6.NS Batting Average

Alignments to Content Standards: 6.NS.B.2

Task

Before a game, Jake's batting average was exactly 0.350. That is, the decimal expansion of the fraction

\[
\frac{\text{number of hits}}{\text{times at bat}}
\]

is equal to 0.350. During the game, Jake bats 4 times and gets 2 hits. If Jake's batting average after the game is 0.359, how many times had Jake batted before the game? Explain.

IM Commentary

The goal of this task is to perform and analyze division with whole numbers in a sports context. Students can use a trial and error strategy using a table of equivalent fractions with decimal 0.350. This requires looking for fractions whose decimal expansion is 0.350. The numbers have been chosen so that this part of the task is not too taxing but the teacher may wish to provide some guidance here so that students do not spend too much time trying to find some of the possibilities for hits and at bats. In the solution, the possible fractions which come up are reduced and then converted to decimals. This is not necessary but it makes the long division easier which is important since there are a lot of calculations to be made.

The steps in the long division process are not shown in the solution. Also because batting averages are rounded to the nearest thousandth, all decimals have been rounded accordingly. The teacher may need to provide some guidance at first, helping
students test a few possibilities for Jake's number of at bats and hits before the game. Because the standard 6.NS.2 is about long division, students should be expected to make some of the calculations by hand. Use of calculators at the beginning of the task as students are getting a sense of the numbers could be appropriate.

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Solution

We can solve this by making a table which shows how many hits and at bats Jake had both before and after the game. For his batting average to be exactly 0.350 before the game means, letting $h$ denote the number of hits and $b$ the number of at bats, that

$$\frac{h}{b} = 0.350.$$

Some of the possibilities for $h$ and $b$ are shown in the ratio table below:

<table>
<thead>
<tr>
<th>Hits $(h)$</th>
<th>At Bats $(b)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>1000</td>
</tr>
<tr>
<td>35</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>14</td>
<td>40</td>
</tr>
<tr>
<td>21</td>
<td>60</td>
</tr>
</tbody>
</table>

To check Jake's batting average after the game with 2 hits in 4 at bats, we can take a row of numbers from the ratio table, add 2 to the first number and 4 to the second, and then evaluate the quotient. For example, if Jake had 7 hits in 20 at bats before the game, then we would have 9 hits in 24 at bats after the game. Since $\frac{9}{24} = \frac{3}{8} = 0.375$, this is not the correct value. With 14 hits in 40 at bats, Jake would have 16 hits in 44 at bats for a batting average of $\frac{16}{44} = \frac{4}{11} \approx 0.364$ so this is also not correct. With 21 hits in 60 at bats before the game, Jake would have 23 hits in 64 at bats after the game. Since $\frac{23}{64} \approx 0.359$, this could be correct. The next value to calculate would be 28 hits in 80 at bats entering the game so 30 hits in 84 at bats after the game: $\frac{30}{84} = \frac{5}{14} \approx 0.357$, so
this is not correct. The more at bats Jake has before the game, the less the impact of his 2 hits in 4 at bats on the overall batting average. So the only possibility that fits the given information is that Jake had 21 hits in 60 at bats before the game.