

The Science of Golf

Test Lab Toolkit **The Score: Handicap**

Facilitator Guide
Grades 9-12



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Test Lab Toolkits bring math and science to life by showing how STEM studies play a big role in the game of golf. They are funded by the United States Golf Association (USGA).



Welcome to the Test Lab Toolkit!

Handicap



Sometimes the study of science and math can seem a little disconnected from the “real” world. Yet a closer look reveals that science and math are everywhere in the world around us, in familiar and surprising ways.

Take something fun, like the game of golf. Sure, there's math, because you have to keep score. But there's also science, technology, and engineering hidden in the game — from the physics of how you swing, to the mechanics of a golf club, to the remote sensors that tell you when to water the golf course.

To get students more excited about science, technology, engineering, and math (STEM), the United States Golf Association has created a multi-media educational platform that uses golf to bring those fields to life. Hands-on learning experiences let students move beyond the textbook and classroom to explore science as an essential part of a real-world game.

The **TEST LAB TOOLKITS** use the USGA Test Center as inspiration for a fun series of golf-focused science activities. At the Test Center, scientists and engineers play around with golf balls, clubs, and other equipment every day to learn how they work. Since people keep thinking of new ways to improve the game, the Test Center needs to test new equipment to make sure it works with the game's traditions and doesn't give any unfair advantages. And now students can do some of the same experiments that the Test Center does.

Each Toolkit presents a specific topic related to one of the major elements of golf: The Swing, The Club, The Ball, The Course, and The Score. In the **HANDICAP** Toolkit, you will find background information and instructions for four hands-on activities, including:

- 1 Experiment with the **USGA Handicap System™** (and find out how it changes golf scores)
- 2 Design your own game (and handicap it so play is more equal)
- 3 Create a new handicap system for a sport that doesn't have one (and see how it changes the sport)
- 4 Calculate your own actual **Handicap Index®** (and discover your potential golf ability)

We hope you enjoy using this Test Lab Toolkit, and that it leads you to try others. The more Toolkits you do, the more your students will become experts at science — and golf!

How to Use the Toolkit

Handicap



Background

Each Toolkit includes information about the science and math concepts behind a specific golf topic. Each Toolkit also relates directly to one or more videos in the NBC Learn: Science of Golf series — for **HANDICAP**, the related video is “Calculating a Golf Handicap Index.”

You can have the group review this information and watch the video as an introduction before doing any of the activities.

Activities

The four activities in this Toolkit can each be done independently, but they also build on each other:

- **Investigate:** In these two activities, students explore fundamental scientific concepts through hands-on experiments. You can run them informally as a large group activity, or have students do them as more formal science labs with standard scientific procedure (hypothesis, observation, conclusion, etc.).
- **Create:** This activity encourages creative thinking by challenging students to design their own version of a fundamental component of golf, such as a club, a golf ball, a putting green, etc. Students will

rely on the scientific concepts they explored in the *Investigate* activities.

- **Connect:** While all Toolkit activities relate to the real world through the golf focus, this activity actually sends students out into the world to explore science in context. Using the concepts they first investigated through simulations, they will see what happens in an actual golf game or environment.

The student Toolkit includes full instructions and sample charts to record data for each activity. This Facilitator Guide includes each student activity, as well as further instructions for the facilitator.

Materials

Each activity has been designed to require only inexpensive, easy-to-find materials. Often students will also be asked to use a golf ball and club. If you don't have a golf ball, use another small ball (ping pong ball, tennis ball, etc.). If you don't have a club, use a stick of similar length (hockey stick, yardstick, etc.) or simulate one with a long wooden dowel, cardboard tube, or other materials.

Test Lab Log

All of the activities in this Toolkit, and across the other Toolkits, are designed to work together to teach

interconnected science and math concepts. But they can also help students learn more about the game of golf, so that they can improve their understanding and skill.

After each activity, we recommend that students document what they learned in some way — notes, photos, video, diagrams, etc. They can then compile all their results into an ongoing Test Lab Log, which they can use as both a summary of their work and a handbook for the game. Depending on your available resources, the Test Lab Log can be as low-tech or high-tech as you like. Recommendations include:

- **Binder notebook:** Keep a single notebook for the entire class to use, or have students create their own binders of individual and shared materials.
- **Tumblr (tumblr.com):** Use this free site to create a customized microblog for the group, where students can easily upload results, post comments, and build conversations. The microblog can be public, or can be made private through the password protection option.
- **Wordpress (wordpress.com):** Use this free site to create a customized blog for the group. With a username and password, students can easily access the blog, upload results, and post comments.

Investigate: Golf Scores

Facilitator Guide

Handicap



Grades **9-12**



The USGA Handicap System™ enables golfers of all skill levels to compete on a more even basis. Each golfer can calculate a personal Handicap Index®, which can be used to determine the number of strokes that can be subtracted from the golfer's score on a particular course (**course handicap**). It's based on how well you play — a good **scratch golfer** may have a course handicap of 0, while a **bogey golfer** may have a course handicap of 20. In this activity, you'll investigate how golf scores work by playing a made-up game for a real course, and then figuring out how a Handicap Index® would change your score.

Learning Objectives

To understand the **The USGA Handicap System™**.

To use math formulas to calculate handicaps.

STEM Fields

Mathematics: equations, number system

Time Requirement



One session 45 min

Activity Type

No advance planning



Indoors or outdoors
(on a golf course)





What Do You Do?

1 Introduce the Activity

- Read *Background Information* and watch the NBC Learn video “Calculating a Golf Handicap Index” at www.nbclearn.com/science-of-golf.

2 “Play” the Course

Investigate: Golf Scores, steps 1-2

- To make sure you end up with a variety of course handicaps, have students “play” the course with a variety of skill levels.
- You can also have students play from different tee positions (with different levels of difficulty).

3 Calculate the Scores

Investigate: Golf Scores, steps 3-7

- Before calculating course handicaps and subtracting them from the gross scores, ask students to predict who will end up with the best net scores.

What Happens?

Have students create a short report about the activity to add to their Test Lab Log. The report could include notes, photos, diagrams, etc.

What Does it Mean?

Have the group reflect on the activity and encourage them to draw conclusions based on their data.

- What were they surprised by?
- What did they learn about the USGA Handicap System™?
- How does it affect the game of golf?

Challenge!

Have students find out the course rating, slope rating, and par for a second golf course, and “play” that course with a new set of scores. First use the same Handicap Index® you calculated from the first course. Then calculate a new Handicap Index® for the second course. Use each Handicap Index® to figure out your course handicap and net score. How do they compare?

Investigate: Golf Scores

Handicap



Grades **9-12**



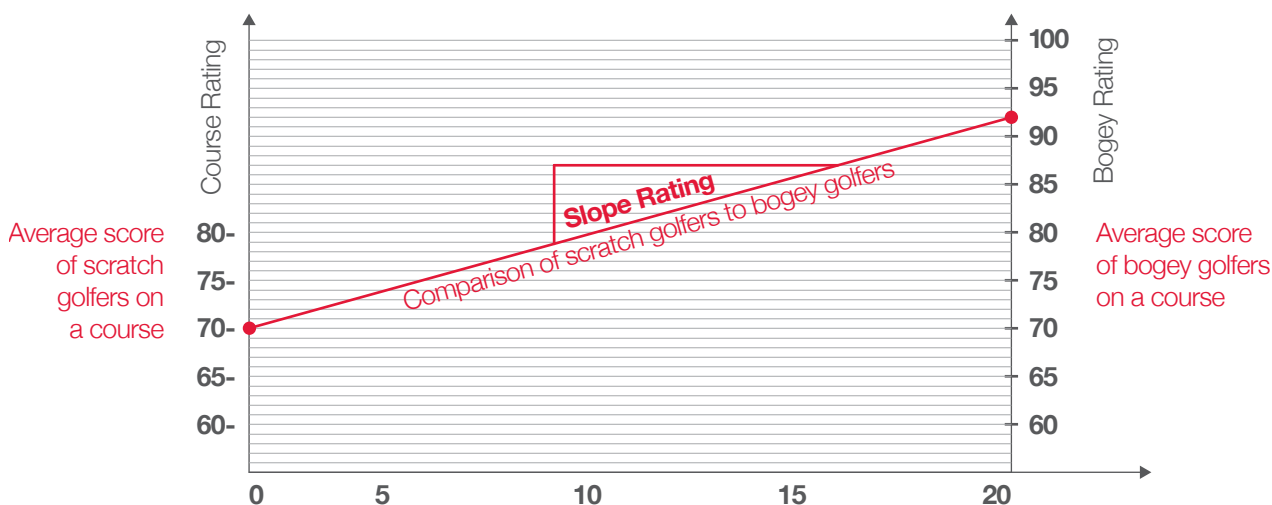
How do your scores change your Handicap Index®?

The USGA Handicap System™ enables golfers of all skill levels to compete on a more even basis. Each golfer can calculate a personal Handicap Index®, which can be used to determine the number of strokes that can be subtracted from the golfer's score on a particular course (**course handicap**). It's based on how well you play — a good **scratch golfer** may have a course handicap of 0, while a **bogey golfer** may have a course handicap of 20. In this activity, you'll investigate how golf scores work by playing a made-up game for a real course.

What Do You Need?

Paper

Pencil



Course and Slope Ratings for a Golf Course

This activity is adapted from NBC Learn: Science of Golf, "Calculating a Golf Handicap Index" (www.nbclearn.com/science-of-golf)

The Science of Golf





What Do You Do?

- 1 Decide whether you will be a scratch golfer or a bogey golfer. Also decide whether you will “play” from the forward (easiest), middle, or back (hardest) tee position.
- 2 On the blank score card, make up golf scores for yourself for a full round (18 holes) for 10 days. Imagine you have both good and bad days, so that your scores vary.
- 3 Add up the total score for each day in the **gross score** column.
- 4 Find the five lowest total scores and calculate the **handicap differential** for each one. Use the course and slope rating numbers from the same tee position for all of them.
- 5 After calculating the differentials, find the average of them. Use that average to calculate the **Handicap Index®**.
- 6 Once you know the Handicap Index®, subtract that number from each gross score, and put the new scores in the **net score** column.
- 7 Then figure out how your Handicap Index® would change if you used the same scores, but the course and slope ratings from a different tee position.

		Course Rating	Slope Rating		Yardage
		Based on scores of scratch golfers	Ratio of scores of scratch and bogey golfers		
Tee Position					
Where you tee off					
Par					
Expected number of strokes					
Score					
Actual number of strokes					

Score Card

Formulas

To find the handicap differential, use the formula:

$$[(\text{gross score} - \text{course rating}) \times 113] / \text{slope rating} = \text{handicap differential}$$

- Take your gross score and subtract the course rating.
- Multiply the result by the standard slope rating of 113.
- Divide by the slope rating for the specific course you played.
- Round to the nearest tenth.

To find the Handicap Index®, continue with the formula:

$$\text{handicap differential} \times 0.96 = \text{Handicap Index®}$$



What Happens?

Use the score card to record your results, and make more as needed.

What Does it Mean?

- What did you learn about the USGA Handicap System™?
- What effect does it have on the game of golf?

Challenge!

Find out the course rating, slope rating, and par for a second golf course, and “play” that course with a new set of scores. First use the same Handicap Index® you calculated from the first course. Then calculate a new Handicap Index® for the second course. Use each Handicap Index® to figure out your course handicap and net score. How do they compare?

Find Out More

- Read *Key Concepts* at the back of this toolkit.
- Read *Handicap: Background Information*.
- Watch the NBC Learn video “Calculating a Golf Handicap Index” at www.nbclearn.com/science-of-golf.

Back	350	536	219	600	418	420	362	359	183	303	367	380	115	418	411	430	245	463	6579	
Middle	336	526	170	561	405	412	352	349	165	293	350	352	115	390	360	408	208	407	6159	
Forward	318	513	154	541	390	394	328	332	151	270	330	320	114	370	334	356	197	395	5807	
Holes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	GROSS SCORE	NET SCORE (gross – handicap)
PAR	4	5	3	5	4	4	4	4	3	4	4	4	3	4	4	4	3	4	70	
Day 1	5	5	4	6	4	5	6	4	3	5	4	5	4	4	5	6	5	4	84	
Day 2																				
Day 3																				
Day 4																				
Day 5																				
Day 6																				
Day 7																				
Day 8																				
Day 9																				
Day 10																				

This chart is adapted from Merion Golf Club, East Course, Haverford, PA

Add this chart to your Test Lab Log!

Investigate: USGA Handicap System™

Facilitator Guide

Handicap



Grades

9-12



The USGA Handicap System™ takes into account not only the **skills of a particular golfer**, but also how he **compares to better and worse golfers** on a particular golf course. So your Handicap Index® can change as your skill increases. In this activity, you'll investigate how and why the USGA Handicap System™ depends on these comparisons by creating your own game and a handicap system for it.

Learning Objectives

To understand the a **USGA Handicap System™**.

To use math formulas to calculate averages and handicaps.

STEM Fields

Mathematics: equations, statistics

Time Requirement



One session 45 min

Activity Type



Plan ahead (gather materials)



Indoors or outdoors





What Do You Do?

1 Introduce the Activity

- Read *Background Information* and watch the NBC Learn video “Calculating a Golf Handicap Index” at www.nbclearn.com/science-of-golf.

2 Design the Game

Investigate: Handicap System™, steps 1-2

- Have students set up the containers so that they have different levels of difficulty.
- Have students write up all the rules, including where you need to stand, how many objects to toss, how to toss them (overhand, underhand), etc.

3 Play and Score the Game

Investigate: Handicap System™, steps 3-6

- Let everyone practice before creating the handicap system.
- After you play the tournament, students can recalculate their handicaps based on the new scores.
- In addition to calculating the mean, median, mode, and range for the group's handicaps, gross scores, and net scores, students can also graph the data.

What Happens?

Have students create a short report about the activity to add to their Test Lab Log. The report could include notes, photos, diagrams, etc.

What Does it Mean?

Have the group reflect on the activity and encourage them to draw conclusions based on their data.

- What were they surprised by?
- What did they learn about handicap systems?
- How does having a handicap system affect the fairness (and the fun) of the game?

Challenge!

Have students rearrange the containers, as if it were a different course. Play again. Does the same handicap seem to work well? Or do you need to calculate a new one, just as you would for a different golf course?

Investigate: USGA Handicap System™

Handicap



Grades **9-12**



How does the USGA Handicap System™ equalize players?

The USGA Handicap System™ takes into account not only the **skills of a particular golfer**, but also how he **compares to better and worse golfers** on a particular golf course. So your Handicap Index® can change as your skill increases. In this activity, you'll investigate how and why the USGA Handicap System™ depends on these comparisons by creating your own game and a handicap system for it.

What Do You Need?

Several containers, such as large cans or buckets

Several small objects, such as pennies or golf balls

Paper

Pencil

Tape measure

Player A		Player B	
Gross Score	79	Gross Score	87
	-		-
Course Handicap	6	Course Handicap	15
Net Score	73	Net Score	WIN! 72
After subtracting course handicaps, Player B wins			

This activity is adapted from NBC Learn: Science of Golf, "Calculating a Golf Handicap Index" (www.nbclearn.com/science-of-golf)

The Science of Golf



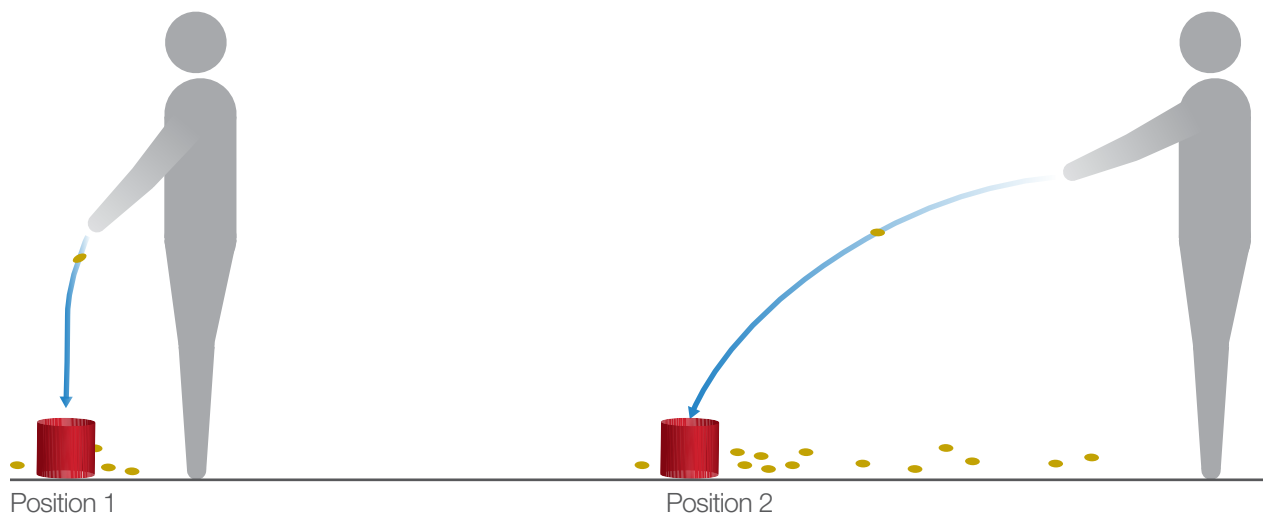


What Do You Do?

- 1 Experiment with tossing small objects into a container from different distances. Figure out which distances are easy or challenging.
- 2 Create a tossing game: Set up several containers. Decide where the player needs to stand for each one, and how many objects they need to toss inside. Name your game. Write up the rules.
- 3 Play a full game to set up the **handicap system**. For each container, use the score card to record how many tosses each person takes to get the right number of objects inside.
- 4 Total all the scores. Add up the better (lower) half of the scores and calculate the “**better half**”

average. Subtract this number from each person’s total score to get their **handicap**. For example, if the “better half” average for the game was 36, but John scored 45, his handicap would be $45 - 36 = 9$.

- 5 Now play a tournament game. Record everyone’s **gross score** (the actual number of tosses). Then subtract their handicap to get their **net score**.
- 6 After the game, calculate the **mean** (average), **median** (middle number), **mode** (most common number), and **range** (top and bottom values) for the group’s handicaps, gross scores, and net scores. What do they tell you about the group’s overall ability?



What Happens?

Use the score card to record your results, and make more as needed.

What Does it Mean?

- What did you learn about creating a handicap system?
- How does having a handicap system affect the fairness (and the fun) of the game?

Challenge!

Rearrange the containers, as if it were a different course. Play again. Does the same handicap seem to work well? Or do you need to calculate a new one, just as you would for a different golf course?

Find Out More

- Read *Key Concepts* at the back of this toolkit.
- Read *Handicap: Background Information*.
- Watch the NBC Learn video “Calculating a Golf Handicap Index” at www.nbclearn.com/science-of-golf.



Name of the Game:

Container	1	2	3	4	5	6	7	8	9	10	Gross Score	Handicap	Net Score (gross-handicap)
Number of Objects to Get Inside	3	3	3	3	3	3	3	3	3	3			
Player 1 # Tosses	3	4	3	5	4	6	3	3	4	5	35		
Player 2													
Player 3													
Player 4													
Player 5													
Player 6													
Player 7													
Player 8													
Player 9													
Player 10													



Add this chart to your Test Lab Log!

Create: Beyond Golf

Facilitator Guide

Handicap



Grades

9-12



If you played golf with a professional golfer like Phil Mickelson, the USGA Handicap System™ would help **equalize your scores** and give you a chance to compete against each other more fairly, though Phil would probably still beat you. There's no system to equalize most other sports, but what if there were? What if you could **create a system** that would let you play a relatively fair game of basketball with LeBron James, or tennis with Maria Sharapova? In this activity, you'll create that handicap system yourself!

Learning Objectives

To understand the **USGA Handicap System™**.

To think creatively about other sports.

STEM Fields

Mathematics: proportional relationships

Time Requirement



One session or more 45 min each

Activity Type

No advance planning



Indoors or outdoors





What Do You Do?

1 Introduce the Activity

- Read *Background Information* and watch the NBC Learn video “Calculating a Golf Handicap Index” at www.nbclearn.com/science-of-golf.

2 Design the Handicap System

Create: Beyond Golf, steps 1-3

- If you have only one session, choose a single sport. Have everyone work together to create the system, so that there is time left to play the sport with the new system.

3 Play the Sport

Create: Beyond Golf, steps 4-5

- If time allows, first play the sport normally (without the new handicap system), and then with the system, so that students can compare them more easily.

What Happens?

Have students create a short report about the activity to add to their Test Lab Log. The report could include notes, photos, diagrams, etc.

What Does it Mean?

Have the group reflect on the activity and encourage them to draw conclusions based on their data.

- What were they surprised by?
- How does having a handicap system affect the fairness (and the fun) of the game?
- Do they think different sports would be better with handicaps?

Create: Beyond Golf

Handicap



Grades **9-12**



How would a handicap system work for other sports?

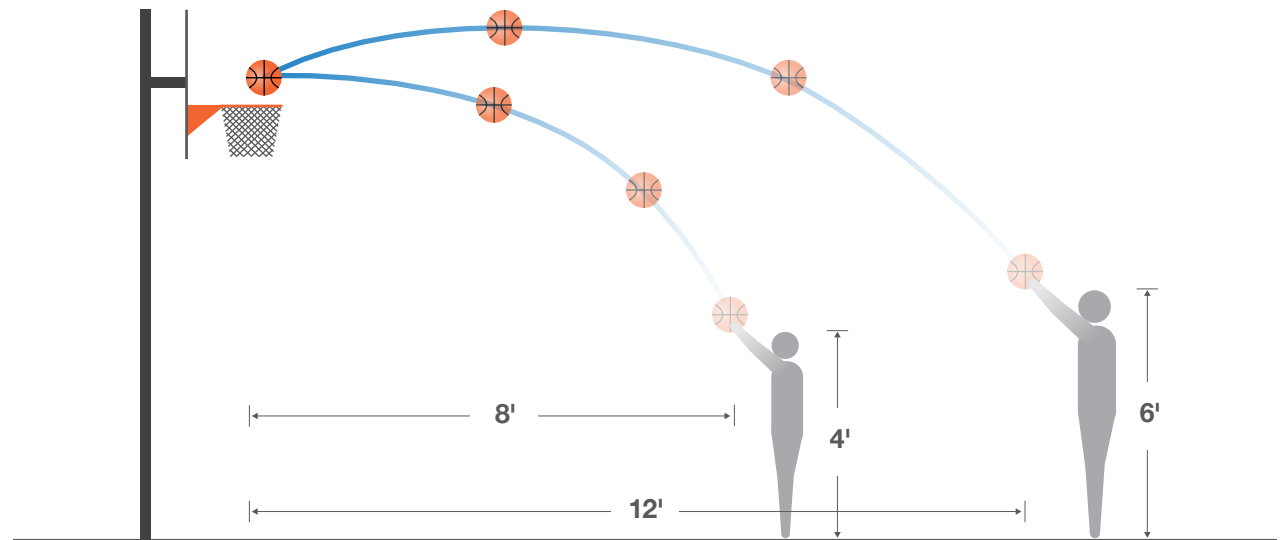
If you played golf with a professional golfer like Phil Mickelson, the USGA Handicap System™ would help **equalize your scores** and give you a chance to compete against each other more fairly, though Phil would probably still beat you. There's no system to equalize most other sports, but what if there were? What if you could **create a system** that would let you play a relatively fair game of basketball with LeBron James, or tennis with Maria Sharapova? In this activity, you'll create that handicap system yourself!

What Do You Need?

Paper

Pencil

Sports equipment



Basketball with a Distance Handicap

This activity is adapted from NBC Learn: Science of Golf, "Calculating a Golf Handicap Index" (www.nbclearn.com/science-of-golf)

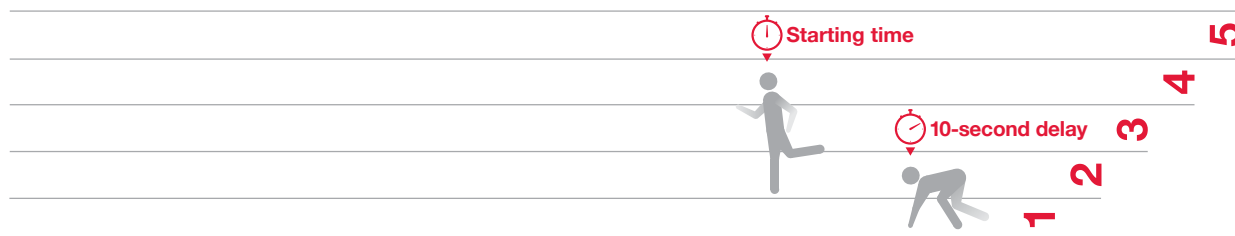
The Science of Golf





What Do You Do?

- 1 Pick a sport that doesn't have a **handicap system**. It should be something that you can play yourself, like basketball.
- 2 Think about the different levels of skill that players have in that sport. How could you create a handicap system that makes the game more equal for everyone? You could change the scoring or the actual game play. For example, in basketball, maybe shorter players get an extra point for each basket. In a running race, maybe faster runners have to start 10 seconds later than slower runners.
- 3 Write up rules for a handicap system for that sport.
- 4 Play a full game to see how well your handicap system works. Make adjustments.
- 5 Invite friends to play your new version of the sport!



Running Race with a Time Handicap

What Happens?

Write up the new handicap system for sport, and note how it changes the way you play (and win).

Add your results to your Test Lab Log.

What Does it Mean?

- What did you learn about creating a handicap system?
- Do you think different sports would be better with handicaps?

Find Out More

- Read *Key Concepts* at the back of this toolkit.
- Read *Handicap: Background Information*.
- Watch the NBC Learn video "Calculating a Golf Handicap Index" at www.nbclearn.com/science-of-golf.

Connect: Your Own Handicap Index®

Facilitator Guide

Handicap



Grades **9-12**



The USGA Handicap System™ gives each golfer a **Handicap Index®** based on ability, adjusting it up or down as the golfer's potential changes. It's calculated with only your best and most recent scores, so that it reflects not how you score once or on average, but your **potential for playing well**. In this activity, you'll use your best scores on an actual golf course to calculate your own Handicap Index®, and find out your own golf potential.

Learning Objectives

To understand the **USGA Handicap System™**.

To use math formulas to calculate handicaps.

To apply scientific concepts in a real-world context.

STEM Fields

Mathematics: Equations, number system

Time Requirement



One full round of golf (3-4 hours) plus time to calculate Handicap Index®

Activity Type

No advance planning (gather materials)



Outdoors (on a golf course)





What Do You Do?

1 Introduce the Activity

- Read Background Information and watch the NBC Learn video “Calculating a Golf Handicap Index” at www.nbclearn.com/science-of-golf.

2 Play a Round of Golf

Connect: Your Own Handicap Index®, step 1

- This activity requires students to play a full round of golf to be able to calculate their Handicap Index® themselves. If you don’t have time for a full round, you can use an online Handicap Index® calculator with scores for a smaller number of tees.

3 Calculate the Handicap Index®

Connect: Your Own Handicap Index®, step 2-8

- Before calculating course handicaps and subtracting them from the gross scores, ask students to predict who will end up with the best net scores.

What Happens?

Have students create a short report about the activity to add to their Test Lab Log. The report could include notes, photos, diagrams, etc.

What Does it Mean?

Have the group reflect on the activity and encourage them to draw conclusions based on their data.

- What were they surprised by?
- How do their scores change their Handicap Index® and why?
- What did they learn about their potential?

Connect: Your Own Handicap Index®

Handicap



Grades **9-12**



How do you figure out your own Handicap Index®?

The USGA Handicap System™ gives each golfer a **Handicap Index®** based on ability, adjusting it up or down as the golfer's potential changes. It's calculated with only your best and most recent scores, so that it reflects not how you score once or on average, but your **potential for playing well**. In this activity, you'll use your best scores on an actual golf course to calculate your own Handicap Index®, and find out your own golf potential.

What Do You Need?

Golf clubs

Golf ball

Local golf course

	Course Rating Based on scores of scratch golfers		Slope Rating Ratio of scores of scratch and bogey golfers		Yardage
Tee Position Where you tee off	Back	73.5/149	350	536	219
Par Expected number of strokes	Middle	71.6/144	336	526	170
	Forward	69.9/140	318	513	154
Score Actual number of strokes	PAR		4	5	3
	HOLE		1	2	3
	Name of Player		4	6	4

Score Card

The Science of Golf





What Do You Do?

- 1 Play at least 1 round of golf at a local course
- 2 Add up the total number of strokes you take. This is the **gross score**.
- 3 Calculate the **handicap differential**, using the course and slope ratings for the course you played.
- 4 Use the differential to calculate your **Handicap Index®**.
- 5 Once you know your Handicap Index®, subtract that number from your gross score to find your **net score**.
- 6 If possible, play more rounds on the same course. Use your Handicap Index® to figure out your net score each time.
- 7 The more rounds you play, the more accurate your Handicap Index® will be. Find your five lowest gross scores and calculate the handicap differential for each one. Use that differential to recalculate your Handicap Index®.
- 8 Compare the Handicap Index® you calculate yourself with the Handicap Index® that the golf course's computer calculates (or use the online USGA Course Calculator at www.usga.org/playing/handicaps/calculator/course_handicap_calculator.asp). How do they compare?



Formulas

To find the handicap differential, use the formula:

$$[(\text{gross score} - \text{course rating}) \times 113] / \text{slope rating} = \text{handicap differential}$$

- Take your gross score and subtract the course rating.
- Multiply the result by the standard slope rating of 113.
- Divide by the slope rating for the specific course you played.
- Round to the nearest tenth.

To find the Handicap Index®, continue with the formula:

$$\text{handicap differential} \times 0.96 = \text{Handicap Index®}$$

◀ Atlanta Athletic Club

Copyright USGA/Russell Kirk



What Happens?

Use the score card to record your results, and make more as needed.

What Does it Mean?

- How do your scores change your Handicap Index® and why?
- What did you learn about your potential?

Find Out More

- Read *Key Concepts* at the back of this toolkit.
- Read *Handicap: Background Information*.
- Watch the NBC Learn video “Calculating a Golf Handicap Index” at www.nbclearn.com/science-of-golf.



Golf Course Name:																			
Course Rating:																			
Slope Rating:																			

Holes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	GROSS SCORE	NET SCORE (gross – handicap)
PAR	4	5	3	5	4	4	4	4	3	4	4	4	3	4	4	4	3	4		
Day 1	5	5	4	6	4	5	6	4	3	5	4	5	4	4	5	6	5	4	84	
Day 2																				
Day 3																				
Day 4																				
Day 5																				
Day 6																				
Day 7																				
Day 8																				
Day 9																				
Day 10																				

Add this chart to your Test Lab Log!

The Score: Handicap

Background Information

Handicap




There are many different scoring systems in sports. Some use points (like basketball), while others use time (like swimming). In golf, unlike most other sports, it's the lowest number of points that wins. But what's more unusual, even unique, is that golf also has a system that lets golfers of all skill levels compete on a more equal basis — the USGA Handicap System™.

Why Have a Handicap System?

In golf, you compete against yourself and others at the same time: you compete against your own past performance, trying to improve, and you compete with other golfers to see who did the best on a set of holes. While you can compete fairly **stroke for stroke** against someone with the same ability as yourself, an average golfer will rarely win against a professional.

That's why the USGA developed the Handicap System™ over 103 years ago, to make the playing field more even. Each golfer can calculate a personal **Handicap Index®**, which can be used to determine the number of strokes that can be subtracted from the golfer's score on a particular course. It's based on how well you play — a good **scratch golfer** may

Player A		Player B	
Gross Score	79	Gross Score	87
	-		-
Course Handicap	6	Course Handicap	15
Net Score	73	Net Score	 72
After subtracting course handicaps, Player B wins			

have a course handicap of 0, while a **bogey golfer** may have a course handicap of 20. Even though a scratch golfer is a much better player, once the bogey golfer subtracts the number of strokes allowed, he may end up winning the round.

It's All About Comparison

The USGA Handicap System™ takes into account not only the skills of a particular golfer, but also how he compares to both better and worse golfers on a particular golf course. So your Handicap Index® can change as your skill increases. To figure out what your course handicap is, you need to start with the difficulty of the golf course you're playing on.

▲ How Course Handicaps Change the Score

Player A may be a better golfer than Player B and have a lower course handicap. But after they subtract their course handicaps from their gross scores, it may turn out that Player B actually played the better game (based on her own potential).

In the United States, State and Regional Golf Associations review every golf course for difficulty and assign two important ratings: a **course rating** and a **slope rating**. The course rating is based on the scores of scratch golfers on that course under normal conditions. In contrast, the **bogey rating** for the same course is based on the scores of bogey golfers and will always be a higher number. When you compare



This information is adapted from The USGA Handicap System™ Manual (www.usga.org/rule-books/handicap-system-manual/handicap-manual) and NBC Learn: Science of Golf, "Calculating a Golf Handicap Index" (www.nbclearn.com/science-of-golf)



the course rating to the bogey rating, you get the slope rating, which represents the relative difficulty of the course for an average golfer. On golf courses around the world, the slope rating ranges from 55 (the least difficult) to 155 (the most difficult). The higher the slope rating, the greater the gap in expected scores between scratch and bogey golfers.

What's Your Handicap Index®?

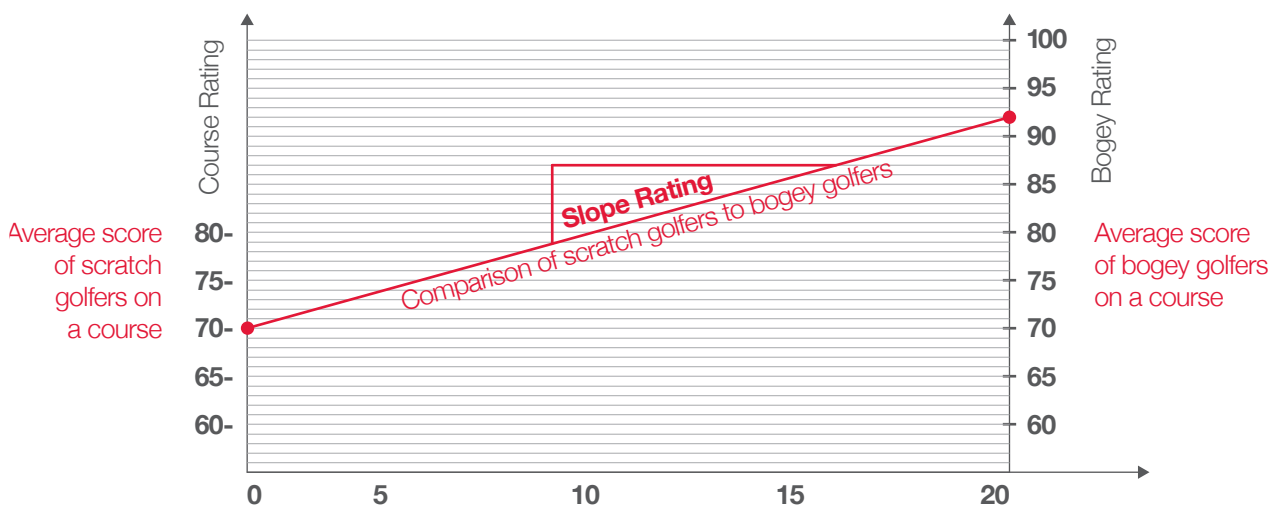
You can use the course and slope ratings, together with your own golf scores, to calculate your Handicap Index®. Just follow these steps.

First calculate your **handicap differential** with the formula:

$$\frac{[(\text{gross score} - \text{course rating}) \times 113] / \text{slope rating} = \text{handicap differential}}$$

- Take your **gross score** (the actual number of strokes) on a course and subtract the course rating.
- Multiply the result by the standard slope rating of 113.
- Divide by the slope rating for the specific course you played.
- Round to the nearest tenth.

**Ex: $[(81 - 71.2) \times 113] / 126 = 8.788$
(rounded to 8.8)**



Course and Slope Ratings for a Golf Course

Then calculate your Handicap Index® by multiplying the differential by 0.96, a constant the USGA calls the **bonus for excellence**.

Ex: $8.8 \times 0.96 = 8.448$

Truncated to the tenth, your Handicap Index® would be **8.4**

You can use a single differential to calculate your Handicap Index®, if that's all you have, but the USGA recommends using the lowest of at least 5 differentials. That's because the USGA Handicap System™ is designed to reflect not how you score once or on average, but your potential for playing well.

▲ How to Calculate a Slope Rating

To find the slope rating for a golf course, subtract the course rating (for scratch golfers) from the bogey rating. Then multiply by a mathematical constant: 5.381 for men or 4.24 for women.

Evening Out the Score

Once you know your Handicap Index®, it will travel with you wherever you go. To find your **course handicap** for any golf course you play, look up your Handicap Index® in that course's handicap calculator. Then you'll know the specific number of strokes you can subtract on that course to adjust your score back to the level of a scratch golfer. That way, golfers of all levels can play together, competing against themselves and each other in a way that keeps the game fair and fun.

Key Concepts

Handicap



Better Half Average

The average of the better half of a golfer's scores. The USGA Handicap System™ looks at only the better half of scores, because it's based on each golfer's potential to play well.

Bogey

A score for a hole that is one stroke more than par.

Bogey Golfer

A golfer who generally plays holes at one above par and has a course handicap around 20.

Bogey Rating

A rating of the playing difficulty of a golf course for a bogey golfer under normal course and weather conditions.

Bonus for Excellence

The mathematical constant 0.96, part of the Handicap Index® formula, which is used as an incentive for golfers to improve their skill.

Course Handicap

A specific number of strokes that a golfer can subtract from a specific set of tees at the course being played, to adjust the player's scoring ability to the level of a scratch golfer.

Course Rating

A rating of the playing difficulty of a golf course for a scratch golfer under normal course and weather conditions.

Gross Score

The actual number of strokes a golfer makes on a hole or round, plus any penalty strokes taken by the golfer.

Handicap Differential

A number that represents how a golfer's scores compare to a golf course's course and slope ratings. Used to calculate the golfer's Handicap Index®.

$$\text{Handicap differential} = \frac{[(\text{gross score} - \text{course rating}) \times 113]}{\text{slope rating}}$$

Handicap Index®

A number that represents a golfer's potential scoring ability. Used to calculate the golfer's course handicap for a specific golf course.

$$\text{Handicap Index}^{\circledR} = \text{handicap differential} \times 0.96$$

**Net Score**

A golfer's score after course handicap strokes have been subtracted from the golfer's gross score.

Par

The score that an expert player would be expected to make for a given hole.

Scratch Golfer

A very good golfer who generally plays holes at par and has a course handicap of 0.

Slope Rating

A rating that indicates the relative difficulty of a golf course for an average golfer. The higher the slope rating, the greater the gap in expected scores between scratch and bogey golfers.

Slope rating = (bogey rating – course rating) x (5.381 for men or 4.24 for women)

Stroke Play

When a golfer counts the total number of strokes per hole.

Additional Resources

Handicap



To further explore the science of the **HANDICAP** or the game of golf, please check out the following resources:

Science of Golf

USGA STEM Resources

www.usga.org/stem

Portal to a variety of STEM-related experiences

The USGA Handicap System™ Manual

www.usga.org/Rule-Books/Handicap-System-Manual/Handicap-Manual

Information about the USGA Handicap System™ and how to calculate a personal Handicap Index®

USGA Course Handicap Calculator

www.usga.org/playing/handicaps/calculator/course_handicap_calculator.asp

An online tool to calculate your handicap for a specific golf course

Handicap Index® Calculator

www.netgolfleague.com/HandicapCalculator.aspx

An online tool to calculate your personal Handicap Index®

USGA Test Center

www.usga.org/equipment/overview/Equipment-Standards-Overview

Information about the Test Center and the Rules of Golf

NBC Learn: Science of Golf

www.nbclearn.com/science-of-golf

Videos and lesson plans about the science of golf

Sports 'n Science: Golf

sportsnscience.utah.edu/science-behind-the-sport/sport/golf

Information about the science of golf, as well as other sports

STEMZone and the World of Golf (Kid Scoop News)

www.kidscoopnews.com/downloads/stem-zone/ksn_stemzone.pdf

Information and activities related to the science of golf

Golf

USGA

www.usga.org

Official Rules of Golf, equipment standards, golf course information, and more

USGA Museum

www.usgamuseum.com

Online exhibits and photos related to the history of golf



Test Lab Toolkits are designed to support Next Generation Science Standards, Common Core Mathematics Standards, and the 21st-century skills of communication, collaboration, critical thinking, and creativity. The specific Common Core Mathematics Standards related to this Toolkit include:

Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Number and Quantity: Quantities

- Reason quantitatively and use units to solve problems.

Algebra: Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning.
- Solve systems of equations.

Statistics and Probability: Interpreting Categorical and Quantitative Data

- Summarize, represent, and interpret data on a single count or measurement variable.

Statistics and Probability: Making Inferences and Justifying Conclusions

- Understand and evaluate random processes underlying statistical experiments.
- Make inferences and justify conclusions from sample surveys, experiments and observational studies.