

# Soccer Math

**Solving Problems From the Pitch**

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David A. Coffland**



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# Introduction for Parents and Teachers

## Activities

The first section poses a variety of problem situations all based on the numbers of soccer. This section includes problems centered on the soccer pitch, famous players, awards, and league play around the world. The problems themselves are varied, including:

- **Activities using different sets of numerals.** By the time students are finished with the eighth grade, they should be proficient with problem solving involving numeral types, such as whole number computation, fraction computation, decimal computation, and percent computation.
- One way to classify problem-solving activities includes two general categories of problems:

1. **Routine Problems:** These problems ask students to apply a computational procedure to real-life situations.
2. **Non-routine Problems:** These problems require the use of *heuristics*, in which the learner creates or invents a new series of steps to solve a problem. With these, the student is not just using a computational procedure. This process involves advanced-level thinking skills, and is preferred by math educators.

It is not appropriate to give students only problems that review the computational operations they have learned. Problems should also ask students to examine data, ask questions, and find or create ways for solving real problems.

## Routine Problems

Students have been asked to solve routine problems for years. These problems ask students to apply learned mathematical

processes in order to answer questions. We will use two types of routine problems here:

1. **Algorithmic Problems:** These are traditional math story problems; they require that a student read a problem, figure out the computational procedure required, and then apply that computational process to solve the problem. For example:

Bobby scored 16 goals in the last soccer season. This year he wants to score 25 goals. How many more goals does he wish to score during the upcoming year than he scored last year?

2. **Multi-step Problems:** These are a special type of routine problem that requires students to use two or more computational operations to obtain the answer. For example:

Last year the Galaxy team played 12 games, winning  $\frac{3}{4}$  of them. This year, during the entire season, they won only 5 games. How many games did they win over the two seasons combined?

Routine problems can be created with any type of number and any type of computational operation. Students should know that computational processes—from adding whole numbers to dividing decimal numerals—can be used to solve real-world problems. As teachers and parents, we cannot stop after assigning only routine problems.

## Non-Routine Problems

In recent years math educators have focused additional energy on non-routine problems—those problems that challenge the learner in new, unique ways. We have attempted to include various kinds of non-routine problems in this book. They include:

**1. Projects:** These projects, which are not simple story problems, involve a “process.” They are open-ended, in that different students may seek different data and obtain different answers. The process is more important than the product; the process stresses such things as solving multiple computational situations, often using multiple problems to obtain the answer, comparing differences in answers, and discussing all considerations to see if everyone agrees. For example:

How can we create and understand a table showing scoring differentials for each team in the league?

This task depends on several variables. Not every table will be the same. Each will have different figures that must be explored. These problems are important for children to solve in order to learn that not all problems have simple answers, and that not all problems have just one answer.

**2. Challenge Problems:** Problems of this type ask the learner to do more than just solve a problem using math procedures. They require the use of communication skills—to explain an answer—or of heuristics, a big word meaning the problem solver must invent and/or create the steps or procedures that will lead to the answer. This act of invention is important, as it is the true test of problem-solving ability. The child cannot stop learning mathematics until he or she is capable of inventing solutions to problems never seen before. For example:

Create a chart showing the differential between goals allowed and goals scored, and whether scoring more goals or limiting the opposition's goals has a greater impact on your team's final league standing.

Professional scientists, engineers, and mathematicians all work to create new ideas and solve new problems. We do not ask these professionals to rehash old ideas to solve old problems. And it is not only those working in the “math professions” who must invent solutions to solve problems. The carpenter, plumber, clerical worker, or housewife all invent solutions to problems every day. All of us are problem solvers, and many of our problems involve numbers and math. The children in one's life should be encouraged to become problem-solvers—it is a skill they will all need!

### Math Projects

Finally, because this book is meant to capture the interest of students by combining mathematics and soccer, we have suggested different projects for students. These are not technically math problems; they are projects students can undertake that require the use of math while offering them the opportunity to examine the history of soccer. These projects will hopefully make both math and soccer some of a child's special interests.

# Introduction for Students

**S**occer is the world's game—and it is played in almost every nation in the world. While people of the United States know this game as soccer, the rest of the world calls it *football*.

This book is about that game, whatever you call it, but we'll call it soccer here for simplicity's sake. Here you will find a great deal of interesting material about soccer—the professional teams and players from around the world, the Olympic contests and the international soccer championships, college men's and women's soccer, and even youth soccer games. But in this book you will also find math. These pages will ask you to solve math problems about soccer and its statistics, its stories, its interesting situations, and its championship seasons.

For example, here you can see how playing fields may differ in size, and you will figure out how difficult it is to defend a penalty kick. You will see how offensive statistics are important—both for the individual players and their teams. You will find problems about soccer statistics to figure examples on how numbers impact the game and its final scores and standing. And you will figure them out for yourself. But you will enjoy the book much more if you tackle the various projects that involve keeping track of soccer statistics for a game or a season, in any of the world's many soccer leagues and championships. Collect all kinds of statistics on your favorite player, then see if you can figure out how he or she helps the team. Or, if you are playing soccer, keep track of your own statistics and rate yourself!

The book also contains a number of facts about national and international soccer events. For example, which female player holds the U.S. career scoring record in international games and championships? Or, which English teams are consistently good and which teams face “relegation”? (That is an interesting concept, and you will find many resources that explain it.) All this information is presented in fun-to-solve math problems.

So, this book is about both soccer and math. It is meant to be fun. We hope you enjoy playing the popular sport of soccer, we hope you enjoy solving problems about soccer, and most of all, we hope that you begin to collect your own statistics about soccer.

Enjoy!





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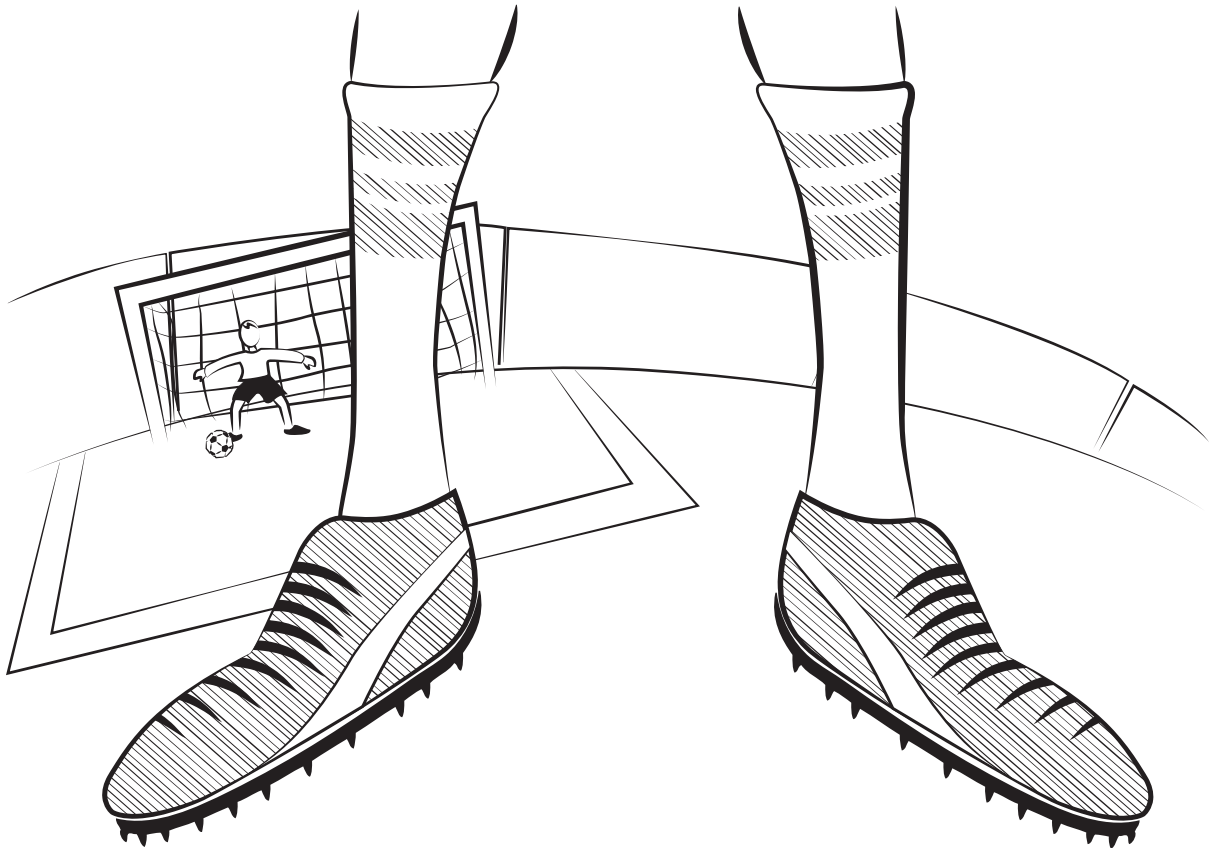
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# Problems

## The Pitch



# Standard Measurements

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**A**n interesting fact about the playing field for soccer, commonly called “the pitch” in England, is that some measurements are “firm” and some are not. Firm measurements are the same on every soccer field, but some measurements are allowed to vary from stadium to stadium. The amount of variance, however, changes from national play to international play; the variation is much smaller for international play.

The following measures are common or standard measurements for every pitch:

**Goal:** The size of the goal is always the same. It must be 24 feet wide and 8 feet high.

**Penalty Box:** This box—the larger box in front of the goal—is 18 yards deep and 44 yards across. If a defensive player commits a foul in his or her penalty box, the offense is given a penalty kick from the penalty spot. That spot is always located 36 feet from the goal.

**6-Yard Box:** Marked on the pitch is a smaller box, called the *goal area*, which is 20 yards across and 6 yards deep. The goal is centered on this box; that means this box extends 3 yards out from each side of the goal.

**Midfield Circle:** The circle in the center of the field has a 10-yard radius. At the start of each half, one team puts the ball in play. No opposing player can be within that circle as the ball is put in play, and all players must be in their half of the field. In other words, no player can be over the center or midfield line as play begins.

Find the area and perimeter for each of these “required size” portions of the field. Then complete the worksheet below.

Section of the Pitch	Area	Perimeter
Goal		
Center Circle		
Penalty Box		
6-Yard Box		

# Non-Standard Measurements

In some ways soccer resembles baseball—within the playing field there are some common measurements (distance from the pitching mound to home plate, distance between bases, etc.) while other distances vary (distance from home plate to left field, right field, and so on). In soccer there are measurements that are always the same, while other field requirements may vary. The rules—some of which are shown below—were originally created in England, so measurements are given in yards:

- The sidelines are called *touchlines*. The touchlines must be the same length and may vary between 100 to 130 yards in length.
- The end lines are called *goal lines*. The goal lines must be the same length and may vary between 50 and 100 yards in length.
- The pitch must be rectangular in shape.
- The goals are placed at the center of each goal line, they must be white, and the upright poles must be 8 yards apart on their inner edges. The crossbar between the uprights must be 8 feet high.

Efforts were made to standardize pitch size, and metric units were introduced. For international matches, rules were written to fix field size at 105 meters in length and 68 meters in width. This was put on hold, however, and has never been fully implemented.

Team Name	Team Founded	Stadium Name	Pitch Measure (Yards)	
			Length	Width
Chelsea	1905	Stamford Bridge	103	67.5
Fulham	1879	Craven Cottage	100	65
Manchester United	1878	Old Trafford	105	68
Stoke City	1863	Brittania Stadium	100	64
Tottenham Hotspur	1882	White Hart Lane	100	67

1. For the soccer fields listed above, what is the difference between the longest field and the shortest field in terms of length and width, expressed as feet and inches?

\_\_\_\_\_

2. Given the rules listed above, what would be the dimensions of a soccer field that is as wide as it can possibly be? What would be the dimensions of a field that is as narrow as it can possibly be?

\_\_\_\_\_

\_\_\_\_\_

3. Do any of the English soccer fields listed approach the maximum length? Width? Which one comes closest to the maximum length or width?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Trivia:** The majority of stadiums in England have a pitch size similar to that of Manchester United—105 yards by 68 yards.

# England's Wembley Stadium

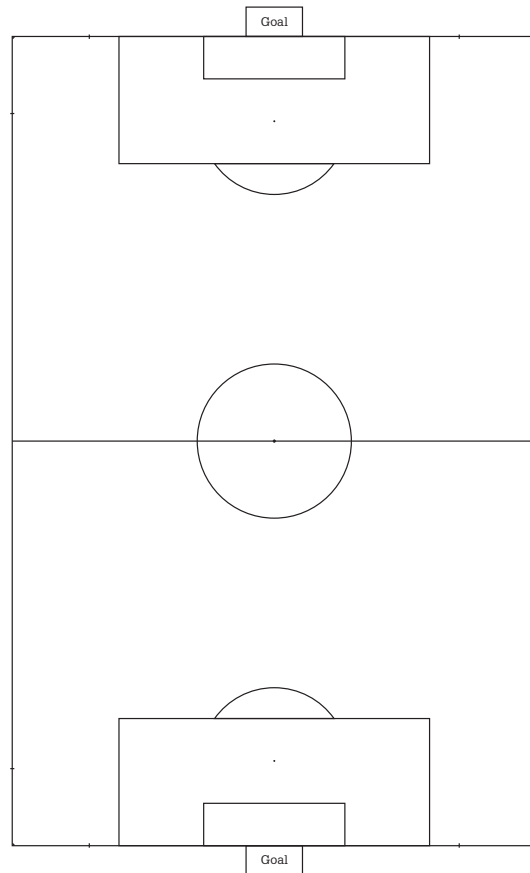
**Length:** 115 Yards

**Width:** 75 Yards

**W**embley Stadium is the most famous (or infamous) stadium in England. It is the home of the English national football team. It's a beautiful stadium, with an arch over it that is so high that it requires aircraft warning lights!

When the stadium was rebuilt, the field was lowered. When matches were played on the new pitch, it was *heavily* criticized.

The pitch grass was replaced 10 times between 2007 and 2010. It was finally replaced with a combination of natural grass intertwined with artificial fibers. These fibers are injected 20 cm into the soil, and the grass roots intertwine with the fiber to create a solid, even playing surface.



1. What is the playing area of the pitch?  
In square yards? In square feet?

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2. Approximately 3% of the playing surface is made up of the artificial fibers. How many "square yards" of artificial fiber surface would there be if all the fibers were in one place? (**Remember:** The fibers are distributed around the field. They are not all in one place!)

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3. Soccer pitches vary in size, but the variations do not occur in the goal areas. Those dimensions are the same for all fields. Because the 18-yard boxes are a fixed measure, how much distance is there between the two 18-yard boxes? (Midfielders run back and forth between these two lines regularly!)

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4. Wembley Stadium seats 95,000 people for soccer, but it can hold up to 105,000 people if standing room tickets are sold. If spectators are charged 12 English pounds to stand for a match, how much extra money is generated by selling standing room tickets?

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# Stadium Size

Soccer is the world's game; it has been played for more than a century. As a result, many soccer stadiums are much smaller than we would expect because they were built so long ago. Consider the Barclay's Premier League stadiums:

**Barclay's Premier League Stadiums by Team**

Team Name	Year Formed	Stadium Name	First Built	Seats
Manchester United	1878	Old Trafford	1909	75,811
Arsenal	1886	Emirates Stadium	2006	60,361
Newcastle United	1892	Sports Direct Arena	1892	52,409
Sunderland	1879	Stadium of Light	1997	48,707
Manchester City	1880	City of Manchester Stadium	1999	47,405
Liverpool	1892	Anfield	1884	45,276
Aston Villa	1874	Villa Park	1897	42,785
Chelsea	1905	Stamford Bridge	1876	42,449
Everton	1878	Goodison Park	1892	40,157
Tottenham Hotspur	1882	White Hart Lane	1889	36,230
Blackburn	1875	Ewood Park	1882	31,154
Bolton	1874	Reebok Stadium	1997	28,100
Wolverhampton Wanderers	1877	Molineux Stadium	1889	27,828
Stoke City	1863	Brittania Stadium	1997	27,740
Norwich City	1902	Carrow Road	1935	27,010
West Bromwich Albion	1878	The Hawthorns	1900	26,360
Fulham	1879	Craven Cottage	1896	25,700
Wigan Athletic	1932	The DW Stadium	1999	25,133
Swansea City	1912	Liberty Stadium	2005	20,520
Queens Park Rangers	1882	Loftus Road Stadium	1904	18,439

- What is the difference in seating capacity between the largest and smallest stadiums?  
\_\_\_\_\_
- What is the oldest stadium? How long has it been used? (**Remember:** A stadium can be remodeled; being old does not mean a stadium is in disrepair.)  
\_\_\_\_\_  
\_\_\_\_\_
- What is the "oldest" team in the Premier League? How old is it?  
\_\_\_\_\_  
\_\_\_\_\_
- Find the oldest and the youngest teams. What is the difference in their ages? Which are the oldest and youngest stadiums? What is the difference in their ages?  
\_\_\_\_\_  
\_\_\_\_\_

### Challenge Question

Do you think a team with a small stadium is more likely to be near the bottom of the standings than a team with a large stadium?  
\_\_\_\_\_  
\_\_\_\_\_

# Comparing Stadium Seating Capacity

One reason the Premier League stadiums seem small is that we sometimes forget just how big football stadiums in the United States are. The following chart shows the seating capacity for the ten largest college football stadiums and ten different English soccer teams. (**Note:** Remember these are college stadiums, not bowl stadiums or professional football stadiums. In terms of size, for example, the Rose Bowl or the Dallas Cowboys' new stadium would be larger than some college stadiums. Also, some stadiums are changed almost every year. The numbers in the table below are from 2011.)

College	Seats	Rank	BPL Club	Seats
Michigan	107,501	1	Manchester United	75,811
Penn State	107,282	2	Arsenal	60,361
Tennessee	104,079	3	Newcastle United	52,409
Alabama	101,821	4	Sunderland	48,707
Ohio State	101,568	5	Manchester City	47,405
Texas	94,113	6	Liverpool	45,276
Georgia	92,746	7	Aston Villa	42,785
LSU	92,400	8	Chelsea	42,449
Florida	90,716	9	Everton	40,157
Florida State	88,300	10	Tottenham Hotspur	36,230

Because the following problems involve large numbers, you might want to use a calculator to check your work.

- How much larger is the seating capacity of Michigan's football field than Manchester United's soccer field?  
 \_\_\_\_\_  
 \_\_\_\_\_
- If you doubled the seating capacity of the fifth-largest Premier League club stadium, would it be as large as the fifth-largest college football field?  
 \_\_\_\_\_  
 \_\_\_\_\_
- If you tripled the seating capacity of Tottenham's soccer field, would it seat more or fewer people than Michigan's stadium?  
 \_\_\_\_\_  
 \_\_\_\_\_
- What is the average seating capacity of the ten U.S. college football fields shown?  
 \_\_\_\_\_  
 \_\_\_\_\_
- What is the average seating capacity of the ten largest Premier League soccer fields?  
 \_\_\_\_\_  
 \_\_\_\_\_

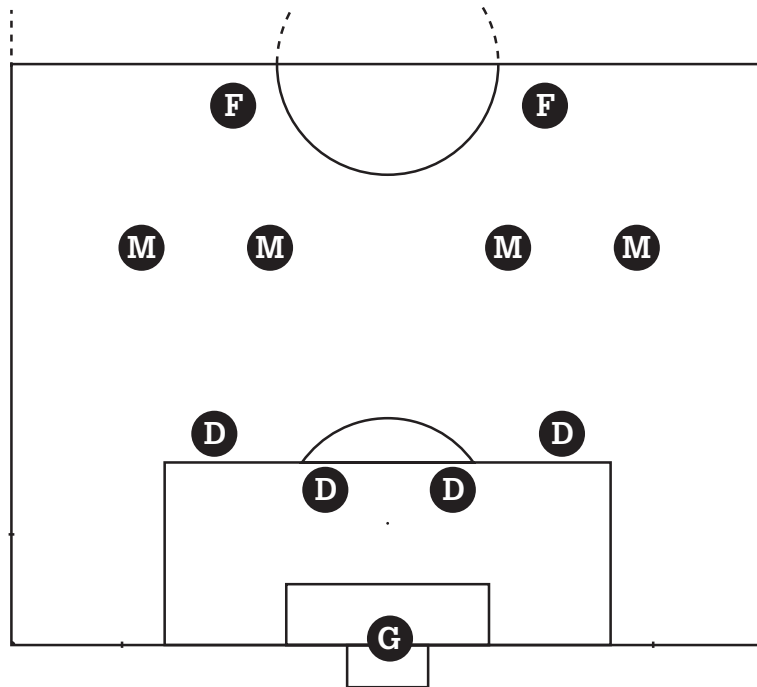
# World's Largest Soccer Stadiums

The table below shows the football stadiums that are currently considered the largest, but making any such list is subject to many factors. New, larger stadiums may be built. The planners of some events may count seats only, while others may count the number of people who might stand through an event. Propaganda can even be involved; a small nation may want to claim the largest stadium. We can do math with any of these numbers—correct or simply claimed!

Rank	Name	City	Nation	Seating
1	Rungrado May Day St.	Pyongyang	North Korea	150,000
2	Salt Lake Stadium	Kolkata	India	120,000
3	Estadio Azteca	Mexico City	Mexico	105,064
4	Azadi Stadium	Tehran	Iran	100,000
5	Camp Nou	Barcelona	Spain	99,345
6	Wembley Stadium	London	England	95,000
7	FNB Stadium	Johannesburg	South Africa	94,700
8	Rose Bowl	Pasadena	United States	93,420
9	Gelora Bung Karno St.	Jakarta	Indonesia	88,306
10	Bukit Jalil National St.	Kuala Lumpur	Maylasia	87,411

1. North Korea claims the largest crowd to see a soccer game—169,000 people in a stadium with a capacity of 150,000 people. How many more people attended that game than the stadium was supposed to hold (its capacity)?  
\_\_\_\_\_
2. Seating capacity can be different for different events or different sports. For example, anyone who has seen a Rose Bowl football game knows that the Rose Bowl can hold 103,000 people. So how many seats were not used when the United States placed Mexico in the 2011 Gold Cup in the Rose Bowl?  
\_\_\_\_\_
3. Stadiums can also be rebuilt or remodeled. England's Wembley Stadium was rebuilt from 2002 to 2007. If the old capacity was 90,000, how many more people can be seated in the new stadium?  
\_\_\_\_\_
4. Stadiums can also add seats. When a Super Bowl was played in the Dallas Cowboys' new stadium, added seats and standing room tickets enlarged seating capacity from 89,000 to 110,000. How many extra people were sold tickets for the Super Bowl? (**Trivia:** The stadium was new and some seats were added in poor locations. Fans complained!)  
\_\_\_\_\_

# Player Positions



**F** = Forwards (also called Strikers)  
**M** = Midfielders  
**D** = Defenders  
**G** = Goalie

**S**hown on this pitch is a 4–4–2 offensive formation: 2 forwards, 4 midfielders, and 4 defenders.

**Note:** Even though there are 11 players on the field, the goalie is not included in the different offensive sets. The goalie remains behind the other players, ready to defend the goal.

- Forwards generally play from the midfield to the other team's goal. Soccer fields vary; assume this field is 110 yards long. Forwards run from the opponents' goal line to about 10 yards into their half of the field, about 65 yards. During a game, the ball changes hands 40 times, and forwards have to run the full distance each time, so how many yards would they run in that game? How many feet?  


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- Midfielders usually run more than other players. They cover the area between the 18-yard boxes but often move forward to attack the opponents and drop back to their own goal to defend penalty kicks or corner kicks. On a field that is 110 yards long, they easily cover a distance 75 yards long. Again, if the ball changed hands 40 times, how many yards would a midfielder run during a game?  


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- Defenders never move too far forward; they cover from their own goal box to midfield, about 50 yards. How far would they run in a game when possession changed 40 times?  


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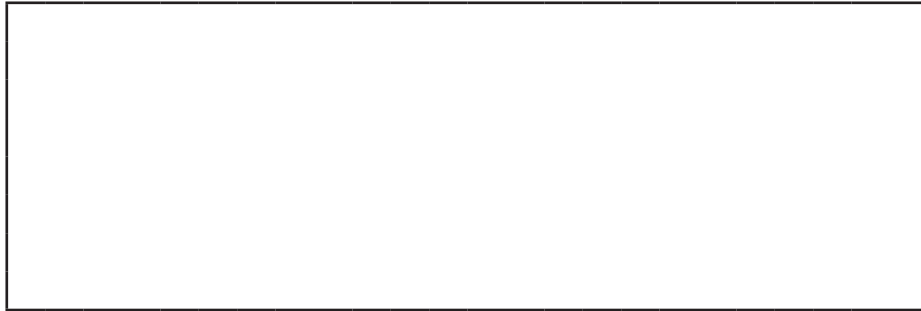
  


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# The Goal Area

The obvious point of soccer is to kick the ball into the goal and score points. So how big is the goal? (In other words, “How wide is the goal?” and “How high is the goal?”) The goal area is defined by the distance between the two side posts: they must be placed so that the distance between the inside edge of each post is exactly 24 feet. (And they must be painted white so they are easy to see!) The bar across the top of the goal posts must be placed so that its lower edge is exactly 8 feet above the ground.

The goal is 8 feet high and 24 feet long.



1. How many square feet are in the entire goal area?  
\_\_\_\_\_
2. The goal box cannot vary in size, nor can the goal area or the 18-yard box. So, if the goal area is 20 yards across, what fraction of the goal box is taken up by the goal itself? What percentage of the goal box area is taken up by the goal? (Remember to change the 20-yard measurement to feet when you make your computations.)  
\_\_\_\_\_  
\_\_\_\_\_
3. You already know that the length of the end line (which defines the width of the pitch) changes from stadium to stadium. What percentage of the end line does the goal take up in the following soccer stadiums?

Old Trafford (Manchester United)

End line: 68 yards \_\_\_\_\_ %

Brittania Stadium (Stoke City)

End line: 64 yards \_\_\_\_\_ %

Craven Cottage (Fulham)

End line: 65 yards \_\_\_\_\_ %

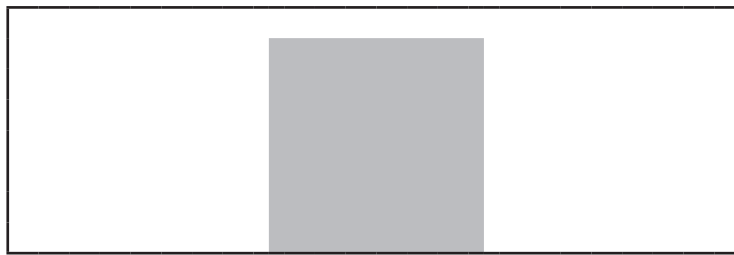
**Trivia:** Why is the goal box important? A goalie is always somewhat protected by the rules; he or she is even more protected in the goal box. For example, a striker cannot run into the goalie, knock him or her down, and get an easier shot into an unprotected goal.

# The Goalie's Position in the Goal Mouth

The offensive team must kick the ball past the goalie and into the goal area.

Consider the goalie's task. He or she is supposed to stop the ball from crossing the goal line. A shot that crosses the goal enters the net and is trapped in the net. But a score occurs as soon as the ball crosses the line of the goal mouth. The basic purpose of the net is to stop arguments about close calls. So a score occurs when a ball crosses the goal line; the goalie's job is to stop the ball. So how big is the goal area, and how difficult is it for the goalie to stop all shots?

A goalie 6 feet tall, standing with arms raised, reaching out, or with legs kicking, would cover an area about 7 feet high and 7 feet wide.



1. How many square feet of the goal does the average goalie cover by standing still and just waving his or her arms and kicking his or her feet? (On the previous page you calculated the area of the goal in square feet. Use that answer.)  
\_\_\_\_\_
2. What percentage of the total goal area does the goalie cover by standing in place? Or, stated differently, what percentage of the goal area does the goalie cover without moving?  
\_\_\_\_\_
3. What is the difference between the area of the goal and the area the goalie without moving? Figure the difference in square feet. This is the amount the goalie has to cover by moving.  
\_\_\_\_\_
4. In question 3, you figured the percentage of the goal area a goalie covers when standing still and waving arms or kicking feet. What percentage of the goal area is not covered when the goalie is simply standing in place and waving arms and kicking feet?  
\_\_\_\_\_
5. If the goalie is standing in the center of the goal mouth with feet spread about 2 feet apart, how far is it to the goal post on his or her left or right? (When standing in the goal's center, both answers should be the same!)  
\_\_\_\_\_

## Challenge Question

Would a tall goalkeeper be able to cover more area than a shorter goalkeeper? Why or why not? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# Player Awards



# The Golden Ball

The Ballon d'Or, or Golden Ball, award was traditionally given to Europe's "best" soccer player. Because the award began in Europe, the earliest winners were European players in Europe's leagues. In 1995 the rules were changed to make anyone who played for a European team eligible for the award. In 2007 the rules were changed again to make anyone eligible—regardless of where they played. Then, in 2010, two awards were merged: the Ballon d'Or award and the Fédération Internationale de Football Association's (FIFA) World Player of the Year award.

In 2001, the award was changed again. The Ballon d'Or award for women soccer players was started. Mia Hamm of the United States was the first woman to win the Ballon d'Or.

Vote reporting procedures and the number of voters changed over the years, thus making direct comparisons of results impossible. As changes were made, the number of voters was changed and the method of reporting the results changed. They are now given in percentages.

Year	Rank	Winner	Citizen	Team	Score
2011	1st	Lionel Messi	ARG	Barcelona	47.88%
	2nd	Cristiano Ronaldo	POR	Real Madrid	21.60%
	3rd	Xavi	ESP	Barcelona	9.23%
2010	1st	Lionel Messi	ARG	Barcelona	22.65%
	2nd	Xavi	ESP	Barcelona	17.36%
	3rd	Andrés Iniesta	ESP	Barcelona	16.48%
2009	1st	Lionel Messi	ARG	Barcelona	473
	2nd	Cristiano Ronaldo	POR	Real Madrid	233
	3rd	Xavi	ESP	Barcelona	170
2008	1st	Cristiano Ronaldo	POR	Manchester United	446
	2nd	Lionel Messi	ARG	Barcelona	281
	3rd	Fernando Torres	ESP	Liverpool	179
2007	1st	Kaka	BRA	Milan	444
	2nd	Cristiano Ronaldo	POR	Manchester United	277
	3rd	Lionel Messi	ARG	Barcelona	255
2006	1st	Fabio Cannavaro	ITA	Real Madrid	173
	2nd	Gianluigi	ITA	Juventus	124
	3rd	Thierry Henry	FRA	Arsenal	121
2005	1st	Ronaldinho	BRA	Barcelona	175
	2nd	Frank Lampard	ENG	Chelsea	148
	3rd	Thierry Henry	FRA	Arsenal	121

1. Look at 2010's players who received the most votes. What do you see?

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2. Does reporting votes as percentages of all votes cast help present results clearly?

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# The Golden Ball (continued)

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Because of the change in reporting voting results, it is impossible to make direct comparisons between players or years shown in the table. The following questions are interpretative in nature; you must examine the table and make inferences about results. There will be no simple numerical answer to any of the questions.

3. From the seven years of results shown in the chart, which player in which year won by the most votes? Explain your thinking.

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4. In all of the years, which two players were closest in number of votes cast for them? (Compare first and second or second and third places.) Explain your reasoning.

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5. In which year were the vote totals closest between all three places—first, second, and third? Why?

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6. Percentage figures are now used to report results. Percentages are ratios built on a consistent base, comparing all figures to 100. (Literally, it comes from the Latin *per century*, meaning “for each 100.”) Take the figures for 2011, round off each percentage to the nearest 10%, convert the percentage figures into fractions with 100 as the denominator, and then reduce each one to a common fraction. Then complete the sentences.

Messi received about \_\_\_\_\_ out of \_\_\_\_\_ votes.

Ronaldo received about \_\_\_\_\_ out of \_\_\_\_\_ votes.

Xavi received about \_\_\_\_\_ out of \_\_\_\_\_ votes.

# The Golden Boot

The top scorers in a league earn an award called the Golden Boot. The following table shows the leading goal scorers for the first 19 seasons of competition in the Barclay's Premier League. Complete this table to find the Average Goals per Game for each of the players. Then use that information to answer the questions.

Season	Team Games	Top Scorer	Goals Scored	Goals per Team Game
1992–1993	42	Teddy Sheringham	22	
1993–1994	42	Andy Cole	34	
1994–1995	42	Alan Shearer	34	
1995–1996	38	Alan Shearer	31	
1996–1997	38	Alan Shearer	25	
1997–1998	38	Dion Dublin Michael Owen Chris Sutton	18	
1998–1999	38	Jimmy Floyd Hasselbaink Michael Owen Dwight York	18	
1999–2000	38	Kevin Phillips	30	
2000–2001	38	Jimmy Floyd Hasselbaink	23	
2001–2002	38	Thierry Henry	24	
2002–2003	38	Ruud van Nistelrooy	22	
2003–2004	38	Thierry Henry	30	
2004–2005	38	Thierry Henry	25	
2005–2006	38	Thierry Henry	27	
2006–2007	38	Didier Drogba	20	
2007–2008	38	Cristiano Ronaldo	31	
2008–2009	38	Nicolas Anelka	19	
2009–2010	38	Didier Drogba	29	
2010–2011	38	Dimitar Berbatov Carlos Tévez	20	

When presented with a table of information, the analysis of that information can be as important as the information itself. So examine the table above, and then, find the information requested for each question. Finally, provide an explanation of the meaning of that number (or numbers).

1. What was the maximum number of goals scored by the Golden Boot winner? (Include the name of the winner and the season.)  
\_\_\_\_\_
2. What was the minimum number of goals scored by the Golden Boot winner? (Include the name of the winner and the season.)  
\_\_\_\_\_

# The Golden Boot (continued)

3. Is it fair to compare Alan Shearer's goals scored in the 1994–1995 season to his goal total in the 1995–1996 season? Why or why not?

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4. Is it fair to compare Thierry Henry's goals scored in the 2003–2004 season to his goal total in the 2004–2005 season? Why or why not?

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5. What was the maximum number of goals scored per team game by the Golden Boot winner? (Include the name of the winner and the season.)

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6. What was the minimum number of goals scored per team game by the Golden Boot winner? (Include the name of the winner and the season.)

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7. Is it fair to compare Alan Shearer's goals scored in the 1994–1995 season to his goal total in the 1995–1996 season using the Goals per Team Game statistic? Why or why not?

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8. What other factors might affect the goal totals of the Golden Boot winners?

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9. What has been the trend in the number of goals scored by the Golden Boot winners over the last six years shown on the table?

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## Challenge Question

Why do you think that the three seasons when the Golden Boot was shared between multiple players were three of the four years with the lowest number of goals scored by the winners?

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# Hat-Tricks

**W**hen a soccer player scores three goals in a single game, it is called a “hat-trick.” (This same term is used in other sports. Do you know which ones?) A hat-trick is a rare event, and scoring one is often the highlight of a player’s season or even his or her career. The following table shows all 17 players in the Premier League who scored hat-tricks during the 2010–2011 season. The table includes two games in which a player scored more than three goals. Answer the following questions using the information from the table.

Player	Goals	Team	Score	Opponent
Didier Drogba	3	Chelsea	6–0	West Bromwich Albion
Theo Walcott	3	Arsenal	6–0	Blackpool
Andy Carroll	3	Newcastle United	6–0	Aston Villa
Dimitar Berbatov	3	Manchester United	3–2	Liverpool
Kevin Nolan	3	Newcastle United	5–1	Sunderland
Dimitar Berbatov	5	Manchester United	7–1	Blackburn Rovers
Mario Balotelli	3	Manchester City	4–0	Aston Villa
Leon Best	3	Newcastle United	5–0	West Ham United
Dimitar Berbatov	3	Manchester United	5–0	Birmingham City
Robin van Persie	3	Arsenal	3–0	Wigan Athletic
Carlos Tévez	3	Manchester City	3–0	West Bromwich Albion
Louis Saha	4	Everton	5–3	Blackpool
Dirk Kuyt	3	Liverpool	3–1	Manchester United
Wayne Rooney	3	Manchester United	4–2	West Ham United
Maxi Rodríguez	3	Liverpool	5–0	Birmingham City
Maxi Rodríguez	3	Liverpool	5–2	Fulham
Somen Tchoyi	3	West Bromwich Albion	3–3	Newcastle United

- Which team scored the most hat-tricks during the 2010–2011 season?  
\_\_\_\_\_
- Which team scored the most hat-tricks without giving up a hat-trick?  
\_\_\_\_\_
- Did every team with a player who scored a hat-trick win its game?  
\_\_\_\_\_
- Which team(s) gave up the most hat tricks?  
\_\_\_\_\_
- Which player scored the most hat-tricks?  
\_\_\_\_\_
- Which team had the most (different) players who scored hat-tricks?  
\_\_\_\_\_
- During the 2010–2011 season, there were 380 games played in the Premier League. In what percentage of the games were hat-tricks scored?  
\_\_\_\_\_

# Golden Boot Top Scorers

In the 2010–2011 season of the Barclay’s Premier League, two players tied for the Golden Boot award by scoring 20 goals each. They were Dimitar Berbatov of Manchester United and Carlos Tévez of Manchester City. It is interesting to note that these high-scoring players had different patterns of scoring goals during the 38-game season. Use the information on this page as well as the table on the previous page to answer the following questions.

1. How many goals did Dimitar Berbatov score in his hat-trick games?

\_\_\_\_\_

2. What fraction of his season’s goals did Berbatov score in hat-trick games?

\_\_\_\_\_

3. What percentage of his season’s goals did Berbatov score in hat-trick games?

\_\_\_\_\_

4. What fraction of his season’s goals did Berbatov score in his other games?

\_\_\_\_\_

5. What percentage of his season’s goals did Berbatov score in his other games?

\_\_\_\_\_

6. How many goals did Carlos Tévez score in his hat-trick games?

\_\_\_\_\_

7. What fraction of his season’s goals did Tévez score in hat-trick games?

\_\_\_\_\_

8. What percentage of his season’s goals did Tévez score in hat-trick games?

\_\_\_\_\_

9. What fraction of his season’s goals did Tévez score in his other games?

\_\_\_\_\_

10. What percentage of his season’s goals did Tévez score in his other games?

\_\_\_\_\_

11. Which player, Berbatov or Tévez, do you think was a more valuable goal scorer for his team?

\_\_\_\_\_

Why? \_\_\_\_\_

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\_\_\_\_\_





# ***Famous Players***



# Lionel Messi

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Lionel Messi is one of the top players in the world today; many regard him as the best player at this time. In 2009 he won both the Ballon d'Or and FIFA Player of the Year Award, and he won the combined award, the FIFA Ballon d'Or award, in both 2010 and 2011, which is given to the "world's best soccer player." Messi was born in Argentina and captains Argentina's national team, but he plays professionally for Barcelona in Spain's La Liga.

1. Messi was born in Rosario, Argentina, on June 24, 1987. How old is he today?

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2. Messi is not a big man. He stands just over 5 feet 6 inches tall. What is his height in inches?

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3. The reason Messi plays for Barcelona is related to his height. At the age of 11, doctors found that he had a human growth hormone deficiency. The medicine he needed was expensive; it cost \$900 each month. Barcelona saw his potential, and they were willing to pay for his medicine if he moved to Spain. From 2000 to 2003, he played for a youth team sponsored by Barcelona. If he played 48 months during that time and took the medicine every month, how much did Barcelona pay for the medication that their future star needed?

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4. By early 2012, Messi had 201 appearances, or apps, for Barcelona's professional team and 67 appearances for Argentina's national team (apps is used in statistical charts for "appearances"—games in which a player actually appeared, or played, in a match). How many combined apps does he have in major or international league competitions?

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5. In those appearances, Messi scored 147 goals for Barcelona and 22 goals for Argentina. How many total goals did he score for those two teams?

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6. Messi is a forward, so he is expected to score goals. During the 2012 season, Messi had 48 goals, including 12 in the Champions League. What fraction of his goals came in Champions League games?

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**Trivia:** Messi had the greatest scoring night ever in a Champions League game when Barcelona defeated the Bayer Leverkusen team from Germany, 7–1, to advance to the 2012 Champions League quarterfinals. He scored 5 goals during that game, the first player to score 5 goals in one Champions League game.

# Landon Donovan

Landon Donovan has played soccer for U.S. Men's National Teams since 1998. The following chart shows his career stats with different U.S. teams.

Year	Team	Caps	Goals
1998–1999	U.S. Under 17 Team	41	35
2001	U.S. Under 20 Team	4	0
2000	U.S. Under 23 Team	15	9
2000–	U.S. National Team	138	46

Data correct as of September 2, 2011.

- At the time this table was updated in 2011, how many years had Landon Donovan played for U.S. age-group teams and/or the U.S. Men's National Team?  
\_\_\_\_\_
- Donovan has scored more goals for the U.S. Men's National Team than any other player. How many more goals has he scored for the Men's National Team than the total number of goals he scored while on all the other U.S. age-group teams on which he played?  
\_\_\_\_\_
- What is Landon's Average Goal per Game statistic when he played for the U.S. Men's National Team?  
\_\_\_\_\_
- For much of his career, Donovan played for the Los Angeles Galaxy, one of the teams in the U.S. Major League Soccer League. He has scored 83 goals for the Galaxy during the 163 games he has played for that team. Assume that he never scored more than one goal per game; in what percentage of his team's games did he score? (By the way, that assumption is not correct. He has scored more than one goal in a game many times.)  
\_\_\_\_\_
- During 1999, Donovan attended the IMG Soccer Academy in Bradenton, Florida, as part of the U.S. Soccer training program. One day, after the soccer training activities for the day, Donovan decided to play a round of golf. During the golf round his foot was almost bitten off by an alligator! How many years ago did that happen?  
\_\_\_\_\_



# Clint Dempsey

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**C**lint Dempsey, who was born in Nacogdoches, Texas, on March 9, 1983, is another famous American soccer player. He presently plays for Tottenham in the Premier League and plays on the U.S. Men's National Team for international matches.

1. On January 7, 2012, Clint Dempsey became the first American player to score a hat-trick for a team in England's Premier League—and he did it twice in the same month. He scored 3 goals as Fulham beat Charlton Athletic in their Football Association (FA) Cup Third Round Game, when Fulham beat Charlton 4 to 0. Then, on January 21, he scored another hat-trick as Fulham beat Newcastle United, 5–2, in a regular-season Premier League game. How old was he when he accomplished this rare scoring event twice in the same month?  

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2. Dempsey appeared in 71 games for the New England Revolution between 2004 and 2006 in America's MLS soccer league. He signed to play with Fulham in England's Premier League in 2006 and, at the time of this book's publication, has played in 172 games for Fulham. What percentage of his total league games did he play for Fulham? What percentage did he play for New England?  

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3. During his career with the two teams, Dempsey scored 25 goals for New England and 43 goals for Fulham. What percentage of his goals in league games did he score for Fulham? What percentage did he score for New England?  

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4. As of December 5, 2011, Dempsey appeared in 82 international matches over 8 seasons. He scored 24 goals in those matches. What is his Average Goals per Season figure for his international career?  

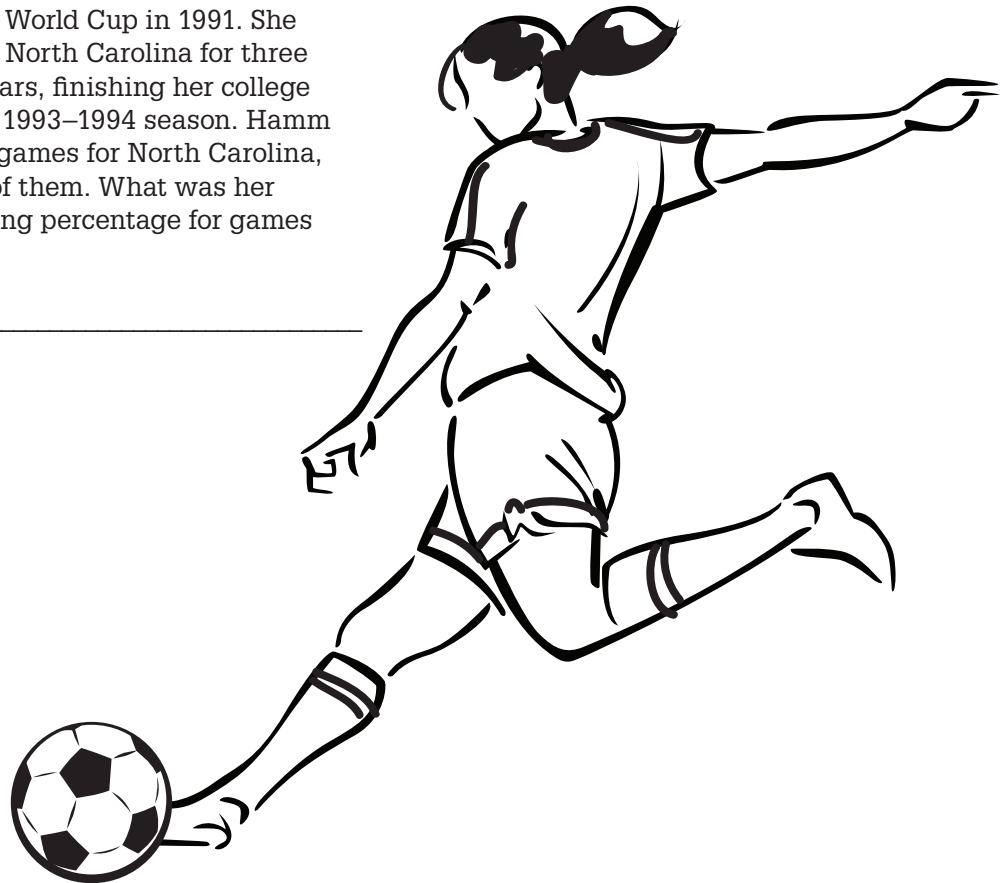
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5. At the time of this writing, Dempsey scored a total of 53 goals for Fulham, with 43 of those goals made during Premier League regular-season games. What percentage of his Fulham goals came in Premier League games? (You might want to look up Dempsey's record on the Internet to see how he helped the Fulham soccer club qualify for appearances in other competitions, such as the Union of European Football Associations [UEFA] Europa League.)  

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**M**ia Hamm stands as the all-time leader for the United States in terms of goals scored in international competitions. Mia began playing for the U.S. Women's National Team in 1987, and she concluded her career in 2004.

1. For how many years was Mia on the National Team?  
\_\_\_\_\_
2. Mia scored 158 goals in 275 appearances. (In other words, she played in 275 international matches and scored 158 goals in those matches.) What was her Average Number of Goals per Appearance?  
\_\_\_\_\_
3. In college, Mia played for the North Carolina Tar Heels. She entered North Carolina for the 1989–1990 season, but she took the 1991 season off to concentrate on playing for the U.S. Women's National Team that won the Women's World Cup in 1991. She went back to North Carolina for three additional years, finishing her college career in the 1993–1994 season. Hamm played in 95 games for North Carolina, winning 94 of them. What was her team's winning percentage for games she played?  
\_\_\_\_\_
4. Mia is the second most capped female player in soccer history, trailing only Kristine Lilly. Mia has appeared in 275 international matches; Kristine has appeared in 352. How many more caps does Lilly have?  
\_\_\_\_\_
5. Mia was inducted into the National Soccer Hall of Fame in the first year she was eligible, 2007. She received 137 votes out of the 141 cast. What percentage of the voters voted to include her in the Hall of Fame?  
\_\_\_\_\_



# Abby Wambach

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In the United States, interest in soccer has grown immensely in the last 20 years. Much of the interest was sparked by the famous American women's teams of the past two decades—1990 to 2000 and 2000 to 2010. The women on those teams have become household names and heroes to many young soccer players. One of the top players on those teams was Abby Wambach.

1. Abby was born on June 2, 1980, the youngest of seven children. How old is Abby today?  

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2. When Abby began to play youth soccer on her girl's team, she had a problem. As the youngest child in her family, she often played soccer with her older brothers and sisters. So in the first three games of a girl's youth soccer league, Abby scored 27 goals. What was her Average Goals per Game figure for those first three games? (**Trivia:** After that, because she was so good, she had to go play with the boys!)  

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3. Abby played soccer for the University of Florida, helping them win the NCAA championship during her freshman year. She still holds numerous Florida Gator records, including most goals scored (96) and most game-winning goals (24). How many of Abby's goals were not game-winning goals?  

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4. By 2012, Abby was the second-highest goal scorer for the U.S. Women's National Team. She scored 134 goals in 176 games. What would her Average Goals per Game figure be? (**Trivia:** Early in her career, Abby scored 66 goals in 84 international matches. This was the highest number of goals scored in the fewest games at the beginning of a career since Michelle Akers began her career.)  

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5. Abby is second only to Mia Hamm in goals scored during international matches. Mia scored 158 goals in 275 appearances. During their time on the U.S. Women's National Team, how many international-match goals did Abby and Mia score, combined?  

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# Homare Sawa

In 2011 Japan won their first ever Women's World Cup by beating the United States 3–1 in a penalty kick shootout. The star of the Japanese team was Homare Sawa; she was also one of the oldest players to appear in the World Cup.

1. Sawa was born in Tokyo on September 6, 1978. If the World Cup championship game was played on July 17, 2011, how old was she when the game was played?  
\_\_\_\_\_
2. Sawa has played on the Japanese National Team since 1993. How many years of experience in international play did she have when Japan won the World Cup in 2011?  
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3. Even though she is a midfielder (a position whose first duties are not to score), Sawa has 176 caps for the Japanese National Team as of the end of 2011. In those games she has scored 80 goals. What is her Goals per Game ratio?  
\_\_\_\_\_
4. Sawa is only 5 feet 5 inches tall and weighs about 121 pounds. Many of the people she plays against are much larger, but Sawa can hold her own. She often is among team or league leaders in fouls taken. If she played against a midfielder who was 6 feet 1 inch tall and weighed 165 pounds, how much shorter and lighter would Sawa be than that opponent?  
\_\_\_\_\_
5. In 2011 Sawa was selected as FIFA's female player of the year. She was given FIFA's Ballon d'Or award for women on January 9, 2012. She played her first professional game in 1993. How old was she when she played that game? How many years had she played professionally before being awarded the Ballon d'Or?  
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# Diego Maradona

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One of the most famous soccer players in the world is probably best remembered for one play in one game. Diego Maradona is one of Argentina's greatest players. In 1986, Argentina defeated England 2–1 on their way to beating West Germany to win the World Cup. His first goal came as the result of hitting the ball with his hand—which the referee did not see. This goal has been credited to “the hand of God.” But his second goal in that game has been called “The Goal of the Century!” Maradona dribbled the ball through and by six English defenders while on a 60-meter dash to score that goal. Maradona was also voted the “Player of the Century” in 2000, defeating such notable players as Pelé and Germany’s Franz Beckenbauer.

1. Maradona—as he is usually referred to—began his adult (senior) playing career in 1976 and played through 1997. He first played for Argentina’s national team in 1977 and finally left that team in 1994. How many years did he play senior-level soccer, and how many years did he play for the national team?

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4. Maradona played for two years at Barcelona in Spain, making 36 appearances and scoring 22 goals. He also played 7 years for Napoli in Italy, making 188 appearances and scoring 81 goals. How many appearances and goals did he have in the two leagues combined?

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2. While playing professionally, Maradona had 492 appearances for teams in Argentina and Spain and scored 258 goals in those games. What was his Average Goals per Game statistic?

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3. While playing for his national team, Maradona had 91 appearances and scored 34 goals. What was his Average Goals per Game statistic for Argentina’s national team? Was that figure higher or lower than the figure for senior level professional games?

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**T**he most famous soccer player in the world is Edson Arantes do Nascimento, a star player from Brazil. Virtually every soccer fan in the world knows and recognizes this international star. However, it is probably true that you (and almost every other soccer fan in the world) have never heard of a player named Edson Arantes do Nascimento.

Why? In many parts of South America, especially Brazil, the most famous players are known by a one-word name. So while few soccer fans know a player named Edson, everyone knows the famous Brazilian “Pelé,” who, according to the International Football Hall of Fame, was “a member of those magical Brazilian squads that won soccer’s greatest prize in 1958, 1962, and 1970.”

1. Pelé was born on October 23, 1940, in Três Corações, Brazil. How old is he today?

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2. Pelé scored 1,283 first-class goals. (These are goals scored in international competition between national teams, during international matches between top league teams, or goals scored in a country’s premier league games.) If he scored those goals over 18 seasons, what was his Average Goals per Season number?

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3. In his career, Pelé scored 1,283 goals in 1,363 games. Use your calculator to compute his Average Goals per Game figure. (**Note:** It will be a decimal number less than 1, but it will be close to 1. Very few players have an Average Goals per Game statistic as high as Pelé’s!)

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4. Pelé had 92 international caps, and he scored 77 goals in those games. If you assume that he scored one goal per game (an incorrect assumption, by the way), then in what percentage of his international games did Pelé score a goal? Use the numerals given here to obtain an answer.

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### Challenge Problem

Pelé often scored more than one goal in an international game; he even scored a hat-trick in an international game. Use the Internet to find out in how many of his 92 international games he actually scored a goal. Or, find the number of international games in which he scored more than one goal.

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# Marta

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It is not only the Brazilian male soccer stars that use one name as their professional identity; Brazilian women soccer stars also often go by one name. One of Brazil's best women soccer players (a sport that is called football in her country), Marta Vieira da Silva, goes simply by the name Marta.

1. Marta was born on February 19, 1986. How old is she today?

\_\_\_\_\_

2. Marta has played for the Brazilian women's national football team since 2002. How old was she when she first joined the team?

\_\_\_\_\_

3. Despite being a relatively young player (as of the time this book was published), Marta had already scored 80 goals in only 72 international matches. What is her Average Goals per Game figure?

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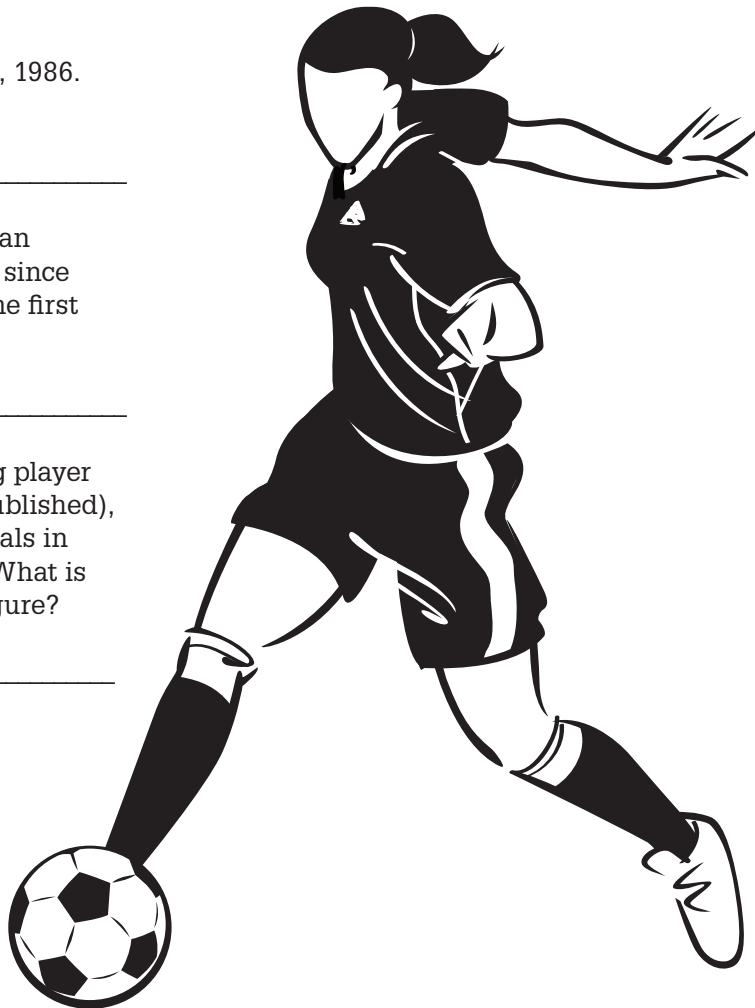
## Challenge Problems

When play for the 2007 Women's World Cup was completed, Marta was given both the Golden Boot (highest scorer) and the Golden Ball (MVP) awards. Look on the Internet to see if any other female player has won both awards during the same season. Has any male player ever done it?

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Marta is a fiery player. During World Cup play in 2011, local fans or fans of the opposing team often jeered at Marta. Reporters thought that the negative fan reaction concerned Marta's unsportsmanlike play. Look for stories about Marta's play, especially her problems with American goalie Hope Solo during the 2008 Olympics.

The problem with using a single name to describe a famous football player is obvious. Someone with the same name may later become a star. Such is the fate of the famous Brazilian star Ronaldo. From 1993 to 2009, Ronaldo played for premier soccer teams in Brazil, the Netherlands, Italy, and Spain. He was a major star over most of those years. But in recent years, Cristiano Ronaldo of Portugal has risen to be a soccer star. Keeping track of Ronaldo's records has become more difficult since Cristiano Ronaldo arrived on the soccer scene.

The following chart shows the final goal scoring results for Ronaldo over the 17 seasons he played in the top leagues in four different countries.

Country	Appearances	Goals
Brazil	73	61
Netherlands	57	55
Spain	226	151
Italy	119	68

- Appearances (Apps) is the term used to describe the number of soccer matches (games) in which Ronaldo actually played. (In other words, he appeared on the field; he was not just a substitute on the bench who did not get into the game.) How many total appearances did Ronaldo have in premier league soccer matches?  
\_\_\_\_\_
- How many goals, in total, did Ronaldo score in league games in the four different countries?  
\_\_\_\_\_
- What is the difference between the number of Ronaldo's appearances and the number of goals he scored? (Remember: This does not ask for the number of games in which he did not score. He played many games in which he scored more than one goal!)  
\_\_\_\_\_

- How many more goals did Ronaldo score in Spain than in Brazil? How many more games did Ronaldo play in Spain than in Brazil?  
\_\_\_\_\_  
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### Challenge Question

In which country's league did Ronaldo achieve his highest Goals per Game figure? Do you think that in this league Ronaldo had the greatest impact on his team? Why or why not?

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# Shining Moments

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**A**s in all sports, the game of soccer is defined by sportsmanship and performing to the best of one's abilities.

1. **The Sick Soccer Player Does Her Best:**

Michelle Akers was a leader on the first great American women's soccer teams. She played on the U.S. Women's National Team from 1985 to 2000. In 1990 and 1991 Michelle was named by the United States Soccer Foundation as the Female Soccer Player of the Year. But at the end of 1991, she began to feel tired and lethargic. She did not get better; in fact, she collapsed during a game in a later season. Finally, she was diagnosed with Chronic Fatigue Immune Dysfunction Syndrome (CFIDS). One of the greatest moments of women's soccer was the emotional scene of Michelle trying to play, even though she could hardly stand up on the pitch. Her effort was truly heroic. In her career, Michelle scored 105 goals in international matches; she scored 51 of those goals after she was diagnosed with CFIDS. What percentage of Michelle's goals came after her health problems began?

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2. **The Soccer Goalie Shows His**

**Sportsmanship:** During the Premier League's 2011–2012 season, Tim Howard—a U.S. soccer star playing for Everton—became the fourth Premier League goalie to score a goal in a game. Howard cleared a ball that rolled into his goal area by running forward and kicking the ball toward the Bolton goal. But the game was played in gale-force winds; winds of 50 miles an hour helped Howard's kick on its journey to the Bolton goal. With a helping wind, the ball traveled further than anyone expected. (Watch the video replay on the Internet; you will see four players—two Bolton defenders and two Everton strikers—chasing the ball as hard as they can. But the wind carried the ball past them all.) Adam Bogdan, the Bolton goalie, ran

forward to catch the ball, but he couldn't get there. A huge bounce, with wind still helping, took the ball over Bogdan's outstretched arms. The second bounce landed just inside the goal, and Howard was given credit for a 102-yard goal. Howard refused to celebrate. When he saw the ball was going to go into the net, he turned his back and returned to his own goal. Later, he said, "It was cruel." He blamed his success on the wind. "You saw the back four (players) and the keepers not being able to believe balls all night, and at the back one wrong step and it can be a nightmare." If Howard was given credit for a 102-yard goal kick, and the first bounce (over the defenders, in front of the goalie) was 28 yards from the Bolton Goal, how far did Howard's wind-aided kick travel in the air?

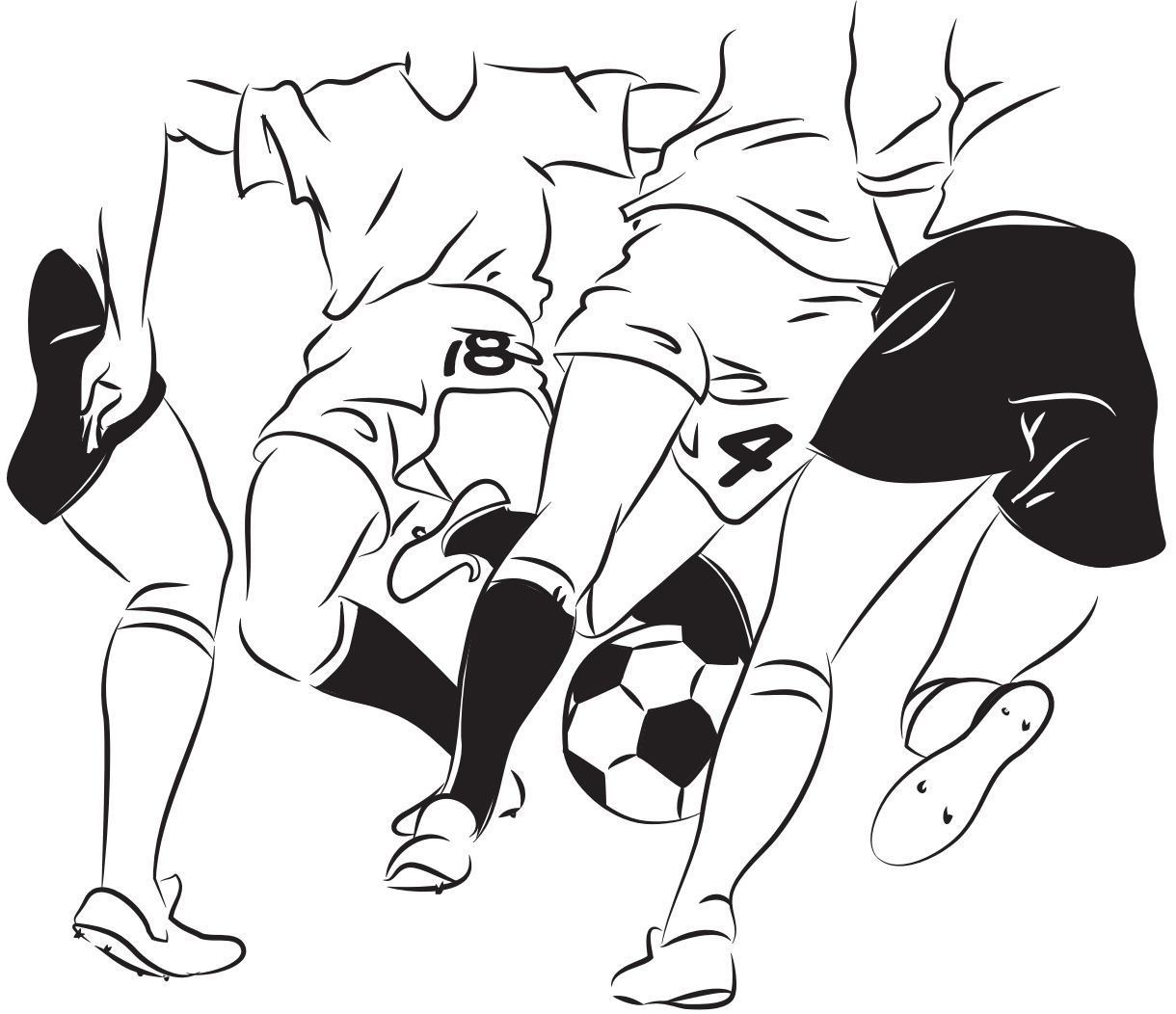
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3. **Soccer Stars Show Their Respect for**

**Each Other:** In one of soccer's most famous games, England played Brazil in the 1970 World Cup. Combined, the two teams had won the three previous World Cups. During the game, the English goalie, Gordon Banks, made what has been called the "Save of the Century" to deflect a Pelé header over the bar. England defended well, but Brazil still won the game 1–0. The defining moment came after the game. Pelé and England's greatest defender, Bobby Moore, had played against each other all night. At the end, they stood in the middle of the field and traded their team jerseys with each other. It was a simple act between two great players, an act meant to recognize the other's greatness. How many years has it been since these two great stars traded shirts to honor each other?

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# League Play



# Barclay's Premier League Goals per Game

In the Premier League's first three seasons, 22 teams were part of the league. Each Premier League team played every other team twice, once at home and once on the road. This resulted in 462 games per season for the first three years of the league.

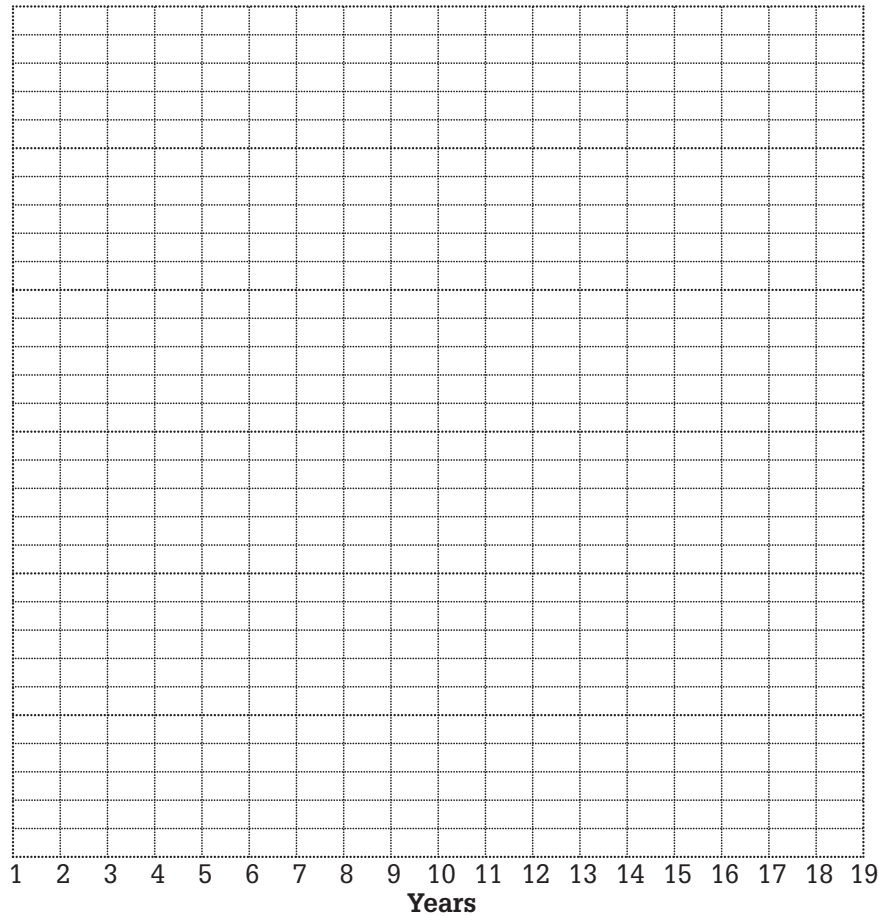
After the 1994–1995 season, league membership was reduced to 20 teams to conform with FIFA rules. The same scheduling format—a home game and an away game between all teams—continued. This meant the league's season was reduced to 380 games after 1995. What was the reason for the change? FIFA was concerned that top teams in Europe scheduled more than 60 games a year. To protect players from overwork and injury, guidelines limiting the number of league games played were instituted.

During its first 19 years, the Barclay's Premier League teams have scored 19,525 goals. The following table shows the goals scored in every year of the league's existence. Find the mean number of goals per game for each season listed in the table. Round your answers to two decimal places. (This series of division problems has three-digit divisors; you might wish to use a calculator to compute the answers. Remember to round each answer to two decimal places.)

Year	Season	League Teams	League Games	League Goals Scored	Mean Goals per Game
1	1992–1993	22	462	1,222	
2	1993–1994	22	462	1,195	
3	1994–1995	22	462	1,195	
4	1995–1996	20	380	988	
5	1996–1997	20	380	970	
6	1997–1998	20	380	1,019	
7	1998–1999	20	380	963	
8	1999–2000	20	380	1,060	
9	2000–2001	20	380	992	
10	2001–2002	20	380	1,000	
11	2002–2003	20	380	1,000	
12	2003–2004	20	380	1,012	
13	2004–2005	20	380	974	
14	2005–2006	20	380	944	
15	2006–2007	20	380	931	
16	2007–2008	20	380	1,002	
17	2008–2009	20	380	942	
18	2009–2010	20	380	1,053	
19	2010–2011	20	380	1,063	

# Graphing the Premier League's Goals per Game

Use the graph below to plot the Mean Goals per Game statistics from the previous page. Then answer the questions below.



1. Which season had the highest mean goals per game? \_\_\_\_\_
2. Which season had the lowest mean goals per game? \_\_\_\_\_
3. Which two years saw the biggest change in mean goals per game? \_\_\_\_\_
4. Which years saw the smallest change in mean goals per game? \_\_\_\_\_
5. Which two seasons saw the biggest increase in scoring? \_\_\_\_\_
6. Which two seasons saw the biggest decrease in scoring? \_\_\_\_\_
7. In the last several years on this graph, has the number of goals gone up or down?  
\_\_\_\_\_

### Challenge Question

Is Mean Goals per Game a fair comparison between the years when the Premier League had 22 teams and the years when it had 20 teams? Why or why not?

\_\_\_\_\_  
\_\_\_\_\_

# Germany's Bundesliga

The Bundesliga is the highest-level soccer league in Germany. Below are the final standings with scoring information for the 2010–2011 season of the Bundesliga.

Team	Goals For	Goals Against	Goal Differential
Borussia Dortmund	67	22	
Bayer Leverkusen	64	44	
Bayern Munich	81	40	
Hannover 96	49	45	
FSV Mainz 05	52	39	
FC Nuremberg	47	45	
FC Kaiserslautern	48	51	
Hamburger SV	46	52	
SC Freiburg	41	50	
FC Koln	47	62	
1899 Hoffenheim	50	50	
VfB Stuttgart	60	59	
Werder Bremen	47	61	
Schalke 04	38	44	
VfL Wolfsburg	43	48	
Borussia Monchengladbach	48	65	
Eintracht Frankfurt	31	49	
FC St. Pauli	35	68	

Some teams don't score many goals but are successful because they play strong defense. Other teams have weak defenses but win with strong offenses that score goals. One way to compare teams is to examine Goal Differential. Goal Differential is the difference between the Goals Scored and the Goals Allowed. It is found by subtracting the Goals Allowed from Goals Scored. The Goal Differential may be positive or negative. A positive Goal Differential indicates that the team scores more goals than it allows. A negative Goal Differential shows that a team gives up more goals than it scores. A team that scored exactly as many goals as it allowed would have a Goal Differential of 0.

1. Calculate the Goal Differential for each Bundesliga team in the 2010–2011 season.

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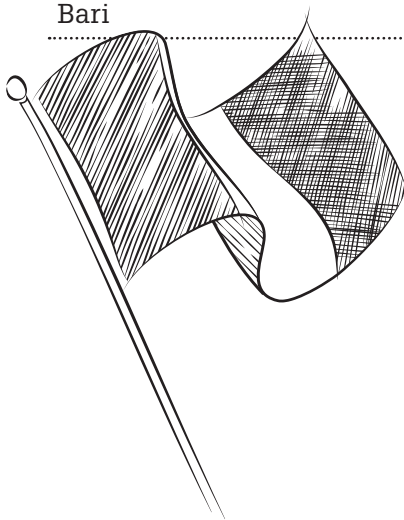
2. Do the teams with positive Goal Differentials usually finish near the top of the standings?

\_\_\_\_\_

# Italian Serie A

The Serie A is the highest-level soccer league in Italy. Below is the final scoring information for Serie A teams in the 2010–2011 season.

Team	Goals For	Goals Against	Goal Differential
Milan	65		41
Internazionale	69		27
Mapoli	59		20
Udinese	65		22
Lazio	55		16
Roma	59		7
Juventus	57		10
Palermo	58		-5
Fiorentina	49		5
Genoa	45		-2
Chievo	38		-2
Parma	39		-8
Catania	40		-12
Cagliari	44		-7
Cesena	38		-12
Bologna	35		-17
Lecce	46		-20
Sampdoria	33		-16
Brescia	34		-18
Bari	27		-29



Using the Goal Differential and the Goals For statistics, calculate the Goals Against for each team in the Italian Serie A for the 2010–2011 season.

# Spain's La Liga

La Liga is the highest-level soccer league in Spain. Below is the final scoring information for La Liga teams in the 2010–2011 season.

Team	Goals For	Goals Against	Goal Differential
Barcelona		21	74
Real Madrid		33	69
Valencia		44	20
Villarreal		44	10
Sevilla		61	1
Athletic Bilbao		55	4
Atlético Madrid		53	9
Espanyol		55	-9
Osasuna		46	-1
Sporting de Gijon		42	-7
Malaga		68	-14
Racing Santander		56	-15
Zaragoza		53	-13
Levante		52	-11
Real Sociedad		66	-17
Getafe		60	-11
Mallorca		56	-15
Deportivo La Coruna		47	-16
Hercules		60	-24
Almeria		70	-34

Using the Goal Differential and the Goals Against statistics, calculate the Goals For for each team in La Liga for the 2010–2011 season.

# Barclay's Premier League

The Barclay's Premier League is the highest-level soccer league in England. Below is the final scoring information for the 2010–2011 season of the Premier League.

Team	Goals For	Goals Against	Goal Differential
Manchester United	78		41
Chelsea	69	33	
Manchester City		33	27
Arsenal	72		29
Tottenham Hotspur		46	9
Liverpool	59	44	
Everton	51	45	
Fulham	49		6
Aston Villa		59	-11
Sunderland	45		-11
West Bromwich Albion		71	-15
Newcastle United	56	57	
Stoke City	46		-2
Bolton Wanderers	52	56	
Blackburn Rovers		69	-13
Wigan Athletic	40		-21
Wolverhampton Wanderers	46	66	
Birmingham City		58	-21
Blackpool	55		-23
West Ham United		70	-27

Fill in the missing cells in the table.

# Major League Soccer in the United States, Western Division

Soccer in the United States is often played in larger stadiums than in European cities, but American clubs travel much further to play each other than European teams do. Consider the Premier League: several teams call London home, such as Chelsea, Tottenham, and Arsenal, and all play their home games near London, so travel is just a trip across town. That is not true for MLS teams. Trips are longer; Western Conference trips usually involve air travel:

	Chivas USA	Colorado Rapids	FC Dallas	LA Galaxy	Portland Timbers	Real Salt Lake	San Jose Earthquakes	Seattle Sounders FC	Vancouver Whitecaps FC
Chivas USA		845	1234	0	840	582	318	973	1094
Colorado Rapids			642	845	985	374	936	1021	1107
FC Dallas				1234	1615	977	1442	1661	1748
LA Galaxy					840	582	318	973	1094
Portland Timbers						643	566	145	261
Real Salt Lake							584	709	812
San Jose Earthquakes								709	827
Seattle Sounders FC									122
Vancouver Whitecaps FC									

1. What is the difference in miles between the longest flight (Dallas to Vancouver) and the shortest (Vancouver to Seattle)? (This excludes Chivas USA and LA Galaxy, who play their home games in the same stadium in Carson, California.)  


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2. Because Colorado has to make two trips to Los Angeles, one to play Chivas and one to play the Galaxy, how many miles will they travel while going to and from Los Angeles? (Remember that both trips will be round trips; they must fly from Colorado to Los Angeles and then back to Colorado each time.)  


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3. There are two groups of “three teams each” that are located close to each other. (Portland–Seattle–Vancouver and San Jose–Chivas–LA Galaxy). If each team makes one trip to the other’s home, which group has to travel the furthest to play their home and home series. (Hint: It takes six round trips to find the answer, but one trip is tricky!)

# Major League Soccer in the United States, Eastern Division

Teams in the Major League Soccer (MLS) Eastern Division don't travel quite as far as those in the Western Division do. Examine the following air mile chart showing distances between the eastern cities, and answer the questions below.

	Chicago Fire	Columbus Crew	D.C. United	Houston Dynamo	Montreal Impact	New England Revolution	New York Red Bulls	Philadelphia Union	Sporting Kansas City	Toronto FC
Chicago Fire		280	604	934	759	850	713	667	412	445
Columbus Crew			445	991	613	628	468	404	633	310
D.C. United				1,223	494	373	197	107	958	352
Houston Dynamo					1,610	1,589	1,413	1,328	651	1,302
Montreal Impact						266	335	407	1,170	318
New England Revolution							176	266	1,250	427
New York Red Bulls								90	1,099	336
Philadelphia Union									1,037	335
Sporting Kansas City										857
Toronto FC										

1. If each team travels just once to every other team's home field, then:

a. Which team has to travel the greatest number of miles?

\_\_\_\_\_

b. Which team has to travel the least number of miles?

\_\_\_\_\_

(Remember that each team must take 9 round trips.)

2. If D.C. United had to make three round trips to play Montreal (one regular-season trip and two trips for playoff games), how many total miles would the team travel?

\_\_\_\_\_

3. When New York plays Philadelphia, do you suppose the trip between the two teams would be quicker in a bus or by plane? Why?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. If Sporting Kansas City had a Tuesday game in New York and a Thursday game with D.C. United, they would probably fly from Kansas City to New York, from New York to Washington, and then from Washington back to Kansas City. How long would this trip be in air miles?

\_\_\_\_\_

# Mexican Primera Division

The European soccer season runs from August to May. Each team faces all other teams twice. The champion is the team earning the most points during the season. (**Note:** In standings, points are given for both wins and ties. Check the glossary for details.) But not all leagues use this system. In the United States, Major League Soccer's regular season sometimes has an "unbalanced" schedule, in which some teams are played more. MLS uses the regular season to determine which clubs will make the playoffs. The league champion is the winner of the playoffs.

The Mexican Primera Division has a different structure to its season. Instead of one long season, there are two "short" seasons. From August to December, the first season is called the *Apertura* (Opening). After the *Apertura*, there is an eight-team playoff to determine the *Apertura* champion. The *Clausura* (Closing) runs from January to May. The *Clausura* champion is the winner of the eight-team *Clausura* playoff. This system crowns two champions per year but sometimes leads to situations in which the most consistent club over the whole year does not win either championship. Following are the tables showing statistics for the *Apertura* and *Clausura* of the 2010–2011 soccer year.

## Apertura 2010

Team	Played	W	D	L	Pts.
Cruz Azul	17	12	3	2	39
Monterrey	17	9	5	3	32
Santos Laguna	17	9	3	5	30
América	17	7	6	4	27
San Luis	17	8	2	7	26
Jaguars	17	6	7	4	25
Pachuca	17	7	4	6	25
UNAM	17	7	4	6	25
UANL	17	6	6	5	24
Guadalajara	17	4	10	3	22
Toluca	17	5	7	5	22
Morelia	17	5	6	6	21
Puebla	17	5	4	8	19
Querétaro	17	5	4	8	19
Necaxa	17	4	4	9	16
Atlante	17	4	4	9	16
Estudiantes Tecos	17	4	3	10	15
Atlas	17	3	4	10	13

Apertura Champion: Monterrey

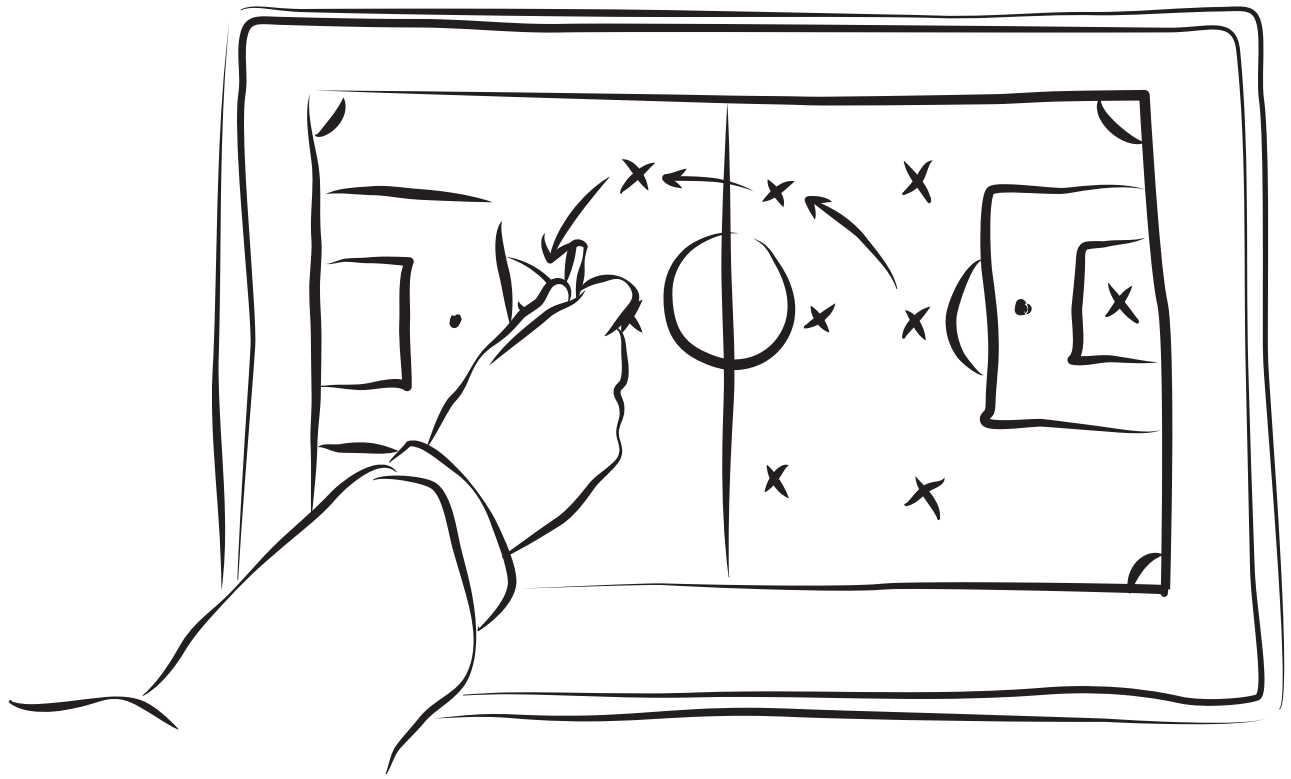
## Clausura 2011

Team	Played	W	D	L	Pts.
UANL	17	10	5	2	35
UNAM	17	10	5	2	35
Morelia	17	9	4	4	31
Atlante	17	8	3	6	27
Cruz Azul	17	7	5	5	26
América	17	8	2	7	26
Monterrey	17	7	5	5	26
Guadalajara	17	6	7	4	25
Santos Laguna	17	7	2	8	23
Atlas	17	6	5	6	23
San Luis	17	4	9	4	21
Toluca	17	5	6	6	21
Pachuca	17	4	6	7	18
Puebla	17	5	3	9	18
Estudiantes Tecos	17	4	5	8	17
Querétaro	17	4	4	9	16
Necaxa	17	3	6	8	15
Jaguars	17	4	2	11	14

Clausura Champion: UNAM

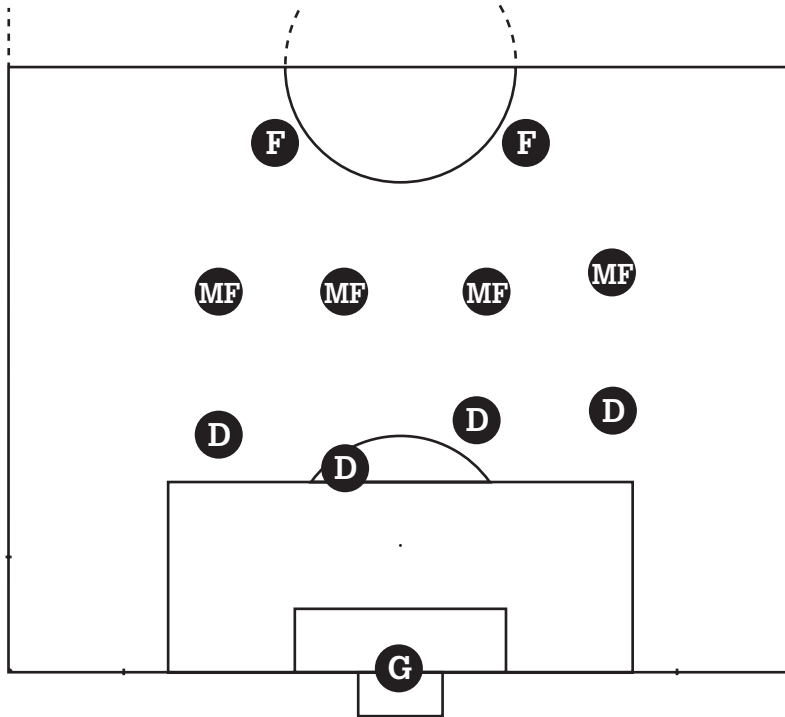
1. Was either the *Apertura* or *Clausura* champion the same team that finished at the top of its league table?  
\_\_\_\_\_
2. Find the total number of points for each team during the entire season.  
\_\_\_\_\_
3. Which team would have finished first if the Mexico's Primera Division used the European method to crown its champion?  
\_\_\_\_\_

# Soccer Formations



# Positioning the Players I

Following is a diagram of a basic 4–4–2 formation of players on a soccer team. There are 4 defenders, 4 midfielders, and 2 forwards. Note that the only players shown on the field are those on this team. They are attacking the goal shown at the top of the diagram; the goalie is defending the goal at the bottom of the diagram.



For these questions, *field players* describes all players on a team except the goalie.

1. In a 4–4–2 formation, what percentage of the team's field players are most involved in the offense?

\_\_\_\_\_

2. In a 4–4–2 formation, what percentage of the team's field players are most involved in defense?

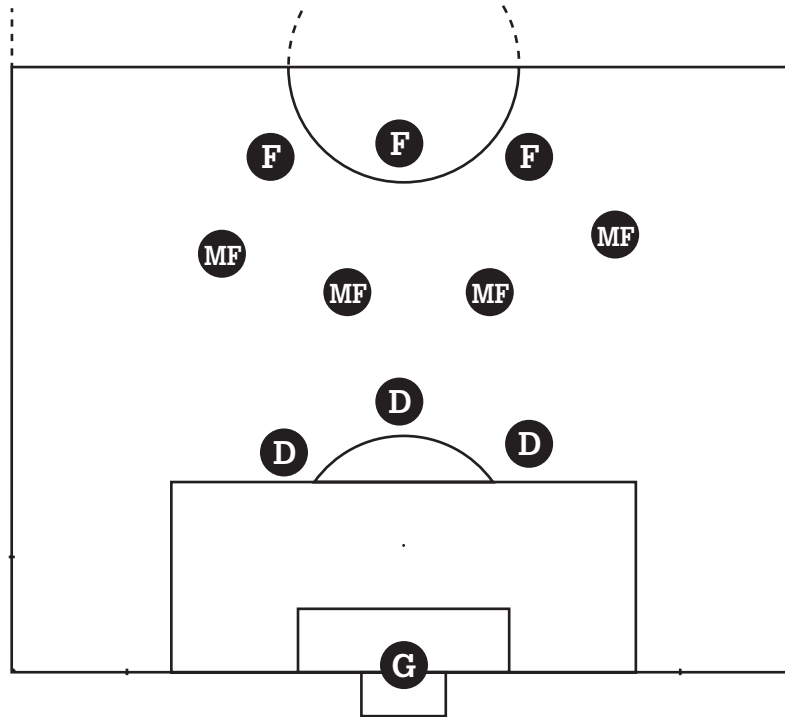
\_\_\_\_\_

3. What percentage of field players seem to divide their time more evenly between offense and defense?

\_\_\_\_\_

## Positioning the Players II

The following diagram shows a 3–4–3 formation. There are 3 defenders, 4 midfielders, and 3 forwards. Note that the only players shown on the field are those on this team. They are attacking the goal shown at the top of the diagram; the goalie is defending the goal at the bottom of the diagram.



For these questions, "field players" describes all players on a team except the goalie.

1. In a 3–4–3 formation, what percentage of the team's field players are most involved in the offense?

\_\_\_\_\_

2. In a 3–4–3 formation, what percentage of the team's field players are most involved in defense?

\_\_\_\_\_

3. What percentage of field players seem to divide their time more evenly between offense and defense?

\_\_\_\_\_

# Why Are They Needed?

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It isn't enough for a coach or manager to tell the field players that they are forwards, midfielders, or defenders. The team has formations so each player has a good idea of where his or her teammates are and what they will do in any situation. Players on the best teams know each other so well that they don't have to speak to make a great play.

A wide midfielder can make a long pass to the middle of the opponent's penalty box because he or she is confident that the forward teammates will be moving into position to head the ball toward the goal. Or, when a central defender gains possession, he or she can make a pass to a midfielder to start an attack. It is important for players to know where teammates will be and where they will go. That is why each team has formations.

Formations are numeric ways of telling players where they should be on the field, with the first number being the players who are furthest back (defenders) and the attacking players (forwards) represented by the last number. For example, a 4-4-2 formation has 4 defenders, 4 midfielders, and 2 forwards. Notice that only 10 players are listed and soccer teams have 11 players on the pitch during the game. The goalie, who is almost always the last line of defense, is not included in the formation.

In most formations, the defenders are primarily concerned with defense, the midfielders have equal responsibility for both offense and defense, and the forwards are concerned with offense. (**Note:** This is a simplification. There are many offensive-minded defenders, defensive midfielders, and goal-scoring midfielders. On opponents' set pieces, such as a corner kick, forwards may come back to their own goal box to help defend.)

1. In a 4-5-1 formation, what percentage of the team's field players are most involved in the offense?  

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2. In a 4-5-1 formation, what percentage of the team's field players are most involved in the defense?  

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3. Which of these formations allows the greatest percentage of the team to focus on offense?  

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4. Which of these formations leaves the lowest percentage of the team focusing on defense?  

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## Challenge Problem

Given the percentages of offensive and defensive responsibilities, why is it often difficult to score goals in soccer?  

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# Positions and Theory

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In soccer the responsibilities of each member of the team are not identical. Some players are expected to score goals; others are expected to prevent the opponent from scoring. A player that is almost completely devoted to defense is the goalie. Goalies have special rules that allow them to use their hands on defense but only in specific areas of the field. To make it clear which player is the goalie, he or she must wear a uniform in a color that is obviously different from those of other players on the field. The other players are referred to as field players. Soccer coaches usually label field players as defenders, midfielders, or forwards. But there are situations when defenders come forward to attack or forwards retreat into their team's penalty box to defend. The following problems examine those situations. To answer these questions, use the measurements of "Old Trafford," the Manchester United stadium, which is 105 yards long and 68 yards wide.

1. Defenders who play on the right or left sides of the defense are sometimes called right backs or left backs. For many teams, these players are expected to get involved in the offensive attack by making "overlapping runs" in which the defender "overlaps" his midfielder in an attempt to get behind the defense. Usually the right or left back gets a pass from the midfielder as he or she streaks down the side of the field. The back usually sends a long, crossing pass from the edge of the field to the forwards in dangerous positions in front of the opponent's goal. If an overlapping run starts at a team's own penalty box and ends at the opponent's penalty box, how far did the defender have to run?

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2. Central defenders also get involved in their team's offensive plays. Because central defenders tend to be taller than most players, a team will often have them come forward on corner kicks. When a teammate crosses the ball from the corner, the central defenders use their height to attempt a header into the goal. The problem occurs when the central defenders can't get to the corner kick. If their opponents control the ball, the central defenders must sprint all the way back down the field to their normal position. If a central defender misses a header at the opponent's 6-yard box and runs all the way back to his or her own 6-yard box, how far will he or she sprint?

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3. When a team sends its central defenders forward for a corner kick, the other team usually brings its forwards back to a defensive position. If the forward is positioned on the 6-yard line for the corner kick and then runs to the opponent's penalty box on the counterattack, how far does he or she run?

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## Challenge Problem

Use the blank pitch on page 46 to invent your own formation. How would you place the offensive, defensive, or special players?

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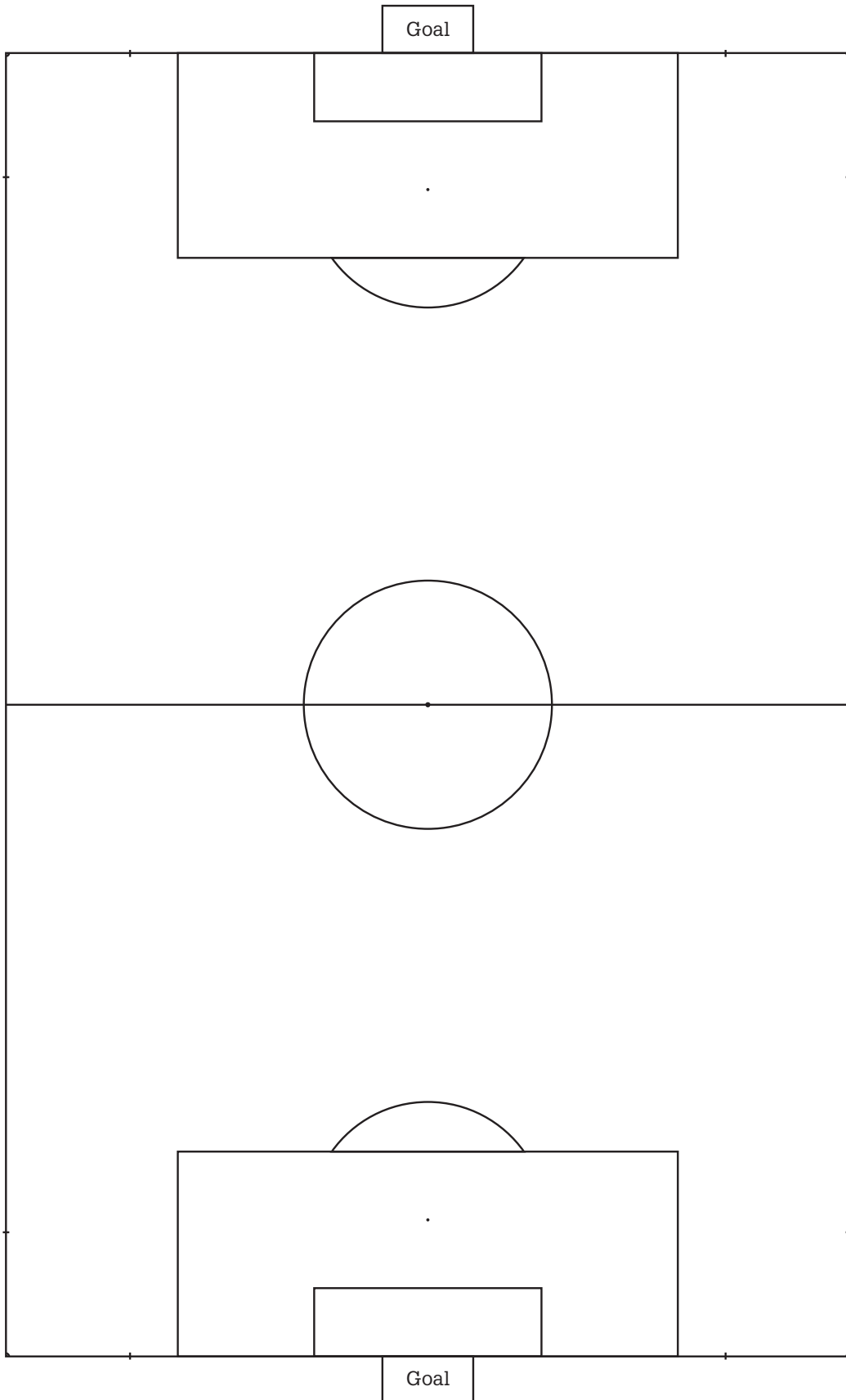
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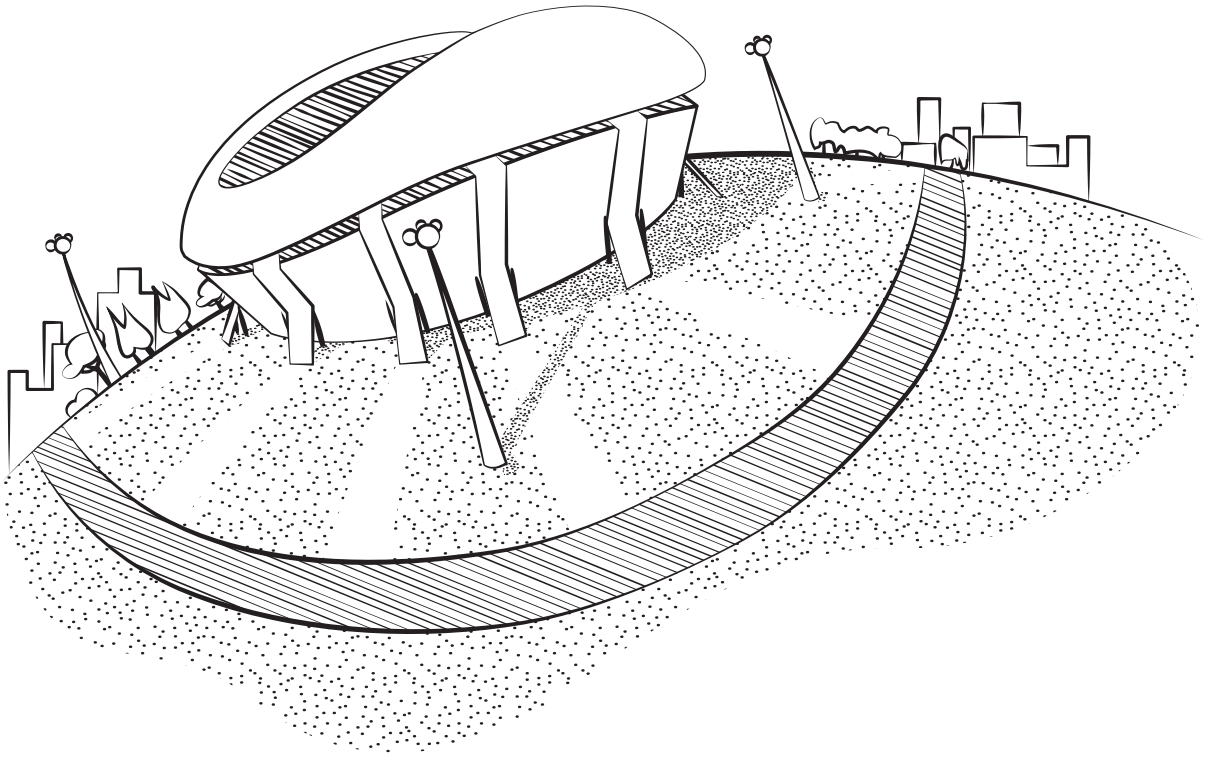
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# Your Soccer Pitch

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# Professional Leagues



## Goals Scored and Allowed: Barclay's Premier League Statistics

**D**uring the 2002–2003 season, the 20 teams in the Barclay's Premier League tallied exactly 1,000 goals in their league matches. However, not all the teams scored the same number of goals. Following is a table showing each team in the Premier League that season and the goals each scored.

Final Standings	Team	Goals Scored	Goals Allowed	Goal Differential
1	Manchester United	74	34	
2	Arsenal	85	42	
3	Newcastle United	63	48	
4	Chelsea	68	38	
5	Liverpool	61	41	
6	Blackburn Rovers	52	43	
7	Everton	48	49	
8	Southampton	43	46	
9	Manchester City	47	54	
10	Tottenham Hotspur	51	62	
11	Middlesbrough	48	44	
12	Charlton Athletic	45	56	
13	Birmingham City	41	49	
14	Fulham	41	50	
15	Leeds United	58	57	
16	Aston Villa	42	47	
17	Bolton Wanderers	41	51	
18	West Ham United	42	59	
19	West Bromwich Albion	29	65	
20	Sunderland	21	65	

First, compute the differences between the Goals Scored and Goals Allowed for each team. Remember that in many cases the number might be negative, meaning that the team allowed more goals than its players scored. This will be especially true for teams with losing records.

Some of the most common statistics are the mean, median, and mode. Each of these statistics tries to provide a measure of the most typical score in the data.

To compare the statistics, answer the questions about this table.

## Goals Scored and Allowed: Barclay's Premier League Statistics (continued)

1. What is the mean of the goals scored by the teams in the Premier League during the 2002–2003 season?

\_\_\_\_\_

2. How many teams in the top half of the standings scored more than the mean number of goals? Which teams were they?

\_\_\_\_\_

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\_\_\_\_\_

3. How many teams in the top half of the standings scored fewer than the mean number of goals? Which teams were they?

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4. How many teams in the bottom half of the standings scored more than the mean number of goals? Which teams were they?

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\_\_\_\_\_

\_\_\_\_\_

5. How many teams in the bottom half of the standings scored fewer than the mean number of goals? Which teams were they?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6. What is the median of the goals scored for the teams in the Premier League during the 2002–2003 season?

\_\_\_\_\_

7. How many teams in the top half of the standings scored more than the median number of goals? Which teams were they?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. How many teams in the top half of the standings scored fewer than the median number of goals? Which teams were they?

\_\_\_\_\_

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\_\_\_\_\_

9. How many teams in the bottom half of the standings scored more than the median number of goals? Which teams were they?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

10. How many teams in the bottom half of the standings scored fewer than the median number of goals? Which teams were they?

\_\_\_\_\_

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\_\_\_\_\_

# Goals Scored and Allowed: Barclay's Premier League Statistics (continued)

11. What is the mode of goals scored for the teams in the Premier League during the 2002–2003 season?

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12. How many teams in the top half of the standings scored more goals than the mode? Which teams were they?

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13. How many teams in the top half of the standings scored fewer goals than the mode? Which teams were they?

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14. How many teams in the bottom half of the standings scored more goals than the mode? Which teams were they?

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15. How many teams in the bottom half of the standings scored fewer goals than the mode? Which teams were they?

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16. Which statistic, the mean, median, or mode, did the best at predicting a finish in the top half of the standings? Why?

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17. Which statistic, the mean, median, or mode, did the best at predicting a finish in the bottom half of the standings? Why?

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18. Which statistic, the mean, median, or mode, did the worst at predicting a finish in the top half of the standings? Why?

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# Goals Allowed I: Barclay's Premier League Statistics

The data from the 2002–2003 season can be examined using a different point of view. On pages 48–50 these scoring figures were examined using measures of central tendency. The mean, median, and mode are all measures of central tendency. These three statistics attempt to describe the typical or center score.

In addition to knowing the most “typical” score for a group of data (found by calculating the mean, median, or mode), sometimes it is useful to find measures of “variability.” Measures of variability provide information about how far apart the data points are. Commonly used measures of variability are the range and standard deviation.

As the table on the previous page shows, the most goals scored in the Premier League's 2002–2003 season were Arsenal's 85 goals. The fewest goals scored were Sunderland's 21. That is a difference of more than 60 goals between the highest- and lowest-scoring teams. This indicates that Sunderland needed to improve its offense considerably to match the best teams in the league.

Final Standings	Team	Goals Scored	Goals Allowed
1	Manchester United	74	34
2	Arsenal	85	42
3	Newcastle United	63	48
4	Chelsea	68	38
5	Liverpool	61	41
6	Blackburn Rovers	52	43
7	Everton	48	49
8	Southampton	43	46
9	Manchester City	47	54
10	Tottenham Hotspur	51	62
11	Middlesbrough	48	44
12	Charlton Athletic	45	56
13	Birmingham City	41	49
14	Fulham	41	50
15	Leeds United	58	57
16	Aston Villa	42	47
17	Bolton Wanderers	41	51
18	West Ham United	42	59
19	West Bromwich Albion	29	65
20	Sunderland	21	65

1. What was the maximum number of goals allowed by a team in the Premier League during the 2002–2003 season?  
\_\_\_\_\_
2. What was the minimum number of goals allowed by a team in the Premier League during the 2002–2003 season?  
\_\_\_\_\_
3. What is the range of goals allowed by teams in the Premier League during the 2002–2003 season?  
\_\_\_\_\_
4. What is the range of goals scored by teams in the Premier League during the 2002–2003 season?  
\_\_\_\_\_

5. Which is larger, the range for goals scored or goals allowed?  
\_\_\_\_\_

## Challenge Question

The best teams in the league usually are better at both offense (Goals Scored) and defense (Goals Allowed) than the worst teams. However, according to the range statistics you calculated, is the difference between the best and worst teams larger on offense or defense?  
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\_\_\_\_\_

# Goals Allowed II: Barclay's Premier League Statistics

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One of the concerns with the range statistic is that it is calculated only from the maximum and minimum scores in the data set. In many cases, this is not a problem when interpreting the meaning of the statistic, but there are occasions when the range doesn't give a complete picture of how far apart the teams really are.

As an example, use the 2002–2003 information about goals scored by the Premier League (on page 51) to answer the questions below.

1. Which teams had the two highest-scoring offenses?

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2. Which teams had the two lowest-scoring offenses?

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3. What is the range of goals scored for the whole league?

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4. What team had the third highest-scoring offense?

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5. How many goals did the team in question 4 score?

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6. Which teams scored the third fewest goals?

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7. How many goals did each of the teams in question 6 score?

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8. What would be the range if you ignored the two highest-scoring and two lowest-scoring offenses?

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## Goals Allowed III: Barclay's Premier League Statistics

**A**nother statistic, called the Mean Absolute Deviation, uses all of the scores in the data set to give an idea of the variability of the scores. The Mean Absolute Deviation is found by averaging how far each score is from the mean of the data set. Deviations are found by subtracting the mean from every score in the data set.

Final Standings	Team	Goals Scored	Deviations	Absolute Deviations
1	Manchester United	74		
2	Arsenal	85		
3	Newcastle United	63		
4	Chelsea	68		
5	Liverpool	61		
6	Blackburn Rovers	52		
7	Everton	48		
8	Southampton	43		
9	Manchester City	47		
10	Tottenham Hotspur	51		
11	Middlesbrough	48		
12	Charlton Athletic	45		
13	Birmingham City	41		
14	Fulham	41		
15	Leeds United	58		
16	Aston Villa	42		
17	Bolton Wanderers	41		
18	West Ham United	42		
19	West Bromwich Albion	29		
20	Sunderland	21		

- Find the mean for the numbers in the Goals Scored column below. (Remember that exactly 1,000 goals were scored in the 2002–2003 Premier League season.)
- Fill in the Deviations column by subtracting your answer for question 1 from each teams' Goals Scored statistics. (Deviations may be positive, negative, or zero, so include negative signs where appropriate.)
- Find the mean of the deviations in the table.
- Write the absolute value of the deviations in the Absolute Deviations column.
- What is the difference between the numbers in the Deviations and the Absolute Deviations columns?  
\_\_\_\_\_
- Find the mean of the Absolute Deviations. (This is the Mean Absolute Deviation, or M.A.D., statistic.)  
\_\_\_\_\_

# Data Organization I: Italian Serie A Statistics

Soccer fans and experts alike say, “Every goal is important.” But do the numbers of goals scored or goals allowed predict where a team will finish in the table? Here is the final table for the Italian Serie A (First Division) from the 2009–2010 season. Use the information in the table to answer the questions below.

Final Standings	Team	Goals Scored	G. S. Rank*	Goals Allowed	G. A. Rank**
1	Internazionale	75		34	
2	Roma	68		41	
3	Milan	60		39	
4	Sampdoria	49		41	
5	Palermo	59		47	
6	Napoli	50		43	
7	Juventus	55		56	
8	Parma	46		51	
9	Genoa	57		61	
10	Bari	49		49	
11	Fiorentina	48		47	
12	Lazio	39		43	
13	Catania	44		45	
14	Chievo	37		42	
15	Udinese	54		59	
16	Cagliari	56		58	
17	Bologna	42		55	
18	Atalanta	37		53	
19	Siena	40		67	
20	Livorno	27		61	

\* G. S. Rank is “Goals Scored Rank.”

\*\* G. A. Rank is “Goals Allowed Rank.”

- Fill in the G. S. Rank column of the table by how many goals a team scored during the season. (If there are two teams tied for a position, give them both the same rank and skip the next rank. For example, if two teams tie for fifth in goals scored, rank each of them as fifth and skip the sixth rank. Rank the next team seventh.)
- Are there any teams in the top half of the standings that finished tenth or worse in the G. S. Rank scores? Which teams, what was the final standing of each, and what was the G. S. Rank of each?

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# Data Organization I: Italian Serie A Statistics (continued)

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3. Are there any teams in the bottom half of the standings that finished tenth or better in the G. S. Rank scores? Which teams, what was the final standing of each, and what was the G. S. Rank of each?

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4. Is Goals Scored a perfect predictor of a team's finish in the standings?

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5. Fill in the G. A. Rank column of the table by how many goals each team allowed during the season. Remember: The lowest number of goals allowed ranks first. (Use the same procedure for breaking ties that you used for G. S. Rank.)

6. Are there any teams in the top half of the standings that finished eleventh or worse in the G. A. Rank scores? Which teams, what was the final standing of each, and what was the G. A. Rank of each?

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7. Are there any teams in the bottom half of the standings that finished tenth or better in the G. A. Rank scores? Which team(s), what was the final standing of each, and what was the G. A. Rank of each?

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8. Is the Goals Scored statistic a perfect predictor of a team's finish in the standings?

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# Data Organization II: Italian Serie A Statistics

Some teams are high scoring and give up a lot of goals. Other teams focus on their defense and try to score a goal or two on counterattacks. The best teams score a lot of goals while allowing only a few. Teams that score few and surrender many goals may be in danger of relegation.

The Goal Differential statistic was developed to give fans an idea of the difference between a team's offense and its defense. But Goal Differential does not always guarantee a team's position in the final standings table.

Compute the Goal Differential for each team in the Italian Serie A for the 2009–2010 season shown below. Then answer the questions that follow.

Final Standings	Team	Goals Scored	Goals Allowed	Goal Differential
1	Internazionale	75	34	
2	Roma	68	41	
3	Milan	60	39	
4	Sampdoria	49	41	
5	Palermo	59	47	
6	Napoli	50	43	
7	Juventus	55	56	
8	Parma	46	51	
9	Genoa	57	61	
10	Bari	49	49	
11	Fiorentina	48	47	
12	Lazio	39	43	
13	Catania	44	45	
14	Chievo	37	42	
15	Udinese	54	59	
16	Cagliari	56	58	
17	Bologna	42	55	
18	Atalanta	37	53	
19	Siena	40	67	
20	Livorno	27	61	

1. Did all the teams with a positive Goal Differential finish in the top half of the standings?

\_\_\_\_\_

2. If your answer to question 1 was no, which team(s) with a positive Goal Differential finished in the bottom half of the standings? In what position did this team(s) finish?

\_\_\_\_\_

3. Did all the teams with negative Goal Differential finish in the bottom half of the standings?

\_\_\_\_\_

4. If your answer to question 3 was no, which team(s) with a negative Goal Differential finished in the bottom half of the standings? In what positions did these team(s) finish?

\_\_\_\_\_

5. Is the Goal Differential statistic a perfect predictor of a team's finish in the standings?

\_\_\_\_\_

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# Data Organization III: Spain's La Liga Statistics

**M**any soccer fans want to say that their favorite team's offense or defense is above average. But not every team can be above average. The following table shows the results of Spain's La Liga during the 2004–2005 season.

Final Standings	Team	Goals Scored	Goals Allowed	Goal Differential
1	Barcelona	73	29	44
2	Real Madrid	71	32	39
3	Villarreal	69	37	32
4	Betis	62	50	12
5	Espanyol	54	46	8
6	Sevilla	44	41	3
7	Valencia	54	39	15
8	Deportivo La Coruña	46	50	-4
9	Athletic Bilbao	59	54	5
10	Malaga	40	48	-8
11	Atlético Madrid	40	34	6
12	Zaragoza	52	57	-5
13	Getafe	38	46	-8
14	Real Sociedad	47	56	-9
15	Oasuna	46	65	-19
16	Racing Santander	41	58	-17
17	Mallorca	42	63	-21
18	Levante	39	58	-19
19	Numancia	30	61	-31
20	Albacete	33	56	-23

1. Find the mean number of goals scored for La Liga in the 2004–2005 season.

\_\_\_\_\_

3. Find the mean number of goals allowed for La Liga in the 2004–2005 season.

\_\_\_\_\_

2. Which teams scored more goals (or equal to) than the league average?

\_\_\_\_\_

\_\_\_\_\_

4. Which teams allowed fewer goals than the league average?

\_\_\_\_\_

\_\_\_\_\_

# Data Organization IV: Spain's La Liga Statistics

**P**lace the name of each team in the box of the table below that represents the team's offensive and defensive statistics. For example, Barcelona belongs in the upper left box because its Goals Scored are above average and its Goals Allowed are better than average. (Remember that a low number of goals allowed is better than a higher number.)

		Goals Scored	
		Above average	Below average
Goals Allowed	Better than average		
	Worse than average		

1. Do the teams that finished highest tend to be in the upper left quadrant?

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3. Is this method a good predictor of a team's final position in the standings?

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2. Where are the teams that are lowest in the standings located?

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# Players—Goalies

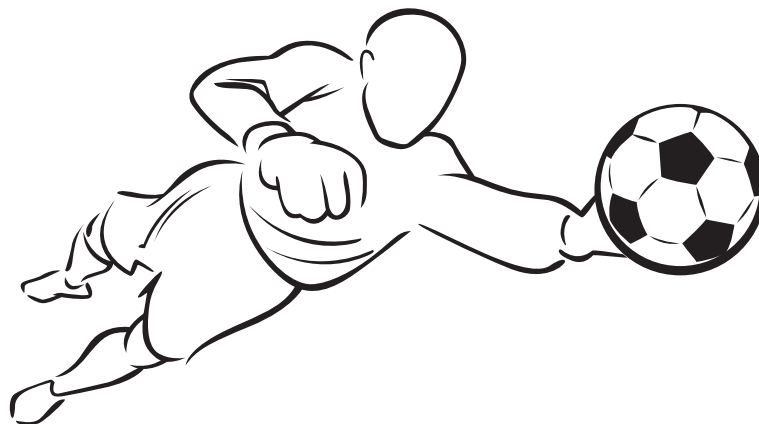


# Goalkeeper Position and Strategy

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The goalkeeper has the ultimate defensive responsibility. When the attacking team manages to avoid all other defenders and gets a shot “on goal,” the goalie must attempt to catch, deflect, or somehow stop that shot from going into the goal. If any member of the defending team knocks the ball over his or her own end line, opponents are given a corner kick. This is a dangerous time. A good striker can kick a ball with spin so it curves either toward or away from the goal. Every team practices “set piece plays”—plays with planned movements to screen a defender. This gives a striker a good chance to head the ball into the goal. While any defender can knock a corner kick away from the goal, the goalie has the best chance to knock the ball away. (Why? Only the goalie can use his or her hands to either catch the ball or punch it away from the goal.)

1. If the opposing team had 24 corner kicks, and the goalie caught the ball in the air 7 times, what percentage of the corner kicks did he defend by catching the ball?  
\_\_\_\_\_
2. The goalie punched away the ball 9 times. What percentage of the 24 corner kicks did he defend by punching the ball away from the goal?  
\_\_\_\_\_
3. A goalie caught 40% of the opposing team's corner kicks. If he caught 8 of the corner kicks, how many corner kicks were the opponents given?  
\_\_\_\_\_
4. The opposing team was given 15 corner kicks. The goalie (and his teammates) kept the ball out of the goal on 80% of the shots. How many goals did the opponents score on corner kick “set pieces”?  
\_\_\_\_\_
5. When a goalkeeper keeps the opponents from scoring, his team obviously wins by a score of “something to zero.” The goalie is given credit for a “clean sheet” when the opposition doesn't score. If, in a 38-game season, the goalie is given credit for 11 “clean sheets,” in what percentage of the games did the goalie prevent the opponents from scoring?  
\_\_\_\_\_



**T**im Howard was born on March 6, 1979, in North Brunswick, New Jersey. He first began to play soccer professionally in 1997 and was added to the U.S. Men's National Team in 2002. He was selected as the third-choice goalkeeper for the U.S. Men's National Team in 2006, and after that year's World Cup competition he became the first choice goal keeper. He was signed by Manchester United in 2003 and was first loaned (2006) and then traded (2007) to Everton. Since then, he has played for Everton in the Premier League.

1. Tim Howard is one of the rare goalies who has scored a goal. He has 256 appearances in the Premier League. Can you figure the (very small) percentage of games he has appeared in in which he scored a goal? (**Remember:** It will be less than 1%.)  

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2. By early 2012, Tim had played in 45 matches for Manchester United, 211 for Everton, and 72 for the U.S. Men's National Team. How many total appearances does he have in Premier League and international matches?  

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3. Tim was also a star on his high school basketball team, which he helped to reach the state finals. He averaged 15 points a game. If his team played 30 games during his last season, how many points did he score on the basketball court? (That is a lot more than the one goal he made for Everton!)  

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4. While playing professional soccer in the United States—before he went to Manchester United—Tim had a Goals per Game Average of 1.33. He achieved that average while playing in 26 games. How many goals did Tim allow in that season? (**Remember:** You will have to round your answer to the nearest whole number.)  

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5. Howard's date of birth is shown above. Calculate his age at the time you are solving this problem. Then consider: How much longer do you think Howard will be able to play? Goalies have to react quickly, so goalies over the age of 40 are not common in professional leagues or international matches.  

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# Hope Solo

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**H**ope started as a goalie on the United States Women's National Team in 2000. She was born in Richland, Washington and played college soccer for the University of Washington. She has 114 caps from playing for the United States national team. She also appeared on the TV program *Dancing With the Stars*, where she and her partner made it to the semi-final round before being eliminated.

1. Hope Solo was born in Richland, Washington, on July 30, 1981. Calculate her age at the time you are solving this problem. Then consider: How much longer do you think Hope will be able to play? (Assume she will stop at 40.)

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2. Hope has 112 appearances as a goalie in international competition. In four years at the University of Washington, Hope started 68 games. How many more international appearances than UW starts does Hope have?

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3. Hope once went 1,054 minutes without allowing a goal. Obviously, she had several "clean sheets" in the process. If a normal soccer match lasts 90 minutes, how many games did she go without allowing a goal? (**Note:** The time during a game when the streak started and the time during a game when it ended might influence the actual number of "clean sheet games.")

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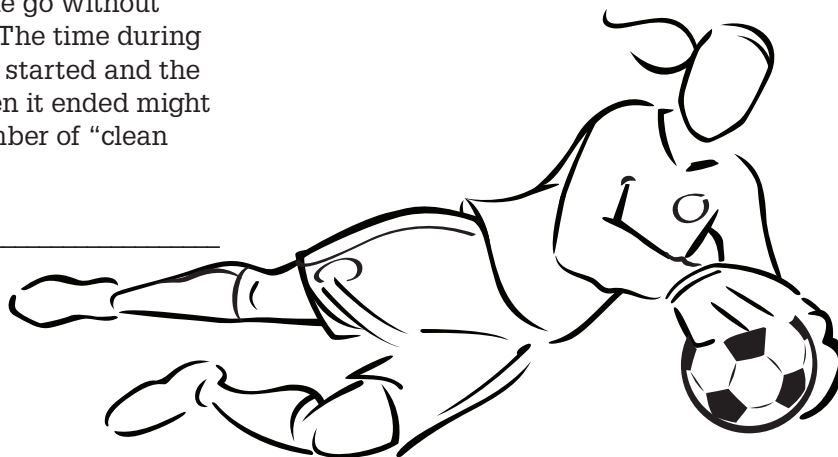
4. Hope started all 18 games for the University of Washington during her senior year. She allowed 22 goals. What was her Average Goals per Game?

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5. During Hope's junior year, she started all 17 games for the Huskies and allowed only 12 goals. That is still the University of Washington's record for fewest goals allowed in a season. What was Hope's Average Goals per Game during her record-setting junior year?

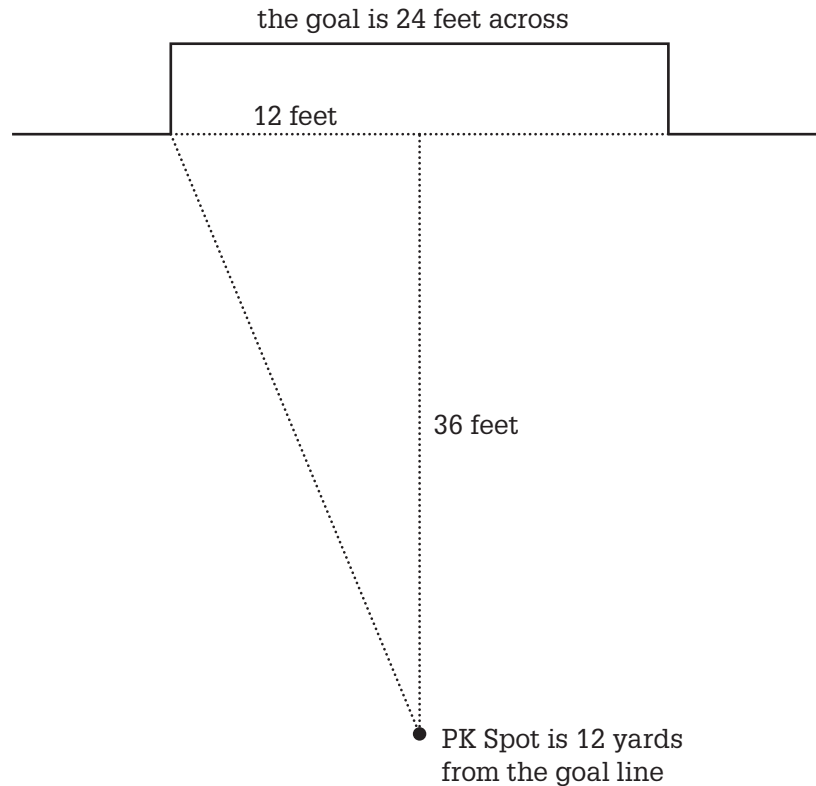
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**Trivia:** Look on the Internet for more information about Hope Solo. She is an outspoken young lady—quick to give praise where it is deserved, and sometimes quick to question decisions with which she disagrees.



# The Penalty Kick

Consider the penalty kick, or PK. A PK may be awarded to an offensive team when one of its players is fouled inside the 18-yard box. Or, penalty kicks may also be used to break a tie when the score is still tied after the 90-minute match plus 30 minutes of overtime.



Consider the poor goalie's problem when a penalty kick is awarded. He or she must stop the kick from going into the net, when a striker gets a free run at the ball, can kick it as hard or as soft as desired, and can kick it to any spot within the goal mouth to score a point for his or her team.

How can the goalie keep the ball out of the goal? The striker may kick it to any spot in the goal mouth. Does the goalie have time to react after the ball is kicked? Or must the goalie guess which way the striker will kick the ball—and dive in that direction before the ball is actually kicked?

The question for a goalie is simple. How long does it take for a ball—kicked from the penalty kick spot—to cross the goal line? Can we figure that out mathematically?

**(Note:** The pure physics of kicking a soccer ball, in terms of speed and distance traveled, is that the ball is standing still and accelerates to a top speed after being kicked. Using the acceleration formula would make these problems just too difficult. So the number given for speed will always be the average speed of the ball.)

Following is the formula for distance and time problems:

$$\text{Distance Traveled} = \text{The Rate of Speed} \times \text{The Amount of Time Given}$$

Summarized, the formula is  $D = R \cdot T$ , or Distance traveled = Rate (speed) multiplied by Time. Using algebra, the formula could be changed to Time = Distance traveled divided by Rate of speed, or  $T = D/R$ .

# The Penalty Kick (continued)

1. If the striker kicks the ball directly at the goal, it must travel 36 feet. If the ball is kicked at an average speed of 36 feet per second, how long would it take the ball to travel from the PK spot to the goal line?

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2. If the ball is kicked at 108 feet per second, how long would it take to travel from the PK spot to the goal line?

\_\_\_\_\_

3. A striker fakes the goalie into diving right, then gently kicks the ball to the goalie's left with a slowly bouncing kick that travels only 12 feet per second. How long must the goalie look at the slowly bouncing ball before it crosses the goal line behind him or her?

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## Challenge Questions

A striker kicks the ball hard to the goalie's left—and high. The ball is set to squeeze into the upper corner of the goal mouth—more than 6 feet off the ground—just inches inside the side and top of the goal. Would the goalie be able to stop such a shot? Why or why not?

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Why do you suppose strikers rarely try to hit the ball into the upper corners of the goal mouth?

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# Women's Soccer



# Cap Leaders

In soccer, a player is “capped” when he or she starts or enters a game for the national team. At one time, actual caps were given to players each time they played for their nation in an international match. Some national soccer federations still give a cap for each game, but others provide an actual cap only for milestones, such as the tenth or fiftieth appearance for the national team.

Following is the list of the ten women players with the most caps. Use the information in the table to answer the questions below.

Rank	Player	Country	Caps	Start Year	End Year
1	Kristine Lilly	United States	352	1987	2010
2	Mia Hamm	United States	275	1987	2004
3	Julie Foudy	United States	272	1988	2004
4	Christie Rampone	United States	243	1997	2011
5	Joy Fawcett	United States	239	1987	2004
6	Birgit Prinz	Germany	214	1996	2011
7	Tiffeny Milbrett	United States	204	1991	2005
8	Kate Markgraf	United States	201	1998	2010
8	Pu Wei	China	201	1997	2008
10	Li Jie	China	200	1997	2008

1. How many years did caps leader Kristine Lilly play for the U.S. Women's National Team?

\_\_\_\_\_

2. How many national team games did Lilly average for each year of her career?

\_\_\_\_\_

3. At the end of 2011, Christie Rampone was the only active player on this list. How many caps per year has Rampone averaged in her career?

\_\_\_\_\_

4. How many more years will Rampone have to maintain her pace to catch up to Kristine Lilly's record?

\_\_\_\_\_

5. The men's cap leader is Ahmed Hassan of Egypt. At the close of 2011, Hassan, who was still an active player, had earned 179 caps for the Egyptian national team during a 16-year career. How many more years would Hassan have to play to catch up to Lilly's mark? (Be careful! This is a multi-step problem.)

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## Challenge Question

Why is the record for national team appearances by a woman so much higher than for men?

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# Scoring Leaders

Following is a table of the top-scoring women soccer players in the history of international soccer as of the end of 2011. Use this information to answer the questions below.

Rank	Player	Country	Goals	Caps	Goals per Game
1	Mia Hamm	United States	158	275	
2	Abby Wambach	United States	131	171	
3	Kristine Lilly	United States	130	352	
4	Christine Sinclair	Canada	129	171	
5	Birgit Prinz	Germany	128	214	
6	Julie Fleeting	Scotland	116	120	

1. Fill in the Goals per Game column.  
Round each entry to two decimal places.

2. Which of these players scores goals at the highest rate?

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3. Which of these players scored goals at the lowest rate?

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Three players on the list, Abby Wambach, Christine Sinclair, and Julie Fleeting, were active on their national teams in 2012. Check on the Internet to see if they are still active. (For Questions 4, 5, and 6, round your answer to a whole number.)

4. At her current scoring rate, how many more games will it take Abby Wambach to break Mia Hamm's record?

\_\_\_\_\_

5. At her current scoring rate, how many more games will it take Christine Sinclair to break Mia Hamm's record?

\_\_\_\_\_

6. At her current scoring rate, how many more games will it take Julie Fleeting to break Mia Hamm's record?

\_\_\_\_\_

# NCAA Women's Soccer Championships

**W**omen's college sports have not always been part of the NCAA. At one time, women's college sports had their own organization and their own record-keeping system. But the NCAA finally incorporated both men's and women's sports into its program. The NCAA and its women's soccer division have held national championships every year since 1982. The record of all the championship games is shown in the following table.

Year	Team (Record)	Score	Notes	Runner-Up
2011	Stanford (25-0-1)	1-0		Duke
2010	Notre Dame (21-2-2)	1-0		Stanford
2009	North Carolina (23-3-1)	1-0		Stanford
2008	North Carolina (25-1-2)	2-1		Notre Dame
2007	Southern California (20-3-2)	2-0		Florida State
2006	North Carolina (27-1)	2-1		Notre Dame
2005	Portland (23-0-2)	4-0		UCLA
2004	Notre Dame (25-1-1)	1-1	2 OT, PK	UCLA
2003	North Carolina (27-0)	6-0		Connecticut
2002	Portland (20-4-2)	2-1	2 OT	Santa Clara
2001	Santa Clara (23-2)	1-0		North Carolina
2000	North Carolina (21-3)	2-1		UCLA
1999	North Carolina (24-2)	2-0		Notre Dame
1998	Florida (26-1)	1-0		North Carolina
1997	North Carolina (27-0-1)	2-0		Connecticut
1996	North Carolina (25-1)	1-0	2 OT	Notre Dame
1995	Notre Dame (21-2-2)	1-0	3 OT	Portland
1994	North Carolina (25-1-1)	5-0		Notre Dame
1993	North Carolina (23-0)	6-0		George Mason
1992	North Carolina (25-0)	9-1		Duke
1991	North Carolina (25-0)	3-1		Wisconsin
1990	North Carolina (24-0)	6-0		Connecticut
1989	North Carolina (24-0-1)	2-0		Colorado College
1988	North Carolina (18-0-3)	4-1		North Carolina State
1987	North Carolina (23-0-1)	1-0		Massachusetts
1986	North Carolina (24-0-1)	2-0		Colorado College
1985	George Mason (18-2-1)	2-0		North Carolina
1984	North Carolina (24-0-1)	2-0		Connecticut
1983	North Carolina (19-1)	4-0		George Mason
1982	North Carolina (19-2)	2-0		UCF

While any list of national champions has interesting features, one thing should be obvious from examining this list. North Carolina has won many national soccer titles!

# NCAA Women's Soccer Championships (continued)

1. How many national titles has the North Carolina soccer team won? They've also played in a few championship games in which they lost. How many times did they lose the national championship game? Use this information to complete the following chart:

Total Number of Title Games	
Times NC Won the Title Game	
Percentage of all Titles won by NC	
Times NC Lost the Title Game	
Percentage of All Title Games Lost by NC	
Total Number of Times NC Played for Title	
Percentage of all Title Games Played by NC	

2. How many points did North Carolina score in all of its championship appearances?
- \_\_\_\_\_
3. What was the team's Average Points per Game when it won the championship?
- \_\_\_\_\_
4. What was its Average Points per Game when it lost the championships?
- \_\_\_\_\_
5. How many points did North Carolina's opponents score in all of its championship appearances? (In other words, count the opponent's points if North Carolina won or lost.)
- \_\_\_\_\_
6. How many different teams have won the NCAA Division I women's soccer title?
- \_\_\_\_\_
7. How many others have appeared in the championship game and never won the title?
- \_\_\_\_\_
8. What is the total number of teams that have ever appeared in the women's soccer championship game—win or lose? It is not a very long list!
- \_\_\_\_\_



# Women's World Cup Match 2011

**D**uring the 2011 FIFA Women's World Cup, the United States played three games in the group stage and then moved into the single-elimination, or "knockout," rounds of the tournament. The team's first knockout game was a quarterfinal match against Brazil.

The game was hard fought between two of the favorites to win the tournament. The game featured an own goal, a penalty kick, a red card, extra time, and a short-handed goal that was the latest goal in any World Cup game—men's or women's—in the 122nd minute. The winner was finally decided on a penalty kick shoot-out.

The statistics for the match are shown below.

Brazil	Statistics	USA
16	Shots	14
6	Shots on goal	5
2	Goals scored	2
6	Corner kicks	11
19	Fouls	17
1	Free kicks	4
1/1	Penalty kicks	0/0
50%	Possession	50%

1. What fraction of the United States' shots were on goal?  
\_\_\_\_\_
2. Which of these common fractions (0,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or 1) is your answer to question 1 closest to?  
\_\_\_\_\_
3. What fraction of Brazil's shots were on goal?  
\_\_\_\_\_
4. Which of these common fractions (0,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or 1) is your answer to question 3 closest to?  
\_\_\_\_\_
5. What fraction of the United States' shots on goal were saved by Brazilian goalkeeper Andrea?  
\_\_\_\_\_

## Penalty Kick Shoot-out

(USA went first)

USA Player	Result	Brazil Player	Result
Shannon Boxx	Goal	Christiane	Goal
Carli Lloyd	Goal	Marta	Goal
Abby Wambach	Goal	Daiane	Saved
Megan Rapinoe	Goal	Francielle	Goal
Alex Krieger	Goal		

6. Which of these common fractions (0,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or 1) is your answer to question 5 closest to?  
\_\_\_\_\_
7. What fraction of Brazil's shots on goal were saved by American goalkeeper Hope Solo?  
\_\_\_\_\_
8. Which of these common fractions (0,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or 1) is your answer to question 7 exactly equal to?  
\_\_\_\_\_
9. What fraction of Brazil's penalty kicks scored goals in the shoot-out?  
\_\_\_\_\_
10. What fraction of the United States' penalty kicks scored goals in the shoot-out?  
\_\_\_\_\_

## Challenge Question

Why didn't Brazil get to try a fifth penalty kick during the shoot-out?  
\_\_\_\_\_

# Women's World Cup Matches

In the final match of the 2011 FIFA Women's World Cup, the United States played Japan for the title of World Champion. After a scoreless first half, the United States went ahead on a goal by Alex Morgan. Aya Miyama tied the game with ten minutes to go in regulation. In extra time, Abby Wambach gave the United States the lead again before Homare Sawa tied the game at 2–2. The winner was finally decided on a penalty kick shoot-out.

The statistics for the match are shown below.

Japan	Statistics	USA	Penalty Kick Shoot-out			
			USA Player	Result	Japan Player	Result
14	Shots	27	Shannon Boxx	Saved	Aya Miyama	Goal
6	Shots on goal	5	Carli Lloyd	Missed	Yuki Nagasato	Saved
2	Goals scored	2	Tobin Heath	Saved	Mizuho Sakaguchi	Goal
4	Corner kicks	8	Abby Wambach	Goal	Saki Kumagai	Goal
11	Fouls	9				
0	Free kicks	0				
0/0	Penalty kicks	0/0				
53%	Possession	47%				

1. What percentage of the United States' shots were on goal?

\_\_\_\_\_

2. Which of these common fractions ( $0$ ,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or  $1$ ) is your answer to question 1 closest to?

\_\_\_\_\_

3. What percentage of Japan's shots were on goal?

\_\_\_\_\_

4. Which of these common fractions ( $0$ ,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or  $1$ ) is your answer to question 3 closest to?

\_\_\_\_\_

5. What percentage of the United States' shots on goal were saved by Japanese goalkeeper Ayumi Kaihori?

\_\_\_\_\_

6. Which of these common fractions ( $0$ ,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or  $1$ ) is your answer to question 5 closest to?

\_\_\_\_\_

7. What percentage of Japan's shots on goal were saved by American goalkeeper Hope Solo?

\_\_\_\_\_

8. Which of these common fractions ( $0$ ,  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or  $1$ ) is your answer to question 7 exactly equal to?

\_\_\_\_\_

9. What percentage of Japan's penalty kicks scored goals in the shoot-out?

\_\_\_\_\_

10. What fraction of the United States' penalty kicks scored goals in the shoot-out?

\_\_\_\_\_

## Challenge Question

Why didn't either team need to try a fifth penalty kick during the shoot-out?

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# Women's Olympic Soccer Tournament

The FIFA Women's World Cup is not the only worldwide soccer tournament for women. The Olympics holds a soccer tournament for men and women. Olympic rules impose age restrictions on men's teams, so a country's senior national team can't play at the Olympics. However, there are no age restrictions for women's teams, so each country can send their full national team to the tournament.

In the 2008 Olympics, the United States was one of 12 teams participating. All of the teams opened with three matches in the group stage of the tournament. The following table shows the results after the end of group play for Group G. (**Note:** The three groups in the women's tournament were named groups E, F, and G to avoid confusion with the four men's tournament groups, named groups A, B, C, and D.)

The following abbreviations are used in the table:

- Pld. = Games Played
- W = Wins
- D = Draws
- L = Losses
- GF = Goals For
- GA = Goals Against
- GD = Goal Differential
- Pts. = Points

Group G

Team	Pld.	W	D	L	GF	GA	GD	Pts.
United States	3	2	0	1	5	2	+3	
Norway	3	2	0	1	4	5	-1	
Japan	3	1	1	1	7	4	+3	
New Zealand	3	0	1	2	2	7	-5	

Soccer tournaments like the World Cup and the Olympics, as well as soccer leagues, use a formula for calculating the order of finish. The formula is three points for a win, one point for a draw, and no points for a loss.

1. Write the mathematical formula to calculate each team's points in its group play.
2. Calculate the points for each team in Group G.



# Women's Olympic Soccer Tournament (continued)

Here are the tables for the other two groups in the 2008 Olympics.

## Group E

Team	Pld.	W	D	L	GF	GA	GD	Pts.
China	3	2	1	0	5	2	+3	
Sweden	3	2	0	1	4	3	+1	
Canada	3	1	1	1	4	4	0	
Argentina	3	0	0	3	1	5	-4	

## Group F

Team	Pld.	W	D	L	GF	GA	GD	Pts.
Brazil	3	2	1	0	5	2	+3	
Germany	3	2	1	0	2	0	+2	
North Korea	3	1	0	2	2	3	-1	
Nigeria	3	0	0	3	1	5	-4	

- Calculate the points for each team in Group E.
- Calculate the points for each team in Group F.
- Which groups have ties in points for first place?

Ties are broken by goal differential. When two teams have the same number of points, the team with the higher goal differential is placed higher on the standings. Head-to-head record is not used as a tie-breaker in soccer.

- Using goal differential as the tie breaker, which teams won their groups?

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# 2010 World Cup



# England–United States Game Statistics

**A**fter a game has been played, a table of statistics is published. Below is the statistical table for the game in the 2010 World Cup game between England and the United States. The game ended in a 1–1 tie.

England	Statistics	USA
18	Shots	13
8	Shots on goal	4
12	Fouls committed	14
8	Corner kicks	4
2	Direct free kicks to goal	0
0	Indirect free kicks to goal	0
0/0	Penalty kicks	0/0
5	Offsides	2
0	Own goals	0
3	Cautions	3
0	Expulsions due to second caution	0
0	Direct expulsions	0
53%	Possession (%)	47%
32	Actual playing time	28

Coaches and commentators look at game statistics to make decisions about the game. Each of the pairs of questions below can provide insight into how a team played during the game.

1. What was the percentage of total shots on goal for England? For the United States?

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2. Which team was more accurate in shooting?

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3. What was the percentage of shots on goal that scored for England? For the United States?

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4. Which team was more efficient in scoring goals?

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\_\_\_\_\_

Corner kicks and direct free kicks to goal are called “set pieces” because play stops while the ball is readied for the kick. The stoppage allows teams to arrange their players in a desired position.

5. How many set pieces did England have? How many did the United States have?

\_\_\_\_\_

\_\_\_\_\_

6. Which team created more attacking opportunities in the game?

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# England–United States Game Statistics (continued)

7. How many minutes did England have possession? How many minutes did the United States have possession?

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8. What was the total time the ball was in possession of one of the two teams?

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9. How many minutes was the ball not in either team's possession?

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Unlike basketball, football, and hockey, the clock in soccer doesn't stop running when play stops. When players are injured, play stops and trainers come onto the field to treat injuries. When a team is awarded a free kick in a dangerous position, play pauses while more players move up the field to join in the set piece attack. Play also stops for substitutions, yellow cards, and red cards. The referee keeps track of all of these stoppages and then adds on that amount of time at the end of each half. The added minutes are called "added time." At the end of each half, the fourth official holds up a sign that shows the crowd how much extra time will be added on. All of the stoppages and extra time affects the Possession statistic.

10. During the England–United States game, three minutes of added time were put on for the first half and another three were put on for the second half. How many minutes of actual game time did the match have?

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11. How many minutes was the ball not in either team's possession?

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12. What percentage of actual game time did England have possession of the ball?

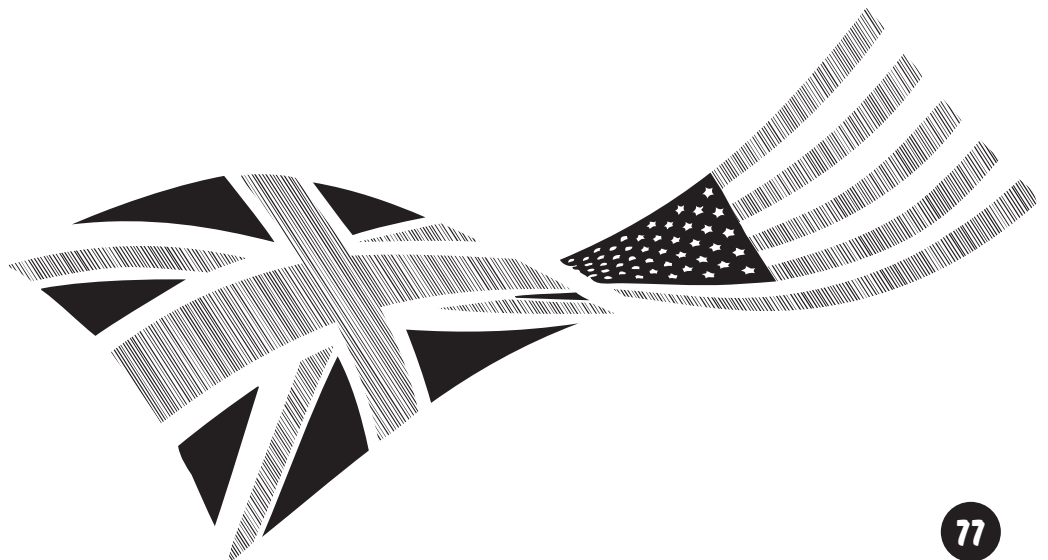
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13. What percentage of actual game time did the United States possess the ball?

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14. What percentage of actual game time was neither team in possession?

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# The Netherlands' Route to the Finals

In the 2010 World Cup, the Netherlands team was attempting to win its first ever championship. The team started with three games in group play and then moved on to the knockout rounds. Here are partial statistical tables for their group games.

Netherlands	Statistics	Denmark
18	Shots	10
7	Shots on goal	3
2	Goals scored	0
58%	Possession	42%
38	Actual playing time	28

Netherlands	Statistics	Japan
9	Shots	10
5	Shots on goal	3
1	Goals scored	0
61%	Possession	39%
38	Actual playing time	24

Netherlands	Statistics	Cameroon
15	Shots	15
8	Shots on goal	3
2	Goals scored	1
49%	Possession	51%
33	Actual playing time	35

- How many total minutes of actual playing time did the Netherlands team possess the ball in all of its group games?  
\_\_\_\_\_
- How many total minutes of actual playing time did its opponents possess the ball in the three group games?  
\_\_\_\_\_
- What percentage of possession did the Netherlands team earn in its group games? (Remember, the possession percentage is calculated from the total actual playing time for both teams rather than the total minutes in the games.)  
\_\_\_\_\_

# The Netherlands' Route to the Finals (continued)

Here is the partial statistics table for the Netherlands' first three knockout round games.

Netherlands	Statistics	Slovakia
16	Shots	12
9	Shots on goal	3
2	Goals scored	1
51%	Possession	49%
33	Actual playing time	31

Netherlands	Statistics	Brazil
11	Shots	15
5	Shots on goal	4
2	Goals scored	1
50%	Possession	50%
30	Actual playing time	29

Netherlands	Statistics	Uruguay
12	Shots	11
6	Shots on goal	7
3	Goals scored	2
47%	Possession	51%
33	Actual playing time	35

- How many total minutes of actual playing time did the Netherlands team possess the ball in its first three knockout games?  
\_\_\_\_\_
- How many total minutes of actual playing time did its opponents possess the ball in these three games?  
\_\_\_\_\_
- What percentage of possession did the Netherlands team earn in these three games? (Remember, the possession percentage is calculated from the total actual playing time for both teams rather than the total minutes in the games.)  
\_\_\_\_\_
- Compare your answers in questions 1–3 with your answer from questions 4–6. Did the Netherlands possession numbers increase or decrease during the knockout rounds?  
\_\_\_\_\_

# Spain's Route to the Finals

In 2010 the Spanish team was attempting to win its first ever championship in the World Cup. Spain started with three group play games and then moved on to the knockout games. Here are partial statistical tables for the team's group games.

Spain	Statistics	Switzerland
24	Shots	8
8	Shots on goal	3
0	Goals scored	1
63%	Possession	37%
42	Actual playing time	25

Spain	Statistics	Honduras
22	Shots	9
8	Shots on goal	0
2	Goals scored	0
56%	Possession	44%
38	Actual playing time	29

Spain	Statistics	Chile
9	Shots	9
3	Shots on goal	4
2	Goals scored	1
59%	Possession	41%
39	Actual playing time	26

Spain is known as a team that wants to possess the ball in order to control the tempo of the game as well as to tire the other team, who must chase the ball.

- How many total minutes of actual playing time did the Spanish team possess the ball in all of its group games?  
\_\_\_\_\_
- How many total minutes of actual playing time did Spain's opponents possess the ball in the three group games?  
\_\_\_\_\_
- What percentage of possession did the Spanish team earn in its group games? (Remember, the possession percentage is calculated from the total actual playing time for both teams rather than the total minutes in the games.)  
\_\_\_\_\_
- In some games, teams score goals on sudden counterattacks after the opponent has dominated possession. This is called scoring a goal "against the run of play." Which opponent was most likely to have scored against the run of play?  
\_\_\_\_\_

# Spain's Route to the Finals (continued)

Here are the partial statistics table for Spain's first three knockout round games.

Spain	Statistics	Portugal
19	Shots	9
10	Shots on goal	3
1	Goals scored	0
60%	Possession	40%
45	Actual playing time	29

Spain	Statistics	Paraguay
16	Shots	9
6	Shots on goal	4
1	Goals scored	0
60%	Possession	40%
37	Actual playing time	25

Spain	Statistics	Germany
13	Shots	5
5	Shots on goal	2
1	Goals scored	0
52%	Possession	48%
39	Actual playing time	37

- |   |   |
|---|---|
| <p>5. Which opponent did the best job of limiting Spain's possession during these three games?</p> <p>_____</p> | <p>7. What percentage of possession did the Spanish team earn in these three games combined? (Remember, the possession percentage is calculated from the total actual playing time for both teams rather than the total minutes in the games.)</p> <p>_____</p> |
| <p>6. In what statistical category (or categories) did Spain far exceed Germany?</p> <p>_____</p>               | <p>8. Compare your answer in question 3 with the your answer from question 7. Did Spain's possession numbers increase or decrease during the knockout rounds?</p> <p>_____</p>  |

# The Final Game

In 2010, Spain and the Netherlands both advanced to the championship game of the World Cup. Neither nation had ever won the trophy, so a first-time champion was guaranteed to be crowned. Spain tried to control the game by keeping possession while the Dutch attempted to counterattack and use their height to score. At the end of regulation, the game was tied at 0–0. The game went into extra time. The 30 minutes of extra time are played in two 15-minute periods with the teams switching ends after the first extra period. The full time would be played, even if a team scored a goal. This meant that there was no “sudden death,” so teams could attack with less fear of instantly losing on a counterattack. In soccer terms, a “sudden death” goal is called a “Golden Goal,” so the rules were listed as “No Golden Goal.”

Following is the statistical table for the game.

Netherlands	Statistics	Spain
13	Shots	18
5	Shots on goal	6
28	Fouls committed	19
6	Corner kicks	8
3	Direct free kicks to goal	4
0	Indirect free kicks to goal	0
0/0	Penalty kicks	0/0
7	Offsides	6
0	Own goals	0
7	Cautions	5
1	Expulsions due to second caution	0
0	Direct expulsions	0
43%	Possession (%)	57%
36	Actual playing time	48

The final was a hard-fought, physical game with 12 cautions or “yellow cards” between the two teams. This doubled the previous record for yellow cards in a World Cup final. This had a big impact on the game when John Heitinga picked up his second yellow card in the first extra time period and was expelled from the game. From that point, the Dutch had to play with only 10 players instead of the usual 11.

Spain took advantage of the Dutch team being a man down when Andrés Iniesta scored in the 116th minute of the game. Spain then kept possession for most of the rest of the game to limit the Netherlands team’s scoring opportunities and win its first World Cup title.

1. What fraction of the yellow cards did the Dutch receive?

\_\_\_\_\_

2. What percentage of the yellow cards did the Dutch receive?

\_\_\_\_\_

3. What fraction of the yellow cards did Spain receive?

\_\_\_\_\_

4. What percentage of the yellow cards did Spain receive?

\_\_\_\_\_

## The Final Game (continued)

5. What fraction of the fouls did the Dutch commit?

\_\_\_\_\_

6. What percentage of the fouls did the Dutch commit?

\_\_\_\_\_

7. What fraction of the fouls did Spain commit?

\_\_\_\_\_

8. What percentage of the fouls did Spain commit?

\_\_\_\_\_

Each half and extra time period of the game had some added time. Two minutes were added to the first half while three were added to the second half. One minute was added to the first extra time period. The second extra time period had two minutes added to it.

9. What was the total length of the game in minutes?

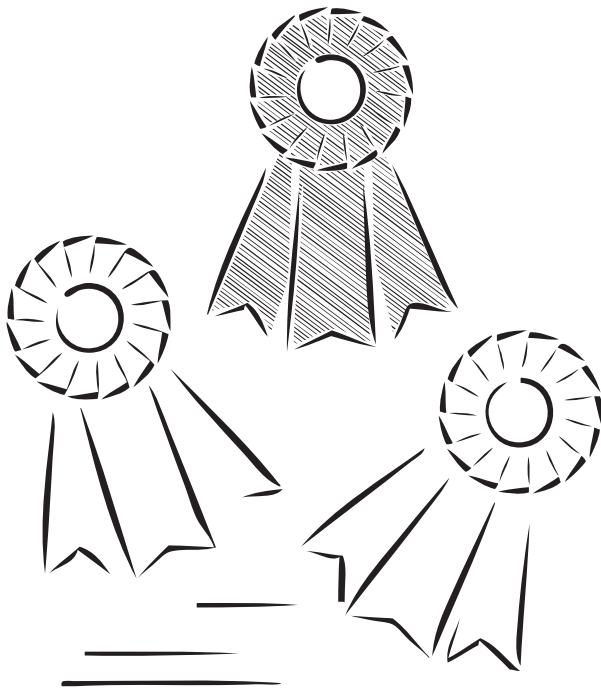
\_\_\_\_\_

10. What percentage of actual game time did Spain possess the ball?

\_\_\_\_\_

11. What percentage of the actual game time did the Dutch possess the ball?

\_\_\_\_\_





# Point System



# The Formula

The number of wins and losses a team has does not automatically determine its standing in its league. The reason? Matches can end in ties—or what is called a *draw*. So points are given on the results of a match, and the points are used to determine standings.

The number of points a team earns in its games determines the champions of soccer tournaments and league play. A team earns 3 points for a win, 1 point for a draw, and no points for a loss. The formula for team points is:  $3W + D = \text{Points}$ .

Use the formula to find the number of points that each team in the Premier League earned during the 2008–2009. Write your answers in the Pts. Column below. Then answer the questions that follow.

Team	Games	W	D	L	GF	GA	GD	Pts.
Arsenal	38	20	12	6	68	37	+31	
Aston Villa	38	17	11	10	54	48	+6	
Blackburn Rovers	38	10	11	17	40	60	-20	
Bolton Wanderers	38	11	8	19	41	53	-12	
Chelsea	38	25	8	5	68	24	+44	
Everton	38	17	12	9	55	37	+18	
Fulham	38	14	11	13	39	34	+5	
Hull City	38	8	11	19	39	64	-25	
Liverpool	38	25	11	2	77	27	+50	
Manchester City	38	15	5	18	58	50	+8	
Manchester United	38	28	6	4	68	24	+44	
Middlesbrough	38	7	11	20	28	57	-29	
Newcastle United	38	7	13	18	40	59	-19	
Portsmouth	38	10	11	17	38	57	-19	
Stoke City	38	12	9	17	38	55	-17	
Sunderland	38	9	9	20	34	54	-20	
Tottenham Hotspur	38	14	9	15	45	45	0	
West Bromwich Albion	38	8	8	22	36	67	-31	
West Ham United	38	14	9	15	42	45	-3	
Wigan Athletic	38	12	9	17	34	45	-11	

# The Formula (continued)

---

1. Which team won the title by earning the most points?

\_\_\_\_\_

2. Which teams finished in last place?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Were there any teams that had the same number of points?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. How many ties involved two teams?

\_\_\_\_\_

\_\_\_\_\_

5. How many ties involved three teams?

\_\_\_\_\_

\_\_\_\_\_

When two or more teams have the same number of points, the higher position in the standings goes to the team with the larger goal differential.

6. Make a list of the teams that finished in the eighth through fifteenth places in the league standings.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

7. What was the only team in your list that was not tied in points with another team?

\_\_\_\_\_

8. Now that you know how to break a tie, which team finished in last place?

\_\_\_\_\_

# German Bundesliga

Remember that each team in their league table is ranked based on points. A win is worth three points while a draw is worth one point. No points are earned for losses. The table below is from the German Bundesliga from the 2005–2006 season. Fill in the empty cells in the table with the correct number of wins, draws, or points.

Team	W	D	L	GF	GA	GD	Pts.
Arminia Bielefeld	10		17	32	47	-15	37
Bayer Leverkusen		10	10	64	49	+15	52
Bayern Munich	22	9	3	67	32	+35	
Borussia Dortmund	11		10	45	42	+3	46
Borussia Monchengladbach		12	12	42	50	-8	42
Eintracht Frankfurt		9	16	42	51	-9	36
1. FC Kaiserslautern	8		17	47	71	-24	33
1. FC Koln	7	9	18	49	71	-22	
1. FC Nuremberg		8	14	49	51	-2	44
FSV Mainz 05	9	11	14	46	47	-1	
Hamburger SV	21		8	53	30	+23	68
Hannover 96	7	17	10	43	47	-4	
Hertha BSC	12	12	10	52	48	+4	
MSV Duisberg		12	17	34	63	-29	27
Schalke 04	16		5	47	31	+16	61
VfB Stuttgart	9	16	9	37	39	-2	
VfL Wolfsburg	7		14	33	55	-22	34
Werder Bremen		7	6	79	37	+42	70

Once you have filled in the table, answer the following questions:

1. Which team had the most points?

\_\_\_\_\_

2. Which team had the fewest points?

\_\_\_\_\_

3. Which team had the most wins?

\_\_\_\_\_

4. Which team had the fewest wins?

\_\_\_\_\_

5. Which team had the most draws?

\_\_\_\_\_

6. Which team had the fewest draws?

\_\_\_\_\_

7. Which teams had the same number of points?

\_\_\_\_\_

8. Of the teams with the same number of points, who was ranked higher in the standings?

\_\_\_\_\_

# Relegation: Barclay's Premier League

**E**xamine the final standings—or in 2011–2012, the “close to final standings”—for Barclay’s Premier League. You might want to focus your efforts on comparing league teams between the years. (Team names are abbreviated in the table.).

	Season			
	2008–2009	2009–2010	2010–2011	2011–2012
1	Man Utd	Chelsea	Man Utd	Man Utd
2	Liverpool	Man Utd	Chelsea	Man City
3	Chelsea	Arsenal	Man City	Tottenham
4	Arsenal	Tottenham	Arsenal	Arsenal
5	Everton	Man City	Tottenham	Chelsea
6	Aston Villa	Aston Villa	Liverpool	Newcastle
7	Fulham	Liverpool	Everton	Liverpool
8	Tottenham	Everton	Fulham	Swansea
9	West Ham	Birmingham	Aston Villa	Sunderland
10	Man City	Blackburn	Sunderland	Everton
11	Wigan	Stoke City	West Brom	Fulham
12	Stoke City	Fulham	Newcastle	West Brom
13	Bolton	Sunderland	Stoke City	Norwich
14	Portsmouth	Bolton	Bolton	Stoke City
15	Blackburn	Wolves	Blackburn	Aston Villa
16	Sunderland	Wigan	Wigan	Blackburn
17	Hull City	West Ham	Wolves	Bolton
18	Newcastle	Burnley	Birmingham	QPR
19	Middlesbrough	Hull City	Blackpool	Wigan
20	West Brom	Portsmouth	West Ham	Wolves

- Are the same teams always in the league? Find the bottom three teams in seasons starting in 2008, 2009, and 2010. Can you find those team names in the next year?

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- Can you find which three teams moved up in 2009?

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- Can you find a team that was relegated to the lower league and then came back to the Premier League after just one season? After two seasons?

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- Find the new teams that came into the league and did well. How high did they finish?

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This is called *relegation*. Each year the three worst Premier League teams have to move down to the Football League Championship group; the top three teams in that league move up to the Premier League. A comparison to sports in the United States might suggest that each year the last place major league baseball team would move down to the minor leagues and a minor league champion would move up to replace them. So:

# Relegation: German Bundesliga

Bundesliga			
2008–2009	2009–2010	2010–2011	2011–2012
VfL Wolfsburg	Bayern Munich	Borussia Dortmund	Borussia Dortmund
Bayern Munich	Schalke 04	Bayer Leverkusen	Bayern Munich
VfB Stuttgart	Werder Bremen	Bayern Munich	Schalke 04
Hertha BSC	Bayer Leverkusen	Hannover 96	Borussia Mönchengladbach
Hamburger SV	Borussia Dortmund	FSV Mainz 05	Bayer Leverkusen
Borussia Dortmund	VfB Stuttgart	1. FC Nuremberg	VfB Stuttgart
1899 Hoffenheim	Hamburger SV	1. FC Kaiserslautern	Hannover 96
Schalke 04	VfL Wolfsburg	Hamburger SV	VfL Wolfsburg
Bayer Leverkusen	FSV Mainz 05	SC Freiburg	Werder Bremen
Werder Bremen	Eintracht Frankfurt	1. FC Köln	1. FC Nuremberg
Hannover 96	1899 Hoffenheim	1899 Hoffenheim	1899 Hoffenheim
1. FC Köln	B. Mönchengladbach	VfB Stuttgart	SC Freiburg
Eintracht Frankfurt	1. FC Köln	Werder Bremen	FSV Mainz 05
VfL Bochum	SC Freiburg	Schalke 04	FC Augsburg
B. Mönchengladbach	Hannover 96	VfL Wolfsburg	Hamburger SV
Energie Cottbus	1. FC Nuremberg	B. Mönchengladbach	Hertha BSC
Karlsruher SC	VfL Bochum	Eintracht Frankfurt	1. FC Köln
Arminia Bielefeld	Hertha BSC	FC St. Pauli	1. FC Kaiserslautern

The Bundesliga uses a different system for relegation than the Premier League. In the Bundesliga the bottom two teams are sent down to the Bundesliga 2. However, the team in the third-worst position has a chance to stay in the top league. The team in this position plays a tie (a home and home series) with the third-place team in Bundesliga 2. The winner of this playoff earns a spot in next year's Bundesliga.

- Which teams from the 2008–2009 season were directly relegated to the Bundesliga 2? Which team from 2008–2009 participated in the playoff? Did this team win or lose the playoff?

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## Relegation: German Bundesliga (continued)

2. What fraction of the 2008–2009 Bundesliga teams were relegated to the Bundesliga 2?

\_\_\_\_\_

3. Which teams from the 2009–2010 season were directly relegated to the Bundesliga 2? Which team from 2009–2010 participated in the playoff? Did this team win or lose?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. What fraction of the 2009–2010 Bundesliga teams was relegated to the Bundesliga 2?

\_\_\_\_\_

5. Which teams from the 2010–2011 season were directly relegated to the Bundesliga 2?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Which team from 2010–2011 participated in the playoff? Did this team win or lose?

\_\_\_\_\_  
\_\_\_\_\_

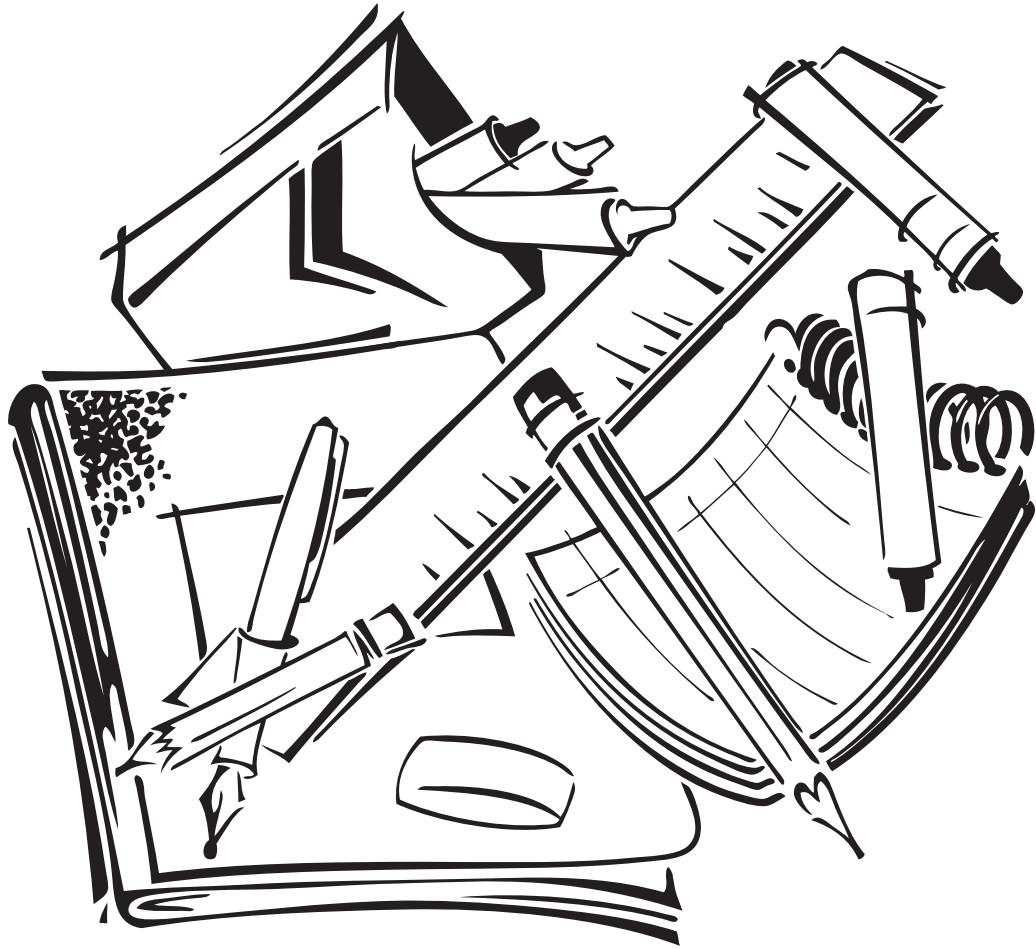
7. What fraction of the 2010–2011 Bundesliga teams was relegated to the Bundesliga 2?

\_\_\_\_\_





# Projects



# Famous Players

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It is impossible to cover all of the greatest historical and modern players in one book. It is worth any soccer fan's time to use the Internet as a resource to examine the careers of famous players—from one country, from various historical periods, or from a list of today's stars. Here are some examples:

- **Germany's Bundesliga:** Franz Beckenbauer was a famous player of the 1970s and 1980s; he then coached the German National Team.
- **Spain's La Liga:** Portugal's Cristiano Ronaldo has been one of the best players in the world over the last 10 years. He is not to be confused, however, with Ronaldo—the Brazilian star who used only one name.
- **Barclay's Premier League:** Bobby Moore is regarded as one of England's most famous players. Wayne Rooney is a current goal scorer in the Premier League. Or one of the most famous former players is David Beckham.
- **Spain's La Liga:** All three of the top finishers for the FIFA's 2010 Player of the Year award came from Barcelona. You've read about Lionel Messi already, but Xavi and Andrés Iniesta are two players worth examining.
- **France:** France's team had one of the multiple winners of the Ballon d'Or; his name was Zinedine Zidane. What can you find on the Internet about him?

France also had a great player who was involved in a questionable play during a World Cup qualifying game. What can you find about Thierry Henry?



# Wembley Stadium

**W**embley Stadium is England's most famous stadium; it is also one of the two largest stadiums in Europe. And it is relatively new. The old Wembley was to be demolished by 2000, but it actually occurred later than that. Can you find out when? The new stadium was then finished almost a year late. Can you find out when it was finally completed?

Any stadium can be used for more than one purpose, and Wembley is no exception. For example, rock concerts are regularly held in the stadium. Can you find lists of what other events have been held at Wembley?

By far the most famous use of the stadium occurred in 2012 when England (and London) hosted the 2012 Olympics. Wembley Stadium was featured in the 2012 Olympics, as some soccer matches were scheduled to be played there.

Find and examine stories and pictures about the 2012 Olympics to see how Wembley Stadium was used. What soccer matches were played there—all of them, or just those matches that would draw a huge crowd? Were the opening and closing ceremonies held at Wembley? Was the stadium used only for soccer events, or were other Olympic contests held there? If so, what other Olympic sporting events took place at Wembley?

Can you find pictures of the stadium, the events, or other things of interest? For example, there is a huge steel arch over the stadium. How high is it? (You already know that it is so high that it must have warning lights for low flying airplanes.) How long is the arch? How much does it weigh? Is it the largest arch of its type in the world?



# Hat-Tricks

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Look back at page 16 and examine the final score for each game in which a player made a hat-trick. (Remember, that means scoring three—or more—goals in a game.)

Which player's hat-trick seemed to make the most difference for his team?

If the score was 6–0, does that simply mean the player making the hat-trick made the score more lopsided?

If that player scored the first 3 goals, would you still answer in the same way? And how would you feel if the player scored the last three goals?

What if the final score was 3–3, or 3–2? What would you think about the value of the hat trick?

Now pick another year from the Premier League (or another league) and find the hat-tricks for that year. Identify the hat-tricks you think helped the player's team the most, and explain why.



# NCAA Women's Soccer Championships

Look back to page 68 for a table showing all of the NCAA women's soccer championship teams. The list is rather small; remember that the North Carolina women's soccer team has played in (and won) the majority of the women's soccer championship games!

1. Notre Dame has been involved in the two longest championship games ever played. How long did each game last? Why do you suppose the most recent championship game only went to two overtimes and was then settled by penalty kicks?

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2. Two college teams that are not well known have won the women's soccer championship. (By that we mean that almost everyone has heard of Notre Dame, Stanford, or North Carolina—mostly because they have won numerous men's national championships in football and basketball!) But what do you know about George Mason University and Santa Clara University? Where are they located? How big are they? Have they been to the Final Four additional times without winning the championship game or playing in the championship game?

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3. One college's soccer team has captured the national women's championship title twice—and almost no one has heard of that team. Use the Internet to research the University of Portland. Where is it located? How large is it? What is the team's nickname? What other facts can you find about Portland? (**Note:** Do not confuse the University of Portland with Portland State University. They are different schools.)

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4. The University of Florida has captured one national women's soccer title. On that team was a soccer player who went on to star with the U.S. Women's National Team, the U.S. Olympic team, and women's professional soccer teams. Who is that famous University of Florida female soccer player?

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# Goal Differential

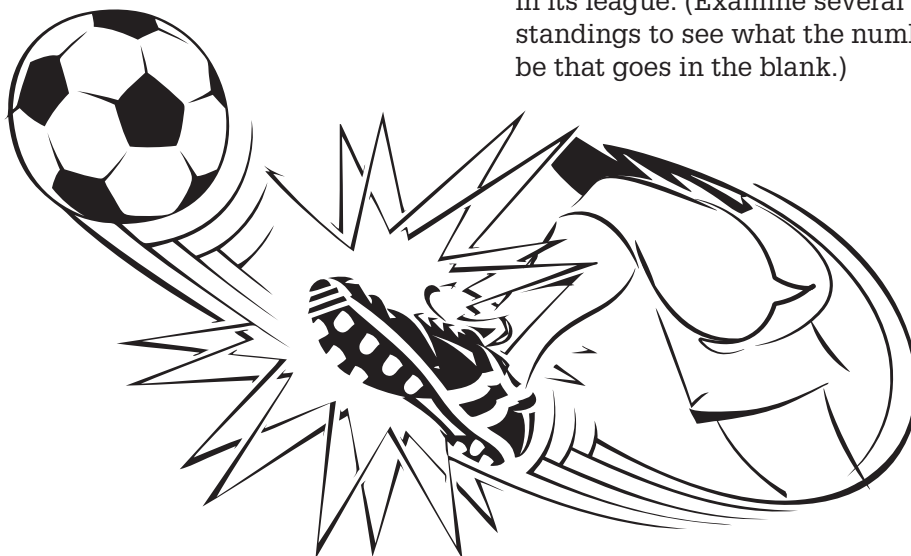
Look back at the table on page 34, where you examined the relationship between goal differential—the number of goals one team scored compared to the number of goals they allowed—and examined whether this figure had a relationship with how well a team did in the German Bundesliga. The idea seems to make sense. If a team scores more goals than other teams do, and the team's defense allows fewer goals than other teams do, it certainly seems logical to say, "A team with a high point differential will do better than a team with a low point differential." And it seems extremely logical to say "A team with a positive point differential will finish above a team with a negative point differential."

Is this always true? Or is it usually true? Or does it just sound good but really doesn't predict much? To find out:

1. Select any soccer league of interest to you.
2. Find the final standings for three or four years of play.
3. Find the total number of goals scored by each team in the league for each year.
4. Find the total number of goals allowed by each team for each year.
5. Find the goal differential for each team.

Then, make predictions and test to see if they are true for each of the teams and/or years you selected. (Several sample predictions are shown below. Can you think of more?)

6. Teams with high positive point differentials finish in the top half of the standings.
7. Teams with high negative point differentials finish at the bottom of the league.
8. The higher the team's point differential, the higher that team finishes.
9. No team with a negative point differential has won its league.
10. No team with a negative point differential has finished higher than \_\_\_\_\_  
\_\_\_\_\_ in its league. (Examine several years of standings to see what the number would be that goes in the blank.)



# NCAA Championships

Look back at the table on page 69, which displayed the success the North Carolina Lady Tar Heels have had over the years in the NCAA championship games. But one of the interesting facts about NCAA championships is that there are different champions for different-sized colleges and universities. The major universities that everyone has heard about—usually during football and basketball games on television—compete for what is called the Division I championship. That is the division where the Lady Tar Heels have won so many times.

But the NCAA also has women's soccer championships at two other levels—Division II and Division III. So:

1. Look on the Internet for the record of colleges and universities that have won the Division II soccer championship. Then consider these questions:
  - a. For how many years has a Division II championship been held?  
\_\_\_\_\_
  - b. How many different teams won that championship?  
\_\_\_\_\_
  - c. Has any team dominated at that level as North Carolina has in Division I?  
\_\_\_\_\_
  - d. Are most games close, or are there some real blowouts? (You may remember that some Division I championship games have not been close.)  
\_\_\_\_\_  
\_\_\_\_\_
  - e. Do you recognize all of the colleges or universities that have won the Division II championships? Where are they all located?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. Use the Internet to research the record of colleges and universities that have won the Division III soccer championship. Then consider the same questions:
  - a. How many years has a Division III soccer championship been held for?  
\_\_\_\_\_
  - b. How many different teams have won that championship?  
\_\_\_\_\_
  - c. Has any team dominated at that level as North Carolina has in Division I?  
\_\_\_\_\_
  - d. Are most games close, or are there some real blowouts? (You may remember that some Division I championship games have been routs.)  
\_\_\_\_\_  
\_\_\_\_\_
  - e. Do you recognize all of the colleges or universities that have won the Division III championships? Do you know where they are all located? (As these are the smaller colleges, there are probably many that you have never heard of before reading their names on the champions list!)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# The Barclay's Premier League

Look back at the table on page 48, which shows the number of goals each member of the Premier League scored during the 2002–2003 season. Combined, the teams scored a total of exactly 1,000 goals during that season. That should make it easy to find each team's percentage of the total number of goals scored.

Final Standings	Team	Goals Scored	Percentage of League Total
1	Manchester United	74	
2	Arsenal	85	
3	Newcastle United	63	
4	Chelsea	68	
5	Liverpool	61	
6	Blackburn Rovers	52	
7	Everton	48	
8	Southampton	43	
9	Manchester City	47	
10	Tottenham Hotspur	51	
11	Middlesbrough	48	
12	Charleton Athletic	45	
13	Birmingham City	41	
14	Fulham	41	
15	Leeds United	58	
16	Aston Villa	42	
17	Bolton Wanderers	41	
18	West Ham United	42	
19	West Bromwich Albion	29	
20	Sunderland	21	

Complete the table by computing each team's percentage of the total goals scored in the Premier League during the season. Remember, you can check to see if you are correct by adding all of the partial percentage figures. They should add up to 100%, or very close to it.

Find another year's goal scoring statistics for the Premier League, both the statistics for each team and the total number of goals scored during the entire season. Then complete the following chart. (**Hint:** If the total number of goals scored is "close to" 1,000, then you may want to use a calculator for this project!)



# Sorting Teams by Offense and Defense

**O**n page 58 you created a 2-by-2 chart and placed teams into the chart based on whether their offenses were above or below average. The chart on that page was completed using data from Spain's 2004–2005 La Liga results. Soccer is—obviously—a game of both scoring goals for your team and preventing your opponent from scoring goals. The chart summarizes a team's ability to do both in relationship to other teams in its league. Such data should be interesting in analyzing the success or failure of any team during an entire season:

1. Select a soccer league and season.
  2. Find the Goals Scored and Goals Allowed statistics for your league and season from the final results table for that league and season.
  3. Next, compute the Mean Goals Scored and Mean Goals Allowed for the league. These will be the same. Why?
  4. Then place each team (for the year you selected) into the table provided below.
- Go back to page 58 and answer the previous four questions given above using data from the year and league you selected for this activity. Then consider these additional questions:
5. Which teams were relegated to a lower league after this season?
  6. In which cell or cells in the chart were the relegated teams located?
  7. Make the chart for other years. Are the relegated teams always found in the same cell locations?

		Goals Scored	
		Above average	Below average
Goals Allowed	Better than average		
	Worse than average		

**Remember:** For Goals Allowed, what does *better* than average mean? And what does *worse* than average mean?

# Soccer Leagues Around the World

**O**n page 53 you learned how to calculate the Mean Absolute Deviation (M.A.D.) of a set of scores. M.A.D. scores were on that page for the teams in the Premier League.

The M.A.D. is a measure of how spread out the scores in a data set are. By itself, the M.A.D. doesn't provide a lot of information. However, when several M.A.D. statistics are available, they can be compared to each other. The larger the M.A.D. statistics, the more spread out the scores are. A smaller M.A.D. value indicates that the scores tend to be closer together. Statistics that measure variance—that indicate how scores in a data set are spread apart—are called *measures of variability*.

Use copies of the following table to calculate the M.A.D. for each of the leagues on pages 34–37. (**Note:** You will need only 18 lines for the Bundesliga.)

Final Standings	Team	Goals Scored	Percentage of League Total
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

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# Soccer Leagues Around the World (continued)

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1. Which of the leagues had the highest M.A.D. statistic?

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2. Which of the leagues had the lowest M.A.D. statistic?

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3. What does your answer to question 1 tell you about the offenses in that league?

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4. What does your answer to question 2 tell you about the offenses in that league?

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5. Is there data in the league scoring tables that made you think one league would have a higher or lower M.A.D. statistic?

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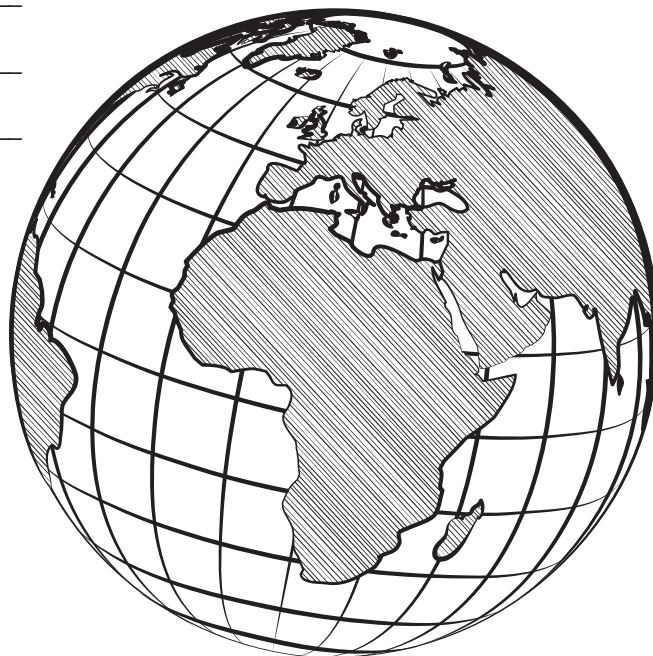
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You can calculate the M.A.D. statistic for goals scored by each team for any league during any season.



# Relegation Project 1

Using the Internet, find the final standings for any of the European leagues for three straight years.

1. Can you identify the new teams that came into the league from one year to the next?

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2. Can you identify who was relegated to a lower level of play for each year?

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3. Can you find a team that was relegated one year that managed to get back into the top or major league the next year?

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4. Can you find a team that moved up into the top league that was then relegated down after the next year or two?

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5. Can you find a team that moved up into a top league and managed to finish in the top half of the standings in the premier league?

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6. What would you do if your favorite team were relegated?

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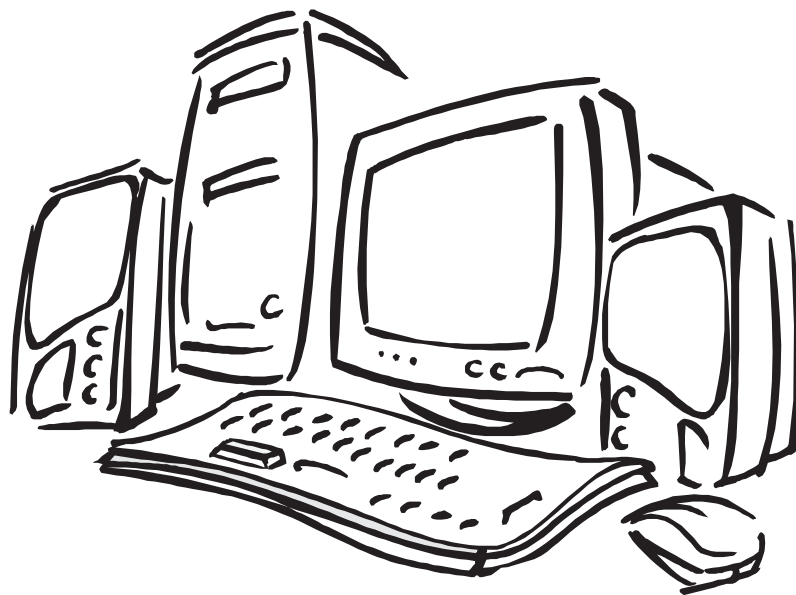
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## Relegation Project 2

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**T**oward the end of any soccer season, you will begin to see articles about the bottom teams in a league and what they will have to do to avoid relegation. One way to consider how vital relegation is to a soccer team is to put that idea into perspective by considering some other sport. For example, what would happen if the New York Yankees finished in the relegation zone? Can you imagine baseball without the Yankees being in the major leagues? Or what would happen if the Yankees, the White Sox, and the Angels were all relegated in the same season? That would mean three of America's largest cities—New York, Chicago, and Los Angeles—would not have a team in the American League. (They would still have National League teams, of course, unless the Mets, Cubs, and Dodgers were also relegated in the same year!)

1. Pick a soccer league of your choice.
2. Examine the Internet for articles on the teams at the bottom of the league's standings.
3. See if you can find an article about what a team has to do to avoid relegation.
4. Do the same for all teams that appear to be close to relegation. (That means they have only a few more points than the team you chose to look up first.)
5. Examine the schedule of games left to play. If two teams at the bottom have to play each other, one of them should get the points awarded for winning a game. Will those points help move the winner out of a regulation position?
6. Similarly, does the schedule have one team at or near the bottom playing only games with the best or top teams in the league? What does that mean for that team? Will it be easy for that team to escape relegation?



## The Pitch

### Standard Measurements pg. 2

Pitch Section	Area	Perimeter
Goal	192 sq. ft.	64 ft.
Center Circle	314 sq. yd.	62.8 yd.
Penalty Box	792 sq. yd.	124 yd.
6-Yard Box	120 sq. yd.	52 yd.

### Non-standard Measurements pg. 3

- Length = 5 yd. or 15 ft.  
Width = 4 yd. or 12 ft.
- Widest, but must be a rectangle:  
Minimum length = 100 yd.  
Maximum width = 100 yd.  
A square is a special rectangle.  
Longest, but must be a rectangle:  
Maximum length = 130 yd.  
Minimum width = 50 yd.
- None approach maximum length. None approach maximum width. Old Trafford is the longest and widest.

### England's Wembley Stadium pg. 4

- Playing area: 8,625 sq. yd.,  
77,625 sq. ft.
- 258.75 sq. yd.
- 79 yd.
- 120,000 English pounds

### Stadium Size pg. 5

- 57,372 seats
- Stamford Bridge, 136 years old in 2012
- Stoke City, 144 years old in 2012
- Oldest: Stoke City  
Youngest: Wigan Athletic  
Difference = 69 Years

### Challenge Question:

A team with a bigger stadium makes more money in ticket sales. A team with more money can pay more for players. If a team can't afford better players, they are more likely to be relegated.

### Comparing Stadium Seating Capacity pg. 6

- 31,690
- No.  $47,405 \times 2 = 94,810$ ; fifth-ranked Ohio State has more seats than 94,810
- More;  $36,230 \times 3 = 108,690$
- College average = 98,052 (Given as whole number. Do you know why?)
- Pitch average = 49,159

### World's Largest Soccer Stadiums pg. 7

- 19,000 people over capacity
- 9,580 unused seats
- 5,000 more seats
- 21,000 extra seats

### Player Positions pg. 8

- 2,600 yd. or 7,800 ft.
- 3,000 yd.
- 2,000 yd.

### The Goal Area pg. 9

- 192 sq. ft.
- $\frac{8}{20}$  or  $\frac{2}{5}$ ; 40%
- 11.8%; 12.5%; 12.3%

### The Goalie's Position in the Goal Mouth pg. 10

- 49 sq. ft.
- 25.5% of the goal mouth
- 143 sq. ft.
- 74.5%
- 11 ft.

### Challenge Question:

Yes, he or she could reach higher and further to each side with less movement.

## Player Awards

### The Golden Ball pg. 12–13

- All three players came from the same team! Barcelona must have been very good.
- By using percentages, it changes hundreds or even

thousands of votes into an artificial scale based on 100. So in 2011 you see that Messi received almost half of the votes; he was a clear winner. But in 2010 he received less than one-fourth of the votes. The voting was much closer in 2010 than in 2011.

3. Messi in 2011 received more than double the percentage figure of votes than the second-place finisher. The only other year that was similar was in 2009, when Messi received slightly more than twice the votes of the second-place finisher. But you don't know what 2009's numerical figures represent. For example, if ten or twelve other players received more than 150 votes, Messi's victory would not be as dramatic.
4. In 2010 Messi received only 5.29% more of the votes than his teammate Xavi. So, if 1,000 votes were cast, he would have won by only 52 or 53 votes. The only year in which fewer than 50 votes separated the winner from second place was in 2005. But you know that more voters were added in 2007, and you might suspect that when FIFA took over the award in 2010 that—again—more voters were added. So the “fewer than 50-voter difference” would not be important if the number of voters dropped dramatically.
5. 2010; all three figures are given in percentages, and they are relatively close
6. Messi was named by (about) 1 out of every 2 voters. Ronaldo was named by (about) 1 out of every 5 voters. Xavi was named by (about) 1 out of every 10 voters.

## Answer Key (continued)

### The Golden Boot pg. 14–15

The question asked that you complete the final column, Goals per Team Game. That column is shown, paired with the first column showing the year. Three columns have been omitted in the center of the table.

Season	Team Games	Top Scorer	Goals Scored	Goals Per Team Game
1992–1993	42	Teddy Sheeringham	22	0.52
1993–1994	42	Andy Cole	34	0.81
1994–1995	42	Alan Shearer	34	0.81
1995–1996	38	Alan Shearer	31	0.82
1996–1997	38	Alan Shearer	25	0.66
1997–1998	38	Dian Dublin Michael Owen Chris Sutton	18	0.47
1998–1999	38	Jimmy Floyd Hasselbaink Michael Owen Dwight York	18	0.47
1999–2000	38	Kevin Phillips	30	0.79
2000–2001	38	Jimmy Floyd Hasselbaink	23	0.61
2001–2002	38	Thierry Henry	24	0.63
2002–2003	38	Ruud van Nistelrooy	22	0.58
2003–2004	38	Thierry Henry	30	0.79
2004–2005	38	Thierry Henry	25	0.66
2005–2006	38	Thierry Henry	27	0.71
2006–2007	38	Didier Drogba	20	0.53
2007–2008	38	Cristiano Ronaldo	31	0.82
2008–2009	38	Nicolas Anelka	19	0.50
2009–2010	38	Didier Drogba	29	0.76
2010–2011	38	Dimitrar Berbatov Carlos Tévez	20	0.53

- 34 by Alan Shearer in 1994–1995 and Andy Cole in 1993–1994
- 18 by a trio of players (Dublin, Owen, and Sutton) in 1997–1998 and 18 by another trio of players (Hasselbaink, Owen, and York) in 1997–1998
- No. He played in 4 more games in 1994–1995.
- Yes. He played in the same number of games in both years.
- Alan Shearer scored an average of .82 goals per game in 1995–1996.
- Both trios of players who tied for the Golden Boot award in 1997–1998 and 1998–1999 averaged only .47 goals per game.

- Yes. Despite the fact that he played in a different number of games, the Goals per Game statistic takes that into account.
- Many factors might influence the award. One example should be given. When facing a major goal-scoring star, defending teams might create a special defense to keep that individual from scoring. Coaches who create such special defenses often say, "If we lose, that individual star will not make the goal that beats us!"
- It seems to alternate between a year when the winner has many goals to a year when the winner has fewer goals.

#### Challenge Question:

It is more likely to have several players score the same number of goals when that number is smaller. It is less likely to have several players all score a high number of goals.

#### Hat-Tricks pg. 16

- Manchester United
- Manchester City
- No. Everyone won except West Bromwich Albion, who had a draw in its match.
- West Bromwich Albion, Blackpool, West Ham United, and Birmingham City all gave up two hat-tricks during the season.

5. Dimitar Berbatov had three. No other player did that.
6. Newcastle United had three different players with hat tricks.
7. 4.5%
2. 70.8% for Fulham, 29.2 for New England
3. 36.8% for New England; 63.2% for Fulham
4. .29 goals per game
5. He scored 81.1% in Premier League games.
4. 224 appearances with 103 goals scored in the Spanish and Italian leagues combined

**Golden Boot Top Scorers pg. 17**

1. 11 goals
2.  $\frac{11}{20}$  of his goals
3. 55% came in the three games
4.  $\frac{9}{20}$  of his goals
5. 45% came in all the other games
6. 3 goals
7.  $\frac{3}{20}$  of his goals
8. 15% came in his hat-trick game
9.  $\frac{17}{20}$  came in the other games
10. 85% came in the other games
11. Tévez, because he was more consistent, scoring in many more of his team's games

**Famous Players**

**Lionel Messi pg. 20**

1. 25 years old in 2012; answers change in later years.
2. 66 inches
3. \$43,200 over the years
4. 268 appearances
5. 169 total goals
6. 1 out of 4, or  $\frac{1}{4}$

**Landon Donovan pg. 21**

1. 13 years
2. 2 more goals
3. .33 goals per game for the U.S. Men's National Team
4. .51 goals per game
5. 13 years ago in 2012; answer changes in later years.

**Clint Dempsey pg. 22**

1. 28 years old, going on 29

**Mia Hamm pg. 23**

1. 17 years
2. .57 goals per game
3. North Carolina won 98.9% of its games when Mia was on the team.
4. 77 caps
5. 97.1% of the voters approved her entry into the Hall of Fame.

**Abby Wambach pg. 24**

1. 32 years old in 2012; answers change in later years.
2. 9 goals per game
3. 72 of her goals were not game-winning goals
4. .761 goals per game
5. 292 goals (combined) scored by the two women

**Homare Sawa pg. 25**

1. 32 years old, almost 33
2. 18 years (It must have felt good to help win a first World Cup near the end of her career!)
3. .455 goals per game
4. 8 inches and 44 pounds
5. She was 15 in her first pro game. She was 33 when she won her the Ballon d'Or. She played professionally for 18 seasons before she won the award.

**Diego Maradona pg. 26**

1. 21 years at the senior (championship) level; 17 years on the national team
2. .52 goals per game
3. .37 goals per game for the national team

**Pelé pg. 27**

1. 62 years old in 2012; answers change in later years.
2. 71.3 goals per season
3. .94 goals per game
4. 83.7 percent of the games

**Marta pg. 28**

1. 26 years old in 2012; answers change in later years.
2. 16 years old
3. 1.11 goals per game average

**Ronaldo pg. 29**

1. 475 appearances
2. 335 goals
3. 140 more apps than goals scored
4. He scored 90 more goals in Spain than in Brazil, and he played 153 more games in Spain than in Brazil.

*Challenge Question:*

He scored 55 goals in just 57 games in the Netherlands, so it would seem that he made an important contribution to that team. Such a rate of scoring should have a major impact on his team. But any final decision on where Ronaldo had the greatest impact would depend on more than just his number of goals. Did the team win more games? Did the team immediately place higher in the league after he arrived? Questions such as this would be important in determining his impact.

**Shining Moments pg. 30**

1. 48.6%
2. 74 yards
3. 42 years in 2012; answers change in later years.

## League Play

### Barclay's Premier League Goals per Game pg. 32

The completed table is shown below.

Year	Season	League Teams	League Games	League Goals Scored	Mean Goals per Game
1	1992–1993	22	462	1,222	2.65
2	1993–1994	22	462	1,195	2.59
3	1994–1995	22	462	1,195	2.59
4	1995–1996	20	380	988	2.60
5	1996–1997	20	380	970	2.55
6	1997–1998	20	380	1,019	2.68
7	1998–1999	20	380	963	2.53
8	1999–2000	20	380	1,060	2.79
9	2000–2001	20	380	992	2.61
10	2001–2002	20	380	1,000	2.63
11	2002–2003	20	380	1,000	2.63
12	2003–2004	20	380	1,012	2.66
13	2004–2005	20	380	974	2.56
14	2005–2006	20	380	944	2.48
15	2006–2007	20	380	931	2.45
16	2007–2008	20	380	1,002	2.64
17	2008–2009	20	380	942	2.48
18	2009–2010	20	380	1,053	2.77
19	2010–2011	20	380	1,063	2.80

### Graphing the Premier League's Goals per Game pg. 33

- Season 19, 2010–2011 at 2.80 goals per game
- Season 15, 2006–2007 at 2.45 goals per game
- Season 17, 2.48 goals per game, to Season 17, 2.77 goals per game
- Season 2 and Season 3 had no change; 2.59 goals per game each season  
Season 10 and Season 11 had no change; 2.63 goals per game
- Season 17 to 18, when goals increased from 942 to 1053; that is 111 more goals
- Season 3 to 4, when 207 fewer goals were scored
- For the last three years, the number of goals rose. For the last 5 years, the number of goals rose except for one season.

#### Challenge Question:

It is fair to compare the mean goals per game when the number of teams in the league changed, as the mean (or average) goals per game takes into account the number of teams. It would not be fair to compare the total number of goals, as the number of games would increase.

German's Bundesliga pg. 34

Team	Goals For	Goals Against	Goal Differential
Borussia Dortmund	67	22	45
Bayer Leverkusen	64	44	20
Bayern Munich	81	40	41
Hannover 96	49	45	4
FSV Mainz 05	52	39	13
FC Nuremberg	47	45	2
FC Kaiserslautern	48	51	-3
Hamburger SV	46	52	-6
SC Freiburg	41	50	-9
FC Koln	47	62	-15
1899 Hoffenheim	50	50	0
VfB Stuttgart	60	59	1
Werder Bremen	47	61	-14
Schalke 04	38	44	-6
VfL Wolfsburg	43	48	-5
Borussia Monchengladbach	48	65	-17
Eintracht Frankfurt	31	49	-18
FC St. Pauli	35	68	-33

2. Yes. It means you score more goals than your opponents.

Italian Serie A pg. 35

Team	Goals For	Goals Against	Goal Differential
Milan	65	24	41
Internazionale	69	42	27
Mapoli	59	39	20
Udinese	65	43	22
Lazio	55	39	16
Roma	59	52	7
Juventus	57	47	10
Palermo	58	63	-5
Fiorentina	49	44	5
Genoa	45	47	-2
Chievo	38	40	-2
Parma	39	47	-8
Catania	40	52	-12
Cagliari	44	51	-7
Cesena	38	50	-12
Bologna	35	52	-17
Lecce	46	66	-20
Sampdoria	33	49	-16
Brescia	34	52	-18
Bari	27	56	-29

## Answer Key (continued)

### S Italian Serie A pg. 36

Team	Goals For	Goals Against	Goal Differential
Barcelona	95	21	74
Real Madrid	102	33	69
Valencia	64	44	20
Villarreal	54	44	10
Sevilla	62	61	1
Athletic Bilbao	59	55	4
Atlético Madrid	62	53	9
Espanyol	46	55	-9
Osasuna	45	46	-1
Sporting de Gijon	35	42	-7
Malaga	54	68	-14
Racing Santander	47	56	-15
Zaragoza	40	53	-13
Levante	41	52	-11
Real Sociedad	55	66	-17
Getafe	49	60	-11
Mallorca	45	56	-15
Deportivo La Coruna	31	47	-16
Hercules	36	60	-24
Almeria	36	70	-34

### Barclay's Premier League pg. 37

Team	Goals For	Goals Against	Goal Differential
Manchester United	78	37	41
Chelsea	69	33	33
Manchester City	60	33	27
Arsenal	72	43	29
Tottenham Hospur	55	46	9
Liverpool	59	44	15
Everton	51	45	6
Fulham	49	43	6
Aston Villa	48	59	-11
Sunderland	45	56	-11
West Bromwich Albion	56	71	-15
Newcastle United	56	57	-1
Stoke City	46	48	-2
Bolton Wanderers	52	56	-4
Blackburn Rovers	56	69	-13
Wigan Athletic	40	61	-21
Wolverhampton Wanderers	46	66	-20
Birmingham City	37	58	-21
Blackpool	55	78	-23
West Ham United	43	70	-27

**Major League Soccer in the United States, Western Division**  
pg. 38

- Greatest difference = 1,626 miles; longest = 1,748 miles (Dallas to Vancouver); shortest = 122 miles (Seattle to Vancouver)
- 3,380 miles for their trips to Los Angeles
- The trio of San Jose, LA Galaxy, and Chivas. Their travel is 1,272 miles. The Seattle, Vancouver, and Portland trio travel only 1,056 miles for their series.

**Major League Soccer in the United States, Eastern Division**  
pg. 39

- Greatest Travel by a Team  
Total = Houston, 11,241 miles
  - Least Travel by a Team  
Total = Philadelphia, 4,641 miles
- 2,964 air miles for the three round trips
- Answers will vary. Lost time (wait time, loading time, unloading time, etc.) in an airport must be considered.
- 2,254 air miles

**Mexican Primera Division**  
pg. 40

- No. The regular-season champs both lost in the eight-team playoff rounds.
- The following table shows the total points for each team (combined from both short seasons).

Cruz Azul	65
Monterrey	58
Santos Laguna	53
America	53
San Luis	47
Jaguares	39
Pachuca	43
UNAM	60
UANL	59
Guadalajara	47
Toluca	43
Morelia	52
Puebla	37
Querétaro	25
Necaxa	31
Atlante	43
Estudiantes Tecos	32
Atlas	36

- Cruz Azul

**Soccer Formations**

**Positioning the Players I** pg. 42

- 60%
- 80%
- 40%

**Positioning the Players II** pg. 43

- 70%
- 70%
- 40%

**Why Are They Needed?** pg. 44

- 60%
- 90%
- The 3–4–3 formation
- The 3–4–3 formation

**Positions and Theory** pg. 45

- 69 yd.
- 93 yd.
- 81 yd.

**Blank Pitch Page:** pg. 46

Formations will vary, but there should be 11 players (counting the goalie) in all formations. It might also be interesting to plan formations in which a team is down one or more players. (Players who receive a red card or two yellow cards are ejected and the team must play "short-handed.")

## Professional Leagues

Goals Scored and Allowed: Barclay's Premier League Statistics pg. 48–50

Final Standings	Team	Goals Scored	Goals Allowed	Goal Differential
1	Manchester United	74	34	40
2	Arsenal	85	42	43
3	Newcastle United	63	48	15
4	Chelsea	68	38	30
5	Liverpool	61	41	20
6	Blackburn Rovers	52	43	9
7	Everton	48	49	-1
8	Southampton	43	46	-3
9	Manchester City	47	54	-7
10	Tottenham Hotspur	51	62	-11
11	Middlesbrough	48	44	4
12	Charleton Athletic	45	56	-11
13	Birmingham City	41	49	-8
14	Fulham	41	50	-9
15	Leeds United	58	57	1
16	Aston Villa	42	47	-5
17	Bolton Wanderers	41	51	-10
18	West Ham United	42	59	-17
19	West Bromwich Albion	29	65	-36
20	Sunderland	21	65	-44

- Mean = 50 goals scored is the average goals scored per team
- Seven, including Manchester United, Arsenal, Newcastle United, Chelsea, Liverpool, Blackburn, and Tottenham
- Three, including Everton, Southampton, and Manchester City
- One, including Leeds United
- Nine, including Middlesbrough, Charleton, Birmingham City, Fulham, Aston Villa, Bolton, West Ham United, and West Bromwich Albion, and Sunderland
- Median = 47 goals per team
- Eight, including Manchester United, Arsenal, Newcastle United, Chelsea, Liverpool, Blackburn, Tottenham, and Everton
- Two, including Southampton and Manchester City
- Two, Leeds United and Middlesbrough
- Eight, including Charleton, Birmingham City, Fulham, Aston Villa, Bolton, West Ham United, and West Bromwich Albion, and Sunderland
- Mode = 41 goals per team
- 10, including all teams in the top half
- No one in the top ten scored fewer than 41 goals in the season.
- Five, including Middlesbrough, Charleton, Leeds United, Aston Villa, and West Ham United
- Two, including West Bromwich and Sunderland
- The median; It predicted all but two of the top teams, and it predicted all but two teams.
- The mean; It predicted all but one of the bottom teams.
- The mode; All ten of the top-half teams did better than the mode, but five of the lower teams also did better than the mode. In this situation, the "goals scored by the greatest number of teams" was quite low.

**Goals Allowed I: Barclay's Premier League Statistics**  
pg. 51

- 65 goals were allowed by two teams, West Bromwich Albion and Sunderland
- 34 goals were allowed by Manchester United
- The range of goals allowed was 31
- The range of goals scored by all teams was 64
- Goals Scored was larger

*Challenge Question:*

It was bigger on offense. Much larger in fact; the range was more than two times as much. Compare this to the year/league you picked to see if the range for offense or defense was larger.

**Goals Allowed II: Barclay's Premier League Statistics**  
pg. 52

- Manchester United and Arsenal
- West Bromwich Albion and Sunderland
- 64 goals was the range for goals scored in the league
- Chelsea
- 68 goals
- Birmingham City, Fulham, and Bolton
- 41 goals each
- 27 goals

**Goals Allowed III: Barclay's Premier League Statistics** pg. 53

- The Goals Scored mean is 50.
- Deviations are shown in the Deviation Column in the chart.

Final Standings	Team	Goals Scored	Deviations	Absolute Deviations
1	Manchester United	74	24	24
2	Arsenal	85	35	35
3	Newcastle United	63	13	13
4	Chelsea	68	18	18
5	Liverpool	61	11	11
6	Blackburn Rovers	52	2	2
7	Everton	48	-2	2
8	Southampton	43	-7	7
9	Manchester City	47	-3	3
10	Tottenham Hotspur	51	1	1
11	Middlesbrough	48	-2	2
12	Charlton Athletic	45	-5	5
13	Birmingham City	41	-9	9
14	Fulham	41	-9	9
15	Leeds United	58	8	8
16	Aston Villa	42	-8	8
17	Bolton Wanderers	41	-9	9
18	West Ham United	42	-8	8
19	West Bromwich Albion	29	-21	21
20	Sunderland	21	-29	29

- Zero
- The Absolute Deviations are shown in the column with that name on the chart.
- Plus or minus signs are not included in the Absolute Deviations column.
- The M.A.D. (Mean Absolute Deviation) statistic is 11.2.

## Answer Key (continued)

### Data Organization I: Italian Serie A Statistics pg. 54–55

The completed table is shown below; the numbers entered are shown in italics.

Final Standings	Team	Goals Scored	G. S. Rank	Goals Allowed	G. A. Rank
1	Internazionale	75	1	34	1
2	Roma	68	2	41	3
3	Milan	60	3	39	2
4	Sampdoria	49	10	41	3
5	Palermo	59	4	47	9
6	Napoli	50	9	43	6
7	Juventus	55	7	56	15
8	Parma	46	13	51	12
9	Genoa	57	5	61	18
10	Bari	49	10	49	11
11	Fiorentina	48	12	47	9
12	Lazio	39	17	43	6
13	Catania	44	14	45	8
14	Chievo	37	18	42	5
15	Udinese	54	8	59	17
16	Cagliari	56	6	58	16
17	Bologna	42	15	55	14
18	Atalanta	37	18	53	13
19	Siena	40	16	67	20
20	Livorno	27	20	61	18

- The G. S. Rank scores are shown in the table.
- Yes, three teams. The teams are listed by team, standing, and G. S. Rank.
  - Sampdoria, 4, 10.
  - Parma, 8, 13
  - Bari, 10, 10
- Yes, there were two teams. They are listed below by team, standing, and G. S. Rank.
  - Udinese, 15, 8
  - Cagliari, 16, 6
- No. Two teams with low G.S. Rank scores finished in the top half, and two teams with high G. S. Rank scores finished in the bottom half of the standings.
- The G. A. Ranks are shown in the table.
- Yes, four teams. The teams are listed by team, standing, and G. A. Rank.
  - Juventus, 7, 15
  - Parma, 8, 12
  - Genoa, 9, 18
  - Bari, 10, 11
- Yes, four teams. The teams are listed by team, standing, and G. A. Rank.
  - Fiorentina, 11, 9
  - Lazio, 12, 6
  - Catania, 13, 8
  - Chievo, 14, 5
- No. Four teams with low G. A. Rank scores finished in the top half; four teams with high G. A. Rank scores finished in the bottom half of the league.

**Data Organization II: Italian Serie A Statistics** pg. 56

Final Standings	Team	Goals Scored	Goals Allowed	Goal Differential
1	Internazionale	75	34	41
2	Roma	68	41	27
3	Milan	60	39	21
4	Sampdoria	49	41	8
5	Palermo	59	47	12
6	Napoli	50	43	7
7	Juventus	55	56	-1
8	Parma	46	51	-5
9	Genoa	57	61	-4
10	Bari	49	49	0
11	Fiorentina	48	47	1
12	Lazio	39	43	-4
13	Catania	44	45	-1
14	Chievo	37	42	-5
15	Udinese	54	59	-5
16	Cagliari	56	58	-2
17	Bologna	42	55	-13
18	Atalanta	37	53	-16
19	Siena	40	67	-27
20	Livorno	27	61	-34

- No.
- Fiorentina finished in eleventh place.
- No.
- There are three exceptions: Juventus, Parma, and Genoa, who finished seventh, eighth, and ninth, respectively.
- No.

**Data Organization III: Spain's La Liga Statistics** pg. 57

- Mean scored = 49
- Eight teams were over the mean: Barcelona, Real Madrid, Villarreal, Betis, Espanyol, Valencia, Athletic Bilbao, and Zaragoza.
- Mean allowed = 49
- Nine teams were under the mean in Goals Allowed: Barcelona, Real Madrid, Villarreal, Espanyol, Sevilla, Valencia, Malaga, Atlético Madrid, and Getafe.

**Data Organization IV: Spain's La Liga Statistics** pg. 58

		Goals Scored	
		Above average	Below average
Goals Allowed	Better than average	<ul style="list-style-type: none"> <li>▪ Barcelona</li> <li>▪ Real Madrid</li> <li>▪ Villarreal</li> <li>▪ Espanyol</li> <li>▪ Valencia</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sevilla</li> <li>▪ Malaga</li> <li>▪ Atlético Madrid</li> <li>▪ Getafe</li> </ul>
	Worse than average	<ul style="list-style-type: none"> <li>▪ Betis</li> <li>▪ Athletic Bilbao</li> <li>▪ Zaragoza</li> </ul>	<ul style="list-style-type: none"> <li>▪ Deportivo La Coruna</li> <li>▪ Real Sociedad</li> <li>▪ Oasuna</li> <li>▪ Racing Santander</li> <li>▪ Mallorca</li> <li>▪ Levante</li> <li>▪ Numancia</li> <li>▪ Albacete</li> </ul>

- Yes, five of the top seven are in upper left box.
- Bottom right box; The bottom 6 teams are here.
- It is better than using Goals Scored or Goals Allowed statistics by themselves.

## Players—Goalies

### Goalkeeper Position and Strategy pg. 60

- 29.2%
- 37.5%
- 20 corner kicks total
- 3 goals were scored
- 28.9% of the games were “clean sheet” games for the goalie

### Tim Howard pg. 61

- .4%, which is  $\frac{4}{10}$  of 1%
- 328 appearances
- 450 points
- He allowed 35 goals
- In 2012, he was 33 years old; he would then have approximately 7 years left of play. Answers will vary

### Hope Solo pg. 62

- 31 years old in 2012; answers change in later years. Using 40 as a top age, she could play for 9 more years
- 44 more international appearances
- Somewhere near 11 games
- 1.2 goals per game
- 0.7 goals per game

### The Penalty Kick pg. 63–64

- One second
- One-third of a second
- Three seconds

### Challenge Questions:

- It would be unlikely. The goalie would have to jump up to reach such a shot, and to reach into the upper corner, he or she would have to take a step or two to be able to jump high enough to reach the upper corner of the goal mouth. And most of the movements would have to take place before the striker actually kicked the ball.

- If the striker tries to hit the upper portion of the goal mouth, it brings another possibility to miss. He or she might hit the ball over the net. It usually isn't worth the risk to try to hit the upper corner of the net.

## Women's Soccer

### Cap Leaders pg. 66

- 23 years
- 15.3 games per year
- She has averaged 17.4 caps per year
- 6.3 years
- First, Hassan has 179 caps in 16 years

He averages 11.19 caps per year

He is  $(352 - 179)$ , or 173 caps behind Lilly

So, 173 divided by  $11.19 = 15.46$

If he continued to get caps at his present rate, he would need 15.46 years to catch Lilly

### Challenge Question:

The top five players are all U.S. women. They played on the team for many years. In addition, the team was very successful, so they played a large number of games, especially in championship years. The men's situation is not the same.

### Scoring Leaders pg. 67

- Complete the table's last column:

Rank	Player	Country	Goals	Caps	Goals per Game
1	Mia Hamm	U.S.	158	275	.57
2	Abby Wambach	U.S.	131	171	.77
3	Kristine Lilly	U.S.	130	352	.37
4	Christine Sinclair	Canada	129	171	.75
5	Birgit Prinz	Germany	128	214	.60
6	Julie Fleeting	Scotland	116	120	.97

- Julie Fleeting
- Kristine Lilly
- 36 games
- 40 games
- 44 games

**NCAA Women's Soccer Championships** *pg. 69*

1. **North Carolina Soccer Championships**

Total Number of Title Games	23
Times NC Won the Title Game	20
Percentage of all Titles won by NC	67%
Times NC Lost the Title Game	3
Percentage of All Title Games Lost by NC	10%
Total Number of Times NC Played for Title	23
Percentage of all Title Games Played by NC	77%

- North Carolina scored 64 points in 23 games.
- North Carolina averaged 3.2 points per game when its team won.
- North Carolina scored no points when the team lost: 0.0 average.
- 10 points
- Eight different teams have won the title.
- Nine other teams have played for and lost the title.
- Seventeen different schools have appeared in the final game.

**Women's World Cup Match 2011** *pg. 7*

- $\frac{5}{14}$
- $\frac{1}{3}$
- $\frac{6}{16}$
- $\frac{1}{3}$
- $\frac{3}{6}$
- $\frac{2}{3}$
- $\frac{4}{6}$
- $\frac{2}{3}$
- $\frac{3}{4}$
- $\frac{5}{6} = 1$

*Challenge Question:*

Examine the chart on the penalty kick results. The U.S. goalie saved (prevented the Brazilian striker from scoring) Brazil's third shot. So, after four shots, the United States led 4–3. When Alex Krieger made the last U.S. shot, the score was 5–3. Brazil could not win or tie on its last penalty kick, so the shoot-out was over after Krieger made her PK.

**Women's World Cup Matches** *pg. 71*

- 18.5%
- $\frac{1}{4}$
- 42.9%
- $\frac{1}{2}$
- 60%
- $\frac{2}{3}$
- 66.7%
- $\frac{2}{3}$
- 75%
- 10.25%

*Challenge Question:*

With the score 3–1 after four penalty kicks, there was no chance that a fifth kick from either side would change the outcome.

**Women's Olympic Soccer Tournament** *pg. 772–73*

- $3w + d = \text{Points}$
- United States = 6  
Norway = 6  
Japan = 4  
New Zealand = 1
- China = 7  
Sweden = 6  
Canada = 4  
Argentina = 0
- Brazil = 7  
Germany = 7  
North Korea = 3  
Nigeria = 0

- Groups F and G had ties.
- F = Brazil  
G = United States

**The 2010 World Cup**

**England–United States Game Statistics** *pg. 76–77*

- England = 44.4%  
United States = 30.8%
- England
- England = 12.5%  
United States = 25%
- United States
- England = 10  
United States = 4
- England
- 32 minutes  
28 minutes
- 60 minutes
- 30 minutes
- 96 minutes
- 36 minutes
- 33.3%
- 29.2%
- 37.5%

**The Netherlands' Route to the Finals** *pg. 78–79*

- 109 minutes
- 87 minutes
- 55.6%
- 96 minutes
- 95 minutes
- 50.3%
- Dutch possession time decreased from the group round to the knockout round.

**Spain's Route to the Finals** *pg. 80–81*

- 119 minutes
- 80 minutes
- 59.8%

## Answer Key (continued)

- |   |  |                    |
|---|--|--------------------|
| 4. The Swiss, as they possessed the ball less | <b>The Final Game</b> <i>pg. 82–83</i> | 6. 59.6%           |
| 5. Germany                                    | 1. $\frac{7}{12}$                      | 7. $\frac{19}{47}$ |
| 6. Shots and Shots on goal                    | 2. 58.3%                               | 8. 40.4%           |
| 7. 57.1%                                      | 3. $\frac{5}{12}$                      | 9. 128 minutes     |
| 8. It decreased slightly.                     | 4. 41.7%                               | 10. 37.5%          |
|   | 5. $\frac{28}{47}$                     | 11. 28.1%          |

## Point System

### The Formula *pg. 86–87*

Each team's points are shown below.

Team	Games	W	D	L	GF	GA	GD	Pts
Arsenal	38	20	12	6	68	37	+31	72
Aston Villa	38	17	11	10	54	48	+6	62
Blackburn Rovers	38	10	11	17	40	60	-20	41
Bolton Wanderers	38	11	8	19	41	53	-12	41
Chelsea	38	25	8	5	68	24	+44	83
Everton	38	17	12	9	55	37	+18	63
Fulham	38	14	11	13	39	34	+5	53
Hull City	38	8	11	19	39	64	-25	35
Liverpool	38	25	11	2	77	27	+50	86
Manchester City	38	15	5	18	58	50	+8	50
Manchester United	38	28	6	4	68	24	+44	90
Middlesbrough	38	7	11	20	28	57	-29	32
Newcastle United	38	7	13	18	40	59	-19	34
Portsmouth	38	10	11	17	38	57	-19	41
Stoke City	38	12	9	17	38	55	-17	45
Sunderland	38	9	9	20	34	54	-20	36
Tottenham Hotspur	38	14	9	15	45	45	0	51
West Bromwich Albion	38	8	8	22	36	67	-31	32
West Ham United	38	14	9	15	42	45	-3	51
Wigan Athletic	38	12	9	17	34	45	-11	45

- |   |    |                  |   |
|---|----|------------------|---|
| 1. Manchester United  | 6. |                  | 7. Manchester City  |
| 2. Middlesbrough and West Bromwich Albion   |    | <b>Place</b>     | 8. West Bromwich Albion's Goal Diff. = -31, while Middlesbrough's Goal Diff. = -29. |
| 3. Yes.   |    | <b>Team</b>      |   |
| 4. Three: Tottenham and West Ham (51) and Stoke City and Wigan (45) and West Bromwich Albion and Middlesbrough (32) |    | <b>Points</b>    |   |
| 5. One: Blackburn, Bolton, and Portsmouth (41)  |    | <b>Goal Diff</b> |   |

8	Tottenham	51	0
9	West Ham	51	-3
10	Manchester City	50	8
11	Wigan	45	-11
12	Stoke City	45	-17
13	Bolton	41	-12
14	Portsmouth	41	-19
15	Blackburn	41	-20

**German Bundesliga** *pg. 88*

Answers are shown in italics.

<b>Team</b>	<b>W</b>	<b>D</b>	<b>L</b>	<b>GF</b>	<b>GA</b>	<b>GD</b>	<b>Pts.</b>
Arminia Bielefeld	10	7	17	32	47	-15	37
Bayer Leverkusen	14	10	10	64	49	+15	52
Bayern Munich	22	9	3	67	32	+35	75
Borussia Dortmund	11	13	10	45	42	+3	46
Borussia Monchengladbach	10	12	12	42	50	-8	42
Eintracht Frankfurt	9	9	16	42	51	-9	36
1. FC Kaiserslautern	8	9	17	47	71	-24	33
1. FC Koln	7	9	18	49	71	-22	30
1. FC Nuremberg	12	8	14	49	51	-2	44
FSV Mainz 05	9	11	14	46	47	-1	38
Hamburger SV	21	5	8	53	30	+23	68
Hannover 96	7	17	10	43	47	-4	38
Hertha BSC	12	12	10	52	48	+4	48
MSV Duisberg	5	12	17	34	63	-29	27
Schalke 04	16	13	5	47	31	+16	61
VfB Stuttgart	9	16	9	37	39	-2	43
VfL Wolfsburg	7	13	14	33	55	-22	34
Werder Bremen	21	7	6	79	37	+42	70

1. Bayern Munich
2. MSV Duisberg
3. Bayern Munich
4. MSV Duisberg
5. Hannover 96
6. Hamburger SV
7. FS Mainz and Hannover 96
8. FS Mainz

**Relegation:**  
**Barclay's Premier League** *pg. 89*

1. No. The bottom three teams are relegated each year, which means they are sent down to a lower division. In England, that lower division is called the Football League Championship group. The top three teams from that league move up to the Premier League, so you should be able to find three new teams entering the league each year.
2. Teams that moved up to the Premier League in 2009: Birmingham, Wolves, Burnley
3. Yes. West Bromwich Albion (West Brom on the chart) and Newcastle were relegated after the 2008–2009 season, spent the 2009–2010 season in the Football League Championship group, and then moved back to the Premier League for the 2010–2012 season. But no team that was relegated in 2008–2009 came back (after two full seasons in the Football League) in 2011–2012. The table does not include enough information to check on any other two-year relegation.
4. In 2009–2010, Birmingham came back to the Premier League and finished in ninth place. In 2011–2012 Swansea came back to the Premier League and was in the eighth position with about ten matches left to play.

## Answer Key (continued)

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### Relegation: German Bundesliga

pg. 90–91

1. Karlsruher SC and Arminia Bielefeld were directly relegated. Energie Cottbus was in the playoff but lost and was relegated.
2.  $\frac{3}{18}$  or  $\frac{1}{6}$   $\frac{1}{6}$
3. VfL Bochum and Hertha BSC were directly relegated. FC Nuremberg was in the playoff but won and stayed in the Bundesliga.
4.  $\frac{2}{18}$  or  $\frac{1}{9}$
5. Eintracht Frankfurt and FC St. Pauli were directly relegated.
6. Borussia Mönchengladbach was in the playoff but won and stayed in the Bundesliga.
7.  $\frac{2}{18}$  or  $\frac{1}{9}$

**Added time:** minutes added to a half or extra time period to account for injuries, substitutions, or other stoppages of play. Remember: The clock never stops; play does.

**Aggregate score:** the combined score from two games of a tie or home and home series

**Away goals:** goals scored by a team in its opponent's stadium

**Cap:** an appearance for a player's national team

**Caution:** See *Yellow card*

**Corner kick:** a restart after the defending team sends the ball out of play over its own goal line (but not into its own goal). The kick is taken from the nearest corner of the field where the ball went out of play.

**Draw:** a game that ends in a tied score

**End line:** also called the goal line, the end lines are the boundaries of the field where the goals are located.

**Expulsion:** See *Red card*.

**Extra time:** the two 15-minute periods that are added to games that cannot end in a draw. Extra time periods may have added time due to injuries and stoppages of play.

**Goal box:** the area surrounded by the 6-yard line. All goal kicks must be taken from inside the goal box.

**Goal differential:** the difference between goals for and goals against. This is often a negative number.

**Goals for:** goals scored by a team

**Goals against:** goals scored by an opponent

**Golden goal:** a goal in extra time that stops the game and causes the scoring team to win

**Group play:** games played between teams in a tournament where each team plays all other teams in its group

**Home and Home Series:** scheduling two teams to play two games, with each team having one game on its home pitch and the other game on the opponent's pitch.

**Knockout rounds:** single elimination rounds of a tournament in which the loser of the game is eliminated from the tournament. Also called *elimination rounds*. Games in knockout rounds may not end in a draw.

**Offside:** an infraction in which the offensive player is behind all but one defensive player when the ball is passed forward to him or her by a teammate

**Own Goal:** a goal scored when a player accidentally kicks or deflects the ball into his or her team's goal.

**Penalty box:** the area enclosed by the 18-yard box. A defensive foul in this area results in a penalty kick.

**Penalty kick:** a kick taken from the penalty spot (12 yards in front of the goal mouth) that is awarded to the attacking team when the defense commits a foul in the penalty box

**Penalty kick shootout:** a method of ensuring a game does not end in a draw. Each team is allowed five penalty kicks with the team that scores the most goals in the shootout declared the winner of the game. If the score is tied after five rounds of penalty kicks, each team gets

## Glossary (continued)

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one additional penalty kick. This repeats until the score is no longer tied after each team has taken the same number of penalty kicks.

**Red card:** an expulsion given to a player for violent play or for receiving two cautions. A player expelled from the game by a red card may not be replaced by his or her team. This leads to the team playing “a man down.” The actual red card shown to a player is a small sheet of red paper.

**Save:** occurs when a shot on goal is stopped or deflected away from the goal by the goalkeeper

**Set Piece:** preplanned plays occurring after a play stoppage. Such plays usually occur after a corner kick or a free kick is awarded to a team.

**Tie:** a two-game series between two teams. One game is played at each team’s home field. The winner is determined by aggregate score, with ties broken by the number of away goals. In other words, if both teams scored each team won one of the games, and each team scored six goals, the team that scored more goals on the other team’s home field would be the winner.

**Touch line:** also called the *sideline*, the line that runs the length of the field

**Yellow card:** a caution given to a player by the referee. Two yellow cards result in a red card and expulsion from the game. The actual yellow card shown to a player is a small sheet of yellow cardstock.



