CONDENSATION OF
101 Things Everyone Should Know About Math!

By Mark Zev, Kevin B. Segal, and Nathan Levy

Includes pages: 1, 7, 8, 17, 24, 41, 67, 68, 69, 83, 84, 85,121, 122, 123, 187, 196, 197, 198,

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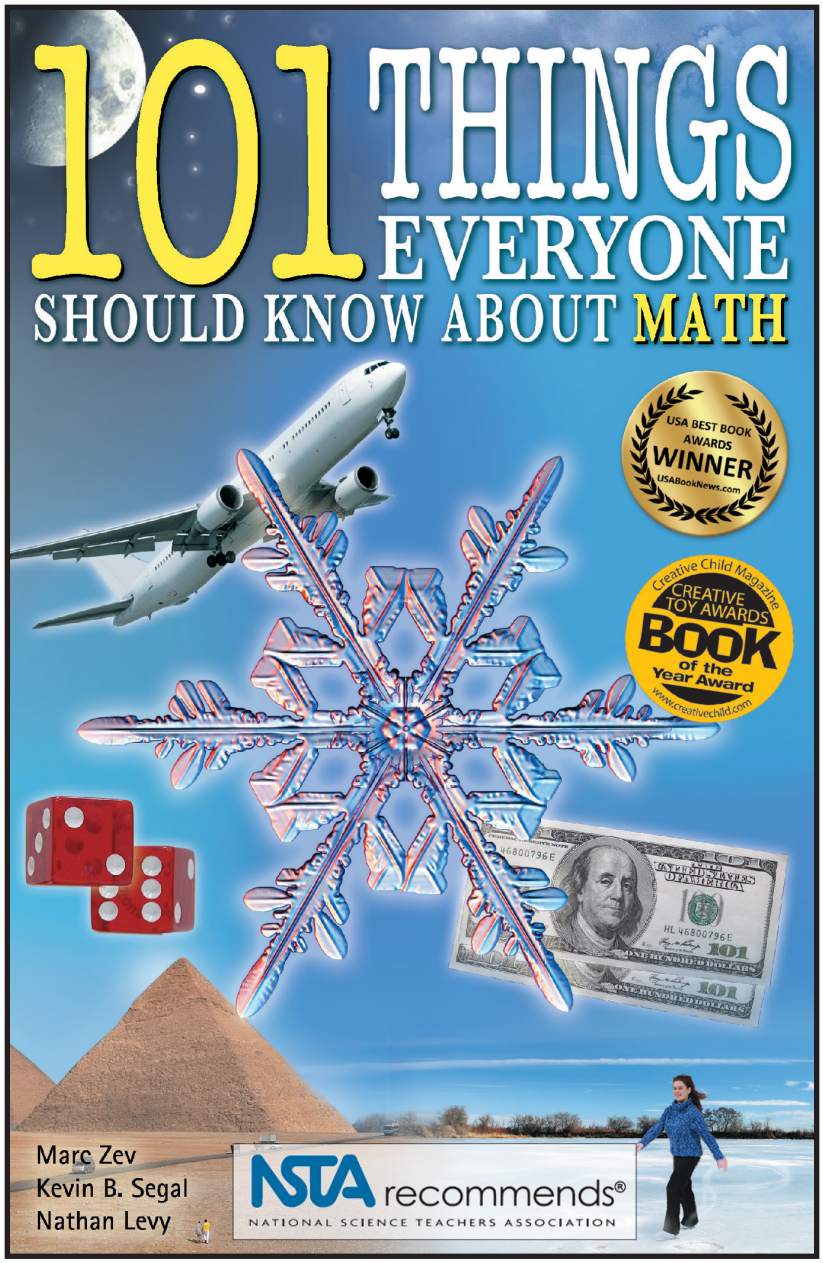

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Table of Contents

Facts, Just Math Facts Questions

F+A+C+T+S=

Answer the questions in the following sections as best you can, then check your answers in the corresponding answer section. The answers to the math facts questions can be found starting on page 67.

1. Easy as Pi

On March 14th, Albert's school celebrated Pi Day. They had several pi-related events, including a pie sale. What was the price of each pie?

A. $1.43 **C. $3.14**
B. $2.31 **D. $4.44**

2. Hip To Be Squared

What is the square of 15?

HINT: The square of a number is that number multiplied by itself. Its notation is a superscripted '2'; a number x squared is written as x^2. For example, the square of 3 is written as 3^2 (3 x 3 = 9). The square of 14 (14 x 14) is 196, and the square of 16 (16 x 16) is 256.

3. A Prime Number

Ogg, a caveperson, went hunting but didn't bring anything home. So, Nahtogg sent him to the butcher to buy some prime rib. Ogg returned with 4 bags of rib bones, each one containing a different quantity:

Bag A: 2 ribs **Bag C: 4 ribs**
Bag B: 3 ribs **Bag D: 5 ribs**

Facts, Just Math Facts Answers

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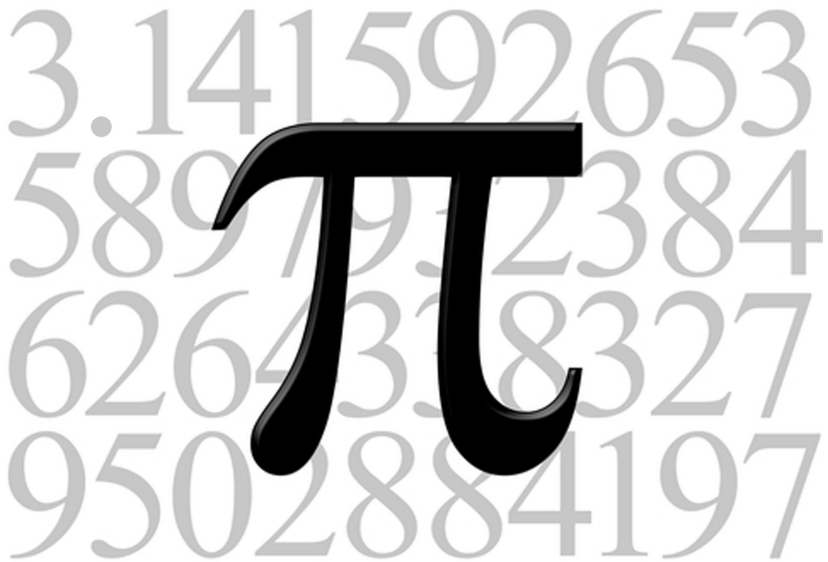
1. Easy as Pi

On March 14th, Albert's school celebrated Pi Day. They had several pi-related events, including a pie sale. What was the price of each pie?

A. $1.43 **C. $3.14** ☞
B. $2.31 **D. $4.44**



The answer is: C, $3.14

$3.14 is a good answer since the value of pi is approximately 3.14. Swiss mathematician Leonhard Euler named this special number pi after the Greek letter. You can calculate pi by dividing the circumference of a circle by its diameter. The answer will always equal 3.14.

Since 1987, people have been celebrating Pi Day on March 14. They also celebrate Albert Einstein's birthday on the same day. He was born on March 14, 1879.

Hmm! Pi (π) was proven to be irrational in 1761 by Johann Heinrich Lambert. A number is considered irrational if it can't be expressed as one whole number (also known as an integer) divided by another whole number. In other words, if you write the number in decimal notation, it never ends and it never repeats. Computers have calculated π out to 16 billion decimal places, just to be sure. So, why is it important that π is irrational? It makes a difference in advanced math.

You can use either 3.14 or the fraction $^{22}/_{7}$ as good approximations when you need to estimate the value of π..

2. Hip To Be Squared

What is the square of 15?

HINT: The square of a number is that number multiplied by itself. Its notation is a superscripted '2'; a number x squared is written as x^2. For example, the square of 3 is written as 3^2 (3 x 3 = 9). The square of 14 (14 x 14) is 196, and the square of 16 (16 x 16) is 256.

The answer is: 225

Here's the fastest way to solve this problem. The hint told you that the answer must be between 196 and 256 (14^2 and 16^2). When a number that ends in the number 5 is squared, the result will always end in 25. Therefore, 15^2 must end in 25. There is only one number between 196 and 256 that has 25 as its last two digits: 225.

3. A Prime Number

Ogg, a caveperson, went hunting but didn't bring anything home. So, Nahtogg sent him to the butcher to buy some prime rib. Ogg returned with 4 bags of rib bones, each one containing a different quantity:

Bag A: 2 ribs **Bag C: 4 ribs** ☞
Bag B: 3 ribs **Bag D: 5 ribs**

Nahtogg complained, "I send you to store for prime rib. One bag not prime rib, but composite rib. Go back to store and get all prime rib!"

Which bag made Nahtogg cranky?

Health, Food & Nutrition Questions

(The answers to these questions begin on page 83)

17. Pi and Pie

Since Albert loves pie, he plans on trying as many different types of pie as possible at his school's Pi Day celebration. The only problem is that Albert's mother told him he could eat no more than the equivalent of a quarter of a pie. Albert has enough money to purchase as many slices as he wants. However, he has difficulty making his choices because not all the pies are cut into the same number of slices.

Type of Pie	Number of Slices per Pie
Strawberry	6
Apple	8
Cherry	10
Chocolate Cream	10
Banana Cream	12
Lemon Meringue	12
Boston Cream	16
Coconut Cream	16

What is the maximum number of slices of different pies Albert can buy so that he ends up with no more than the equivalent of $^1/_4$ of a pie?

NEED A CLUE? Start by choosing the pies that have the most slices per pie. These slices will be the smallest.

Health, Food, and Nutrition Answers

17. Pi and Pie

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NEED A CLUE? Start by choosing the pies that have the most slices per pie. These slices will be the smallest.

The answer is: 3

Start with the pies with the smallest slices. The Boston Cream and the Coconut Cream pies each have 16 slices, so one slice of each pie would total $^2/_{16}$ of a pie, or $^1/_8$. The next smallest slices come from the Banana Cream and Lemon Meringue pies at 12 slices per pie. Adding the two slices already picked and one more slice from a 12-slice pie is $^1/_8 + {}^1/_{12}$.

In order to add these fractions together we need to make the denominators (the bottom numbers) the same. We can do that by finding the least common multiplier for 8 and 12. Relying on our math facts, we know that both 8 and 12 are factors of 24 so $^1/_8 + {}^1/_{12}$ becomes $(^1/_8) \times (^3/_3) + (^1/_{12}) \times (^2/_2) = {}^3/_{24} + {}^2/_{24} = {}^5/_{24}$, which is less than $^6/_{24} = {}^1/_4$. Since there are no pies sliced into 24 pieces, Albert can have a maximum of 3 slices.

18. Smart Cookie

Inara is making her famous Alphabet Cookies for a party. To make sure everyone will get a cookie, she plans to make one and a half batches. Everything is going well until the recipe calls for $^1/_3$ cup of butter. Inara only has measuring cups in the following denominations: $^1/_8$ cup, $^1/_4$ cup, $^1/_3$ cup, $^1/_2$ cup & 1 cup.

Can Inara measure out the correct amount of butter using her measuring cups?

The answer is: Yes

If Inara doesn't have a measure for $^1/_2$ the original amount of butter ($^1/_2 \times {}^1/_3 = {}^1/_6$ cup), maybe she has a measure for 1 $^1/_2$ times the original amount. To figure this out, we can express what we need as fractions ($^3/_2 \times {}^1/_3$). The 3 in the numerator (the top part) of the first fraction cancels the 3 in the denominator (the bottom part) of the second fraction. That leaves us with the fraction $^1/_2$ cup, for which Inara has a measuring cup.

19. Half-Baked

Inara is having another party and is going to make her famous Alphabet Cookies again, but this time she wants to make only half a batch. Everything is going well until, yet again, the recipe calls for $^1/_3$ cup of butter. Inara still has only measuring cups in the following denominations: $^1/_8$ cup, $^1/_4$ cup, $^1/_3$ cup, $^1/_2$ cup & 1 cup.

Can Inara measure out the correct amount of butter using her measuring cups?

The answer is: Yes

Economics Questions

(The answers to these questions can be found on page 121.)

54. Scrimp and Save

True or False: Your dad has agreed to help you save for a baseball bat. The bat costs $100. Your dad has offered to contribute 10% of whatever you save. You work hard and earn $90. Now, with your dad's contribution, you have enough money for the bat.

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

Economics Answers

54. Scrimp and Save

True or False: Your dad has agreed to help you save for a baseball bat. The bat costs $100. Your dad has offered to contribute 10% of whatever you save. You work hard and earn $90. Now, with your dad's contribution, you have enough money for the bat.

The answer is: False!

Dad has agreed to add 10% to the money you actually save. If you saved $90, Dad would add 10%, or $9. That would make your total $90+$9 = $99. One dollar short!

The question, then, is: What amount, plus 10 percent,equals $100?

If S is the amount you plan to save, the equation looks like this:

$$S + 0.10 \times S = \$100$$

Simplify that to:

$$S(1+0.1) = \$100 \quad S = \frac{\$100}{1.1} \quad S = \$90.91$$

So, the amount of money you have to save is $90.91. Now, when your dad adds 10% of that value (rounded off to the nearest penny), he puts in $9.09 and voila, you have the money you need!

Hmm! This equation is essentially the same as the basic equation used to calculate simple bank interest. The equation to calculate simple bank interest is P(1 + i) = B, where P is the principal, i is the interest, and B is the balance. (See question 65.)

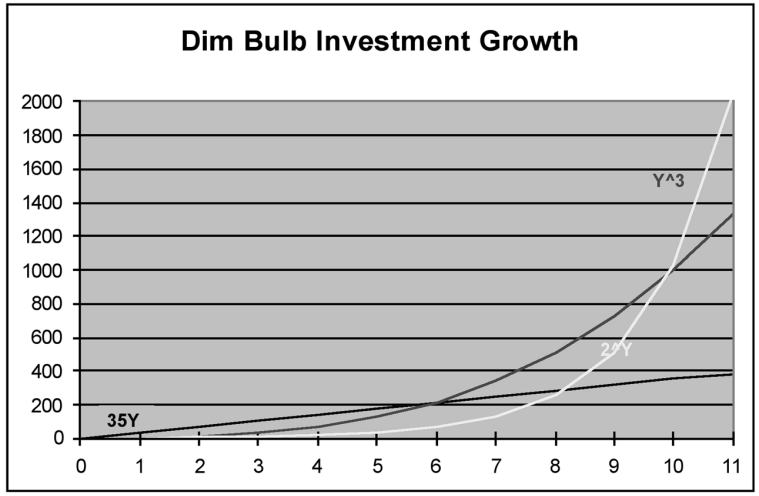
55. A Good Investment

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

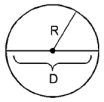
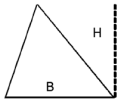
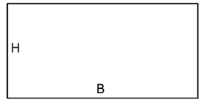
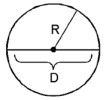
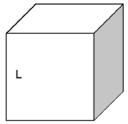
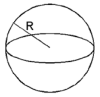
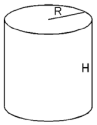
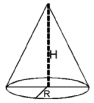
On the graph, we can see that at six years, the cubic growth curve crosses over the linear curve and quickly becomes the better investment. If we extend the time line out to 11 years, we can see that the exponential curve crosses the cubic curve at 10 years. One of the other curves would be the better option if Dim Sum extended the timeline, but the linear growth curve is the best option in the limited cycle of five years.



Conversions

Units	Multiplied by	Units	Multiplied by	Units
Inches	2.54	Centimeters	0.39370	inches
Inches	25.4	Millimeters	0.03937	Inches
Inches	0.0254	Meters	39.37008	Inches
Inches	0.08333	Feet	12.0	Inches
Inches	0.02778	yards	36.0	Inches
Feet	0.33333	Yards	3.0	Feet
Feet	0.00019	Miles	5280.0	Feet
Yards	0.00057	Miles	1760.0	Yards
pound	0.45359	kilogram	2.20462	pound
ounce	0.06250	pound	16.0	ounce
ounce	0.02835	kilogram	35.27396	ounce
gram	0.00100	kilogram	1000.0	gram
ounce	28.34952	gram	0.03527	ounce
gram	0.00220	pound	453.59229	gram
pound	0.00050	ton	2000.0	pound
kilogram	0.00100	metric ton	1000.0	kilogram
pound	0.00045	metric ton	2204.62442	pound
kilogram	0.00110	ton	907.18500	kilogram
teaspoon	0.33333	tablespoon	3.00	teaspoon
cup	0.5000	pint	2.00	cup
cup	0.2500	quart	4.00	cup
cup	0.0625	gallon	16.00	cup
pint	0.5000	quart	2.00	pint
pint	0.1250	gallon	8.00	pint
quart	0.2500	gallon	4.00	quart
fluid ounce	0.125	cup	8.00	fluid ounce
tablespoon	0.5	fluid ounce	2.00	tablespoon

Formulas

Circumference of a circle	$C = 2\pi R = \pi D$	
Area of a triangle	$A = \frac{1}{2} HB$	
Area of a rectangle	$A = HB$	
Area of a circle	$A = \pi R^2 = \frac{1}{2} RC$	
Volume of a cube	$V = L^3$	
Volume of a sphere	$V = \frac{4}{3} \pi R^3$	
Volume of a cylinder	$V = \pi R^2 H$	
Volume of a cone	$V = \frac{1}{3} \pi R^2 H$	

Index by Subject Area

Glossary

abscissa The x coordinate on the Cartesian plane.

acute An angle that is less than 90 degrees.

algebra A mathematical process used to solve equations in which letters stand for unknown or variable quantities.

algorithm A series of steps used to solve a problem.

area The amount of space enclosed by a two-dimensional object.

arithmetic Basic mathematics consisting of addition, subtraction, multiplication, division, and exponentiation.

average The arithmetic mean found by adding the value of two or more items and then dividing by the total number of items.

binary A base two numbering system.

calorie A unit of heat equal to the amount required to raise the temperature of one gram of water one degree Celsius.

circumference The perimeter of a circle.

combination Something that is formed by joining or mixing together several things. The number of ways a group can be selected where the order of the items *does not* matter.

composite Any whole number that is evenly divisible by one, itself, and at least one other whole number.

coordinate A number that defines position with reference to a fixed point or system of lines.

decimal A number written in the base 10 system.

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—Sol Lederman, Columnist, *Wild About Math: Making Math Fun and Accessible*

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