

EACH LAP AT THE DAYTONA 500
AND INDIANAPOLIS 500
IS 2.5 MILES LONG.

2.5

AUTO RACING

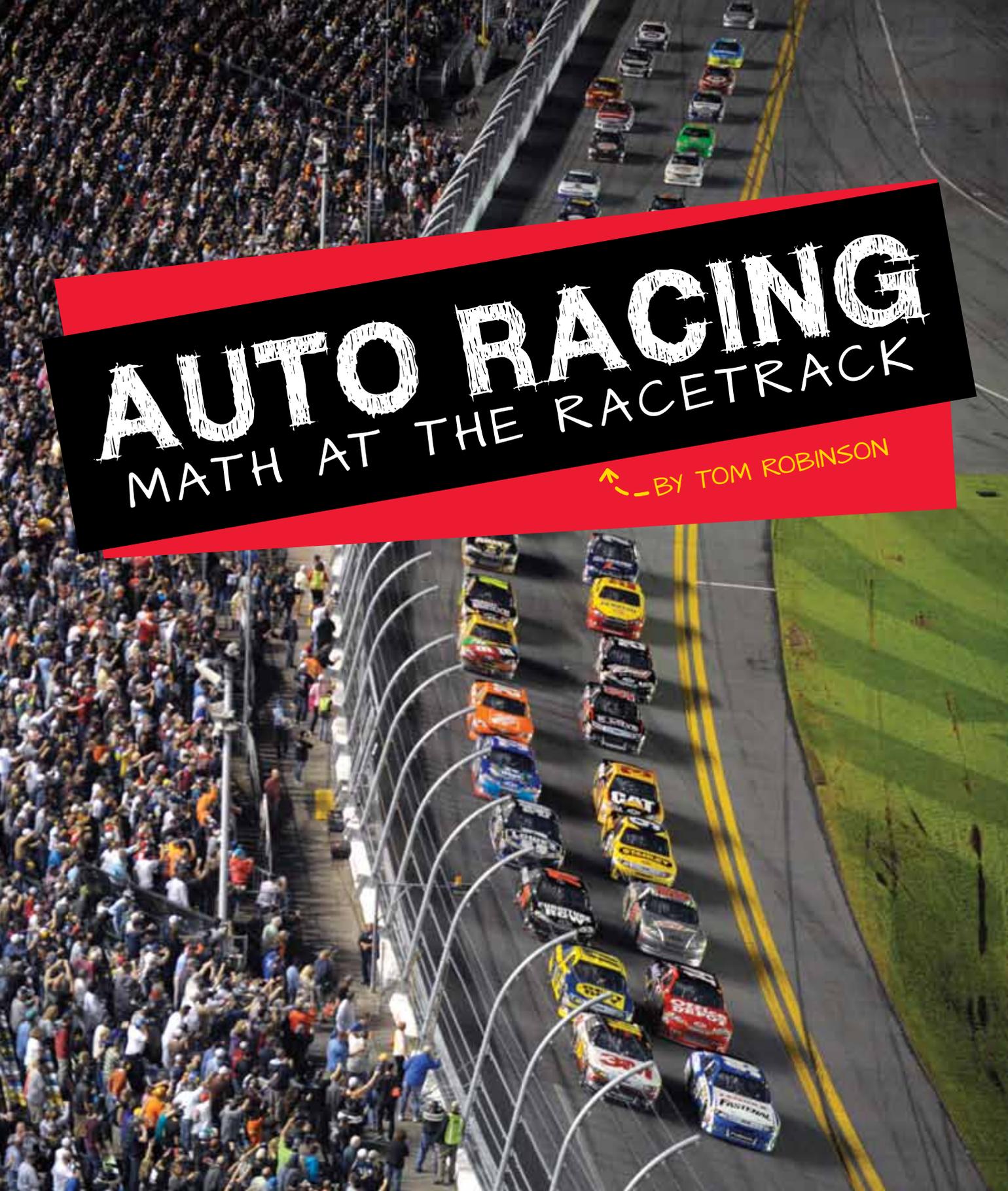
MATH AT THE RACETRACK

BY TOM ROBINSON

A NASCAR
SPRINT CUP
CAR WITH DRIVER
WEIGHS 1.65 TONS.

TOTAL MILES ÷ TOTAL LAPS = MILES PER LAP

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AUTO RACING

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TABLE OF CONTENTS

MATH AT THE RACETRACK... 4

THE BASICS 6

The Sport	6
Track Styles	8
Track Measurements	10

MAN 12

The Racing Team	12
Mechanical Measures	14
Point Standings	16
Season Performance	18

MACHINE..... 20

The Extra Mile	20
Car Comparison	22
Through the Years	24
Winning the Race	26

GO FIGURE 28

GLOSSARY 30

LEARN MORE 31

INDEX 32



Mike Conway
drives an open-
wheel car during
the IndyCar
series Toyota
Grand Prix on
April 17, 2011.

MATH AT THE RACETRACK

At the racetrack, drivers race their cars against each other and the clock. Speed is measured in time and miles per hour (mph). It can also be measured in fractions of seconds spent on pit stops.

Math is used to explain many parts of auto racing. The track's length and the length of each race are both measured in miles. Car parts must meet certain measures as part of the rules.

Series of races often decide all-season champions. Formulas are used to find the number of points drivers receive in each race.

There are many numbers used in an auto race or racing season. Use your math skills as you take a look at auto racing. You'll be surprised at how much they are needed!

THE BASICS

The Sport

The painted numbers and ads say one thing on a car—that it is meant for racing. Without them, the cars racing in the National Association for Stock Car Auto Racing (NASCAR) would look similar to those on the street. The cars, however, move at much faster speeds.

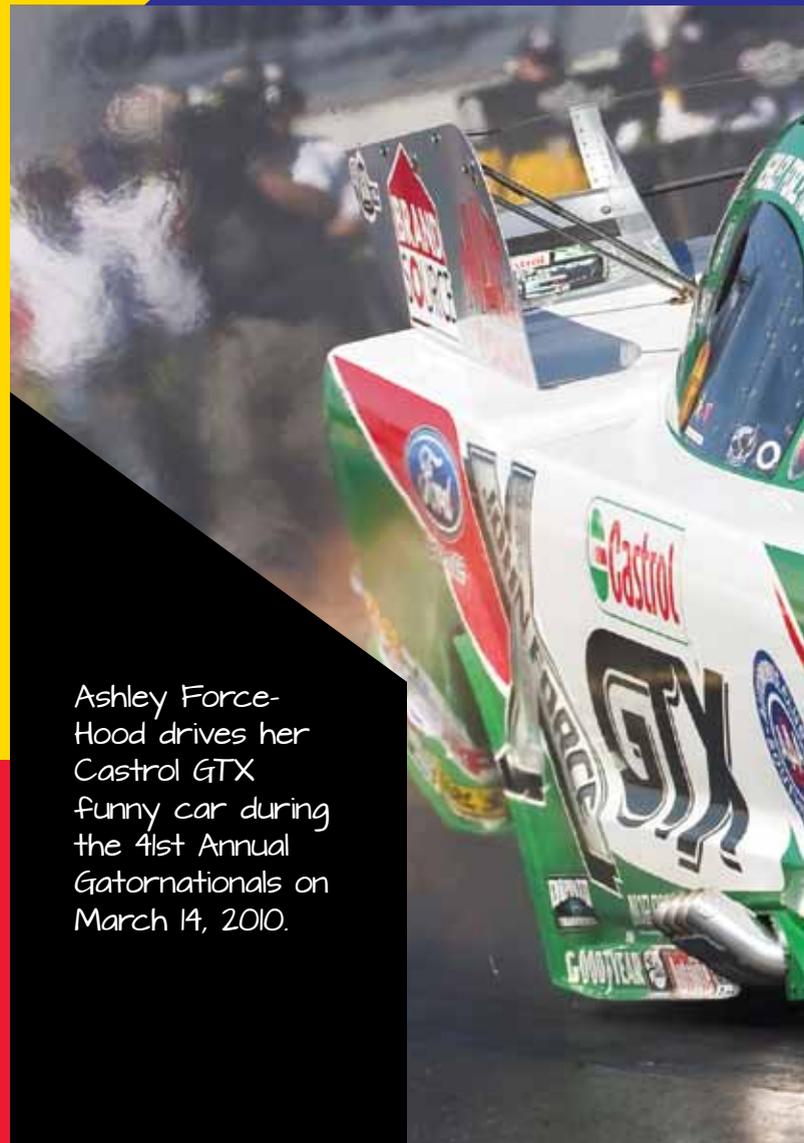
NASCAR is by far the largest stock car racing **organization** in the world. Stock car originally meant racing with a car that was built to be driven on the street. Stock cars have become much different, though. The cars in NASCAR are now built just for racing.

Auto racing comes in many forms. Different types of cars are used in different types of races. Stock car, open-wheel, and drag racing are all forms of racing. The styles are different, but the goal is the same. Each driver wants to be the first to cross the finish line.

Most NASCAR vehicles are heavier than other race cars. They can get into the range of 200 mph. But they usually are not as fast as other forms of race cars.

Open-wheel cars have wheels that are outside the car body. Open-wheel cars are about half the weight of stock cars. They tend to race at higher speeds.

IndyCars are the most common in open-wheel racing in the United States. The Indianapolis 500 is the most famous race for IndyCars. Formula 1 is a major international series for open-wheel cars.



Ashley Force-Hood drives her Castrol GTX funny car during the 41st Annual Gatornationals on March 14, 2010.

Drag racing is one quick burst down a **straightaway**. Many kinds of cars are used. One kind of car used in drag races is a funny car. Drag racers need to reach incredibly high speeds in seconds. Many can go faster than 300 mph in that short burst. A common distance for a drag race is a quarter of a mile.

How long is a quarter-mile race in yards? How about feet? To find this, divide the number of yards in a mile by four. That equals one-fourth of a mile. There are 1,760 yards in a mile.

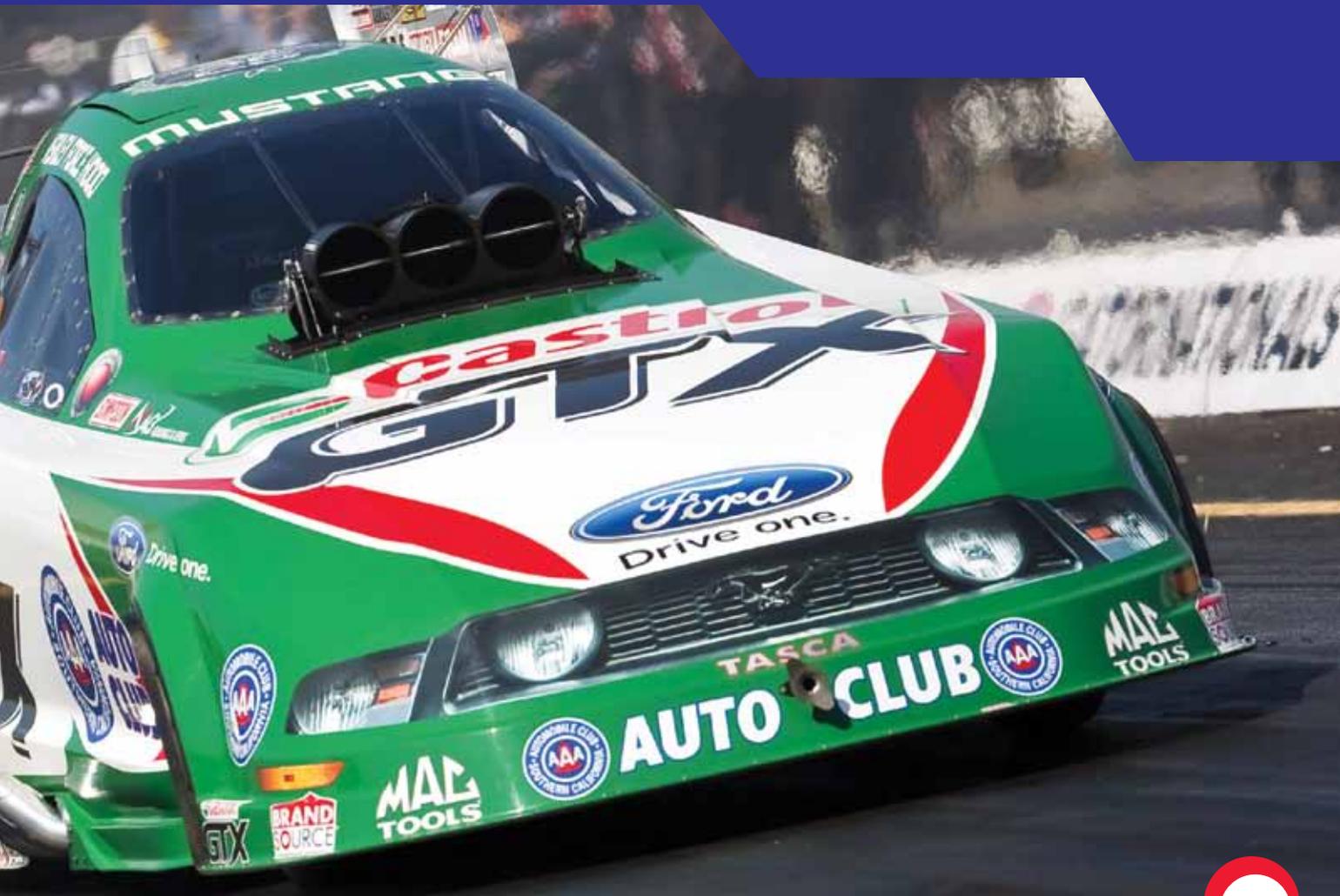
$$1,760 \div 4 = 440$$

There are 440 yards in a quarter mile.

There are 3 feet in a yard. Multiply the yards by three.

$$440 \times 3 = 1,320$$

There are 1,320 feet in a quarter mile.



Track Styles

Drivers race their cars down a pair of 3,330-foot stretches at Indianapolis Motor Speedway. Each stretch leads into the turns at the famous oval track.

The tracks used for auto races come in various shapes and sizes. Many tracks have an oval shape. Oval tracks have two straightaways. They are usually connected by two 180° turns. A pair of 90° turns can also be joined by a shorter straight stretch.

Daytona International Speedway has a tri-oval track. This track has three sets of turns. The **frontstretch** is 3,800 feet. The **backstretch** is 3,000 feet.

Racetracks can be shorter than a mile. They can also be more than 2.5 miles, such as the 2.66-mile Talladega Superspeedway in Alabama.

Some tracks have a quad-oval shape. Others are D-shaped ovals. All the turns are to the left. Another setting for racing is a road course. This kind of course has a series of turns in each direction.

Talladega Superspeedway is a tri-oval racetrack.



Two of the most famous American races share the names of their tracks. The Daytona 500 is a NASCAR event in Florida. The Indianapolis 500 is a famous race in the United States.

Both races are named for the number of miles they have. They are each 200 laps. How many miles are in each lap?

To determine the number of miles per lap, divide the total miles by the total laps.

$$500 \div 200 = 2.5 \text{ miles}$$

Each lap at the Daytona and Indianapolis racetracks is 2.5 miles long.



BACKSTRETCH



FRONTSTRETCH

Track Measurements

NASCAR has short, **intermediate**, superspeedway, and road course tracks. NASCAR breaks down tracks by length. Short tracks are up to 1 mile. Intermediate tracks are 1 to 2 miles. Superspeedways are longer than 2 miles.

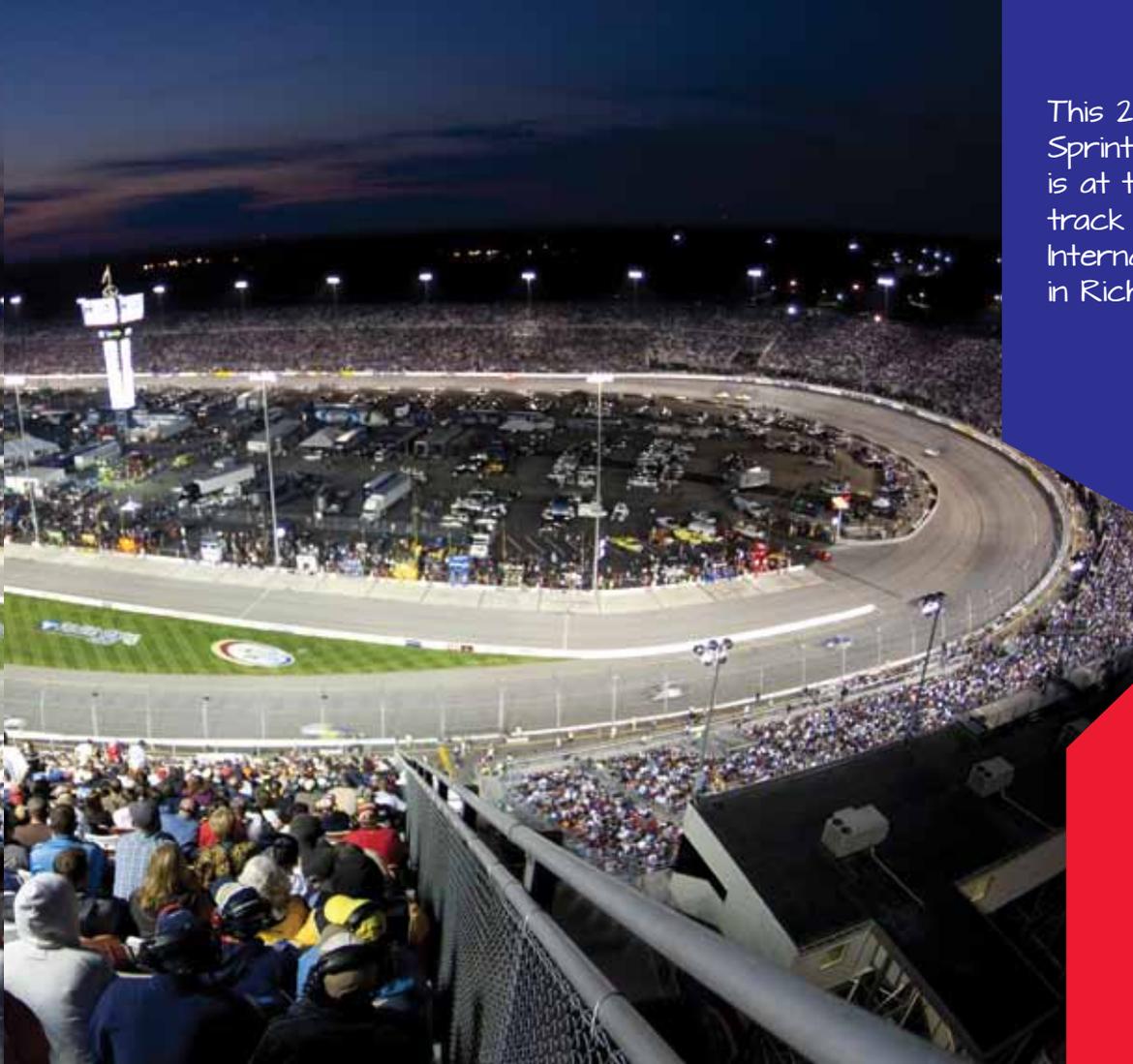
Richmond International Speedway is a short track. It is .75 miles long.

For shapes, NASCAR has different types of oval and road courses. Within those types there are differences in tracks. This table compares the seven D-shaped tracks that host NASCAR Sprint Cup races.



Cars have the greatest speed on straightaways. The longer straightaways and flatter tracks allow the fastest speeds. Michigan has a 3,600-foot straightaway. It has the fastest track records.

TRACK	LENGTH (MILES)	FRONTSTRETCH (FEET)	BACKSTRETCH (FEET)
Chicagoland Speedway	1.5	2,400	1,700
Fontana Auto Club Speedway	2.0	3,100	2,500
Kansas Speedway	1.5	2,685	2,207
Kentucky Speedway	1.5	1,662	1,600
Las Vegas Motor Speedway	1.5	3,330	3,330
Michigan International Speedway	2.0	3,600	2,242
Richmond International Raceway	.75	1,290	860



This 2011 NASCAR Sprint Cup series race is at the D-shaped track at Richmond International Raceway in Richmond, Virginia.

Dale Jarrett drove an **average** of 174 mph for an entire race at Michigan. Ryan Newman averaged 194.2 mph for a qualifying lap.

Fontana has the second-best set of times. As a wider track, it has more room in its corners for better **average** speeds over the course of an entire lap.

The slowest overall records are on the smallest track. Richmond's race record was set by Dale Jarrett's 109 mph. Its **qualifying** record was set by Brian Vickers at 130 mph.

Jimmie Johnson won the 2012 Brickyard 400 in 2 hours, 54 minutes, 19 seconds. Because 54 minutes is $\frac{9}{10}$ of an hour, 2 hours 54 minutes equals 2.9 hours. What was his average speed?

$$400 \text{ miles} \div 2.9 \text{ hours} = 137.9 \text{ mph}$$

His average speed was 137.9 mph.

MAN

The Racing Team

A racing team is made of more than just a driver and car. There are people who work on the business of racing. And there are people who work on the cars. Mechanics get cars ready. Pit crews adjust cars during a race in what are called pit stops.

During a race, all work is done as quickly as possible to return the car to the track. Fuel is added, tires are changed, and urgent repairs are made.

NASCAR began an annual Sprint Pit Crew Challenge in 2005. For one day, pit crews from the top 24 teams become the center of attention. Crews compete to see which can complete a pit stop in the least amount of time.

Jimmie Johnson's crew won in 2012. Johnson's team was able to change four tires, put in gas, and push the car 40 yards in 22.239 seconds in the final. Teamwork and planning save time.

Figure out how much time a crew can save through teamwork. A crew might need 13.7 seconds to change tires, 9.2 seconds to refuel, and 9.5 seconds to push the car back onto pit road. Add the seconds together to find the total time.

$13.7 + 9.2 + 9.5 = 32.4$ seconds
It took 32.4 seconds to do the tasks separately.



Dale Earnhardt Jr.'s pit crew works on his car during a NASCAR Sprint Cup series race on August 5, 2012, at Pocono Raceway.

But the same team can complete the stop in 23.2 seconds total if all tasks are done at the same time. How many seconds does working at the same time save?

$32.4 - 23.2 = 9.2$ seconds

Done together, the tasks were done 9.2 seconds faster.



Mechanical Measures

A mechanic needs to tighten a bolt in an engine. It is important to match the wrench size to the object on which it is used. Mechanics use different sizes of tools. Gauges check tires for wear and how much air is in them. Other tools and computers look at how well the engine is working.

The wrenches that mechanics use are measured in fractions of inches. The fractions are fourths, eighths, sixteenths, and thirty-seconds.

A race car mechanic needs to find a wrench quickly. Imagine the mechanic needs to organize a set of wrenches by their sizes. Put the following wrenches in order from smallest to largest fractions of an inch:

$\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{5}{16}$, $\frac{7}{8}$, $\frac{7}{16}$, $\frac{9}{16}$, $\frac{11}{16}$, $\frac{11}{32}$, $\frac{13}{16}$

To place in order, you first need to convert all of the fractions to a common **denominator**. All the wrench sizes measured can be changed to have a denominator of 32.

Mechanics rush to service Lewis Hamilton's car at a pit stop during the final race of the 2009 Formula 1 Petronas Malaysian Grand Prix.

Convert $\frac{3}{4}$ to 32nds by multiplying the **numerator** and denominator by the same number.

$$\frac{3}{4} \times \frac{8}{8}$$

Multiply the numerators together.

$$3 \times 8 = 24$$

Then multiply the denominators together.

$$4 \times 8 = 32$$

The fraction is $\frac{24}{32}$.

