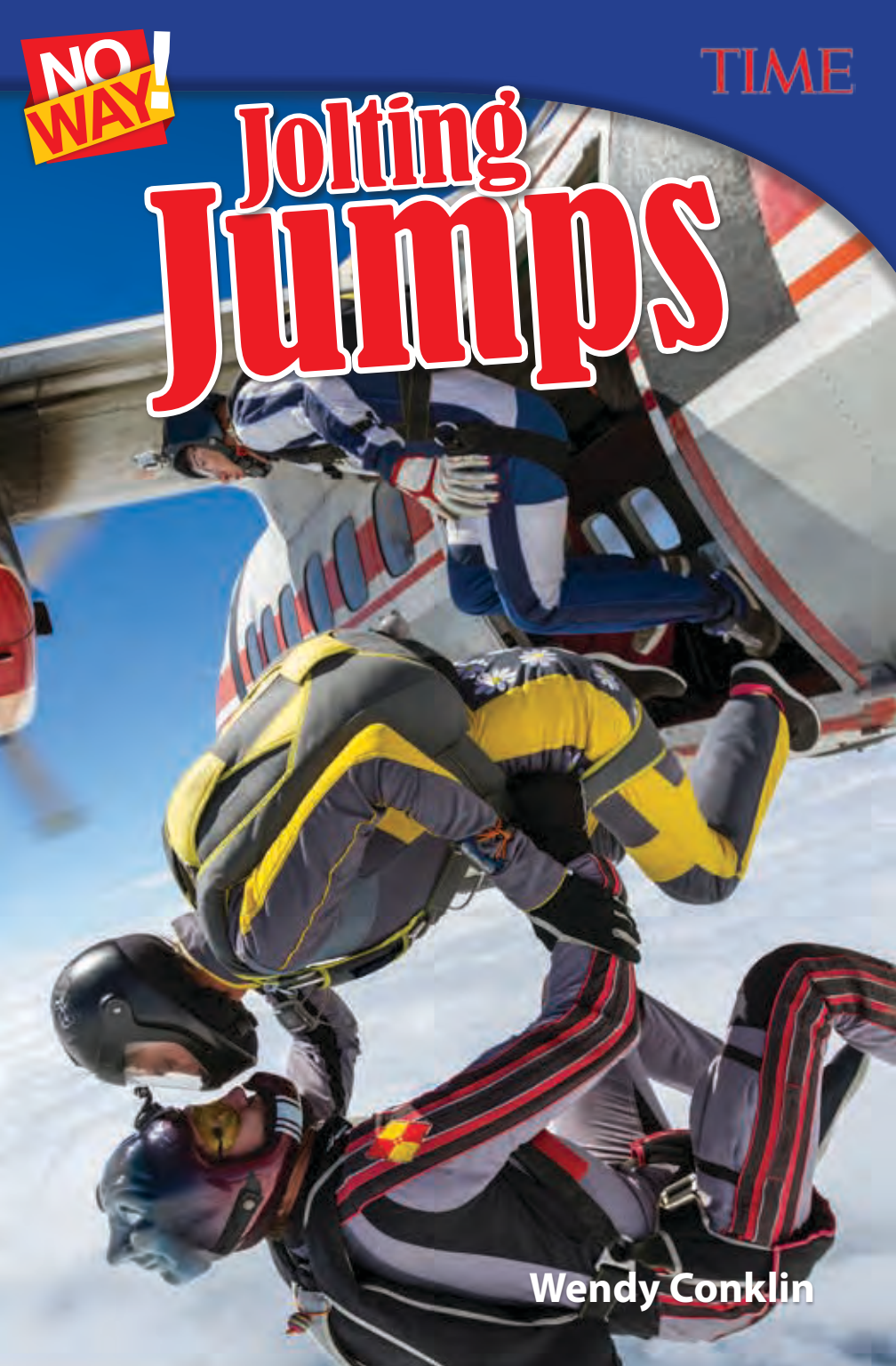
NO WAY!

TIME

Jolting Jumps



Wendy Conklin

NO WAY!

Jolting Jumps

Wendy Conklin, M.A.

Consultants

Timothy Rasinski, Ph.D.
Kent State University

Lori Oczkus, M.A.
Literacy Consultant

Publishing Credits

Rachelle Cracchiolo, M.S.Ed., *Publisher*
Conni Medina, M.A.Ed., *Managing Editor*
Dona Herweck Rice, *Series Developer*
Emily R. Smith, M.A.Ed., *Content Director*
Stephanie Bernard/Susan Daddis, M.A.Ed. *Editors*
Robin Erickson, *Senior Graphic Designer*

Image Credits: p.2 Muslianshah Masrie/Shutterstock.com; p.5 Dennis Hallinan/Alamy Stock Photo; p.6 Darminladiro/Shutterstock.com; p.8 ben bryant/Shutterstock.com; p.9 DeAgostini/Getty Images; pp.16–17 Vadzim Kandratsenkau/Alamy Stock Photo; p.19 Photo by Simon Ward/REX (217221b) A PARACHUTE STACK SKYDIVING-1993; p.20 blickwinkel/Alamy Stock Photo; pp.24–25, 34–35 Illustrations by Timothy J. Bradley; pp.28–29 Dean Treml/Red Bull via Getty Images; p.31 blickwinkel/Alamy Stock Photo; p.38 Bondariev Volodymyr/Dreamstime.com; all other images from iStock and/or Shutterstock.

Notes: Only people with the proper training should perform the various jumping sports and activities described in this book. The answers to the mathematics problems posed throughout the book are provided on page 48.

Teacher Created Materials
5301 Oceanus Drive
Huntington Beach, CA 92649-1030
http://www.tcmpub.com

ISBN 978-1-4938-3610-9

Table of Contents

Risky Business 4

Jumping Off a Base 6

Oh, Go Jump Out of an Airplane! 14

Surfing the Sky. 20

Glide Like an Eagle 22

Diving Off a Cliff 28

Superheroes in the Sky. 32

Jump, Bounce, and Roll! 36

Take It to the Limit 42

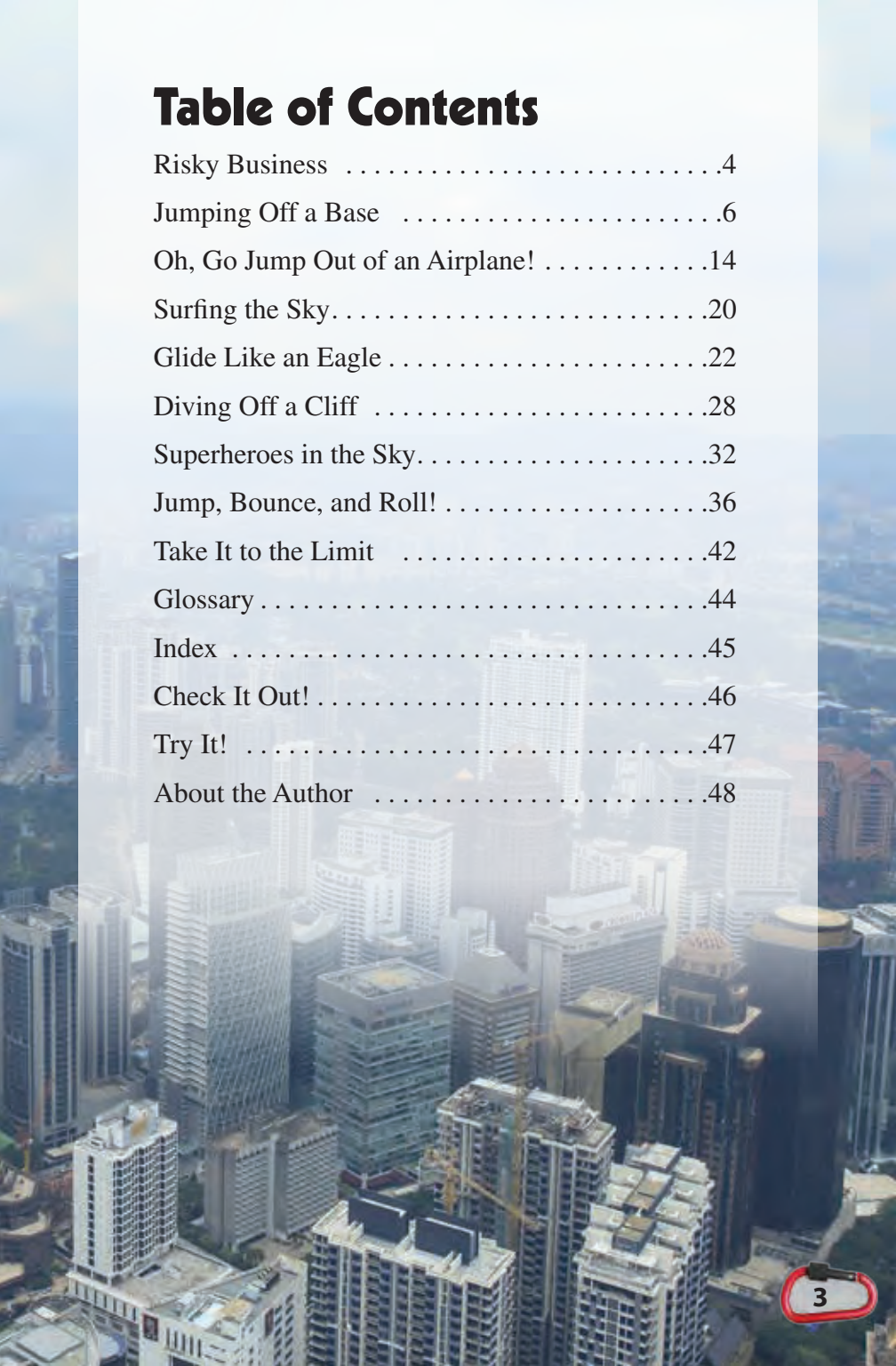
Glossary 44

Index 45

Check It Out! 46

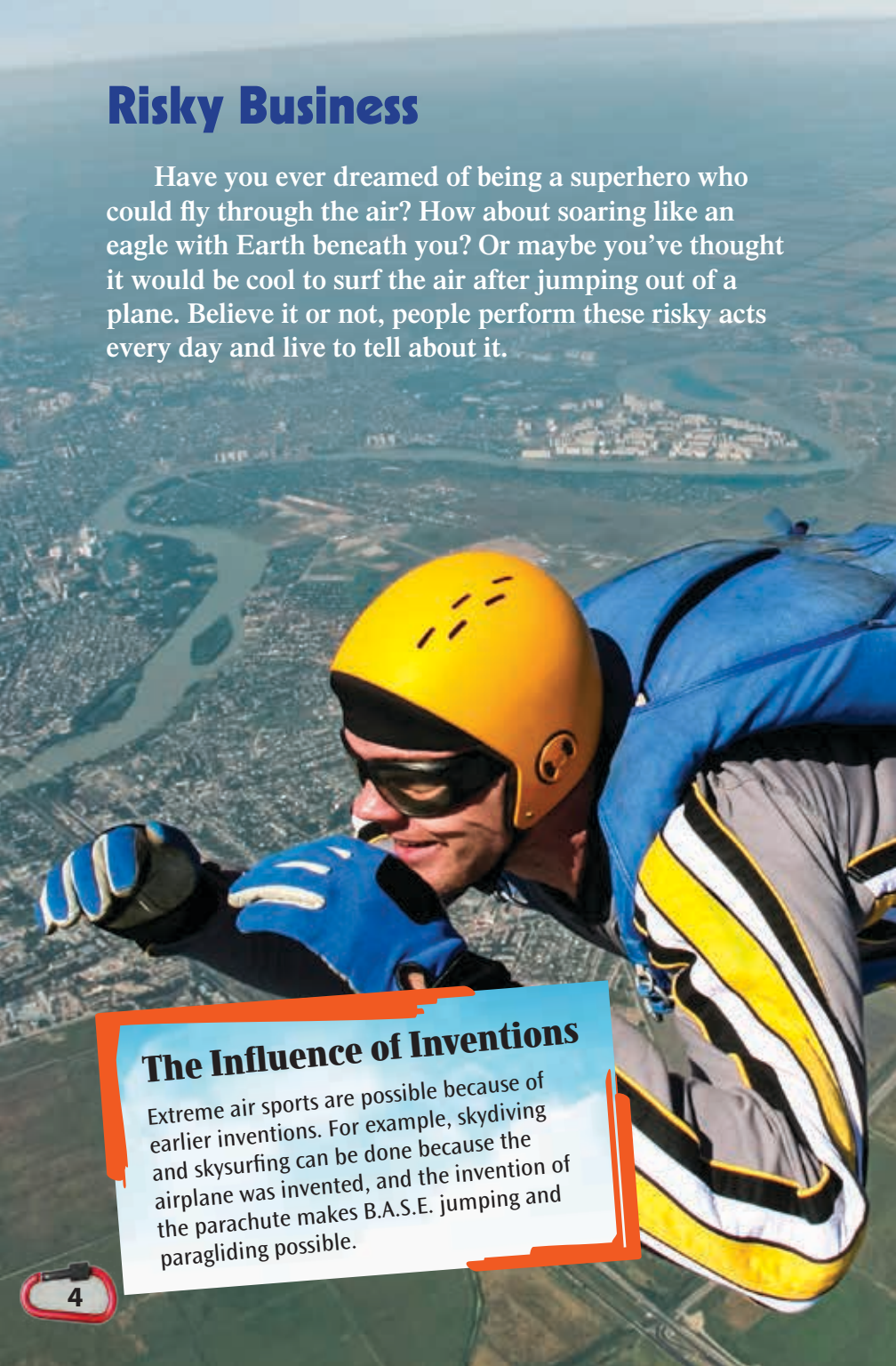
Try It! 47

About the Author 48



Risky Business

Have you ever dreamed of being a superhero who could fly through the air? How about soaring like an eagle with Earth beneath you? Or maybe you've thought it would be cool to surf the air after jumping out of a plane. Believe it or not, people perform these risky acts every day and live to tell about it.



The Influence of Inventions

Extreme air sports are possible because of earlier inventions. For example, skydiving and skysurfing can be done because the airplane was invented, and the invention of the parachute makes B.A.S.E. jumping and paragliding possible.

Dreaming of Flying

More than 500 years ago, Leonardo da Vinci dreamed of human flight. He sketched ideas for wings that would help humans fly, as well as a balloon that inflated in the sky. The technology did not exist in da Vinci's time for these things to become realities, but that did not stop him from dreaming about them.

Whether it's bungee jumping, skydiving, or wingsuit flying, these activities require an abundance of creativity and courage. Enthusiasts are always challenging themselves to perform better for competitions or simply to try stunts that are more difficult than anything they've done before. They spend many hours and lots of money perfecting their skills. It takes dedication to master these extreme sports.

Jumping Off a Base

You count down—three, two, one—and calmly plunge from the cliff's edge. You free fall for mere seconds before **deploying** a parachute and landing safely on the ground. Jumping from airplanes is not adventurous enough for people like you! Instead, you jump 3,212 feet (979 meters) from Angel Falls in Venezuela. For another jump, you climb an antenna tower that looms 2,000 feet (609 meters) in the air. Tall buildings that rise 1,000 feet (305 meters) provide you the thrill of a lifetime.

This extreme sport is known as *B.A.S.E. jumping*. *B.A.S.E.* is an acronym for building, antenna, span, and earth. These are the structures used as bases for the jumps. A jumper's goal is to complete jumps in all four categories and take his or her place among a group of elite jumpers.

Human Terminal Velocity

Human terminal velocity is the fastest speed a human can go while in free fall. The speed of the fall is about 120 miles per hour (mph) or about 193 kilometers per hour (kph). It takes about 12 seconds to reach this speed if the jumper falls from a height of about 1,500 feet (457 meters).

How Fast Is That?

In short jumps, jumpers often don't reach the human terminal velocity before they must deploy their chutes. After three seconds, a jumper reaches 50% of human terminal velocity. How fast, then, is that jumper traveling in mph and kph?

Buildings, Antennas, Spans, and Earth

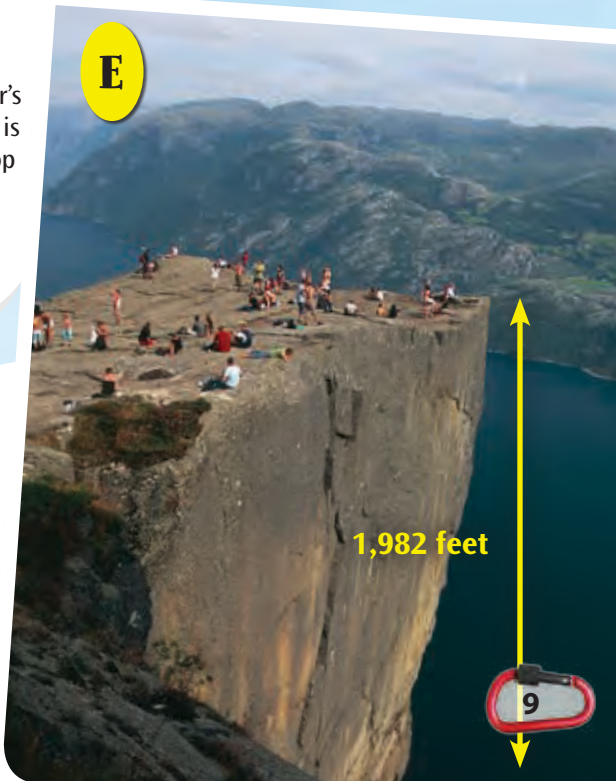
Once a B.A.S.E. jumper completes at least one jump in all four categories, he or she is assigned a number. This number indicates the order of the jumpers who have completed the categories. The first person to do this was Phil Smith in 1981, so he will forever have the B.A.S.E. number of 1. This is known as a *forever number*.

Most buildings and monuments are locked and under surveillance. For that reason, many jumpers select buildings under construction instead. The jump from Marina Bay Sands in Singapore is a favorite at 656 feet (200 meters).

Antenna towers are popular structures to jump from because they are often very tall and easily accessible. These jumps are usually about 1,000 feet (305 meters).

Spans or bridges must cross over large gorges or canyons to be tall enough for a jump. In Fayetteville, West Virginia, the New River Gorge Bridge is open to B.A.S.E. jumpers only one day a year, on Bridge Day. The jump is 876 feet (267 meters).

Earth includes any natural formations such as **fjords**, cliffs, and canyons. Preacher's Pulpit in Lysefjord, Norway, is a 1,982-foot (604-meter) drop and is a popular place for B.A.S.E. jumping.



Pilot Chutes

Some B.A.S.E. jumpers use **pilot chutes**. These are larger chutes than ones used in skydiving because the jumps are made from lower **altitudes** and speeds. The pilot chute opens and creates an initial drag before the main chute opens. This method helps increase the safety of the sport, since most B.A.S.E. jumpers don't pack a backup chute.

B.A.S.E. jumping is the most risky of all jumping sports because the jumps are so close to the ground. These short distances leave very little time to deploy parachutes before reaching the ground. If a jumper is not quick enough releasing a chute, the fall could be deadly. In preparation for B.A.S.E. jumping, it is recommended that a person completes at least 100 skydives. During a skydive, the jumper has more time to become familiar with parachute gear. If the chute doesn't deploy right away, the jumper has time to redeploy the chute or use a backup chute. B.A.S.E. jumpers are not so lucky.

How Far Will You Fall?

If you free fall 164 feet per second, how far will you have fallen after 7 seconds?

The distance of a free fall on a B.A.S.E. jump usually determines how the jumpers will hold their chutes. Jumpers can hold chutes in their hands or in backpack pockets. A short jump only allows about two seconds of free fall before jumpers have to deploy their chutes. For very short distances, most jumpers use handheld chutes. At 250 feet (76 meters) from the ground, a handheld chute is easier and quicker to deploy. Longer jumps allow about seven seconds of free fall, so jumpers have more time to deploy their chutes.

Illegal Jumping

Modern B.A.S.E. jumping had its beginnings at El Capitan, an outcropping in Yosemite National Park. Sadly, several people have died from this jump. Today, it is illegal to jump from this spot, and park rangers arrest those who do it.

Expensive Parachutes

B.A.S.E. jumping is not a cheap hobby. Parachutes built for B.A.S.E. jumpers usually cost between $1,200 and $1,500 each!

B.A.S.E. jumps require a certain kind of parachute or canopy. A **ram-air canopy** is among the most popular because it deploys quickly and gives the jumper steering control. If jumping off an outcrop, a jumper needs to steer clear of jagged rocks. A **round canopy**, by comparison, doesn't provide as much steering control.

The most important skill for B.A.S.E. jumpers is the ability to judge whether to jump. This decision needs to be made carefully. Jumpers consider the wind, the surrounding structures, and the landing site. Besides making the jump, it is just as important that B.A.S.E. jumpers take on the ritual of hiking to the top of the structure, known as the **exit point**. This ritual gives jumpers time to plan the different parts of their jumps. There is very little time during jumps, so jumpers must visualize their plans beforehand. They see in their minds how the jump will go, step by step.

Since B.A.S.E. jumping is so risky, it has become illegal in many places. Although some jumpers break the law, most B.A.S.E. jumpers defy gravity by safely following rules and regulations.

Oh, Go Jump Out of an Airplane!

The plane climbs higher and higher until it reaches 13,000 feet (3,962 meters). Going any higher than 15,000 feet (4,572 meters) would require supplemental oxygen to breathe. When the plane flies over the drop zone, you jump out. You free fall for 60 seconds before throwing out your pilot chute, which deploys your parachute. You steer the chute toward the target and land safely.

Skydiving Methods

Skydiving students learn to skydive using one or more methods. For the static-line method, the parachute automatically deploys once the jumper is out of the way of the aircraft. There is very little free-fall time in this method. For the tandem free-fall method, the jumper is connected to a certified instructor during the fall. For the accelerated free-fall method, a student jumps solo. But to be safe, the instructor jumps near the student until the parachute deploys.

You Have a Backup!

Parachutes have automatic activation devices (AAD) in case jumpers become unconscious or lose track of when to deploy the parachutes. An AAD is a tiny computer that keeps track of the altitude and will deploy a reserve chute if necessary.

The Mass of the Skydivers

In a normal skydive, a person's mass causes him or her to free fall at the rate of 120 mph (193 kph). But in a tandem fall, the combined mass causes the person and the instructor to free fall at 200 mph. What is the percent increase in the free-fall rates between the two jumps?

Parachuting Pilot

Cheryl Stearns is a pilot and one of the most accomplished skydivers in the world. She made her first jump at the age of 17. In 1977, she joined the U.S. Army and became the first female of the elite Army Golden Knights parachute team. After her time in the Army, she went on to win several parachuting and accuracy awards.

This young woman is packing a parachute.

Controlling the Chute

The most important piece of equipment for a skydiver is the parachute. If a chute does not deploy correctly, the skydiver's life is in danger. It's best not to have surprises while free falling 13,000 feet (3,962 meters) in the air! Packing the chute the same way every time is important so that it always opens safely. Not packing it correctly could result in twisted lines or quick deployment, which could hurt the jumper or damage the equipment.

To control the landing, skydivers use ram-air parachutes. Ram-air chutes contain two sets of lines, one on the right side and one on the left side of the chute, each set connected to **toggles**. When a jumper pulls on the lines on the right, the chute lowers on that side. This **decelerates** and turns the jumper to the right. The same thing happens on the left side when a jumper pulls down on the left lines. If a jumper wants to slow down the fall, he or she pulls on the lines on both sides.

Parachute Fabric

Parachutes are made using a **zero porosity** fabric with a special coating that does not allow air to flow through the fabric. This gives jumpers the best performance possible from the parachutes. However, it can also make it difficult to get all the air out when folding the parachutes!

Skydiving Tricks

It takes practice to learn how to jump from an airplane. Once a jumper feels more comfortable jumping from an airplane, he or she can work on more advanced tricks. Some of these tricks help in skydiving competitions. These competitions include target accuracy, formation free fall, and canopy stacking.

Landing on a target that is just 20 inches (50.8 centimeters) in diameter takes a lot of skill. In 2014, Elena Borisova, a female skydiver from Kazakhstan, won a competition in accuracy at an event in Russia. Not only did she come in first place in the female division, but she also defeated the men.

Formation free fall is when several skydivers jump together. As they fall, they hold on to one another to create a formation. In 2006, skydivers in Thailand created a 400-diver formation, establishing a new world record.

Canopy-stacking formation happens once jumpers deploy their parachutes. One by one, the jumpers form a vertical line. They do this by hooking their feet into the lines of the canopy of the jumper below. The goal is for all the jumpers to stack their canopies one on top of the other. In 2007, 100 jumpers set a world record when they created a stacked canopy formation.

Ballet Diving

One competitive skydiving sport is aerial ballet. The jumper performs gymnastic movements in the sky. These are captured on video and then judged.

STOP! THINK...

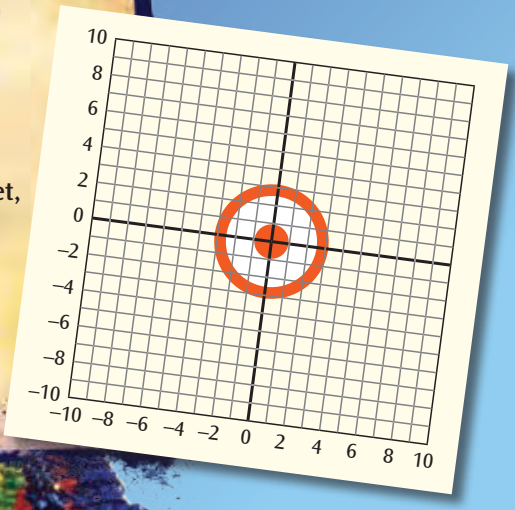
Four skydivers landed at these coordinates on a map. Which skydiver landed closest to the target, which is at the origin or bull's-eye?

Randy (7, –9)

Maria (8, 7)

Ty (–5, 9)

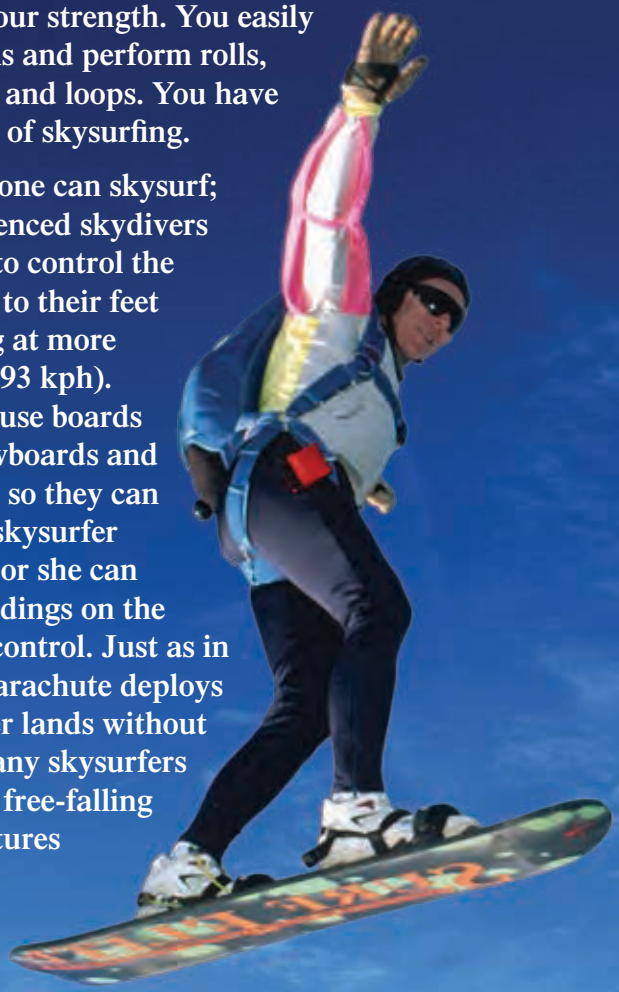
Reagan (–8, –1)



Surfing the Sky

You strap the board to your feet and leap from an airplane that is 10,000 feet (3,048 meters) above the ground. You stand on the board, leaning into the wind and surfing across the sky. With this board, you have greater **lateral** movement than if you were simply skydiving. Your board creates drag, but you manage to control it with your strength. You easily change directions and perform rolls, helicopter spins, and loops. You have mastered the art of skysurfing.

Not just anyone can skysurf; only very experienced skydivers have the ability to control the boards strapped to their feet while free falling at more than 120 mph (193 kph). Most skysurfers use boards shaped like snowboards and wear parachutes so they can land safely. If a skysurfer loses control, he or she can cut away the bindings on the board and gain control. Just as in skydiving, the parachute deploys and the skysurfer lands without harm. Today, many skysurfers compete while a free-falling cameraman captures their stunts.



Skysurf Slang

Skysurfers have their own slang terms for the sport. For example, *chicken soup* refers to a jump that doesn't go as well as planned. To *helicopter* is to spin your body to make the board look like chopper blades.

THINK LINK

- Why would it be difficult for a skysurfer to use a board the size of a surfboard?
- Why would a set of skis present problems for a skysurfer rather than a snowboard?
- What kinds of challenges would a skydiving cameraman have while trying to film a skysurfer?

Glide Like an Eagle

With just a few brisk steps, you launch your hang glider off the hill into the sky and soar like an eagle. You glide through the crisp air with your wings above and Earth thousands of feet below. Instead of falling to Earth, you find **thermals** that allow you to rise higher and higher, even above the birds. **Updrafts** of air keep you flying for hours, but at some point, the thermals diminish. You gently glide down to land and touch the ground. You are hooked on the ability to fly.

There are two types of gliding: hang gliding and paragliding. Both involve using air currents and a pilot's foot speed for taking off. There are two important differences between hang gliders and paragliders. Hang gliders are rigid and have metal frames, and the glider maintains a horizontal position during flight. A paraglider uses a ram-air canopy and glides in a seated position.

The hang gliding wing came about in the 1960s, thanks to the work of NASA engineer Francis Rogallo. While researching parachutes and kites as a way for spacecrafts to land back on Earth, he invented the **delta wing parachute**. A few other individuals took this lightweight structure and perfected it into the hang gliding wing that is most often used by professionals today.

A hang glider takes off.

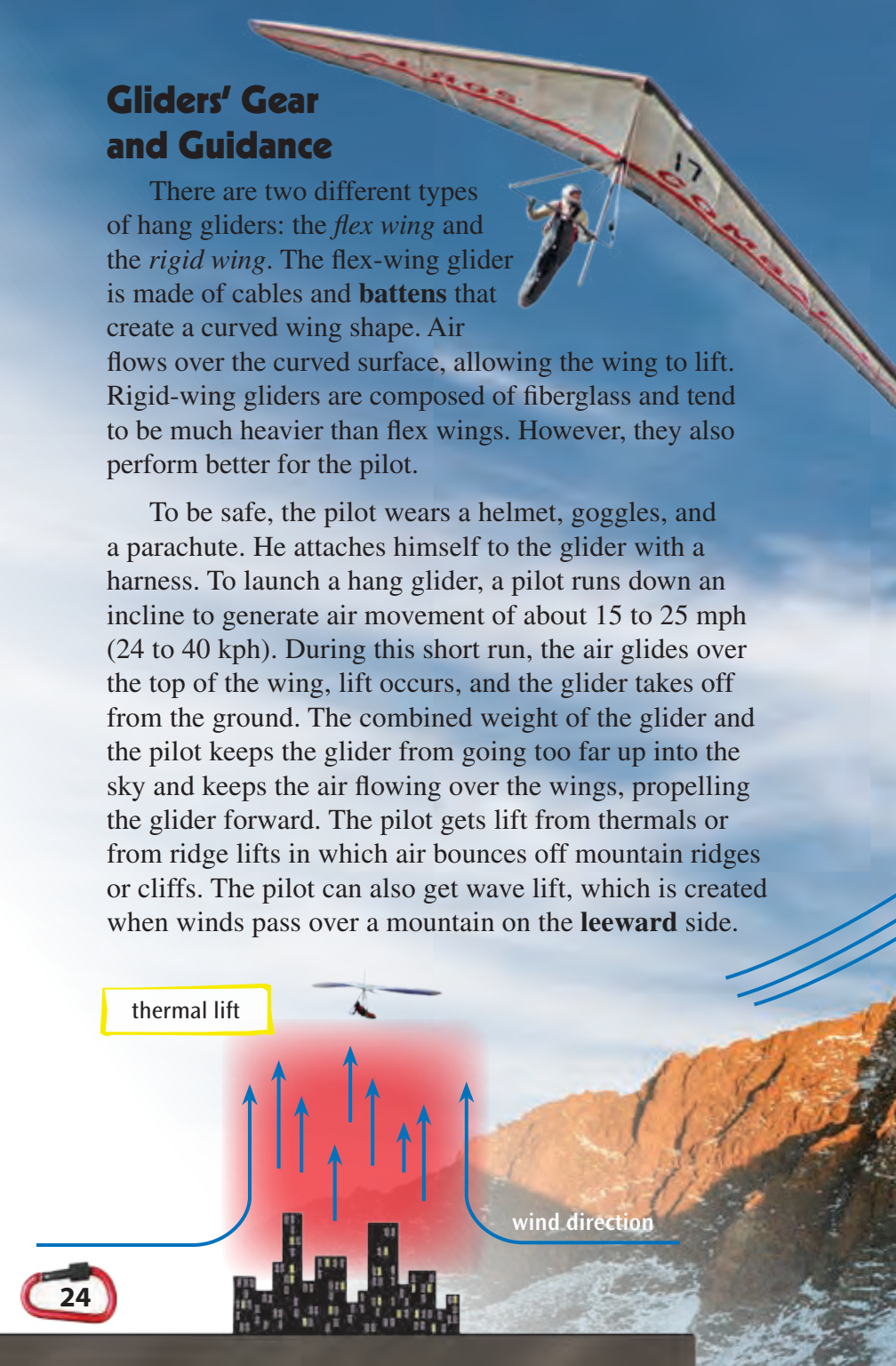
Paragliding

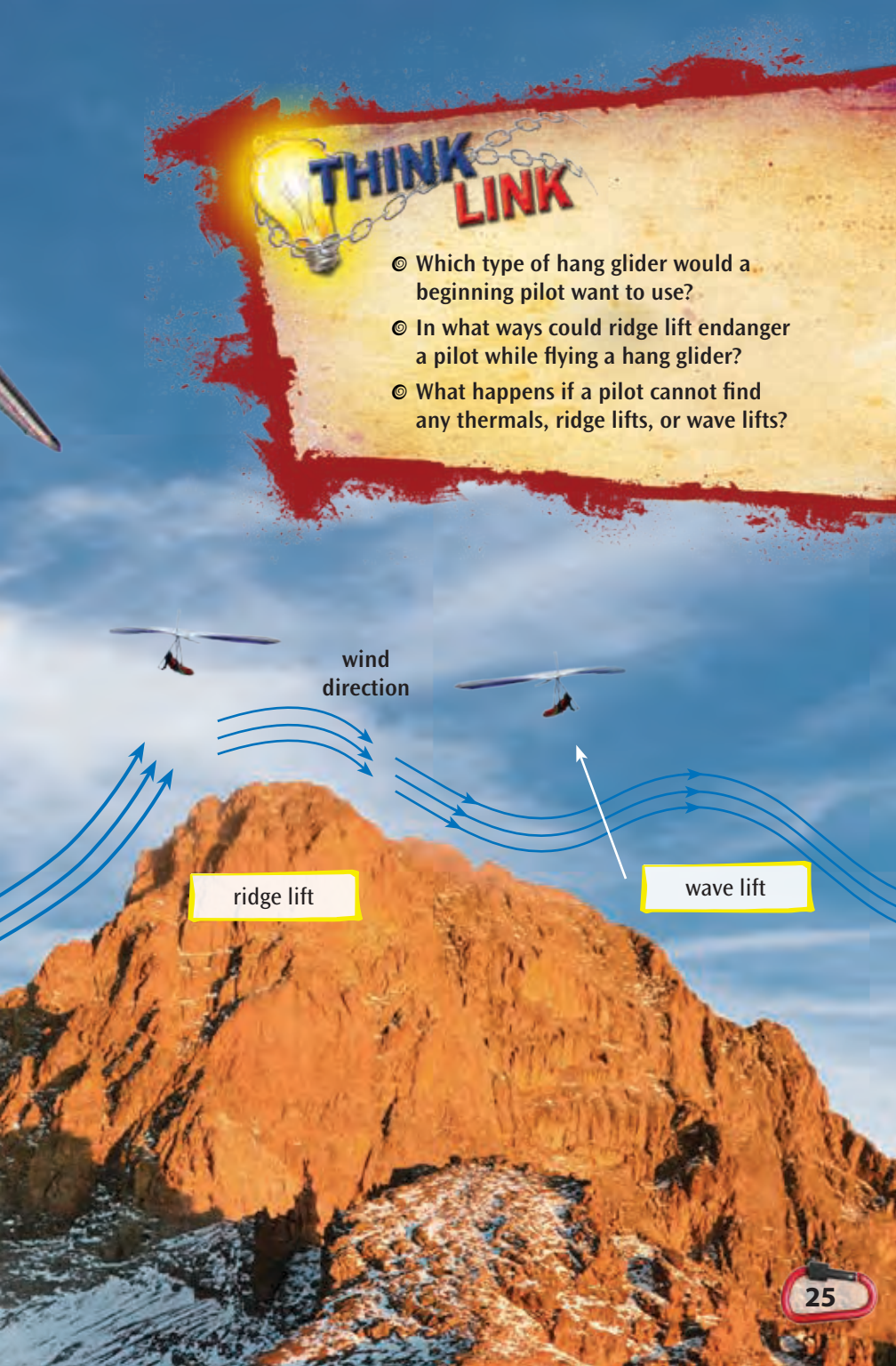
Paragliding is a free-flying sport that uses a wide canopy, similar to a parachute, to suspend a person in air. The canopy is attached to the pilot's body by a harness, which doubles as a seat. The canopy is deployed before the pilot runs to gain **momentum** and jumps off a cliff. The canopy inflates with air, and the pilot takes off!

Gliders' Gear and Guidance

There are two different types of hang gliders: the *flex wing* and the *rigid wing*. The flex-wing glider is made of cables and **battens** that create a curved wing shape. Air flows over the curved surface, allowing the wing to lift. Rigid-wing gliders are composed of fiberglass and tend to be much heavier than flex wings. However, they also perform better for the pilot.

To be safe, the pilot wears a helmet, goggles, and a parachute. He attaches himself to the glider with a harness. To launch a hang glider, a pilot runs down an incline to generate air movement of about 15 to 25 mph (24 to 40 kph). During this short run, the air glides over the top of the wing, lift occurs, and the glider takes off from the ground. The combined weight of the glider and the pilot keeps the glider from going too far up into the sky and keeps the air flowing over the wings, propelling the glider forward. The pilot gets lift from thermals or from ridge lifts in which air bounces off mountain ridges or cliffs. The pilot can also get wave lift, which is created when winds pass over a mountain on the **leeward** side.




THINK LINK
Which type of hang glider would a beginning pilot want to use?
In what ways could ridge lift endanger a pilot while flying a hang glider?
What happens if a pilot cannot find any thermals, ridge lifts, or wave lifts?
wind direction
ridge lift
wave lift

A hang-glider pilot gets information about a flight through an altimeter, which tells the altitude, and a variometer, which tells how fast the glider is climbing or descending. If the hang glider reaches a really high altitude, the pilot will need an oxygen mask. Lack of oxygen could make the pilot sick or impair his or her judgment.

How Many Miles?

If a hang glider travels for 11 hours at the speed of 43 mph, how many miles will it travel?

A pilot controls his or her flight using the **control bar** and his or her body. A pilot shifts his or her body to control the direction of the glider. He or she can pull back on the control bar and tip the nose down or push forward and tip the nose up. By tipping the nose of the glider down, the pilot causes the glider to speed up. By tipping the nose up, the glider slows down and can even stall in midair. A pilot can make a safe landing on his or her feet by slowing down the hang glider.

High and Long

Some hang gliders fly at 18,000 feet (5,486 meters), higher than many birds. These flights can last several hours. In fact, the longest glider flight on record is 11 hours in the air.

Diving Off a Cliff

You look down to the water below. You're on a cliff that's 85 feet (26 meters) high, as tall as an eight-story building! You calm your nerves by focusing your mind on the dive zone. No special equipment is necessary for this sport, just your body. As with any extreme sport, helmets are recommended. There are only three seconds to perform two somersaults in the air before hitting the water. You rise on your toes and dive. Your stunts are perfect, and you enter the water feet first, scoring a perfect 10 points. As a professional cliff diver, this is not your first diving competition.

Birdman

Cliff diving dates back to 1770, when the last king of Maui dove off a cliff 63 feet (19 meters) high without making a splash. He earned the name Birdman and demanded that his warriors prove their loyalty and courage by diving off cliffs, too.

Don't Break Anything!

Cliff divers hit the water at such high speeds that if they were to hit a fish or a piece of seaweed in the water, they could break a leg or foot. A belly flop would feel like hitting concrete.

Height Relates to Speed

When you jump off a cliff, you travel at 9.8 meters per second. Gravity pulls you toward the water. How long will it take a cliff diver to hit the water if she jumps from 20 meters? How about from 30 meters? What about from 3 meters?

A professional cliff diver's goal is to enter the water with as little splash as possible. A diver will straighten his body, keep his arms to his sides, press his feet together, and point his toes. Entering the water feet first ensures that the diver will touch as little of the water's surface area as possible.

Most dives are from heights ranging from 80 to 115 feet (24 to 35 meters). The force of gravity pulls cliff divers toward the water. Known as **free-fall acceleration**, this rate means that the longer the dive, the faster the diver travels through air toward the water. This happens because the diver has more time to accelerate during the dive.

The height of the fall dictates how fast the diver enters the water. Once the diver hits the water, the speed decreases to almost zero. Traveling at high speeds creates stress on the diver's body and can lead to injuries or death.

Showing Off

Cliff divers who perform shows can dive from up to 148 feet (45 meters). These divers have a lot of experience. However, sometimes injuries do occur even with experienced divers.

Superheroes in the Sky

You climb to the tallest **precipice**, dive head first, spread your wingsuit, and fly. The wingsuit, which looks like a snow angel or a flying squirrel, allows you to soar horizontally through the air at high speeds, much like a superhero, until you deploy your parachute and land safely. For a brief moment, you do feel like a superhero with the power to fly! You can't wait to experience your next wingsuit dive.

Wingsuits

When a wingsuit diver jumps from a tall building or a moving plane, both weight and gravity pull the diver toward the ground. The wingsuit provides lift to propel the diver through the air as she descends toward Earth. Wingsuits have webbed surfaces that fill with air under the arms and between the legs. The suit acts like a large wing as the force of air opens the membranes in the suit. The diver then uses her body to control her movements in the sky.

Which Is More Thrilling?

A wingsuit diver soars across the sky at 70 mph, while a skydiver travels 30 mph horizontally through the air. A wingsuit flyer falls at a rate of 50 mph, while a skydiver falls at a rate of 120 mph. Who would cover more distance in a given elapsed time, the wingsuit flyer or skydiver?

They Cost *How* Much?!

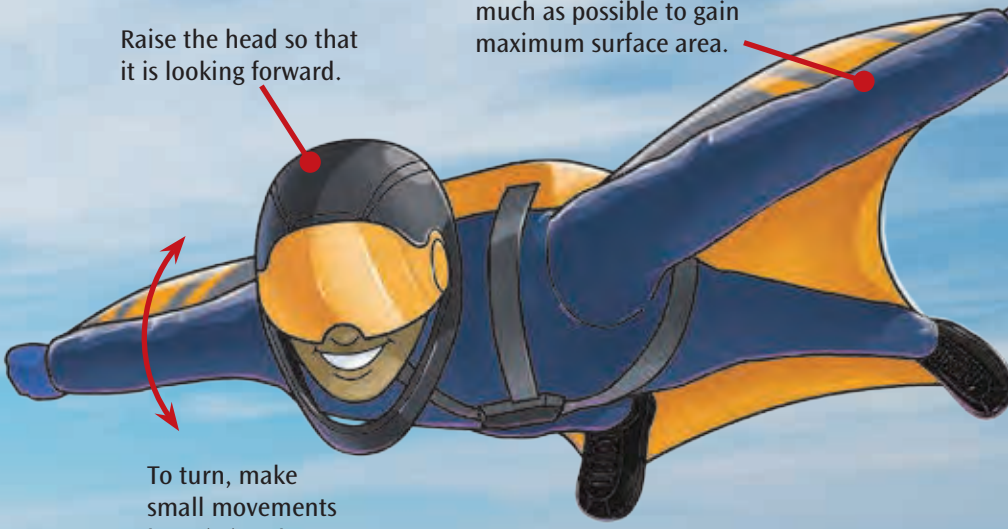
Wingsuits are handmade, which can hike up their prices. The cost of a wingsuit starts at around $1,000. But more experienced flyers often buy suits that cost twice that amount!

Steering a Wingsuit

After jumping, straighten your legs and your spine while spreading the wings on your arms and legs. This will help you to gain surface area. Increased surface area helps produce the lift necessary for flying.

If the goal is to go a long distance, get into a head-low position.

If the aim is more flying time, get into a head-up position.



Jump, Bounce, and Roll!

You stand with your ankles tethered to bungee cords. You take the plunge and swan dive off a platform that is 200 feet (61 meters) aboveground. The ground seems to rush toward you until you feel a quick snap and a jolt that keeps you from crashing. You bounce back up and down until the momentum eases, and you hang upside down. As a bungee-jumping junkie, you love the rush of **adrenaline** this sport gives you.

Sandbagging for More Intensity

Some jumpers jump with added weight to get more rebound and intensity from the jump. This is called *sandbagging*. Once the jumper reaches the bottom of the jump, he or she releases the weight and is propelled upward with more energy.

The Legend Behind Bungee Jumping

Legend says that bungee jumping began at Pentecost Island in the South Pacific, when a woman wanted to escape her husband who she felt was mistreating her. She climbed a tall tree, and as her husband began to follow her, she tied a vine to her ankles. Just as he reached out to grab her, she jumped. He fell to his death, while she bounced back. The men of the village began imitating this stunt to see how she did it. Over the years, villagers began jumping from a tower on the island. It wasn't until the 1970s that a Westerner brought this bungee jumping phenomenon across the ocean.

Not Just Jumping Rope!

A new sport called *rope jumping* is similar to bungee jumping except that jumpers dive off a platform with nylon ropes that do not stretch.

In spite of how dangerous bungee jumping seems, most people consider this to be the safest of the extreme sports. Jumpers wear helmets and safety harnesses, and in some jumps, they wear two harnesses. The stretchy cord wraps around the ankles of the jumper.

The intensity of the jump is dependent on the weight of the jumper, the distance of the jump, and the stretch of the cords. Once the person jumps, the energy builds and stores in the cord until the cord stretches to its farthest point. Then, the **potential energy** stored in the cord releases and propels the jumper back up for a few more free falls until the cord comes to a stop. While most people jump with longer cords to allow for longer free falls and greater deceleration once the cord catches, heavier people jump with shorter cords. The shorter cords catch the free fall earlier and make the jump more comfortable.

Shock Cords for More Weight

Shock cords are added to the bungee cord to accommodate weight. One cord is used for every 23 kg. How many shock cords would need to be added for a jumper weighing 100 kg?

Zorbing Fun!

Have you ever wondered what it's like to be a sock in a washing machine? If you ride in a zorb filled with five gallons of water, you would know! A zorb is a large ball made from two layers of plastic material. The ball rolls downhill on a track. To protect and cushion a rider, there is about 459 cubic feet (13 cubic meters) of air and a harness that straps the rider into the middle of the zorb.

Going at Zorb Speed

The speed of a zorb ride depends on the weight of the rider, the headwind, and whether a rider is strapped in. Riders who are strapped in cause the zorb to roll faster.

At the top of the hill, a zorb operator pushes the ball so that it begins rolling down a track, typically 700 feet (213 meters) long. The zorb gains speed and momentum. It might seem that rolling around and around inside a ball would make a rider sick. But the zorb is so large that it takes 30 feet (9 meters) for a rider to complete a full rotation inside the ball. Therefore, a rider isn't spinning too fast. Once the zorb reaches the bottom of the hill, it comes to a stop, and the ride is over.

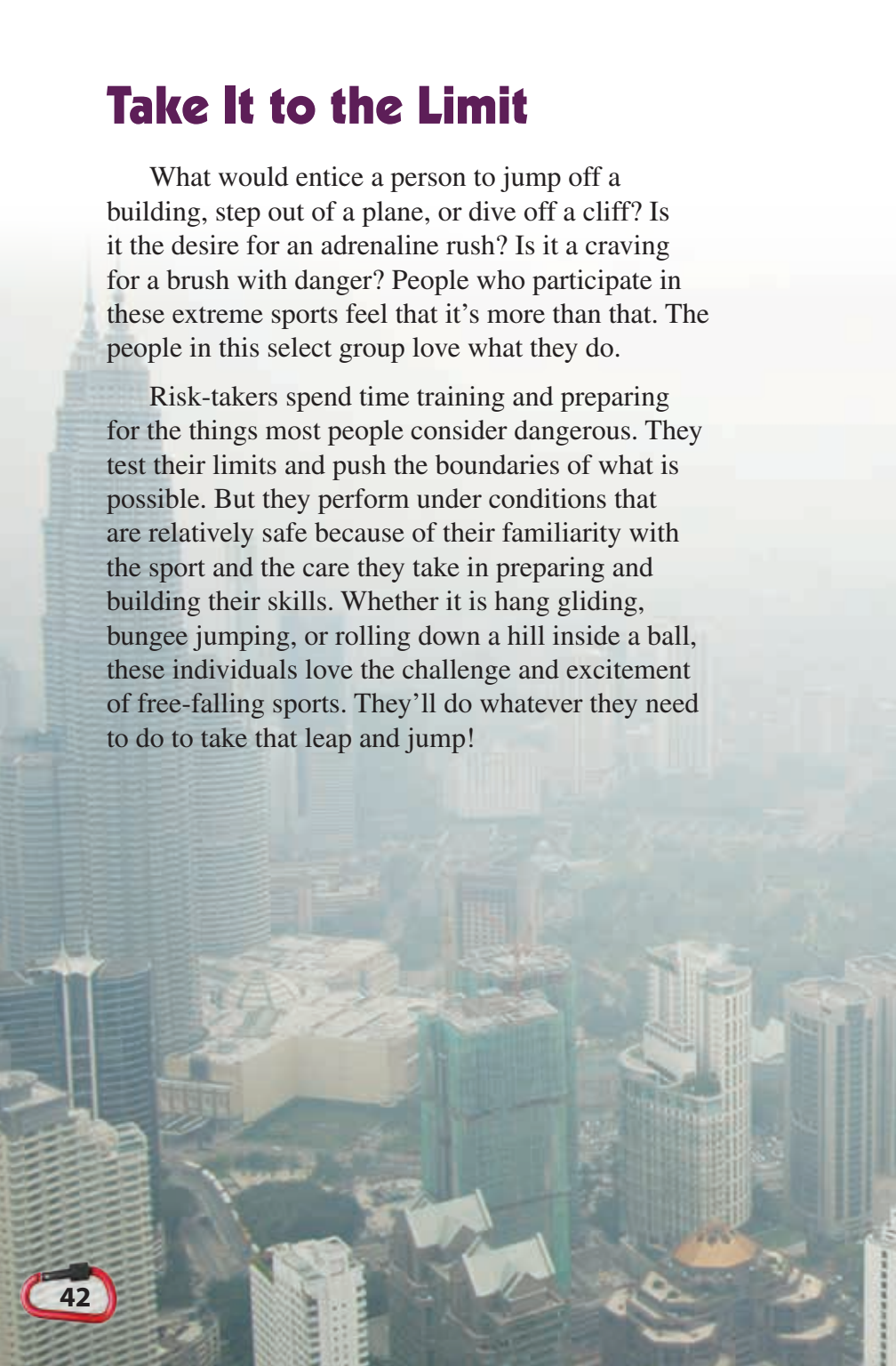
Zorb Circumference

If it takes 30 feet to complete a full rotation of the zorb, about what length is the diameter of the zorb?

Take It to the Limit

What would entice a person to jump off a building, step out of a plane, or dive off a cliff? Is it the desire for an adrenaline rush? Is it a craving for a brush with danger? People who participate in these extreme sports feel that it's more than that. The people in this select group love what they do.

Risk-takers spend time training and preparing for the things most people consider dangerous. They test their limits and push the boundaries of what is possible. But they perform under conditions that are relatively safe because of their familiarity with the sport and the care they take in preparing and building their skills. Whether it is hang gliding, bungee jumping, or rolling down a hill inside a ball, these individuals love the challenge and excitement of free-falling sports. They'll do whatever they need to do to take that leap and jump!



Always Start at the Beginning

To be safe, all free-fall activities require people to start at the easiest level so that they can learn the skills first. Once they master the small skills, it's possible to go to the next level and try something harder.

Glossary

adrenaline—a hormone released when frightened, excited, or angered that speeds up heart rate and increases blood flow

altitudes—heights of objects above sea level

battens—thin strips of wood inserted into glider wings

control bar—bar that a pilot of a hang glider holds on to and controls his or her glider

decelerates—reduces speed

delta wing parachute—a type of parachute used in hang gliding

deploying—opening a parachute while free-falling

exit point—the top of the structure that a B.A.S.E. jumper jumps from

fjords—narrow inlets of the sea between cliffs or steep slopes

free-fall acceleration—the idea that a person continues to accelerate in a fall because of the force of gravity

lateral—across, horizontally

leeward—downwind; located on the side of a mountain sheltered from the wind.

momentum—the act of gaining speed, forward motion, and active force

pilot chutes—smaller chutes that help anchor jumpers and open main parachutes

potential energy—stored energy

precipice—a tall, dangerous peak or cliff

ram-air canopy—a square or rectangular parachute with two nylon layers that fill with air, making control easier

round canopy—dome-shaped parachute

thermals—hot columns of air

toggles—the pulls on a ram-air parachute that control and slow the chute

updrafts—warm air currents moving upward

zero porosity—a characteristic of a specialized fabric through which no air can pass

Index

Angel Falls, 6
B.A.S.E. jumping, 4, 7–13
bungee jumping, 5, 36–38, 42
cliff diver, 28–31
da Vinci, Leonardo, 5
El Capitan, 12
flex-wing glider, 24
free-fall acceleration, 30
hang gliding, 22–27, 42
human terminal velocity, 7
Lysefjord, Norway, 9
Marina Bay Sands, 8
Maui, 28
NASA, 22
New River Gorge Bridge, 9
paragliding, 4, 22–23
Pentecost Island, 37
Preacher's Pulpit, 9
ridge lifts, 24–25
rigid-wing gliders, 24
Rogallo, Francis, 22
shock cords, 39
skysurfing, 4, 20–21
Smith, Phil, 8
Stearns, Cheryl, 16
thermal lift, 24
wave lift, 24–25
wingsuit, 5, 32–35
zorb, 40–41

Check It Out!

Books

Clark, Tracy. 2016. *Mirage*. HMH Books for Young Readers.

Higgins, Matt. 2014. *Bird Dream: Adventures at the Extremes of Human Flight*. Penguin Press.

Kalman, Bobbie, and John Crossingham. 2006. *Extreme Skydiving*. Crabtree Publishing Company.

Lewis, Wendy A. 2008. *Freefall*. Key Porter Books.

Tomlinson, Joe. 2004. *Extreme Sports: In Search of the Ultimate Thrill*. Firefly Books.

Zeigler, Heidi. 2003. *Hang Gliding*. Rosen Book Works, Inc.

Videos

Roede, Christian, Eric Ellioth, Preben Hansen, and Thomas O. Christensen. 2015. *Wingmen*. Xtreme Video.

Strauch, Marah. 2015. *Sunshine Superman*. Magnolia Pictures.

VanderMost, Macaela. 2012. *Sky High*. Kinonation.

Try It!

Design an exhibit for the National Smithsonian Air and Space Museum chronicling the advancements of individual human flight. Your display has room to feature five different advancements in technology.

- Which technologies from the book will you choose to feature?
- How will they be displayed? Chronologically? Based on importance?
- What statistics about human flight will you include in your display?
- What true stories about human flight will you tell?

About the Author

Besides writing books for students and conducting training sessions for teachers, Wendy Conklin has a wide variety of interests, from reviving old furniture to competing in rigorous athletic competitions. If there's a challenge, she jumps right in to take it on. Her motto in life is to live life to the fullest and have no regrets. Someday, Wendy hopes to live in Hawaii, but right now, she lives with her family and two sweet Boston terriers in Round Rock, Texas.

Answers

page 7—60 mph; 96.5 kph
page 11—1,148 feet
page 15—66.7%
page 19— Reagan (–8, –1)
page 26—473 miles
page 29—2 seconds (20 m); 3 seconds (30 m); 0.3 seconds (3 m)
page 32—a skydiver, since 150 mph is greater than 120 mph
page 39—5 cords
page 41—about 10 feet

Reader's Guide

1. Why are jumps that are closest to the ground the most dangerous in comparison to jumps that are higher in altitude?
2. For what reasons should B.A.S.E. jumpers first complete at least 100 skydiving jumps?
3. Why do you think these extreme sports have the reputation of being reckless?
4. Out of all these sports, why would zorbing and bungee jumping be best for amateurs?

Teacher Created Materials PUBLISHING

SHELL EDUCATION

Thank you for purchasing this eBook.

For further information about our products and services, please e-mail us at: **customerservice@tcmpub.com**.

Thank you for helping us create a world in which children love to learn!

Teacher Created Materials PUBLISHING | SHELL EDUCATION | Teacher Created Materials LIBRARY

5301 Oceanus Drive ▪ Huntington Beach, CA 92649-1030 ▪ 800.858.7339 ▪ FAX 714.230.7070 ▪ www.tcmpub.com

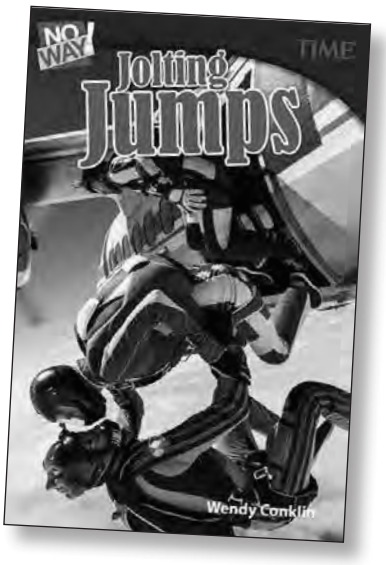
Focus Objectives

Students will be able to:

- make predictions to aid their comprehension of a text.
- compare and contrast information in a passage and write persuasively.

Language Objective

- Students will write descriptions of B.A.S.E. jumping with rich and interesting details.



Word Analysis

- Etymology: Students will learn about the history and origin of the word *adrenaline*.
- Breaking Down Words: Students will study the medical prefixes *hypo–* and *post–* and suffixes *–itis* and *–pathy*.
- *Medical Words* student activity sheet (page 7)

Comprehension

- Model Lesson: Making Predictions: Students will use the table of contents, prior knowledge, text features, and photographs to create predictions about a text.
- *Powerful Predictions* graphic organizer (page 8)

Close Reading

- Close-Reading Lesson: Context Filter: Students will compare and contrast and use persuasiveness in response to a reading passage.
- *Closer Look: Skydiving Tricks* close-reading passage (page 9)
- *Free Falling* close-reading student activity sheet (page 10)

Comparing Sources

- Students will find similarities and differences when looking at two sources about similar topics.
- *No Way! Jolting Jumps* (pages 18–19) and *Another Look at Skydiving* student activity sheet (page 11)

Quick Writing Prompt

- Students will write descriptions of what it would be like to B.A.S.E. jump.

Real-World Connections

- Students will find legal locations for B.A.S.E. jumping.

Opportunities to Develop Fluency

- Students will create interviews between "reporters" and "jumpers" using the text for questions and answers.

Teacher Created Materials
5301 Oceanus Drive
Huntington Beach, CA 92649-1030
http://www.tcmpub.com
TCM 25700 (i13745)
ISBN 978-1-4938-3700-7

Reader's Guide Reminder

The Reader's Guide questions in each book encourage students to think critically and can serve as class discussion starters. Suggested answers are provided in the Digital Resources.

Word Analysis

1. **Etymology**—Remind students that language is something that is alive and always changing. New words are created and added to languages when they are needed. Understanding where a word came from and what all its parts are can help us better know and understand words.
   - Write the word *adrenaline* on the board for students to see. Ask students to give a thumbs up if they know this word and can define it, a thumbs to the side if they have heard of it but are unsure of its meaning, and a thumbs down if this is a new word to them. Ask a student who has his or her thumb up to give an explanation of the meaning.
   - Students may give partial answers or mention an "adrenaline rush," but make sure all students understand what the word means. Adrenaline is a hormone secreted from the adrenal glands at the top of each kidney. When people are stressed or excited, the hormone is made and increases a person's breathing, metabolism, and blood circulation. Have students think-pair-share to discuss when people might get adrenaline rushes.
   - Say, "In 1901, adrenalin (without the e) was coined by a Japanese chemist named Jokichi Takamine. He discovered the hormone and named it for the Modern Latin word *adrenal,* which means 'of or near the kidneys,' and the chemical suffix *–ine*. The term *adrenaline rush* came into use around 1970."
2. **Breaking Down Words**—Students will work on two prefixes and two suffixes commonly used in medical vocabulary. The suffix *–itis* means "inflammation," and *–pathy* means "disease." The prefix *hypo–* means "under," and *post–* means "after."
   - Play a guessing game with the students. Describe or act out a word and have the students guess the word. Bring attention to the prefix or suffix. Or invite students to volunteer to act out the words. For example, you could say, "Oh, my side hurts! I need to go the hospital and have surgery to remove this body part before it bursts!" (appendicitis) "The person next to me has a cold, and now I know I have it. My arm just itched, so I'm pretty sure I'm having an allergic reaction to the air." (hypochondriac)
   - For further practice, have students complete the *Medical Words* student activity sheet (page 7).

Model Lesson: Making Predictions

Before Reading

1. **Model**—Say, "Making predictions is an important reading strategy you have been practicing for years, but it is still a very important one. In fact, as the information and subject matter become more difficult, predicting is a powerful way to mentally be aware of what is happening. When I am predicting about a text, it forces me to constantly compare what I am learning in the book to what I thought I would learn. Big breakdowns between these two ideas can be warning flags about your comprehension."
   - Ask students if they know some ways good readers predict what an informational text will be about. Discuss. Then, explain to students that they are going to practice predicting using prior knowledge, text features, and photographs. Share only the cover of the book (*No Way! Jolting Jumps*) with the students. Model how to look at the cover and give one prediction you have based on the title and art. Turn to the back cover and say, "I think this is about … because I see …."

2. **Guided and Independent Practice**—Distribute the *Powerful Predictions* activity sheet (page 8). Tell students that the Table of Contents contains lots of important clues to predict what the text is about. Look at the first chapter title in the table of contents column, "Jumping Off a Base." Ask students for their opinions on what this could be about. What kind of base could the text be referring to? A baseball base? A military base? If any students are familiar with the acronym *B.A.S.E.*, let them share a little, but don't let them explain the entire concept. Allow students to write their predictions in the *Prior Knowledge* column. They can use a prediction that the class came up with or branch out with their own ideas.
   - Say, "This is what you will be doing for each of the chapters in the Table of Contents. Some chapters have very straightforward titles. Others are a little trickier, making you think a little deeper about what information might be written in that part."
   - Give students a few minutes to write some notes about their predictions for each chapter, based only on the titles. While some are obvious, such as "Jumping from a Bungee," others are more cryptic, such as "Superheroes in the Sky." And a section like "Zorbing Fun!" may really stump everyone! Remind students that their predictions do not have to be correct, and it is okay if they do not know what it all means. Do stress that they should be making thoughtful and specific predictions.
   - Distribute the books to students.

English Language Support

Words like *bungee* and *zorb* are difficult to explain. Print pictures that will support each title in the Table of Contents so that students can visualize the words being used before reading.

Model Lesson: Making Predictions (cont.)

During Reading

1. **Model**—Read the "Risky Business" chapter together. Say, "Using the clues that I have so far, I think I will learn about how people fly when they participate in extreme sports." When you come to the "Jumping Off a Base" chapter, stop students. Point out the sections about text features and photographs on their activity sheets. Give students a moment to look at them, but discourage them from actually reading the text at this point.
   - Say, "As I look through this chapter on pages 6–13, I am focusing first on the text features—the headings, the sidebars, the captions, etc. I notice that the sub-section beginning on page 8 is called 'Buildings, Antennas, Spans, and Earth.' Suddenly, the word *base* is making more sense." Give students time to write predictions based on the text features.
   - Say, "Now, I want to look at the photographs, and they are really something!" Let students share their observations about the photographs and make notes on their activity sheets.

2. **Guided and Independent Practice**—Read through the chapter together and let students complete the "What Was It About?" section of their activity sheets. Remind students before reading a new section that they will be making quick predictions based on the text features and photographs. After reading the section, they will make notes of the actual information.
   - Give students time to continue predicting and reading the text.

English Language Support

Make sure students understand the vocabulary. It may be helpful to match some of the words with photographs.

Assessment Opportunity—As students are predicting and reading, walk around and observe. If you notice students reading without predicting first, remind them to predict first.

After Reading

1. **Model**—Say, "As I was predicting and reading the text, some of the information was what I expected, such as the section about skydiving. Others, such as the zorb, were completely new to me. Predicting with only the chapter titles was a very different experience than predicting with headings, captions, and photographs! But both have their uses."

2. **Guided and Independent Practice**—Discuss the progression of their predictions. Example questions include: *How did your predictions using the Table of Contents differ from the predictions you made using text features and photographs? What benefit would predicting from the Table of Contents give you? What did this activity teach you about making predictions?*
   - Have students discuss the answers to these questions in groups of two to three students. Ask for a few answers to be shared with the whole class.

Close-Reading Lesson: Context Filter: Compare/Contrast and Persuasiveness

Introduction

1. Distribute the *Closer Look: Skydiving Tricks* close-reading passage (page 9).
2. First read: Have students read the excerpt independently to get the gist of the text. After they finish reading independently, ask students to describe the main ideas found in the passage.
3. Direct students to the filter and focus box on their activity sheets. Remind them that the purpose of a close reading is to read with a specific filter in mind.
   - Students will critique the passage, focusing on any information that is compared or contrasted. Students should also consider whether the text is persuading them to think about the information in a particular way.
4. Direct students to the driving questions on their activity sheets and read them aloud: *What information can you compare and contrast in the text? How does the text persuade you to feel about the information?* These are the questions that they need to keep in mind while rereading the text.
5. Remind students that they are looking for comparing, contrasting, and persuasive text.

Activity

6. Second read: Have students read the passage again, this time underlining words and phrases that compare and contrast information. If particular phrases or sentences feel persuasive, have students mark them with *Ps*.
7. After marking each sentence with the necessary notes, have students look back at the passage as a whole. They may choose to label their words and phrases more specifically with *CM* for comparing information and *CT* for contrasting information.
   - If any students are having a hard time organizing their notes, it may be helpful to have them find only two topics and look for ways they are similar or different. Also, to help students find persuasiveness, have them think to themselves, "Does this change my mind or make me think about the topic in a different way?"
8. Third read: Have students read the passage a third time, this time being extremely critical about their notes. Help them study the notes they marked on their close-reading activity sheets to discover larger trends. Students should record notes about what they notice in the margins next to the text. After students have completed their third reads, ask them to share their answers to the driving questions, using evidence in their responses.
9. Provide students with the *Free Falling* student activity sheets (page 10). Using their annotated passages to help them, they should answer the questions. After a set amount of time, students should compare and share their responses with partners.

English Language Support

Remind students that *compare* means to find the ways two or more things are alike and *contrast* means to find the ways they are different. If students are still struggling, give them examples.

Comparing Sources

Have students read a passage from TIME For Kids, *Another Look at Skydiving* (page 9), and compare and contrast it to information given in *No Way! Jolting Jumps*. Discussion should focus on why an author chooses a particular style of writing when delivering information to a reader.

Quick Writing Prompt

Pages 6–13 explain what B.A.S.E. jumping is like. Have students write vivid descriptions using colorful adjectives and adverbs of what they think it would be like to B.A.S.E jump.

- **Below-grade-level students:** Have a short discussion about what B.A.S.E. jumpers do. Brainstorm together some adjectives and adverbs. Encourage students to include at least three adjectives and/or adverbs each.
- **On-grade-level students:** Before writing, have students create outlines and adjective/adverb lists. Tell students to include at least five adjectives and/or adverbs each.
- **Above-grade-level students:** Challenge students to write pieces that include diverse adjective and/or adverb phrases to demonstrate complexity in their writing.

Real-World Connections

- Working in small groups, challenge students to find legal locations that are not mentioned in the book for each kind of B.A.S.E. jump. Have them present their findings to the class using visuals.

Opportunities to Develop Fluency

- *Adrenaline Rush Interview*—Allow students to work in small groups. One student will be the interviewer while the other(s) will pretend to be jumpers. Have students use the text to find questions and answers they can ask their interviews about adrenaline rushes. Give them time to practice the interviews so that they sound natural and not scripted (but not memorized, either).

Name: _____ Date: _____

Medical Words

Directions: Look at the tables about medical prefixes and suffixes. Then, choose the best medical word to complete each sentence.

Prefix	Root Word	Medical Word
hypo– = under	*glykys* = sweet; *haima* = blood	hypoglycemic
hypo– = under	*derma* = skin	hypodermic
post– = after	*partum* = birth	postpartum
post– = after	*lingual* = language	postlingual

1. The _____ woman was released from the hospital with her baby.

2. The nurse gave the shot with a _____ needle.

3. _____ deafness can be caused by illness or injury.

4. The _____ man felt better after he drank some juice and had a cookie.

Root Word	Suffix	Medical Word
arthron = joint	*–itis* = inflammation	arthritis
larynx = voice box	*–itis* = inflammation	laryngitis
myo = muscle	*–pathy* = disease	myopathy
osteon = bone	*–pathy* = disease	osteopathy

5. Older women sometimes take calcium supplements to prevent _____.

6. Having _____ on the play's opening day was bad luck for the lead actor.

7. Luke's _____ causes cramping and spasms after he runs.

8. _____ in the hands and fingers makes knitting very difficult.

Name: _____ Date: _____

Powerful Predictions

Directions: Before reading, make predictions based on the Table of Contents using your prior knowledge. Then, as you read, use text features and photographs to focus your predictions.

Chapters	Prior Knowledge	Text Features	Photographs	What Was It About?
Jumping Off a Base				
Oh, Go Jump Out of an Airplane!				
Surfing the Sky				
Glide Like an Eagle				
Diving Off a Cliff				
Superheroes in the Sky				
Jump, Bounce, Roll!				
Take It to the Limit				

Name: _____ Date: _____

Closer Look: Skydiving Tricks

Directions: First, read for the main idea of the text. On the second read, underline words or phrases that compare and contrast the skydiving tricks. Mark persuasive sentences with *P*s. Review and change as needed to find the best evidence to answer the driving questions.

Context Filter—Focus on Compare/Contrast and Persuasiveness
Driving Questions: What information can you compare and contrast in the text? How does the text persuade you to feel about the information?

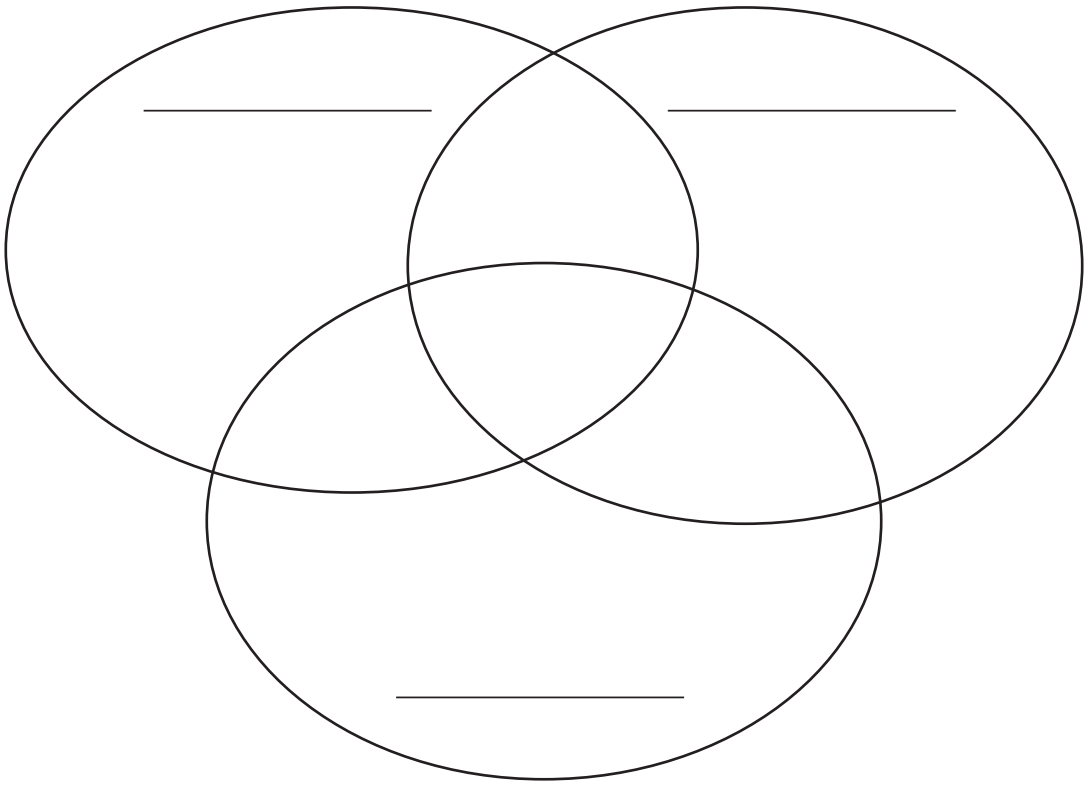
Margin Notes	**Skydiving Tricks**	Margin Notes
	It takes practice to learn how to jump from an airplane. Once a jumper feels more comfortable jumping from an airplane, he or she can work on more advanced tricks. Some of these tricks help in skydiving competitions. These competitions include target accuracy, formation free fall, and canopy stacking. Landing on a target that is just 20 inches (50.8 centimeters) in diameter takes a lot of skill. In 2014, Elena Borisova, a female skydiver from Kazakhstan, won a competition in accuracy at an event in Russia. Not only did she come in first place in the female division, but she also defeated the men. Formation free fall is when several skydivers jump together. As they fall, they hold on to one another to create a formation. In 2006, skydivers in Thailand created a 400-diver formation, establishing a new world record. Canopy-stacking formation happens once jumpers deploy their parachutes. One by one, the jumpers form a vertical line. They do this by hooking their feet into the lines of the canopy of the jumper below. The goal is for all the jumpers to stack their canopies one on top of the other. In 2007, 100 jumpers set a world record when they created a stacked canopy formation.	

Name: _____ Date: _____

Free Falling

Directions: Use your notes from the *Skydiving Tricks* passage to answer the questions. Be sure to include evidence from the text in your responses.

1. Complete the Venn diagram with at least two facts in each section. Label each circle with one of the following: target accuracy, formation free fall, and canopy stacking.



2. Use the information in your Venn diagram to compare and contrast the three types of skydiving tricks.

_____

_____

_____

_____

3. What words or phrases does the author use to persuade you that these tricks are difficult?

_____

_____

_____

Name: _____ Date: _____

Another Look at Skydiving

Directions: Read the following excerpt from TIME For Kids, "Space" from October 26, 2012. Compare it to the information found in *No Way! Jolting Jumps* on pages 18–19.

Fearless Felix Baumgartner jumped from the edge of space on October 14. About nine minutes later, he landed safely on his feet in Roswell, New Mexico. The Austrian daredevil took a leap from a capsule 128,100 feet above the ground. That distance put him on the edge of the stratosphere, the second layer of Earth's atmosphere.

A helium balloon carried Baumgartner and the Red Bull Stratos capsule up to space. The balloon was the largest ever used for a manned flight. The ascent took nearly three hours.

Baumgartner, 42, broke three world records: the highest manned balloon flight, the highest sky dive, and the fastest jump. During his fall, he reached speeds up to 833.9 miles per hour, shattering the sound barrier. The speed of sound is measured at 761.2 miles per hour at sea level. Baumgartner is the first human to travel faster than the speed of sound without the use of a craft.

1. In what ways are the two texts similar?

_____

_____

_____

2. In what ways are the two texts different?

_____

_____

3. How do both texts support the fact that as skydivers become more comfortable, they can work on more innovative tricks?

_____

_____

_____

_____

_____

_____