

# 101 THINGS EVERYONE SHOULD KNOW ABOUT MATH



Marc Zev  
Kevin B. Segal  
Nathan Levy

**NSTA** recommends™  
NATIONAL SCIENCE TEACHERS ASSOCIATION

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*101 Things Everyone Should Know About Science*

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## *101 THINGS EVERYONE SHOULD KNOW ABOUT MATH*



*101 Things Everyone Should Know About Math* won the Children's Educational category in the 2011 Best Book Awards sponsored by USA Book News.



Awarded the highly regarded "**NSTA RECOMMENDS**" by the National Science Teachers Association, the world's largest organization promoting excellence in science teaching.



"We highly recommend this book to anyone who is interested in expanding his or her knowledge of mathematics!"  
—National Council of Teachers of Math



Recommended by *Science News* magazine of the Society for Science and the Public.



"The staff of *Science, Naturally!* proves that math isn't something only for nerds, it's something everyone can, and will, use. *101 Things Everyone Should Know About Math* is a read that will serve well in any children's trivia or mathematics collection."



★★★★★ Reviewer John L. Hoh, Jr. gave it **four stars**: "this book...explores the many disciplines of math, such as logic, geometry, statistics, probability, fractions, etc. This is a book children will enjoy as they learn math skills."

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"Math really is everywhere... *101 Things* does a great job of helping kids (and parents too) to get more comfortable with the Math all around us."

*101 Things Everyone Should Know About Math*

Marc Zev, Kevin B. Segal, and Nathan Levy

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Paperback • Ages 10 to 14 • 8.5" x 5.5" • 176 pages • \$9.95

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*Bridging the gap between  
the blackboard and the blacktop*

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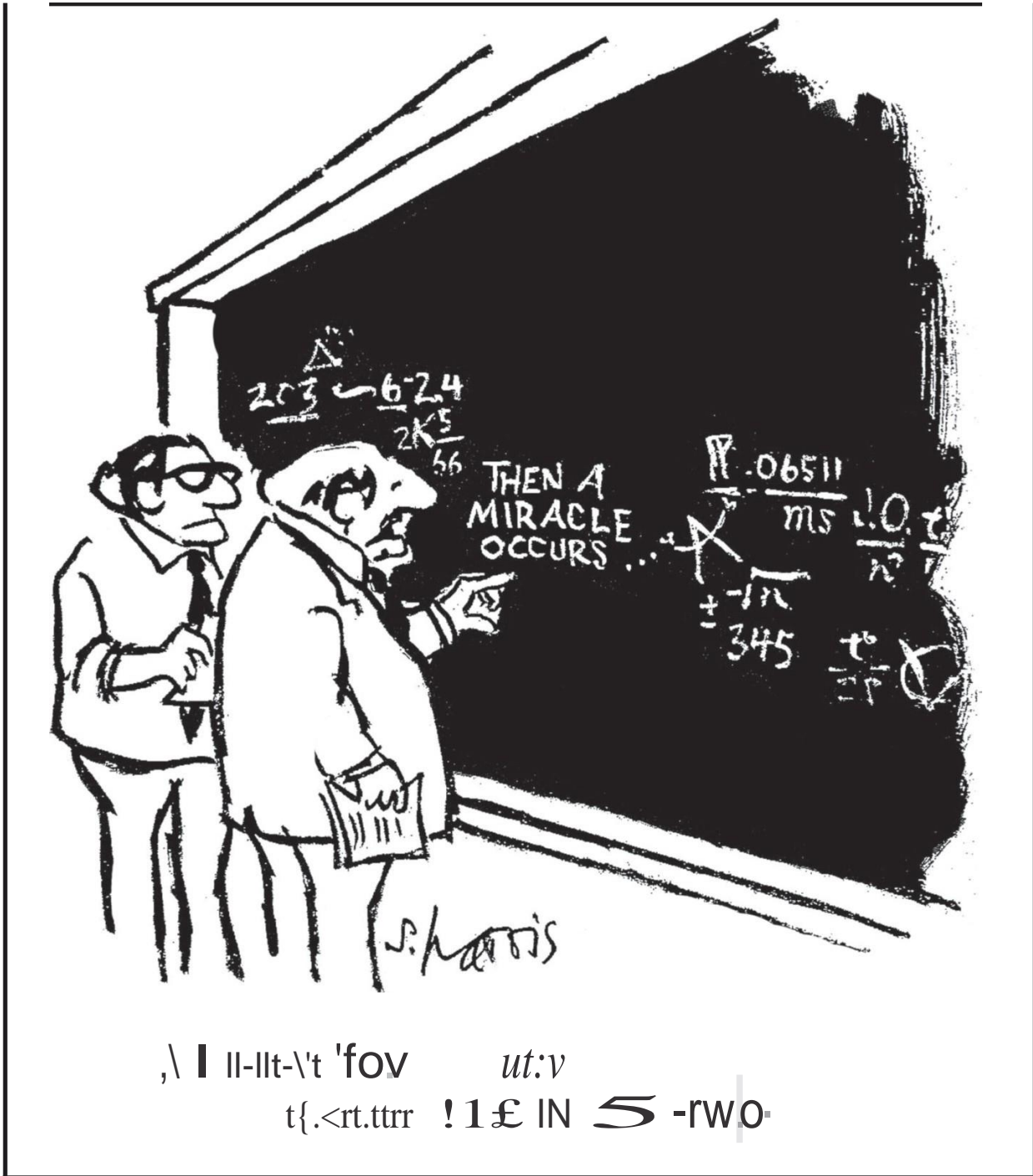
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## Supporting and Articulating

### Curriculum Standards

All Science, Naturally! books align with both the Common Core State Standards and the Next Generation Science Standards. The content in Science, Naturally! books also correlate directly with the math and science standards laid out by the Center for Education at the National Academies. Articulations are available at [www. ScienceNaturally.com](http://www.ScienceNaturally.com)

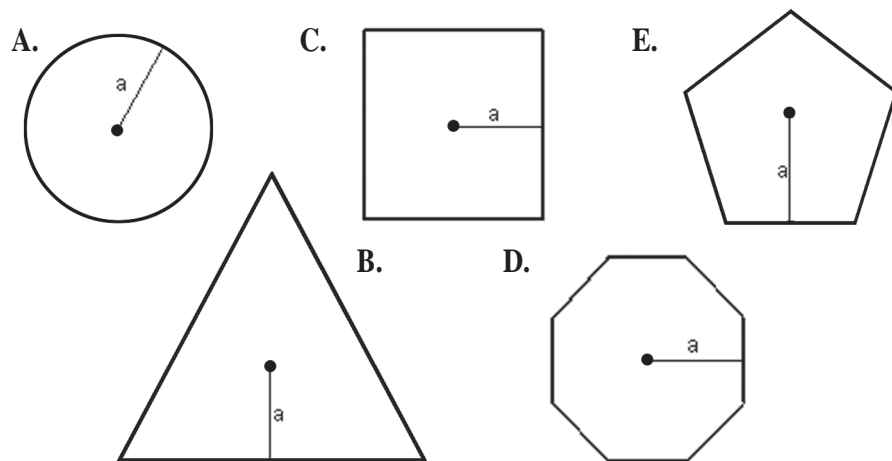


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## 10. Polygon Area

Put these regular geometric shapes in order of least to greatest area.



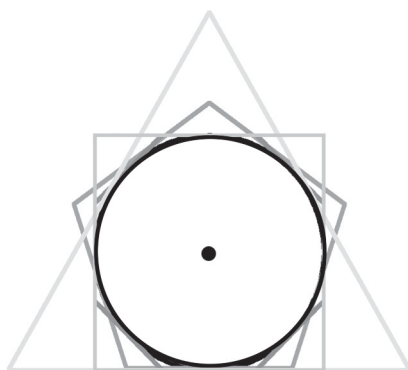
The answer is: A, D, E, C, B

The circle fits neatly inside each of these shapes. Notice that the more sides, the better the fit. All these polygons are superscribed about the circle.

The technical term for the distance from the center of a regular polygon to the midpoint of a side is called the apothem.

The formula for the area (A) of a regular polygon is  $A = \frac{1}{2} ap$ , where "a" is the apothem and "p" is the perimeter of the polygon.

**HINT:** The perimeter of a regular polygon can be calculated by multiplying the length of each side by the number of sides. The formula for this calculation is  $A = \frac{1}{2} nsa$ , where "n" is the number of sides, "s" is the length of each side, and "a" is the apothem.



## 51. Perfect Scores

Match the perfect score with the sport:

- |             |                  |
|-------------|------------------|
| A) 300      | 1) Cross country |
| B) 180      | 2) Bowling       |
| C) 15       | 3) Baseball      |
| D) Shut out | 4) Darts         |

The answer is: C(1), A(2), D(3), B(4)

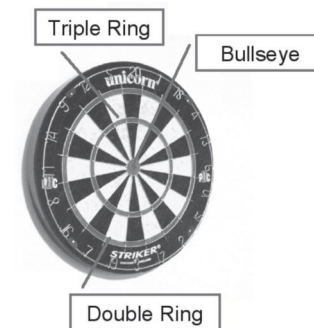
Bowling consists of 10 frames, during which the bowler gets two chances to knock down 10 bowling pins. If the bowler knocks down all the pins with one ball (a strike), the score for the frame will be 10 plus the number of pins knocked down by the next two balls. If the bowler knocks down all the pins with both balls (a spare), the score for the frame is 10 plus the number of pins knocked down with the next ball. Otherwise, the score is the number of pins knocked down. The most that can be scored in one frame is 30 (three consecutive strikes), and this is true for every frame, including the 10th (if you get a strike in the 10th, you get two extra balls).  $30 \times 10 = 300$ , the perfect bowling score.

Darts: The standard dartboard is divided into 20 numbered sections, scoring from one to 20 points. Within the numbered sections, there are also double scoring areas and triple scoring areas. And the circular area in the center of the board is the bullseye. Each player gets three darts to throw in one turn. The highest score possible with three darts is 180, when all three darts land in the triple 20. Here's how to keep score:

○ Hitting one of the large portions of each of the numbered sections, scores precisely the points value of that section.

○ Hitting the thin outer portions of these sections, scores double the points value of that section.

○ Hitting the thin inner portions of these sections, roughly halfway between the outer boundry and the central circle, scores triple the points value of that section



section.

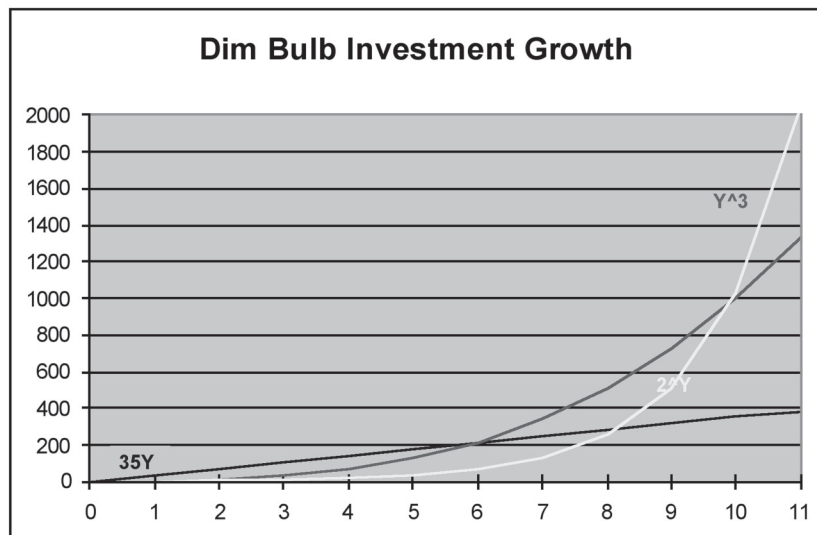
## 55. A Good Investment

As an employee of Dim Bulb Industries, you have an opportunity to invest some of your hard-earned money into one of their investment plans. The way their plan works is that every five years, the Dim Bulb financial advisors select three investments from which you can pick. Your return on the investment is governed by an equation that is a function of what year (Y) of the five-year cycle it is. Here are equations for the growth of the investments. Which choice provides the best rate of return?

- A. Linear Growth:  $35y$
- B. Cubic Growth:  $Y^3$
- C. Exponential Growth:  $2^Y$

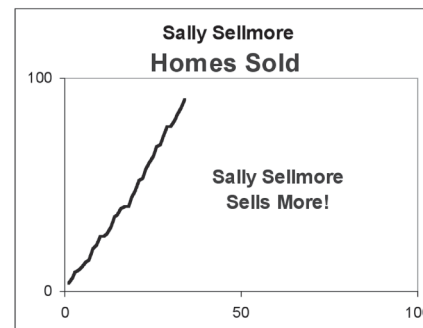
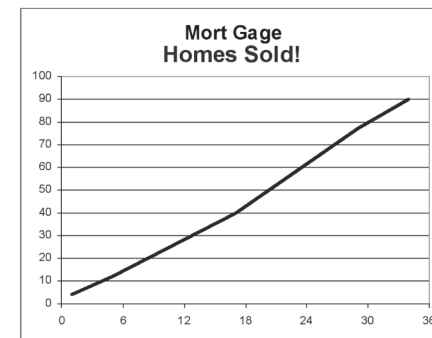
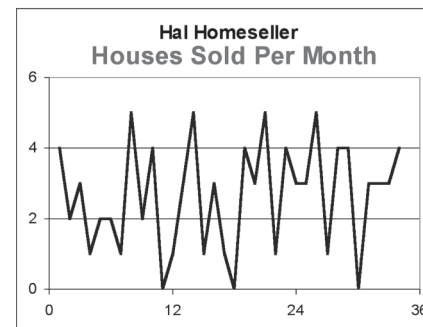
The answer is: A, linear growth

On the graph, we can see that at six years, the cubic growth curve crosses over the linear curve and quickly becomes the better investment. If we extend the time line out to 11 years, we can see that the exponential curve crosses the cubic curve at 10 years. So If Dim Bulb let the investments run longer then one of the other curves would be better, but with only a relatively short cycle of five years, the linear growth is the best.



## 56. Realty Check

Three realtors open an office together. After some length of time they each put up a poster showing their success at selling houses. All three charts represent accurate data over the same time period. If you were going to sell your house and use one of the three realtors, based on their sales chart, which one do you think would be the best pick?



The answer is: They have all sold exactly the same.

The data displayed looks misleading because they are meant to. This is one of the most real-life things in this book. Data can be manipulated and represented a number of different ways. It is because of this that everyone needs a basic understanding of how to distinguish data truth from downright data lies.

## 72. Abby's Birthday

Abby was born on Monday, July 21, 1997. When was the next time her birthday fell on a Monday again?



The answer is: 2003.

There are 365 days in a year and seven days in a week, and 365 divided by 7 leaves a remainder of 1. If there were no remainder, then Abby's birthday would be on a Monday every year. Since the remainder is 1, then every year, Abby's birthday is one day later in the week. In 1998, Abby's birthday was on Tuesday, and in 1999, her birthday was on Wednesday. In 2000, it was a leap year, so instead of moving one day later in the week, Abby's birthday moved two days to Friday.

Abby's first 28 years would be like this:

1997 Monday	2004 Wednesday	2011 Thursday	2018 Saturday
1998 Tuesday	2005 Thursday	2012 Saturday	2019 Sunday
1999 Wednesday	2006 Friday	2013 Sunday	2020 Tuesday
2000 Friday	2007 Saturday	2014 Monday	2021 Wednesday
2001 Saturday	2008 Monday	2015 Tuesday	2022 Thursday
2002 Sunday	2009 Tuesday	2016 Thursday	2023 Friday
2003 Monday	2010 Wednesday	2017 Friday	2024 Sunday

Since there are seven days in the week and four years in a leap year cycle, every 28 years the pattern repeats—for now anyway.

It won't work for the year 2100, because years that end in "00" are not leap years, unless the year is also divisible by 400. 2000 was a leap year, and 2400 will be a leap year, but 2100, 2200 and 2300 will not.

## 88. Around the Sun

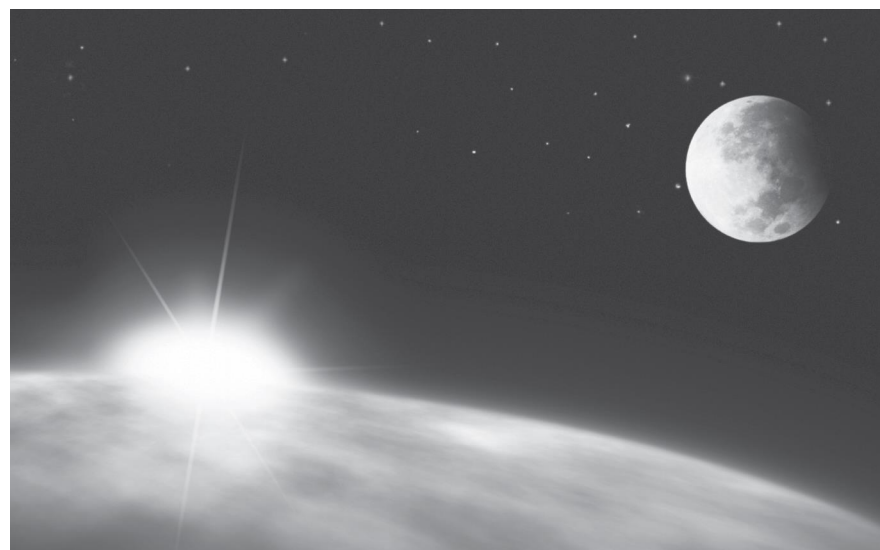
Which travels faster, the earth relative to the sun or the moon relative to the earth?

**Hint:** The earth is about 93 million miles from the sun, the moon is about 240,000 miles from the earth and pi is about 3.14.

The answer is: The earth relative to the sun

First, let's get some figures together. On average, the earth is 93 million miles from the sun and travels in an almost circular orbit. We will estimate the orbit to be circular with a radius of  $9.3 \times 10^7$  miles (This number is written in scientific notation. Instead of writing 93,000,000, we recognize that  $93,000,000 = 9.3 \times 10,000,000$  and 10,000,000 is the same as  $10^7$ ). Since we're estimating here, let make the radius  $10^8$ . It's easier to work with.

It takes a year for the earth to travel around the sun. In that year, the earth travels  $2\pi$  miles (circumference of a circle). In our case that's  $2\pi(10^8)$ , which is about  $6.2 \times 10^8$  miles. Finding the speed of the earth is easy; it's  $6.2 \times 10^8$  miles per year. That's fine for now, but we'll have to convert it later.





## 90. Cave Paper

Ogg the caveperson wants to decorate a cavern in the cave by putting up wallpaper. From floor to ceiling, the cavern is 8 feet tall.

Conveniently, the cavern is rectangular; except one wall is completely gone (it's the entrance). The long walls are 15 feet, and the remaining short wall is 10 feet. The mud-colored wallpaper Ogg buys at Cave Depot is 3 feet wide, and each roll is 20 feet long. Assuming Ogg doesn't care if there are horizontal seams, how many rolls need to be purchased?



The answer is: 6

First, we need to figure out how much surface area needs to be covered:

⌚ The sum of the lengths of the three walls to be covered is 15 feet + 15 feet + 10 feet = 40 feet.

⌚ The height of the walls is 8 feet.

Therefore, the surface area is 40 feet x 8 feet = 320 square feet.

Next we figure out how much surface area each roll of wallpaper will cover:

Each roll is 3 feet wide and 20 feet long so it will cover 3 feet x 20 feet = 60 square feet.

Now we divide the surface area of the walls by the coverage area of the wallpaper and get 5.33. Therefore, Ogg needs to buy 6 rolls.

## 101. Census Consensus

As of the last census, the town of Gooberville has 855 people, 367 households and 230 families residing in the town. The population density was 842.2/mi<sup>2</sup> (323.6/km<sup>2</sup>). There were 411 housing units at an average density of 404.8/mi<sup>2</sup> (155.6/km<sup>2</sup>). There were 678 dogs, 300 cats and 104 birds owned as pets. Based on this information, which one of these statements is true?

- I**
- A. Gooberville is larger than one square mile
  - B. Every household in Gooberville owns at least one dog
  - C. There are no people that live alone in Gooberville
  - D. Every family owns at least one cat

The Answer is: A, Gooberville is larger than one square mile

Population density is a measure of population per unit area. In Gooberville, we know there were 855 people living in town. However, the population density was 842.2 people per square mile. Remember population density is an average and gives no real indication of where, specifically, anyone lives within the area.

If Gooberville took up an area of exactly 1 mi<sup>2</sup> and 855 people lived there, the population density would be 855/mi<sup>2</sup>. Because the population density is less than the population, we can conclude that Gooberville must be larger than one square mile.

The statistics give only the number of dogs and cats, and no indication of who owns them. While statements B and D might be true, we can't know it for sure based on the information given.

The information also states that there are 367 households and 230 families. Assume that a family is two or more people who live together and are related in some way. The fact that there are 137 more households than families indicates that those 137 households are composed of only one person or groups of people who are not related. In either case, we cannot know for sure that no one lives alone.