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Computing Earned-Run Averages

A pitcher's **earned-run average** (ERA) is probably the best statistic to explain how well a pitcher is actually pitching. A pitcher can lose a number of games with a poor team and have a poor win-loss record. The ERA tells you how many earned runs a pitcher gives up for every nine innings he pitches. Runs scored are not counted because of errors, even if they are the pitcher's errors. An earned run is one that is scored by hits, walks, or a batter.

Follow the steps below to calculate an earned-run average:

- Count up all of the innings pitched for all of the games in which you (or someone else) participated.
- Add up all of the earned runs scored in all of the innings you (or someone else) pitched. (Do not count runs that scored with other pitchers on the mound except runners who were on base when you left the game and then scored.)
- Multiply the number of earned runs times 9.
- Divide this number by the number of innings pitched.

Example:

A pitcher pitched a total of **90** innings.

He gave up **30** earned runs in these **90** innings.

A. $30 \times 9 = 270$

B. 270 divided by 90 = 3.0

$$\begin{array}{r} 3.0 \\ 90 \overline{) 270.0} \\ \underline{270} \\ 0 \end{array}$$

C. ERA = 3.0



Directions: Use pencil and paper or a calculator to compute these ERAs.

1. A pitcher gave up 4 earned runs in 8 innings pitched. _____
2. A pitcher gave up 9 earned runs in 20 innings pitched. _____
3. A pitcher gave up 2 earned runs in 23 innings pitched. _____
4. A pitcher gave up 12 earned runs in 7 innings pitched. _____
5. A pitcher gave up 25 earned runs in 100 innings pitched. _____

How the Ball Moves *(cont.)*

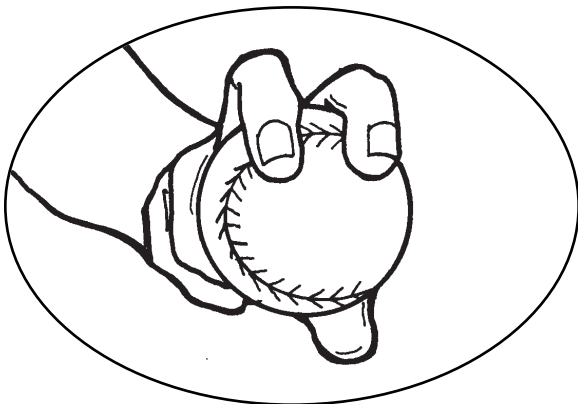
Lift and Drag *(cont.)*

The faster an object travels, the more the object experiences **drag**, which is the resistance of the air to the object moving through it. Streamlined objects, like planes and round baseballs, have less drag than other objects. A fastball takes less than half a second to reach the plate. The baseball's movements are determined by the interplay of lift and drag as the ball is thrown. The stitching can affect the path of the ball.

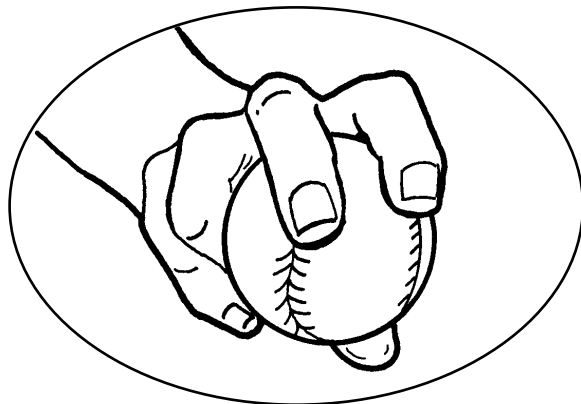
The stitching on a baseball, the grip of the pitcher, the snap of the pitcher's wrist, and how close the ball is held to the pitcher's palm all affect the behavior of the ball as it heads toward the plate. The spin of the ball also affects the ball's movement, and it can deflect the ball to one side or the other. A typical curve ball is spinning at a speed of 1,800 revolutions per minute. It turns about 15 times as it travels 60 feet toward the plate.

Grips

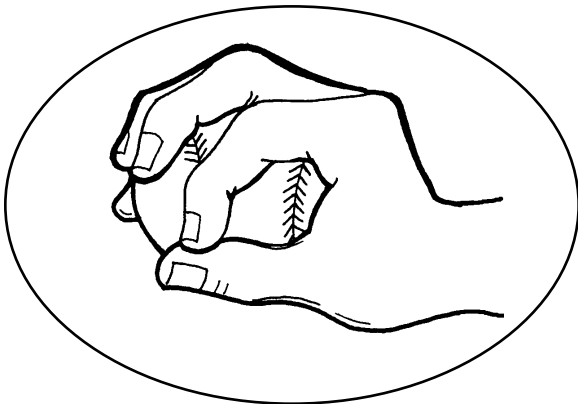
The grip of the baseball is defined in terms of where the stitching is located. The grip of the ball plays an important part in determining in which direction the ball moves. The way a pitcher grips the ball can affect the pitch itself. The pictures below show some of the grips and their effects.



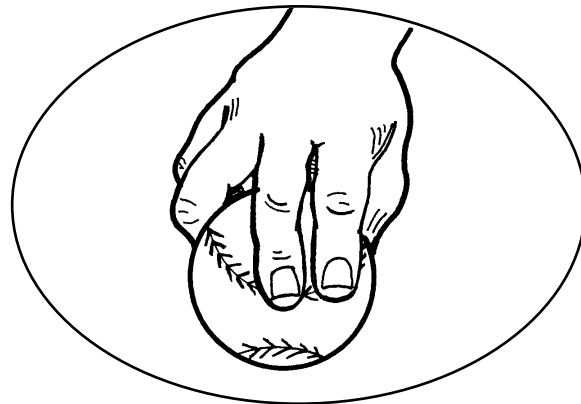
Four-Seam Fastball
(rising fastball)



Two-Seam Fastball
(sinking fastball)



Circle Change
(held closer to the palm; slower pitch with the same movement on the ball)



Curve Ball
(breaks down and away)