

Baseball Statistics **ANSWERS**

Lesson 1 of 4, work individually or in pairs

For a batter in baseball, there are many statistics that people look at to decide if a batter is good. Two of the common ones are the batting average and the slugging percentage.

A player's batting average is the number of times the batter hit his way to a base divided by his number of times at bat (called an "at bat").

(Special note for the baseball experts: We're simplifying things a little bit here. If a batter walks, gets hit by the pitch, reaches a base on an error, or has a sacrifice fly or sacrifice bunt, then we don't count that time at bat as a hit or as an at bat. For these exercises, we will just worry about ordinary hits without any walks, errors, or sacrifices.) The batting average is shown as a 3-digit number after a decimal, such as 0.250. Numbers are always rounded to the nearest thousandth.

Example: Tom has 405 at bats and hit himself on base 123 of those times. His batting average is $123 \div 405 = 0.303704$, which rounds to 0.304.

*Materials Needed: Pencil
Math Journal or Notebook
Calculator (optional)*

1. Find the batting average for a batter who has 48 at bats and 12 hits.

$$12 \div 48 = 0.0250$$

2. You know a player has 450 at bats and his batting average is 0.256. How many hits has he had?

If 'a' is the number of hits, we have $a \div 450 = 0.256$.

Solving for a gives $a = 115.2$ so the player had 115 hits.

Students can also solve by trial and error.

3. You're watching a major league game. Someone comes up to bat, and his batting average is listed as 0.000. He hits and gets on first base. Later in the game, the same batter comes up to bat, but now his batting average is listed as 1.000. Why is that? How many times has he batted in the major league? *These two at-bats were the hitter's first and second time batting in the major leagues.*

4. Pretend you're the owner of a baseball team. You need to choose between two players: One who has 537 at bats and a batting average of 0.283, and one who has 50 at bats and a batting average of 0.300. Which batter do you want to have playing next, and why? Write one or two sentences to support your position.

Answers will vary. Students should do some analysis of what the batter's batting average will be if he hits or misses on this at bat. The batter with the 0.283 batting average has hit 152 of his 537 at bats; the batter with the 0.300 batting average has hit 15 of his 50 at bats. (A miss will change his batting average to 0.294.)

Standards: Statistics, algebra

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Lesson 2 of 4, work individually or in pairs

In addition to the batting average, a batter's skill can also be described by a batter's slugging percentage (abbreviated SLG). To find slugging percentage, you take the total number of bases reached by a player when he hits divided by his at bats. A home run counts as 4 bases, a triple counts as 3 bases, a double counts as 2 bases, and a single is one base.

Example: Mario has batted 87 times. He singled 4 times, got a double 7 times, got a triple 5 times, and had one home run.

Mario reached 4 bases on singles. He got $7 \times 2 = 8$ bases on doubles. He got $5 \times 3 = 15$ bases on triples, and 4 bases on his one home run.

Total bases for Mario: $4 + 14 + 15 + 4 = 37$
37 bases in 87 at bats gives Mario a slugging percentage of $37 \div 87 = 0.425$.

1. A batter who had 112 at bats. He had 17 singles, 4 doubles, 6 triples, and 2 home runs.
 - a. Find the batter's slugging percentage. *The runner reached $17 + (4 \times 2) + (6 \times 3) + (2 \times 4) = 51$ bases, so $51 \div 112 = 0.455$.*
 - b. Find the batter's batting average (see Lesson 1 if you forget how to compute it). *There were 29 hits, so batting avg is $29 \div 112 = 0.259$.*

Materials Needed: Pencil
Math Journal or Notebook
Calculator (optional)

2. **Compare** Would a batter's slugging percentage be a larger or smaller number than the batter's batting average? Under what conditions could the two numbers be equal? Write one or two sentences explaining your answer.

Slugging percentage is larger because you always divide by the same number (at bats) and in the slugging percentage you count some hits more than others. They are equal if the batter only had singles.

3. Pretend you're the manager of a baseball team. You need to pick between two players. George has a 0.215 batting average and a 0.605 slugging percentage. Ahmed has a 0.290 batting average and a 0.450 slugging percentage. Write a few sentences describing in which situations each player is a better choice.

Answers will vary. The number of outs and how many runners on base should be considered.

4. **Challenge Question** Dwight has had 125 at bats. He has a batting average of 0.280 and his slugging percentage is 0.440. Make a table like the one below, showing different combinations of home runs, doubles, triples, and singles that Dwight could have had. Compare your answers with a classmate and see if your classmate came up with combinations that you didn't. Hint: First figure out how many hits and how many total bases Dwight had.

He had 35 hits and 55 bases. There are many right answers.

Singles	Doubles	Triples	Home Runs
24	5	3	3

Standards: Statistics, algebra

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Lesson 3 of 4, work individually or in pairs

Pitchers are also measured by many statistics. The most commonly cited number associated with a pitcher is the earned run average (abbreviated ERA). To find the pitcher's earned run average, you take the number of runs charged against a pitcher, divide by the number of innings pitched, and then multiply that result by 9. The answers are rounded to the nearest hundredth.

Example: Michael has pitched 230 innings and has given up 95 runs.

Michael's ERA is found by first finding that $95 \div 230 = 0.413043$. Now we multiply $9 \times 0.413043 = 3.71739$, which rounds to 3.72.

*Materials Needed: Pencil
Math Journal or Notebook
Calculator (Optional)*

1. Find the ERA of a pitcher who has given up 52 runs in 123 innings.

$52 \div 123 = 0.422764$, and $0.422764 \times 9 = 3.80$, so his ERA is 3.80.

2. The ERA can be described as the total number of runs you expect the pitcher to give up if he pitches a full game. Write a sentence explaining why that description makes sense.

First you are finding the number of runs the pitcher pitches in one inning, and then when you multiply by 9 you're multiplying the number of runs per inning by the number of innings in a game.

3. Before a game, Jesse has an ERA of 3.00 and had pitched 57 innings. Jesse pitched 5 innings of the game, and gave up 6 runs. What is Jesse's new ERA? *First we have to figure out how many runs Jesse had given up before the game. Since his ERA is 3.00, that is the same as $(n \div 57) \times 9 = 3.00$. Solving for n , we find $n = 19$. (Students can use trial and error to figure this out.) After this game, Jesse had given up 25 runs in 62 innings, so Jesse's ERA is $(25 \div 62) \times 9 = 3.63$.*

Standards: Statistics, algebra

Baseball Statistics **ANSWERS**

Lesson 4 of 4, work in individually or in pairs

Another number that is used to show the skill of a pitcher is the WHIP, which is the number of walks and hits divided by the number of innings pitched. The WHIP measures how many people the pitcher permits to reach a bases instead of the number of people the pitcher permits to make a run. The WHIP is rounded to the nearest hundredth.

Example: Jordan has pitched 97 innings, during which he allowed 20 walks and 84 hits. **Jordan's WHIP is found by adding his walks and hits to get $20 + 84 = 104$. Then divide by the number of innings he pitched: $104 \div 97 = 1.07$.**

*Materials Needed: Pencil
Math Journal or Notebook
Calculator (Optional)*

1. Who is better, a pitcher with a high WHIP or a pitcher with a low WHIP? *A low WHIP is better because that means that fewer runners reached a base.*
2. Find the WHIP of a pitcher who has allowed 56 walks and 207 hits in 195 innings pitched. *Walks plus hits = $56 + 207 = 263$, so the WHIP is $263 \div 195 = 1.35$.*
3. **Compare** Two pitchers both have a WHIP of 1.21 and have both pitched 200 innings. However, one of them has an ERA of 3.06 and the other has an ERA of 4.41. How can this happen? *The one with the higher ERA had more runners actually score once they reached base. This could have happened if that pitcher walks or permits a lot of runners in one inning, or if the fielders aren't as good on that pitcher's team.*
4. A pitcher allowed 77 hits in 93 innings and has a WHIP of 1.13. How many walks were allowed? *This can be described by $(walks + hits) \div 93 = 1.13$, so $(walks + hits) = 105$. There must have been $105 - 77 = 28$ walks.*

Standards: Statistics, algebra