ashton in 2000 than in 1980.

LESSON PRACTICE

Practice set* Round each of these numbers to the nearest ten:

a. 57 **b.** 63 **c.** 45

Round each of these numbers to the nearest hundred:

d. 282 **e.** 350 **f.** 426

Round each of these numbers to the nearest thousand:

g. 4387 **h.** 7500 **i.** 6750

Use rounded numbers to estimate each answer.

j. 397 + 206 **k.** 703 − 598

l. 29 × 31 **m.** $29\overline{)591}$

Use the graph in example 4 to answer problems **n** and **o.**

n. About how many fewer people lived in Ashton in 1980 than in 1990?

o. The graph shows an upward trend in the population of Ashton. If the population grows the same amount from 2000 to 2010 as it did from 1990 to 2000, what would be a reasonable projection for the population in 2010?

MIXED PRACTICE

Problem set

1. *(12)* What is the difference between the product of 20 and 5 and the sum of 20 and 5?

2. *(13)* Columbus landed in the Americas in 1492. The Pilgrims landed in 1620. How many years after Columbus did the Pilgrims land in America? (Write an equation and solve the problem.)

3. *(15)* Robin Hood separated his 140 merry men into 5 equal groups. He sent one group north, one south, one east, and one west. The remaining group stayed in camp. How many merry men stayed in camp? (Write an equation and solve the problem.)

4. *(12)* Which digit in 159,342,876 is in the hundred-thousands place?

5. *(12)* In the 2000 U.S. presidental election, 105,396,641 votes were tallied for president. Use words to write that number of votes.

6. *(9)* What number is halfway between 5 and 11 on the number line?

7. *(16)* Round 56,789 to the nearest thousand.

8. *(16)* Round 550 to the nearest hundred.

9. *(16)* Estimate the product of 295 and 406 by rounding each number to the nearest hundred before multiplying.

10. *(1)* $45 + 5643 + 287$

11. *(1)* $40{,}312 - 14{,}908$

12. *(2)* $\frac{7308}{12}$

13. *(2)* $100\overline{)5367}$

14. *(5)* $(5 + 11) \div 2$

15. *(6)* How much money is $\frac{1}{2}$ of \$5?

16. *(6)* How much money is $\frac{1}{4}$ of \$5?

17. *(2)* $\$0.25 \times 10$

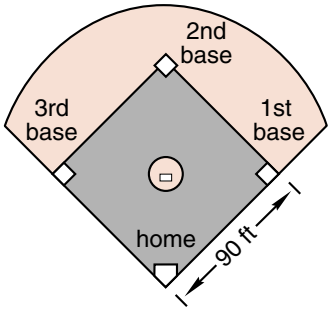
18. *(5)* $325(324 - 323)$

19. *(9)* Compare: $1 + (2 + 3) \bigcirc (1 + 2) + 3$

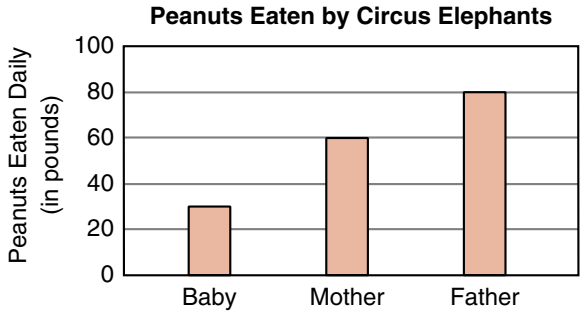
20. *(14)* *Wind chill* describes the effect of temperature and wind combining to make it feel colder outside. At 3 p.m. in Minneapolis, Minnesota, the wind chill was –10° Fahrenheit. At 11 p.m. the wind chill was –3° Fahrenheit. At which time did it feel colder outside, 3 p.m. or 11 p.m.? Explain how you arrived at your answer.

21. *(15)* Your heart beats about 72 times per minute. At that rate, how many times will it beat in one hour? (Write an equation and solve the problem.)

22. (8) The distance between bases on a major league baseball diamond is 90 feet. A player who runs around the diamond runs about how many feet?



Refer to the bar graph shown below to answer problems 23–26.



23. (16) How many more pounds of peanuts does the father elephant eat each day than the baby elephant?

24. (16) Altogether, how many pounds do the three elephants eat each day?

25. (16) How many pounds would the mother elephant eat in one week?

26. (16) Using the information in this graph, write a comparison story problem.

Find each missing number. Check your work.

27. (4) $6w = 66$ **28.** (3) $m - 60 = 37$ **29.** (3) $60 - n = 37$

30. (Inv. 1) Each day Chico, Fuji, and Rolo eat 6, 8, and 9 bananas respectively. Draw a bar graph to illustrate this information.

LESSON

17 The Number Line: Fractions and Mixed Numbers

WARM-UP

Facts Practice: 100 Multiplication Facts (Test E)

Mental Math: Count up and down by $\frac{1}{4}$'s between $\frac{1}{4}$ and 12.

a. 5 × 30 plus 5 × 4

b. 4 × 60 plus 4 × 4

c. 180 + 12

d. 64 + 9

e. 3000 − 1000 − 100

f. $10.00 − $7.50

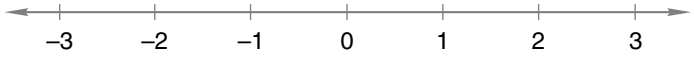
g. Start with 5. Multiply by 4; add 1; divide by 3; then subtract 2. What is the answer?

Problem Solving:

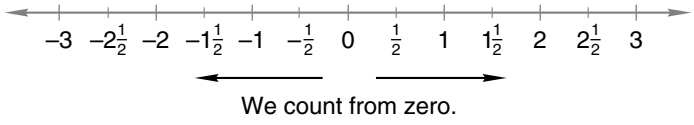
If you pick up a dot cube with two fingers by holding your fingers against opposite faces, your fingers will cover a total of how many dots? (Use a dot cube to find out.)

NEW CONCEPT

On this number line the tick marks show the location of the integers:

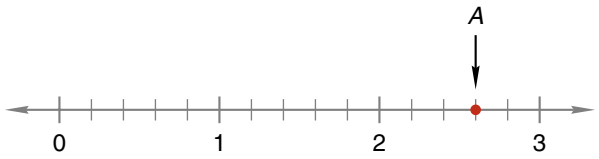


There are points on the number line between the integers that can be named with fractions or **mixed numbers.** A mixed number is a whole number plus a fraction. Halfway between 0 and 1 is $\frac{1}{2}$. Halfway between 1 and 2 is $1\frac{1}{2}$. Halfway between –1 and –2 is $-1\frac{1}{2}$.



The distance between consecutive integers on a number line may be divided into halves, thirds, fourths, fifths, or any other number of equal divisions. To determine which fraction or mixed number is represented by a point on the number line, we follow the steps described in the next example.

Example 1 Point A represents what mixed number on this number line?



Solution We see that point A represents a number greater than 2 but less than 3. So point A represents a mixed number, which is a whole number plus a fraction. To find the fraction, we first notice that the segment from 2 to 3 has been divided into five smaller segments. The distance from 2 to point A crosses three of the five segments. Thus, point A represents the mixed number $\mathbf{2\frac{3}{5}}$.

Note: It is important to focus on the *number of segments* and not on the number of vertical tick marks. The four vertical tick marks divide the space between 2 and 3 into five segments, just as four cuts divide a candy bar into five pieces.

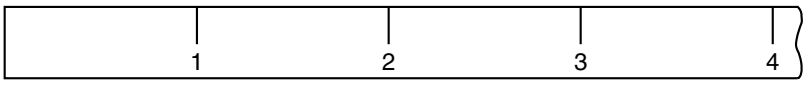
Activity: *Inch Ruler to Sixteenths*

Materials needed:

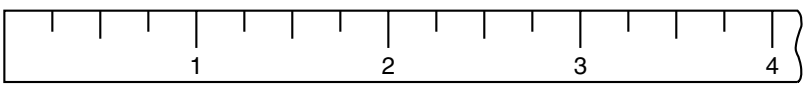
- inch ruler made in Lesson 7

In Lesson 7 we made an inch ruler divided into fourths. In this activity we will divide the ruler into eighths and sixteenths. First we will review what we did in Lesson 7.

We used a ruler to make one-inch divisions on a strip of tagboard.

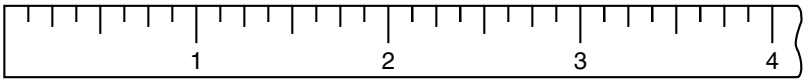


Then we estimated the halfway point between inch marks and drew new marks. The new marks were half-inch divisions. Then we estimated the halfway point between the half-inch marks and made quarter-inch divisions.

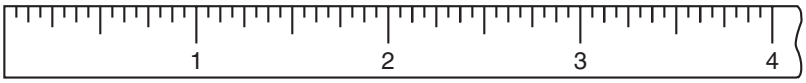


We made the half-inch marks a little shorter than the inch marks and the quarter-inch marks a little shorter than the half-inch marks.

Now divide your ruler into eighths of an inch by estimating the halfway point between the quarter-inch marks. Make these eighth-inch marks a little shorter than the quarter-inch marks.

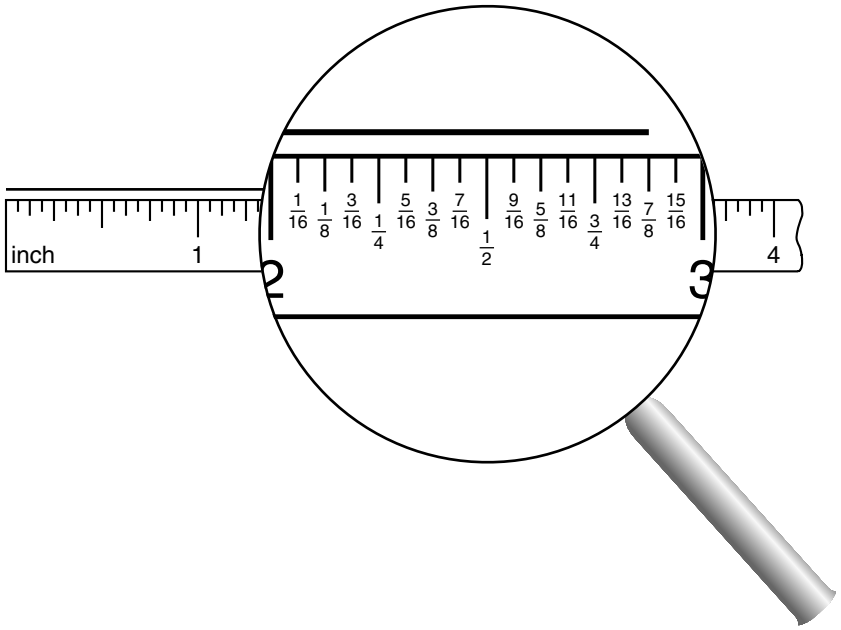


Finally, divide your ruler into sixteenths by estimating the halfway point between the eighth-inch marks. Make these marks the shortest marks on the ruler.



Example 2 Use your ruler to find the length of this line segment to the nearest sixteenth of an inch.

Solution The ruler has been divided into sixteenths. We align the zero mark (or end of the ruler) with one end of the line segment. Then we find the mark on the ruler closest to the other end of the line segment and read this mark. We will enlarge a portion of a ruler to show how each mark is read.



We find that the line segment is about $\mathbf{2\frac{7}{8}}$ **inches long.** This is the nearest sixteenth because the end of the segment aligns more closely to the $\frac{7}{8}$ mark $\left(\text{which equals } \frac{14}{16}\right)$ than it does to the $\frac{13}{16}$ mark or to the $\frac{15}{16}$ mark.