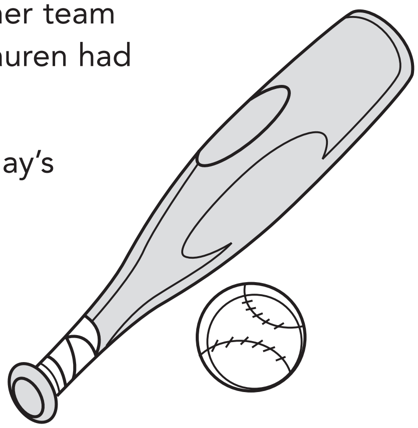
Student Pages

Name

1 Batter Up!

In the first 11 games of the season, in her first 40 times at bat, Lauren's batting average was .300. On Saturday, her team played a doubleheader against the Eagles, and Lauren had 4 hits in 10 at-bats.

What is Lauren's new batting average after Saturday's doubleheader?

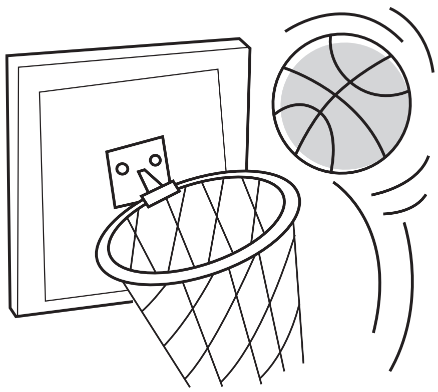


Name

2 Know the Score

The girls' basketball championship game was last night. The winning team's star player, Marla, scored one-half of the team's total points. Louise was the second high scorer with one-fourth of the team's total points. Roz scored one-eighth of the team's total. Pauline scored six points and Judy scored three points.

How many points did each of the five players score?



Teacher Pages

1 Batter Up!

Mathematics Concepts and Skills

Focus: Decimal Operations
Average
Ratio

Related Topic: Rounding Decimals

Problem-Solving Strategies

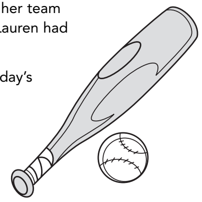
- ✤ **Write an Equation**
- ✤ **Use Logical Reasoning**

Name ______________________

1 Batter Up!

In the first 11 games of the season, in her first 40 times at bat, Lauren's batting average was .300. On Saturday, her team played a doubleheader against the Eagles, and Lauren had 4 hits in 10 at-bats.

What is Lauren's new batting average after Saturday's doubleheader?



About the Mathematics

A batting average is obtained by expressing the ratio of the total number of hits to the total number of times at bat as a decimal with three places (to the nearest thousandth). For example, if a player gets 34 hits in 120 times at bat, then the player's batting average would be 34 ÷ 120 = .283. (The leading 0 is not used with batting averages.) The common error students may make in determining Lauren's average after the doubleheader is to use an average of averages; that is, they may conclude that her average is .350, since she was batting .300 and then batted .400 for the day. This is incorrect. The batting average must reflect the total number of hits and the total number of times at bat.

To find the answer, students must be able to solve a simple equation that shows division. The lesson provides the opportunity to review decimal quotients and place value.

After distributing the problem to the class, have students work in pairs or small groups to find a solution. Once they have had a chance to work, ask students to share their strategies and solutions, or encourage students to find other ways to solve the problem. Use the problem-solving strategies presented in this lesson as a basis for class discussion. Try to relate the Key Questions to students' methods that may differ from the ones presented here.

Problem-Solving Strategies

✤ Write an Equation/Use Logical Reasoning

A player's batting average is found by dividing the number of hits by the number of times at bat.

$$\text{batting average} = \frac{\text{number of hits}}{\text{number of times at bat}}$$

Let H represent the number of hits Lauren got in her first 40 times at bat. Then,

$$.300 = \frac{H}{40}$$

$$.300(40) = \frac{H}{40}(40) \quad \text{Multiply both sides by 40.}$$

$$12 = H$$

Lauren had 12 hits in her first 40 times at bat. In the doubleheader, she had 4 hits out of 10 times at bat, so her new totals for the season were 16 hits out of 50 at-bats. Then,

$$\text{batting average} = \frac{16}{50} = .320$$

Lauren's new batting average is .320.

Key Questions

1. How do you calculate a batting average? *(Divide the number of hits by the number of times at bat.)*
2. What was Lauren's batting average after her first 40 times at bat? *(.300)*

3. What does Lauren's .300 batting average mean? *(It means she averaged 3 hits every 10 times she came to bat.)*

4. Did Lauren's average increase or decrease after the doubleheader? Why? *(It increased, because she went 4 for 10 and her old average was 3 for 10.)*

5. How can you find the number of hits Lauren had before the doubleheader? *(Since her average was .300, substitute in the formula to get .300 = number of hits ÷ 40 at-bats. Then number of hits = 40 at-bats × .300, or 12 hits.)*

6. How many hits in all did Lauren have after the doubleheader? *(12 + 4 = 16)*

7. What was the total number of times Lauren was at bat after the doubleheader? *(40 + 10 = 50)*

8. What is Lauren's new batting average? *(16 ÷ 50 = .320)*

Teacher Tip

Have students practice rounding to the nearest thousandth by giving them hits and at-bats that do not result in a three-place terminating decimal. Let them use a calculator to do the division and explain how they round to the nearest thousandth. *(Look at the digit to the right of the rounding place. If that digit is greater than or equal to 5, increase the digit in the rounding place by 1. Otherwise, leave the digit in the rounding place unchanged. Remove all digits to the right of the rounding place.)*

Assessing Understanding

Use the following problem to assess students' understanding of the mathematical concepts and strategies in this lesson.

[Problem] For his first 60 times at bat, Roy's batting average was .450. In his next 20 times at bat, Roy got only five hits. What is Roy's new batting average? *(.400)*

Key Questions

1. How many hits did Roy get in his first 60 times at bat? *(.450 = number of hits ÷ 60 at-bats, so number of hits = 60(.450) = 27)*

2. If Roy averaged 27 hits for 60 at-bats, how many hits did he average for 20 at-bats? *(9; 20 = 60 ÷ 3 and 27 ÷ 3 = 9)*

3. Did Roy's batting average increase or decrease after the next 20 times at bat? Why? *(His average decreased, because he got five hits for 20 at-bats. Before that, his average was nine hits for 20 at-bats.)*

4. What is Roy's total number of hits? *(27 + 5 = 32)*

5. What is Roy's total number of at-bats? *(80)*

6. What is Roy's new batting average? *(32 hits ÷ 80 at-bats = .400)*

Extending the Mathematics

Extending the Mathematics provides opportunities for students to consider the problem with a new condition. This section may also provide opportunities to introduce other mathematical concepts.

[Problem 1] At the end of last season, Janelle had a batting average of .300 and a total of 42 hits. How many times had Janelle been at bat during the season? *(140 times)*

Key Questions

1. What does Janelle's .300 batting average mean? *(It means she averaged three hits every 10 times she came to bat.)*
2. How many hits did she average in 20 times at bat? *(6)* In 30 times at bat? *(9)*
3. How many groups of 3 hits are in 42 hits? *(14 groups)*
4. How can you find her total number of at-bats? *(Multiply: $14 \times 10 = 140$)*

[Problem 2] This season, Tony has been at bat 20 times and has gotten five hits. If Tony gets a hit each time he comes to bat from now on, how many more at-bats does he need to have a .400 average? *(Five; he will be 10 for 25 with a .400 average.)*

Key Questions

1. What is Tony's batting average so far? *(.250)*
2. If he gets a hit on his next at-bat, how many hits will he have? *(6)* How many at-bats? *(21)* What will his batting average be? *(.286)*
3. If he gets hits in his next two at-bats, how many hits will he have? *(7)* How many at-bats? *(22)* What will his average be? *(.318)*
4. After how many at-bats and hits will Tony's average be .400? *(25 at-bats, 10 hits)*

2 Know the Score

Mathematics Concepts and Skills

Focus: Part-Whole Relationships
Addition of Fractions
(Unlike Denominators)
Solving Equations

Related Topics: Subtraction of Fractions
Time

Problem-Solving Strategies

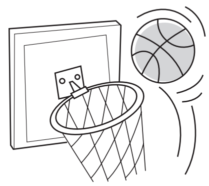
- ✤ **Use Logical Reasoning**
- ✤ **Write an Equation**

Name ______________________

2 Know the Score

The girls' basketball championship game was last night. The winning team's star player, Marla, scored one-half of the team's total points. Louise was the second high scorer with one-fourth of the team's total points. Roz scored one-eighth of the team's total. Pauline scored six points and Judy scored three points.

How many points did each of the five players score?



About the Mathematics

This problem involves understanding part-whole relationships and addition and subtraction of fractions. Students must recognize that the total of nine points scored by Pauline and Judy is the fractional part not included in the sum of the parts for the other players.

Since the fractions given have unlike denominators, students must rewrite them using the least common denominator (LCD). Although this lesson could be used to introduce the method, students will be better able to concentrate on the meaning of the sum in relation to the situation if they are already familiar with the process of adding fractions. The algebraic solution requires that students know how to work with fractional coefficients.

After distributing the problem to the class, have students work in pairs or small groups to find a solution. Once they have had a chance to work, ask students to share their strategies and solutions, or encourage students to find other ways to solve the problem. Use the problem-solving strategies presented in this lesson as a basis for class discussion. Try to relate the Key Questions to students' methods that may differ from the ones presented here.

Problem-Solving Strategies

✤ Use Logical Reasoning

Have students find the sum of the parts of the total scored by Marla, Louise, and Roz.

The LCD of 2, 4, and 8 is 8. Rewrite each fraction as an equivalent fraction with a denominator of 8.

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{4}{8} + \frac{2}{8} + \frac{1}{8} = \frac{7}{8}$$

Since Marla, Louise, and Roz scored $\frac{7}{8}$ of the team's total, this means that the points scored by Pauline and Judy represent the other $\frac{1}{8}$. Pauline and Judy scored $6 + 3 = 9$ points. Since $\frac{1}{8}$ of the total is 9 points, the total is 8 times as much, or 72 points. Then,

Marla scored $\frac{1}{2}$ of 72 points, or 36 points.
Louise scored $\frac{1}{4}$ of 72 points, or 18 points.
Roz scored $\frac{1}{8}$ of 72 points, or 9 points.
Pauline scored 6 points.
Judy scored 3 points.

Teacher Tip

Note that six points is $\frac{1}{12}$ of the total and three points is $\frac{1}{24}$ of the total.

$$\frac{1}{12} + \frac{1}{24} = \frac{2}{24} + \frac{1}{24} = \frac{3}{24} = \frac{1}{8}$$

✤ Write an Equation

Let t represent the total number of points scored by the team.

$\frac{1}{2}t$ = number of points Marla scored
$\frac{1}{4}t$ = number of points Louise scored
$\frac{1}{8}t$ = number of points Roz scored
$\frac{1}{2}t + \frac{1}{4}t + \frac{1}{8}t + 6 + 3 = t$

Multiply both sides of the equation by 8 to clear the fractions. Remember to multiply each term on the left.

$4t + 2t + t + 48 + 24 = 8t$
$7t + 72 = 8t$ Simplify.
$7t - 7t + 72 = 8t - 7t$ Subtract $7t$ from each side.
$72 = t$

Marla scored 36 points, Louise scored 18 points, Roz scored 9 points, Pauline scored 6 points, and Judy scored 3 points.

Key Questions

1. What part of the team's total did Marla score? *($\frac{1}{2}$)*
2. What part of the team's total did Louise score? *($\frac{1}{4}$)*
3. What part of the team's total did Roz score? *($\frac{1}{8}$)*
4. What is the LCD of $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$? *(8)*
5. What part of the team's total did Marla, Louise, and Roz score together? *($\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{4}{8} + \frac{2}{8} + \frac{1}{8} = \frac{7}{8}$)*
6. What part of the team's total did Pauline and Judy score? Why? *($1 - \frac{7}{8} = \frac{1}{8}$)*
7. How many points does the $\frac{1}{8}$ part equal? *(9 points)*
8. What was the total score? *(72 points)*
9. If Pauline and Judy had scored 12 points, what would the team's total be? *(96 points)*

Assessing Understanding

Use the following problem to assess students' understanding of the mathematical concepts and strategies in this lesson.

[Problem] At the end of the Ravens' season, team records showed that Jorge scored $\frac{1}{3}$ of the total points, Larry scored $\frac{1}{4}$, Howard scored $\frac{1}{6}$, and David scored $\frac{1}{12}$. Pablo and Mike scored the remaining 96 points. If Pablo scored twice as many points as Mike, how many points did each player score? *(Jorge, 192; Larry, 144; Howard, 96; David, 48; Pablo, 64; Mike, 32)*

Key Questions

1. What is the LCD of $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, and $\frac{1}{12}$? *(12)*
2. What part of the team's total did Jorge, Larry, Howard, and David score together? *($\frac{1}{3} + \frac{1}{4} + \frac{1}{6} + \frac{1}{12} = \frac{4}{12} + \frac{3}{12} + \frac{2}{12} + \frac{1}{12} = \frac{10}{12} = \frac{5}{6}$)*
3. What part of the team's total did Pablo and Mike score? Why? *($1 - \frac{5}{6} = \frac{1}{6}$)*
4. How many points does the $\frac{1}{6}$ part equal? *(96 points)*
5. How can you find the total score? *(Multiply 96 by 6 to get 576.)*
6. How many points did Jorge, Larry, Howard, and David each score? *(Jorge, 192; Larry, 144; Howard, 96; David, 48)*
7. If Mike scored x points, how many points did Pablo score? *($2x$)*
8. What equation can you write to find Pablo's score and Mike's score? *($2x + x = 96$, so $3x = 96$ and $x = 32$)*
9. How many points did Mike score? *(32)*
   How many points did Pablo score? *(64)*

Extending the Mathematics

Extending the Mathematics provides opportunities for students to consider the problem with a new condition. This section may also provide opportunities to introduce other mathematical concepts.

[Problem 1] Each evening, Marla walks to basketball practice at the gym. She walks at a steady rate for the whole distance and makes no stops. At one-third of the way to the gym, she passes the post office. Halfway to the gym, she passes the library. Today, her watch showed 6:05 when she passed the post office and 6:09 when she passed the library. At what time did Marla arrive at the gym? *(6:21)*

Key Questions

1. What part of the total walk does the distance from the post office to the library represent? *($\frac{1}{2} - \frac{1}{3} = \frac{3}{6} - \frac{2}{6} = \frac{1}{6}$)*
2. How many minutes does it take for Marla to walk from the post office to the library? *(4 minutes)*
3. How long does the whole walk to the gym take? *(24 minutes)*
4. At the library, what part of the walk remains? *($\frac{1}{2}$)*
5. How long does it take Marla to walk from the library to the gym? *(12 minutes)*
6. At what time does Marla arrive at the gym? *(6:21)*

[Problem 2] A swimming pool was $\frac{2}{5}$ full. After the owner added 700 gallons of water, the pool was $\frac{3}{4}$ full. How many more gallons of water does the owner need to add to completely fill the pool? *(500 gallons)*

Key Questions

1. What is the LCD of $\frac{2}{5}$ and $\frac{3}{4}$? *(20)*
2. What fractions with a denominator of 20 are equivalent to $\frac{2}{5}$ and $\frac{3}{4}$? *($\frac{8}{20}$, $\frac{15}{20}$)*
3. What part of the total number of gallons the pool can hold do the 700 gallons represent? *($\frac{15}{20} - \frac{8}{20} = \frac{7}{20}$)*
4. How many gallons does the pool hold? *(2,000 gallons)* Explain. *(Since 700 gallons = $\frac{7}{20}$, 100 gallons = $\frac{1}{20}$, and $\frac{20}{20}$ = 20(100) = 2,000 gallons)*
5. How many gallons are in the pool now? *($\frac{3}{4}$ of 2,000 gallons = 1,500 gallons)*
6. How many more gallons are needed to fill the pool? *(2,000 gallons − 1,500 gallons = 500 gallons)*