Mathematics

Elementary School

1. Look at the following puzzle. Why are some letters on top of the line and some on the bottom?

   A E F H I K L M N T V W X Y Z

   B C D G J O P Q R S U

   Give up? All the letters made with straight lines are on top, and all the letters with curved lines are on bottom (Coolmath, 2009).

2. Pick any number from 1 to 10 (including 1 or 10). Multiply it by 9. Now add the two digits of your answer together (using a 0 with 9). Did you get 9? I bet you did! (Coolmath, 2009).

3. You won't ever find a light-year on a calendar. Why? Because a light-year measures distance and speed instead of time. A light-year is the distance light can travel in one year.

4. Since the year 2000, the U.S. Mint produced more than twenty-eight billion coins per year (The United States Mint, U.S. Department of the Treasury, 2010).

5. Infinity goes on forever, and while a number doesn't represent infinity, you can see it. How? Hold a small mirror in front of a large mirror. You'll see a mirror inside of a mirror forever (Pappas, 1997).

Middle School

1. Math is not a skill we learn like riding a bike or driving. Rather, man seems to be born with an innate mathematical ability. Even babies show basic math skills (Zimmer, 2009).

2. There is a Nobel Prize for peace, literature, physics, chemistry, and medicine, but not for mathematics. It is rumored that Alfred Nobel had a personal dislike of one of the world's foremost mathematicians at the time and did not want the prize awarded to him, but this has never been proven. No one really knows why mathematics was excluded (Pappas, 1997).

3. If you ever find yourself in the U.S. Capitol building, be careful what you say. As John Quincy Adams discovered, the parabolic ceiling (domed hall) creates unique acoustics. Specifically, the way noise bounces off the domed ceiling creates focal points, and if you happen to stand in one of them, you can clearly hear conversations taking place on the other side of the room. Since Adams's desk happened to sit in one of those focal points, he was able to easily eavesdrop on many private conversations that took place in that room (Pappas, 1989).

4. Numbers affect time itself—or at least how we perceive time. Julius Caesar instituted a calendar during his reign, but it was just a little bit wrong—his measurements were off by eleven minutes a year. No one noticed at the time, but 1,628 years later, the spring equinox was calculated to be in the middle of winter. Pope Gregory XIII implemented a more mathematically correct model, and deleted ten days from the year. In other words, everyone went to sleep one night and woke up ten days later! Understandably, this upset many people; riots even broke out. Many refused to accept the change initially, which meant more chaos for years to come—all because of an eleven-minute miscalculation per year (Beyer, 2003).
5. Lewis Carroll wasn't just a fiction author. He was also a self-taught mathematician. When he couldn't sleep at night, he would write and solve mathematical problems that included algebra, geometry, analytical geometry, and trigonometry. He even published seventy-two of them in a book titled *Pillow Problems* (Pappas, 1989).

High School

1. Arne Beurling was a Swedish mathematician and professor of mathematics. In 1940, the mathematician broke the German code used for strategic military communications. This accomplishment is considered one of the greatest achievements in the history of cryptography. Using only teleprinter tapes and ciphertext, he deciphered the code that the Germans believed impossible to crack in just two weeks. Beurling created a device using a cable that enabled Sweden to decipher German teleprinter traffic passing through Sweden from Norway. When Beurling was asked how he broke the code, he replied, "A magician does not reveal his secrets" (School of Mathematics and Statistics, 2005).
2. *Game theory* is a branch of mathematics that attempts to predict the behavior of a person or people based on potential harms and benefits among opposing individuals. Usually game theory is used in economics, but in 2002 Sasha Dall, a mathematics ecologist, used game theory to successfully predict animal behavior. Specifically, he noticed that young ravens scout food alone but then invite other birds to join in. It is an odd behavior; why would ravens do this? Dall applied game theory and came to a prediction: they do this to ward off territorial adult ravens and to secure dominance over younger or weaker birds. Within a year, Dall's own observations and those of behavioral ecologist Jonathan Wright proved the prediction correct (Grant, 2009).
3. It is a matter of dispute as to who invented calculus. In fact, Sir Isaac Newton in England and Gottfried Leibniz in Germany were both responsible for the accomplishment, but neither man nor the countries each came from were satisfied with that conclusion. Leibniz was the first to publish his theories nationally, and this came as quite a surprise to Newton. He and some of his

patriots sought to discredit Leibniz by accusing him of having stolen the work from Newton—of course there was never much evidence to support the claims. In 1711, Leibniz appealed to the Royal Society in England, asking that they settle the dispute. The society voted in favor of Newton, but that was because he had chosen the committee members and drafted the final report himself. It wasn't until both men died that those with impartial views were able to blend the nuances of both men's work and create a unified calculus (Pappas, 1997).

4. The Fibonacci sequence appears in nautilus shells, pinecones, many flowers, and cacti. In 2004, two mathematicians working for the University of Arizona discovered that the structure of the cacti is based on the Fibonacci sequence, and that this particular structure helps the plant carry out the necessities of survival while expending minimum energy. The mathematicians postulated that this discovery might be relevant to medical science. By applying "mathematical models of pattern formation" the mathematicians believe scientists could discover the key to things like tumor formation (Stone, 2004).

5. Think human rights issues are only found in social studies? Wrong. Hypatia is known as the first woman of note in mathematics. She became the head of the Neoplatonist school in Alexandria around 400 CE and was known as an excellent teacher and lecturer. In addition to being a woman, she was a pagan during a time of intolerance for anything other than Christianity. To make matters even worse, she was known for publicly opposing the policies of the Roman Empire. She was obviously a threat, specifically to Cyril, the patriarch of Alexandria, who is thought to have galvanized a fanatical Christian mob to murder her in 415 CE (Hypatia, 2010).

References

Beyer, R. (2003). *The greatest stories never told: 100 tales from history to astonish, bewilder, and stupefy.* New York: HarperCollins.

Coolmath. (2009). *Coolmath4kids.* Accessed at www.coolmath4kids.com/math_puzzles/a1-alphabetsoup_sol.html on March 15, 2010.

Grant, A. (2009). Animal intelligence: Darwin plays game theory—and wins. *Discover Magazine.* Accessed at http://discovermagazine.com/2009/jun/04-game-theory-meets-darwin on March 12, 2010.

Hypatia. (2010). In *Encyclopædia Britannica.* Chicago: Encyclopædia Britannica Online. Accessed at www.britannica.com/EBchecked/topic/279463/Hypatia on March 10, 2010.

Pappas, T. (1989). *The joy of mathematics: Discovering mathematics all around you* (Rev. ed.). San Carlos, CA: Wide World/Tetra.

Pappas, T. (1997). *Mathematical scandals.* San Carlos, CA: Wide World/Tetra.

School of Mathematics and Statistics. (2005). *Arne Carl-August Beurling.* Accessed at www-history.mcs.st-and.ac.uk/Biographies/Beurling.html on March 18, 2010.

Stone, A. (2004). Fibonacci cactus. *Discover Magazine.* Accessed at http://discovermagazine.com/2004/jul/fibonacci-cactus0708 on May 27, 2010.

The United States Mint, U.S. Department of the Treasury. (2010). *Historian's corner: Coin production.* Accessed at www.ustreas.gov/education/faq/coins/production.shtml on May 27, 2010.

Zimmer, C. (2009). The brain: Humanity's other basic instinct: Math. *Discover Magazine.* Accessed at http://discovermagazine.com/2009/nov/17-the-brain-humanity.s-other-basic-instinct-math on March 12, 2010.