SCHOLASTIC

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EXPONENTS
The science of insect stings

GEOMETRY
See the patterns hidden inside Japanese taiko drums
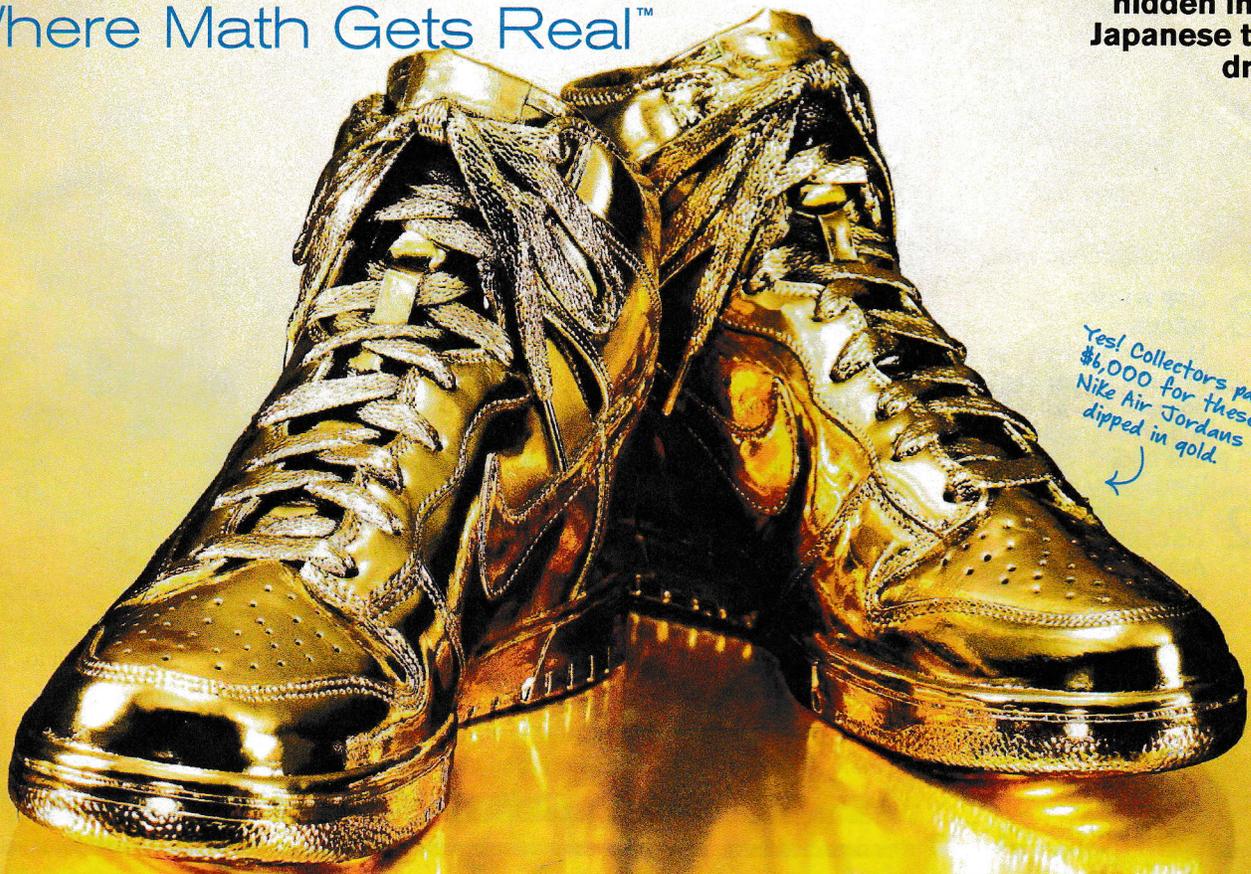
Yes! Collectors paid $6,000 for these Nike Air Jordans dipped in gold.

WOULD YOU PAY $6,000 FOR SNEAKERS?

Why some teens are investing big bucks in collectible sneakers

RECYCLE THIS PLEASE!

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NUMBERS IN THE NEWS

▶DECIMALS

Tasty Tears
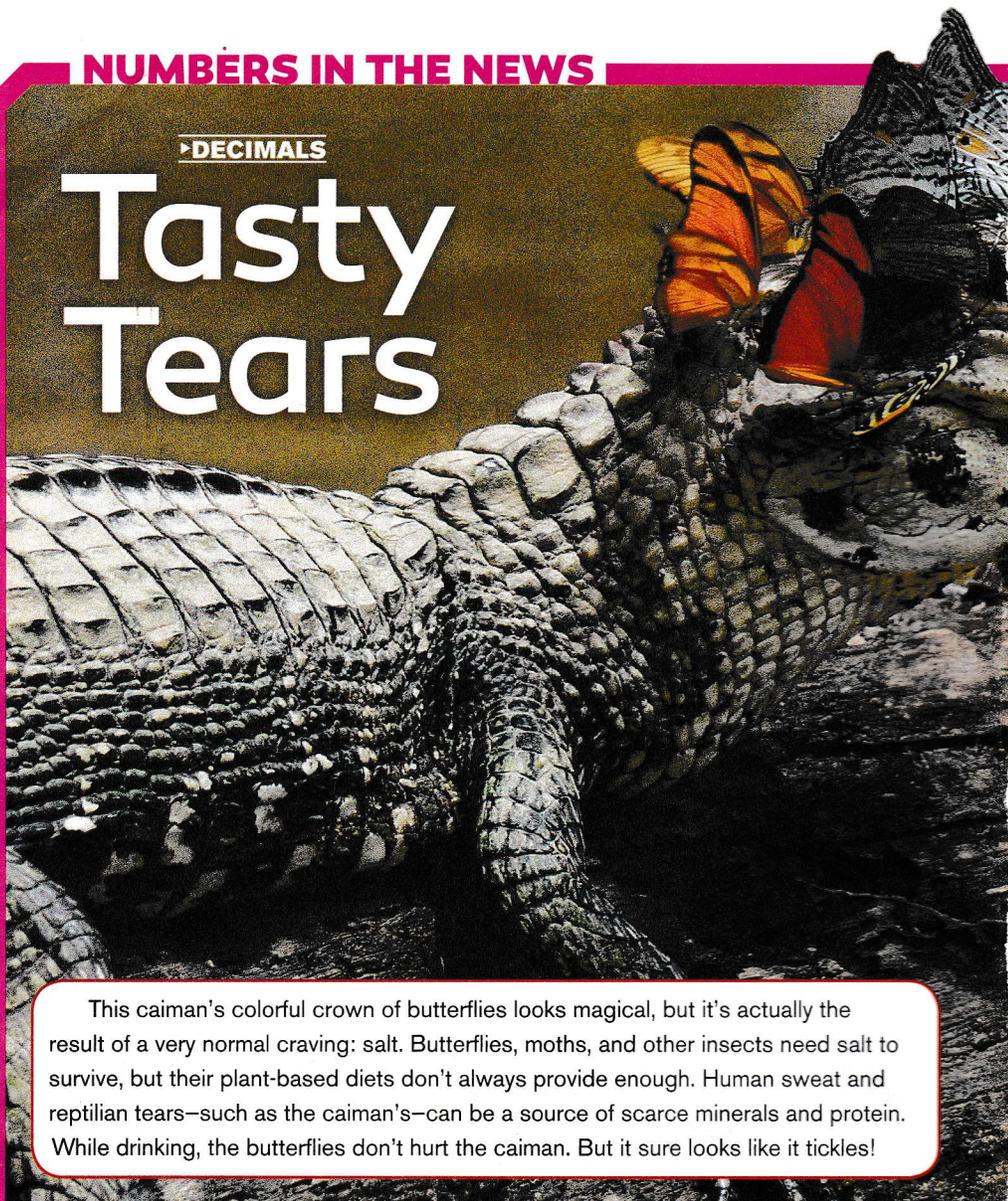
This caiman's colorful crown of butterflies looks magical, but it's actually the result of a very normal craving: salt. Butterflies, moths, and other insects need salt to survive, but their plant-based diets don't always provide enough. Human sweat and reptilian tears—such as the caiman's—can be a source of scarce minerals and protein. While drinking, the butterflies don't hurt the caiman. But it sure looks like it tickles!

▶PERCENTS

Death of the

Ever since it introduced the Macintosh personal computer in 1984, Apple has been known for innovation. Most of its new tech is welcomed with giddy enthusiasm, but the release of the iPhone 7 caused a major uproar. The fuss this time: It doesn't have a headphone jack. This change will force iPhone 7 users to either buy wireless headphones or use an adapter to plug their wired headphones into the phone's charging port.

Apple says getting rid of the jack allows the phone to house bigger, better camera technology, a new pressure-sensitive home button that simulates
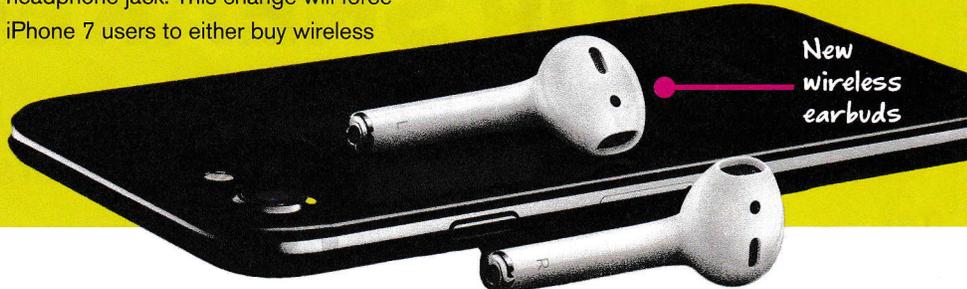
New wireless earbuds

**?** An average caiman is 8.2 feet long. An average butterfly's wingspan is 3.7 inches long. How many butterflies could fit along the length of a caiman's back side-by-side, rounded to the nearest whole butterfly?
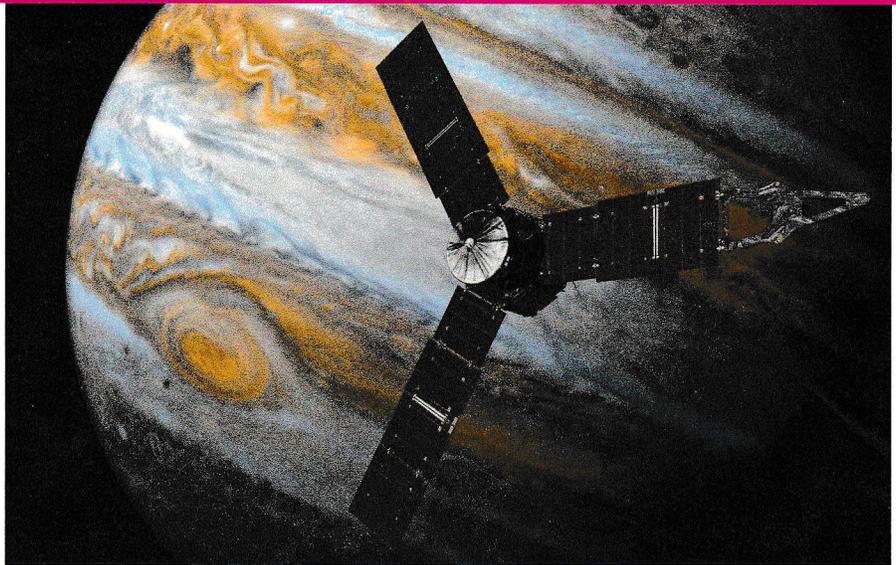
▶ SCIENTIFIC NOTATION

Journey to Jupiter

It took NASA's Juno spacecraft five years to reach Jupiter. It arrived last summer and will perform its 10th of 36 planned orbits around the planet this month. As it makes its rounds, the spacecraft will come within 3,000 miles of our solar system's largest planet.

That's close enough to study its atmosphere and the superstrong magnetic field that surrounds the planet. Juno will also get the first glimpse below Jupiter's dense cloud cover—before burning up in the atmosphere next February. The data collected should tell us more about the origin of our solar system.

? Since it launched in 2011, Juno has traveled over 1,740,000,000 miles. What's that in scientific notation?

Headphone Jack?

the feel of clicking, and a longer-lasting battery. Many people remain skeptical of Apple's choice, but only time will tell if this move will lead the way for other smartphone companies to drop headphone jacks as well.

? The new iPhone 7 has a larger, longer-lasting battery. Battery life is measured in milliamp hours (mAh). The iPhone 6s battery is rated at 1,715 mAh. The iPhone 7 battery is 1,960 mAh. What's the percent change in battery life?

iPhone 6s

The headphone jack was here.

iPhone 7
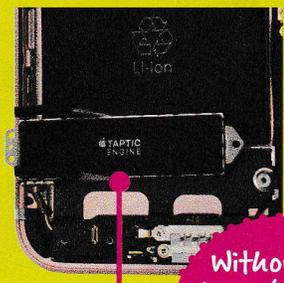
Without it, there's room for a bigger battery and camera.

High-Profit High-Tops

Is buying collectible sneakers a good investment?

A sneakerhead shows off his limited-edition Yeezy Red Octobers signed by Kanye West.

Looking for a hot investment tip? It could be on your feet. Once just the realm of fashion, sneakers are gaining value as collectibles. Sneakerheads—people who collect, trade, and admire sneakers—line up for hours for a chance to snag limited-edition pairs of shoes.

While many sneakerheads want to wear their purchases, some sneakers are in such high demand that teens can capitalize on their kicks. They sell them on the aftermarket, where people resell goods after their original release. This can translate into big bucks. Economists value the sneaker aftermarket at $1 billion.

"The most successful way to make money with shoes is to resell them," says Fedor Kirilenko, a 14-year-old sneakerhead from Los Angeles. He goes by the name Sneaker Boy on his YouTube channel, where he reviews shoes and clothing.

If they have the cash, many sneakerheads will buy in bulk. This, in turn, increases demand and ups the resale price. "They look at it as an investment," says Eric Ariel, founder of Just the Kickz, a website that alerts followers to new sneaker releases.

Josh Luber also saw this connection between shoes and stocks, so he created StockX. It's a marketplace where people can trade sneakers like they would for shares of stock in a company. "Sneakers follow the same basic economic principles of anything with a high resale value," says Luber.

For example, Fedor bought a pair of Adidas Yeezy Boost 750s for $350. He resold them for more than four times that. Critics wonder if spending hundreds on shoes is responsible. No one knows if the sneaker aftermarket will continue to boom or go bust.

But profit isn't the only driving force for sneakerheads. Fedor, who uses his 78-pair collection as the backdrop to his videos, also enjoys the connections he makes with the sneaker community.

"I really love shoes because of their ability to bring people together," says Fedor. "We don't just talk about how the shoes look, but more importantly the story behind them and the origins of the shoe."

—*Joe Fraioli*
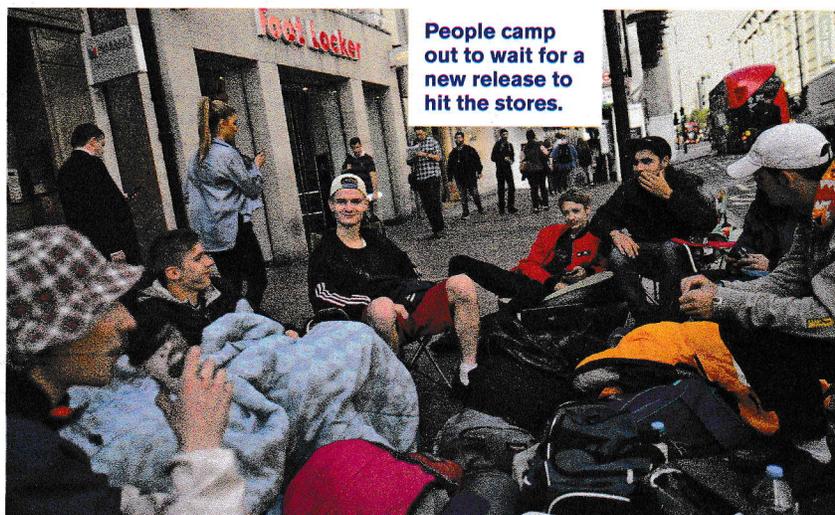
People camp out to wait for a new release to hit the stores.

When an investment changes in value, it can be measured with percent change. If the price of something rises, then it's a percent increase. If the price falls, it's a percent decrease.

EXAMPLE: When they were released, a pair of Nike Flyknit Air Max sneakers retailed for $180. By the next week, their value had increased 35% on the StockX market. What's the aftermarket value of the shoes?

Step 1 Convert 35% into a decimal by dividing by 100: $35\% = \dfrac{35}{100} = 0.35$

Step 2 Multiply the percent as a decimal by the retail price of the shoes: $0.35 \times \$180 = \$63$

Step 3 The shoes increased in value, so add the percent increase to the original amount: (If it decreased, you would subtract.) $\$180 + \$63 = \$243$

→ So the Nike Flyknit Air Max sneakers were valued at $243 a week after they were released.

YOUR TURN

Use the information in the boxes below each sneaker to find the percent change in their aftermarket value. Round your answers to the nearest dollar.

1

ADIDAS ULTRA BOOST GOLD MEDAL

RETAIL PRICE: $200 | 95%

NEW VALUE:

2

REEBOK VENTILATOR PURPLE HAZE

RETAIL PRICE: $125 | 28%

NEW VALUE:

3

NIKE LEBRON X "WHAT THE MVP"

RETAIL PRICE: $200 | 575%

NEW VALUE:

4

UNDER ARMOUR CURRY BACK 2 BACK MVP PACK

RETAIL PRICE: $400 | 12.5%

NEW VALUE:

5

5A. The box below shows how much Fedor resold his Adidas Yeezy Boost 750s for. Round your answer to the nearest 10.

ADIDAS YEEZY BOOST 750

RETAIL PRICE: $350 | 328%

NEW VALUE:

5B. But since then, their price has dropped by 35% on StockX. What's their new value?

Drum Patterns

The secret inner beauty of Japanese taiko drums is what gives them their rich sound

VIDEO See a taiko drum performance.

A drum maker in Japan carves repeating hexagons into a taiko's interior, making a kikkobari pattern.

DON KARA, DON KARA, DON DON DON! That's the thunder of taiko drums!

Taiko drums are traditional Japanese instruments usually played in groups with athletic, dance-like choreography. They're beautiful on the outside: lacquered wood with a natural grain, sometimes hand-carved from a single piece of wood over several weeks. But that's only scratching the surface—some of the most impressive craftsmanship goes entirely unseen.

On the inside of many taiko drums are intricate carvings in geometric patterns. Traditional patterns take inspiration from nature and resemble turtle shells or fish scales, but they're hidden from view when drumheads are stretched tightly over the ends of a taiko.

So why do drum makers go through the trouble? It's all about the sound. "If the interior surface isn't broken up, you'll get a high-pitched ringing when the drum is struck," says Mark Miyoshi, a taiko drum maker in Mount Shasta, California. The carvings break up the drum's sound waves, creating a deeper, richer sound.

Miyoshi began making drums 40 years ago, when his taiko group needed more instruments but couldn't afford to buy new ones from Japan. He likes to carve parallel rings into his drums. Other drum makers pick the patterns they carve to complement the grain of the wood

TESSELLATIONS are patterns made from repeated shapes called tiles that completely cover a plane without any gaps.

TRANSFORMATIONS move a tile without changing its size, which can be seen in a tessellation. Below are three types of transformations:

YOUR TURN ✏️

Many of the carvings inside taiko drums are tessellations. Determine the sequences of transformations used to move the shapes in the taiko drum patterns.

TRANSLATION slides the shape from one position to another.

REFLECTION flips the shape across a line of reflection.

ROTATION moves the shape around a point.

1B. What sequence of transformations is needed to move tile C onto tile D?
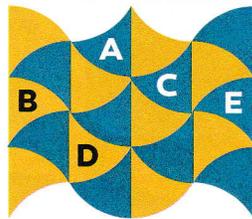
1 A. How might you perform a rotation and then a translation to map tile B onto tile A?

1C. If you first reflect tile A along its straight edge, what sequence of transformations are needed to then move it onto tile E?
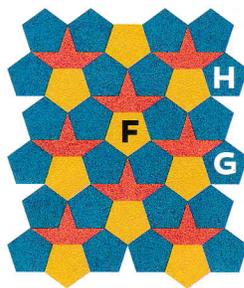
2 A. What are two different combinations of transformations you can perform to move tile F onto tile G?

2B. Is it possible to move tile G onto tile H without using a translation? Explain your answer.

3 On a separate piece of paper, design your own taiko drum pattern. What transformations are necessary for the tiles to repeat?

or the shape of the drum. But the main goal, says Miyoshi, is to make sure the inside of the drum isn't perfectly smooth.

On the other side of the Pacific Ocean, the Asano Taiko Company has been making taiko drums in Japan since 1609. Its standard nagado drums have a wave pattern on the inside, but Asano also makes drums with four specialty patterns.

"Each carving has a different purpose to make different sounds," says Sumiyo Asano, a company spokesperson. Some customers choose a special pattern for drums used in art performances or festivals. Other custom patterns can be used on odaiko, the largest of taiko drums, which are sometimes bigger than the person playing them.

"I hope that most folks appreciate the sound of the drum and perhaps someday they will see the inside and appreciate the attention each drum maker gives to the interior and, ultimately, the sound," says Miyoshi.
—*Greg Uyeno*
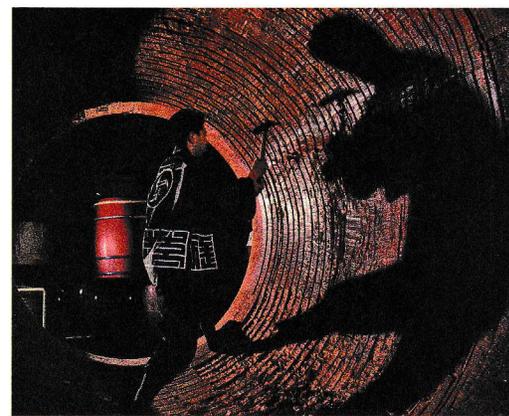
Some taiko drums are so big that drum makers can stand inside them while carving!

Off to the RACES!
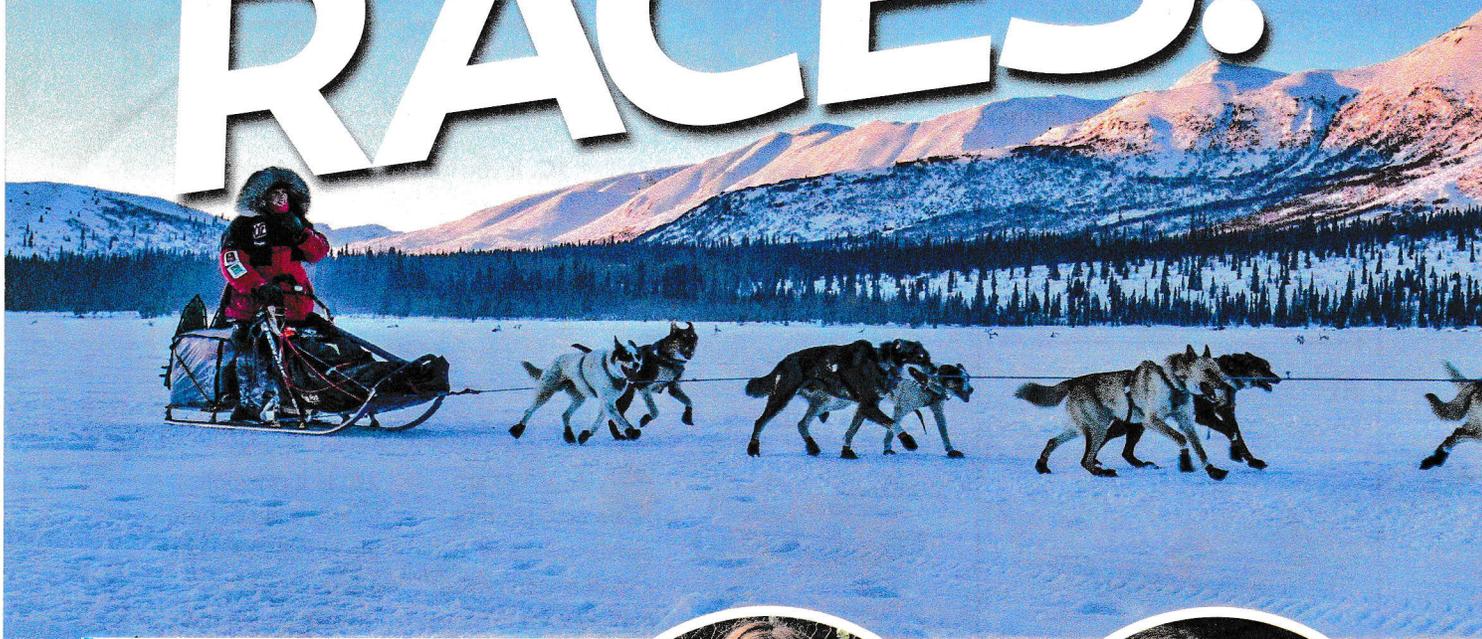
Meet two young sled dog racers hoping to win this year's Jr. Iditarod

Hannah Mahoney

Logan McCready-DeBruin

When Hannah Mahoney was 3 years old, her pet dog pulled her around the house in a sled made out of a laundry basket and a harness created from ribbons. When she was 8, she started training her dogs to pull her in a real sled. She watched YouTube videos to learn how to train the pups and taught them sledding commands like "whoa" (stop), "hike" (go), "gee" (turn right), and "haw" (turn left).

Today, Hannah is 17 and about to compete in one of the toughest sled dog races. On February 25, she will race in the 40th annual Jr. Iditarod. Over two days, teens ages 14 to 17 will compete in this 150-mile race in Alaska. The race is designed to teach young mushers (dog team drivers) how to travel long distances with their dogs. It's a stepping-stone for the Iditarod Trail Sled Dog Race—the famously grueling 1,000-mile trek across Alaska (*see "The Iditarod Trail" on page 10*).
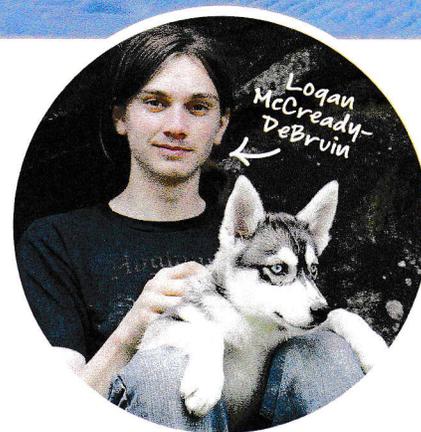
TOUGH TRAIL

On the morning of February 25, the Jr. Iditarod mushers will gather at the starting line in Wasilla, Alaska. Each musher travels with a team of 8 to 10 dogs. The dogs are usually huskies that have trained for months, building strength and learning commands.

"The start of a dogsled race is insane. The dogs are so excited, jumping, barking, and trying to get the sled moving so they can run,"

says 17-year-old Logan McCready-DeBruin from the Canadian province of Ontario. Logan will compete in the Jr. Iditarod for the first time this year, but he's been sled dog racing since he was 8. "Once the announcer starts counting down, it's just you and your dog team," he says. "The adrenaline runs high for both me and the dogs!"

The Jr. Iditarod trail stretches over part of the main Iditarod Trail (*see map, right*). Conditions are often icy, windy, and snowy. Ice can cause sleds to swerve. Mushers pay close attention to the health of their dog team. If a dog is struggling, it can be dropped off at a checkpoint to recover while the rest of the team completes the race.

Logan thinks that racing at night will be the biggest challenge. "I'm not from Alaska, so I'm not very familiar with the trail. To run in the
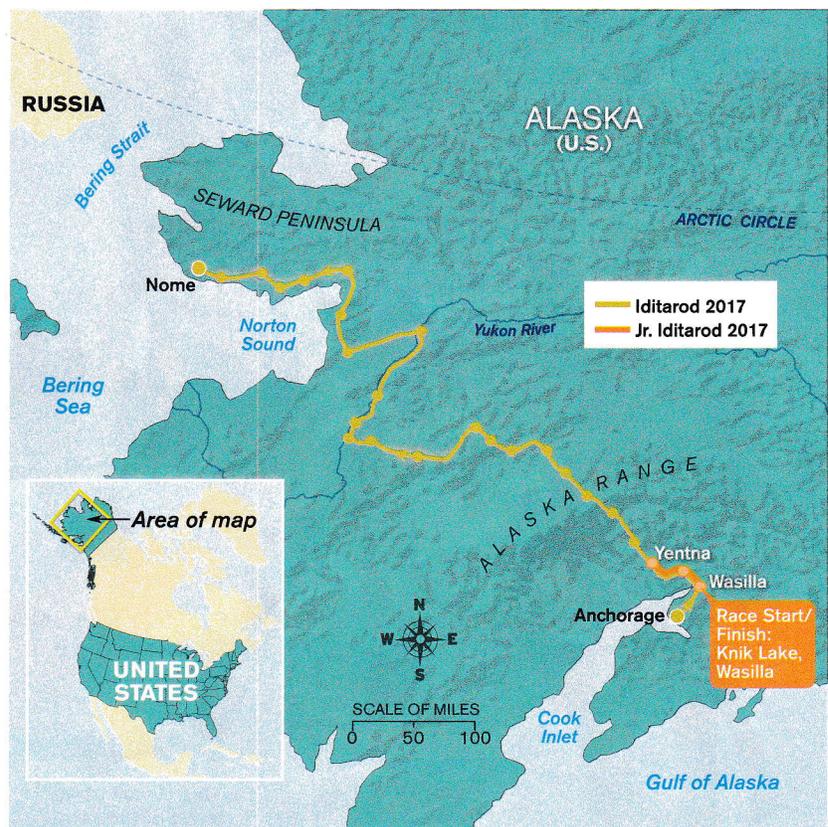
dark with just your headlamp will take a lot of concentration," he says.

Halfway through the race, the teams take a 10-hour break. They camp at a rest stop, where the mushers cook dinner for themselves and their dogs. The mushers also hang out around a bonfire. Many mushers get only a couple of hours of sleep. In the morning, they race back to where they started. The team with the dog whose nose crosses the finish line first wins!

TRAINING FOR THE WIN

Training for the Jr. Iditarod can be just as tough as the race itself. Hannah runs and kickboxes to stay physically fit in the off-season. Since Hannah lives in Bloomfield Hills, Michigan, she flew to Alaska during her summer, Thanksgiving, and winter breaks to train with the team she's leasing from racer Wade Marrs,

who lives in Alaska and finished in fourth place in last year's Iditarod.

Hannah trains the dogs by having them pull her in an all-terrain vehicle. She also takes them out on the Iditarod Trail. "It's usually beautiful and quiet. It's really amazing," says Hannah.

Logan practices karate to stay in shape. Luckily for him, he can train his dogs at home: His family raises purebred Siberian huskies. When the temperature in Ontario started to get cold in September, he began training the dogs to pull him in the sled. He started out with 2-mile trips and increased the length each week. By Christmas, the team hit 100 miles.

"I'm looking forward to the time out on the trail, with just me and my dogs," says Logan. "And to accomplishing a goal I've had for a long time—to compete in the Jr. Iditarod."

—Amy Barth

A happy sled dog jumps at the start of the race.

THE IDITAROD Trail

BALTO →
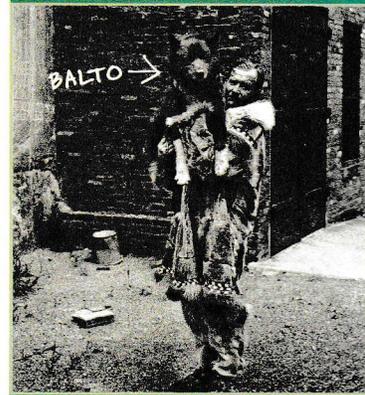
Native Alaskans traditionally used dogsleds to get around the region's snow-covered winter landscape. American settlers adopted the practice when they arrived in Alaska in the 1800s. The Iditarod Trail became the main route traveled by mushers to deliver mail and supplies to towns and outposts across the territory.

The trail was made legendary in 1925 when a group of sled dogs set out on a life-or-death mission. Their task: Deliver medicine to the town of Nome, where a deadly epidemic of the respiratory infection diphtheria had broken out. The first team to arrive was led by a dog named Balto, who became an overnight celebrity.

Who Wins the

One of the highest honors an actor can receive is the 13.5-inch-tall, 8.5-pound gold Oscar statuette. The Oscars are awarded by the Academy of Motion Picture Arts and Sciences, recognizing the best performances by actors and actresses every year. But for the past two years, despite moving performances in films like *Selma* and *Creed*, black, Latino, and Asian actors have not been nominated for Oscars.

Fans used #OscarsSoWhite to protest on Twitter. April Reign, a former lawyer and editor of the website Broadway Black, created the hashtag after the 2015 nominees were announced. She noticed that all 20 acting nominations went to white actors and actresses and used the hashtag to express her frustration.

Reign says one of Hollywood's biggest problems is who gets cast. Leading roles are often assumed to be for white actors. "This is not just a race thing," says Reign. "It's about everyone having the opportunity to see themselves on-screen in a well-developed character."

Critics are also concerned that the Academy, which votes on Oscar nominees and winners, is overwhelmingly white and male. After the #OscarsSoWhite backlash, the Academy announced a goal to diversify by 2020. And the 2016 group of Academy inductees is a good start: It's diverse, both in terms of gender and ethnicity. The Academy, including the new members, is now voting on the 2017 Oscars, which will be held on February 26.

—Jennifer Hackett

THE ACADEMY'S CLASS OF 2016

In response to the #OscarsSoWhite backlash, the Academy added 683 new members with more diverse backgrounds.

Here are some new members!

AMERICA FERRERA

DANIEL DAE KIM

JOHN BOYEGA

BRIE LARSON

CLIFF CURTIS

LATINO	79
ASIAN	77
BLACK	86
OTHER	35
WHITE	406

YOUR TURN
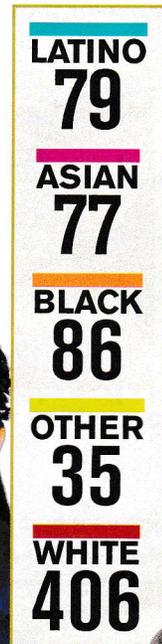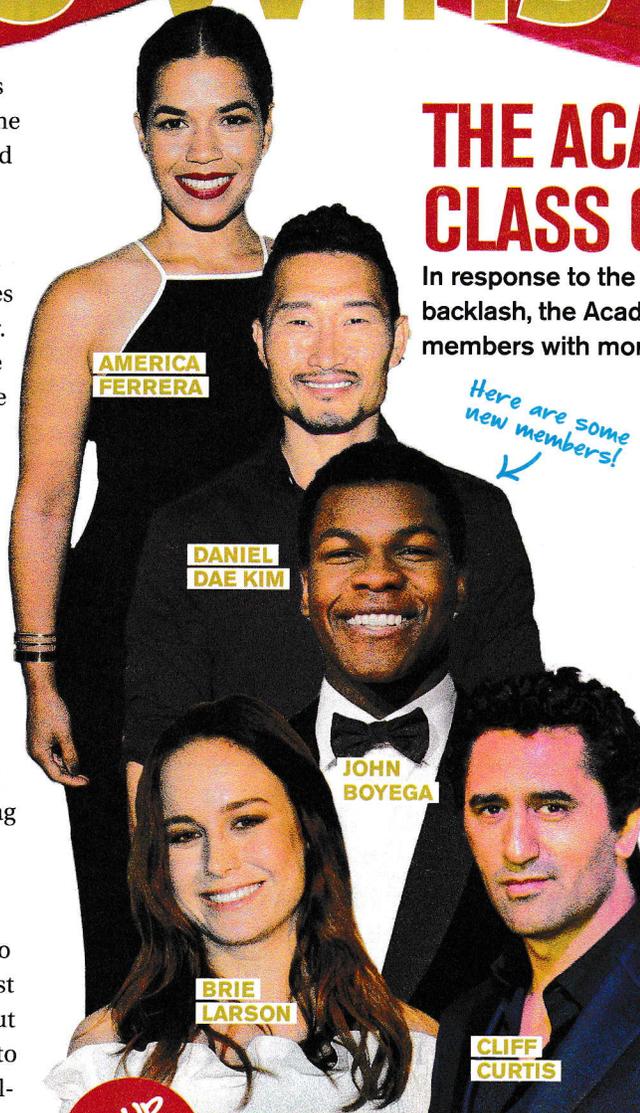
Answer the following questions using the information in the charts and graph above.

1 How many nonwhite inductees were in the 2016 Academy class?
Ⓐ 86 Ⓒ 277
Ⓑ 242 Ⓓ 406

2 How many more tweets about the Oscars were there in 2016 compared with 2015?
Ⓐ 1.8 million Ⓒ 7.2 million
Ⓑ 4.6 million Ⓓ 11 million

3 How many black actors and actresses have won an Oscar in one of the four major acting categories in the past 20 years?
Ⓐ 2 Ⓑ 4 Ⓒ 5 Ⓓ 9

4 The 2015 Oscars were on February 22. How many days passed between the creation of #OscarsSoWhite and the event?
Ⓐ 15 days Ⓒ 38 days
Ⓑ 22 days Ⓓ 45 days

READING BOX-AND-WHISKER PLOTS

A box-and-whisker plot shows the distribution of a data set along a number line by splitting the data into four parts called quartiles. Each quartile is a particular number that marks one-fourth of the data set. Box-and-whisker plots allow you to quickly examine a data set.

LOWER EXTREME: The lowest value

LOWER QUARTILE (Q1): The median of the lower half

MEDIAN (Q2): The middle value

UPPER QUARTILE (Q3): The median of the upper half

UPPER EXTREME: The greatest value

60   69   82   92   99

60   70   80   90   100

YOUR TURN
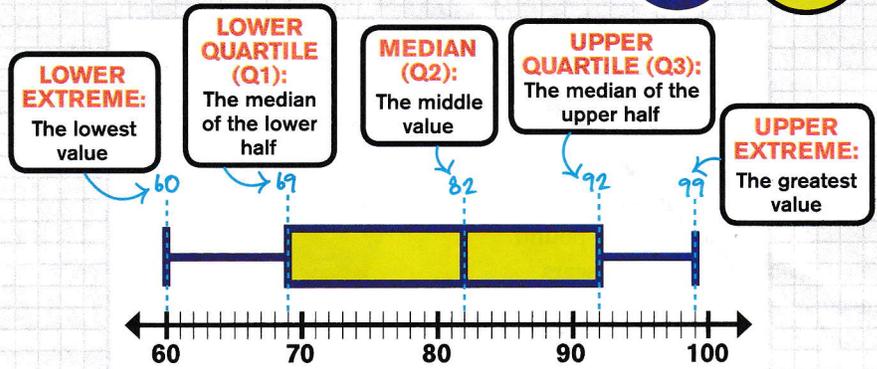
The distribution of race times for the past five Jr. Iditarod races are shown in the box-and-whisker plots below. Use the chart to answer the questions that follow.

DISTRIBUTION OF JR. IDITAROD RACE TIMES

RACE YEAR: 2016, 2015, 2014, 2013, 2012

0 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

FINISH TIMES (HOURS)
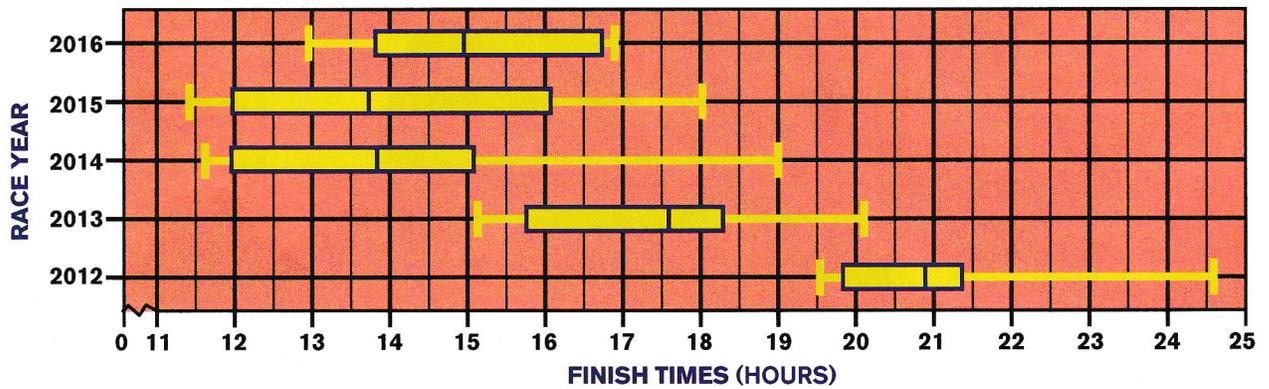
1 Which year had the fastest median race time?

2 Which year had the smallest variation in finishing times?

3 The *interquartile range* is the difference between the upper and lower quartiles. Which year of the Jr. Iditarod had the largest interquartile range?

4 In 2013, Alea Robinson, of Eagle River, Alaska, came in fifth place with a time of 16.77 hours. Between which two quartiles does her time fall?

5 Kevin Harper of Wasilla, Alaska, won first place in 2015 and 2016. About how much faster did he finish the race in 2015 compared with 2016?

6 Which year of the Jr. Iditarod in the chart do you think had the toughest racing conditions? Explain your answer.

7 Which year do you think had the most exciting race for first place? Explain your answer.

8 What do you think are the advantages and disadvantages of box-and-whisker plots? Explain your answer.

Oscars?

AND THE OSCAR GOES TO . . .

Here's the breakdown by ethnicity of Oscar winners in top categories over the past 20 years.

NUMBER OF WINNERS

KEY
- LATINO
- ASIAN
- BLACK
- WHITE

OSCAR CATEGORY

Lead Actor · Lead Actress · Supporting Actor · Supporting Actress · Director · Original Screenplay · Adapted Screenplay · Original Song

Source: Academy of Motion Picture Arts and Sciences
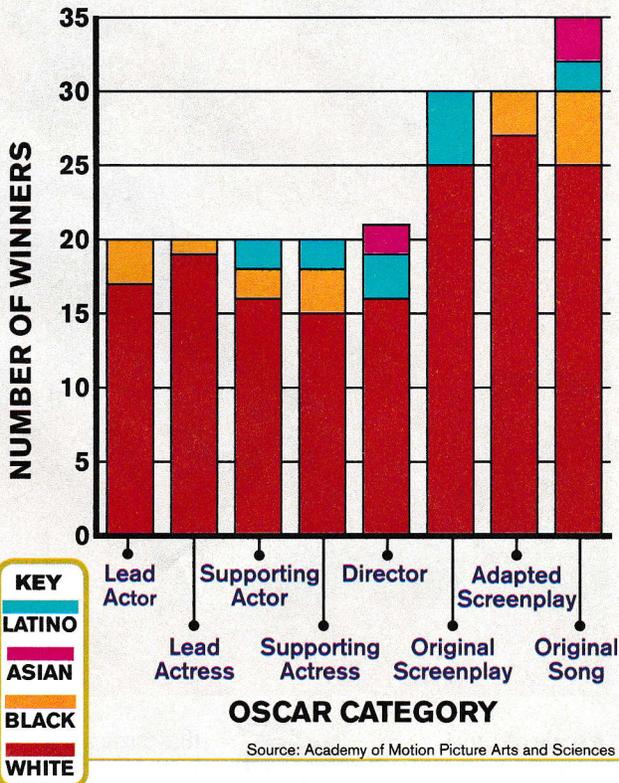
#OSCARSSOWHITE

After the Academy announced the 2015 nominees, April Reign created the #OscarsSoWhite hashtag. It immediately went viral. In 2016, when the Oscars again lacked diversity, it took off again.

JAN. 15, 2015 First use of #OscarsSoWhite

95,000 Tweets per hour with #OscarsSoWhite right after its creation

7.2 MILLION Total number of tweets about the #Oscars in 2015

836,000 Tweets with #OscarsSoWhite between January 14 and February 29, 2016

175,900 Tweets with #OscarsSoWhite on February 28, 2016, the day of the Oscars

11.8 MILLION Total number of tweets about the #Oscars in 2016

Sources: Twitter, Forbes, Sysmos

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5 What percent of the 2016 Academy class is Latino or black?
- Ⓐ 12%
- Ⓑ 13%
- Ⓒ 23%
- Ⓓ 24%

6 Which category in the graph above had the greatest number of nonwhite Oscar winners?
- Ⓐ Director
- Ⓑ Original Screenplay
- Ⓒ Adapted Screenplay
- Ⓓ Original Song

7 If the rate of #OscarsSoWhite tweets per hour had remained constant, how many tweets would there have been during the week after the hashtag was created?

8 Over the past 20 years, what fraction of acting Oscars went to nonwhite actors and actresses?

9 In which categories in the graph have no Latinos won an Oscar over the past 20 years?

10 Before the 2016 class was added, there were 463 nonwhite members in the Academy. What was the percent increase of nonwhite members in 2016?

Getting STUNG for Science

yellow jacket

## Entomologist Justin Schmidt has felt hundreds of insect stings

The first time Justin Schmidt got stung by a type of wasp known as a tarantula hawk, he thought he was going to die. He describes the pain as "shockingly electric," like a "running hair dryer has been dropped into your bubble bath." His advice if you were to get stung by one of these wasps? "Lie down and scream."

As an entomologist at the Southwestern Biological Institute in Arizona, Schmidt studies the behavior of stinging insects such as ants, bees, and wasps. He travels the world in search of live specimens. He will shimmy up a tree to snatch a wasp's nest or scoop an ant colony from the earth with his bare hands. His curiosity has made him a frequent victim of insect attacks: In his 43-year career, Schmidt says, he has been stung more than 1,000 times by 80 different species of insects.

At first, he figured that pain was just part of his job. But then he realized his experiences could help answer some puzzling questions. For instance: Why do some stings hurt a lot more than others?

To compare different kinds of stings, Schmidt created the Sting Pain Index. It ranks stings on a scale of 1 to 4, with 4 the most agonizing. "By putting numbers to the pain, I could begin to see patterns," Schmidt says.
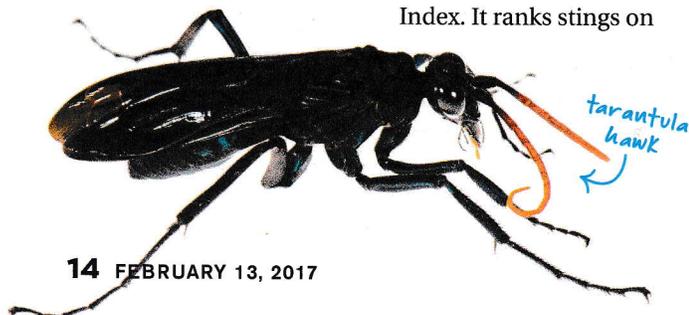
For example, the stings of solitary insects like the tarantula hawk often feel awful, but don't do any real harm. On the other hand, insects that live in social groups, such as honeybees, tend to have moderately painful stings that are highly toxic. These observations told Schmidt

baldfaced hornet

that toxic stings are important defenses for social insects, which have to protect nests full of tasty larvae and sometimes honey. The pain of toxic stings is a warning to predators: Stay away or you could die.

"It turns out that pain is a very valuable mechanism for discouraging a predator from attacking you," says Schmidt. But it's a lesson that's lost on him. "Pain to me is just a bluff."

—*Ariel Bleicher*

tarantula hawk

honeybee

EXPONENTS

An exponential scale grows by a factor greater than 1. The Sting Pain Index is an exponential scale that grows by a factor of 10. This means that each whole number on the scale is 10 times as painful as the previous whole number. For example, a sting ranked 2 is 10 times as painful as a sting ranked 1. The exponential expression $\frac{10^x}{10^y}$ can be used to compare the pain of two stings ranked x and y.

EXAMPLE: The sting of a tarantula hawk is ranked 4 on the Sting Pain Index. How much more painful is it than a honeybee's sting, which is ranked a 2?

Step 1 Write an exponential expression. $\dfrac{10^4}{10^2}$

Step 2 When dividing numbers of the same base with exponents, you subtract the exponents. *(When multiplying, you add the exponents.)* Rewrite your expression using subtraction. $10^{4-2} = 10^2$

Step 3 Evaluate the exponent. $10^2 = 10 \times 10 = 100$

→ So a tarantula hawk sting is 100 times as painful as a honeybee sting.

velvet ant

YOUR TURN
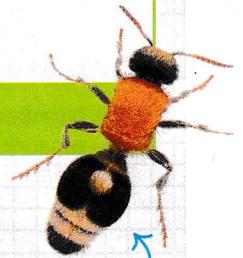
Use exponential expressions to compare the stings of insects at different levels on the pain scale.

1 Schmidt says the sting of an iridescent cockroach hunter feels like "a stinging nettle pricked your hand." He ranks it a 1. How much more painful is the sting of a warrior wasp, which Schmidt ranks as a 4 and equates to being "chained in the flow of an active volcano"?

2 The sting of a baldfaced hornet ranks a 2 on the Sting Pain Index. It feels like "getting your hand smashed in a revolving door." How much more painful is the sting of a red paper wasp, which ranks a 3 and feels like "spilling a beaker of acid on a paper cut"?

3 The yellow jacket, a common wasp, has a highly toxic sting. It ranks a 2 on the Sting Pain Index. The sting of the largest velvet ant is less toxic, but ranks a 3 in terms of pain. How much less painful is a yellow jacket sting compared with a velvet ant sting? *(Hint: When an exponent is negative, as in the expression 10^{-x}, you can rewrite it as $\frac{1}{10^x}$.)*

4 No known insect stings hurt more than a 4 on the Sting Pain Index. But if Schmidt were to discover a new insect whose sting is 100,000 times as painful as a honeybee's 2, how would he rank it?

Justin Schmidt doesn't flinch at the vinegaroon; he knows it's venomless!

velvet ant

mexican redknee tarantula

cow killer velvet ant

Beauty AND THE Beast

Some have called it "a tale as old as time," but the animated movie *Beauty and the Beast* hit theaters just over 25 years ago. This classic tale about not judging a book by its cover—or a beast by its beastliness—introduced the world to a princess with a love of reading and a mind of her own. Next month, a live-action adaptation of the film, starring Emma Watson (who played the equally bookish Hermione in the Harry Potter films) as Belle, is waltzing into theaters.
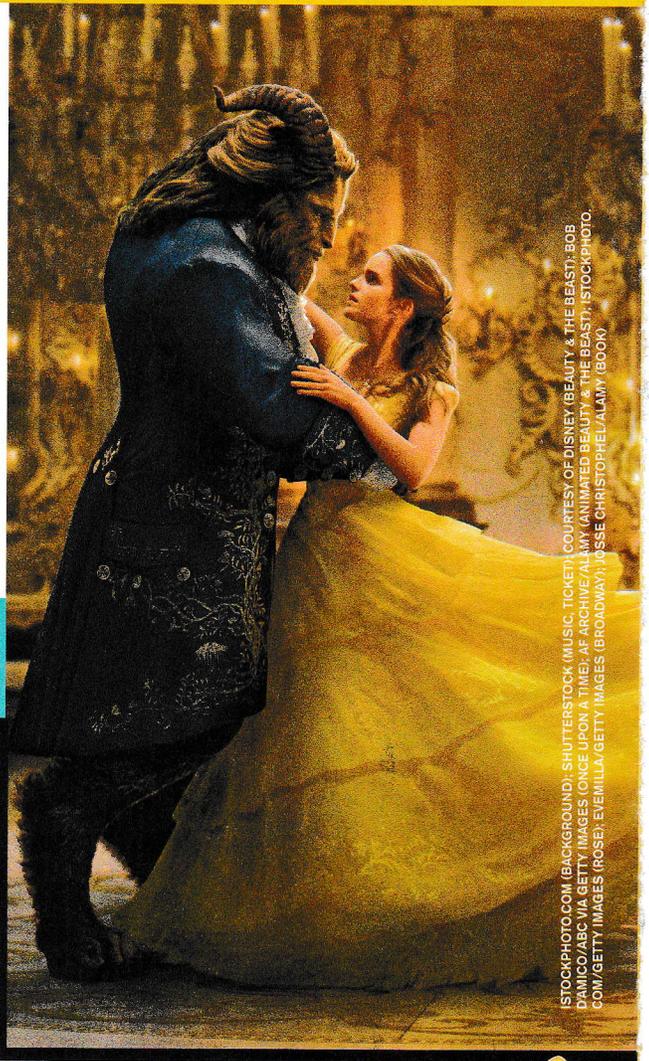
? Read on to learn more about the world-famous fairy tale and movie, then solve the problem for a final Beauty and the Beast fact.

92 Number of episodes Belle appeared in during the first five seasons of ABC's *Once Upon a Time* TV show

30 The 1991 animated film was the 30th animated feature film released by Walt Disney Pictures.

200 Number of times the prologue was rewritten for the 1991 animated film. It tells the story of the enchanted rose and the transformation from prince to beast.

BROADWAY 5,461 Total performances of the musical play on Broadway from 1994 to 2007

18 Number of months it took to plan, shoot, and digitally create the scene for the "Be Our Guest" song, in which Belle is introduced to the castle

CINEMA
BEAUTY AND THE BEAST

$425,000,000 Worldwide box office gross of the 1991 animated film. It was the first animated film to earn more than $100 million.

YOUR TURN Plug in the number that corresponds to each icon. Then use the order of operations to solve.

○ − ○ × ○ − (○ + ○) + 1 = ○

BROADWAY   🎵   🌹   🌙   🦁   *La Belle et la Bête*

Year the original French fairy tale was first published