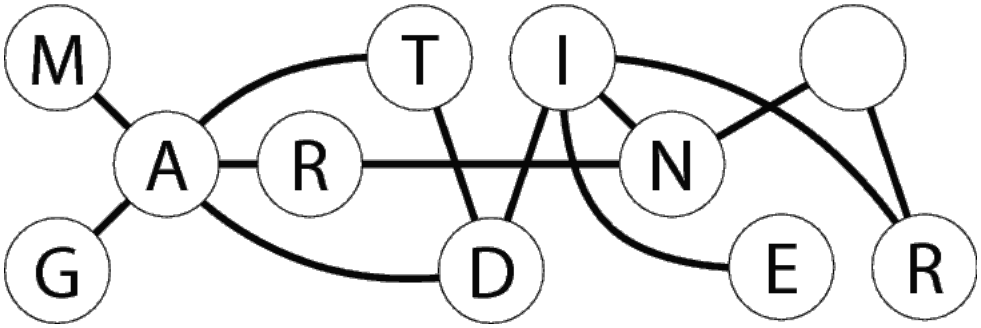


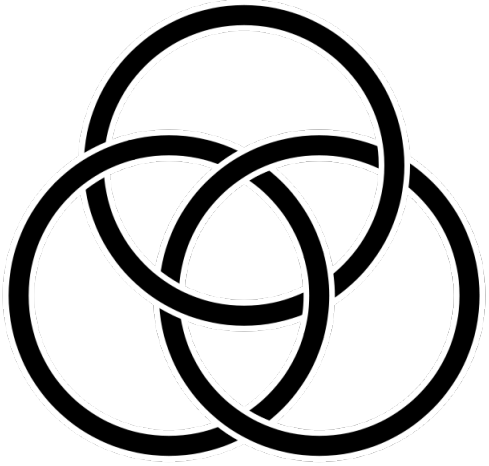
Photo Martin Gardner by Alex Bellos in 2008 in Norman

Born in Tulsa in 1914 and passed away in Norman in 2010.

Stage 1

Stage 1, Round 1 (2 Questions, 3 Minutes)

1. The three interlocked circles in the picture below are called the *Borromean Rings*. What is the fewest number of crossings you need to switch (that is, make an overcrossing into an undercrossing, or an undercrossing into an overcrossing) in order to separate the three circles?



2. Consider the polynomial

$$p(x) = (3x - 2)^5 + 100.$$

If you were to expand out the product and write $p(x)$ in standard form as a combination of powers of x, what would be the constant term?

Stage 1, Round 2 (Blitz Round, 3 Minutes)

a. If you flip a fair coin five times and get heads each time, is that more, less, or equally likely than getting Heads, Heads, Tails, Heads, Tails?

b. If $\sin(\theta) = 3/7$, then what is $\tan(\theta)$?

c. If you have a circular birthday cake and wish to cut it into 100 pieces by making straight, vertical cuts through the center of the cake, how many cuts must you make?

d. Let $x = 2014^{11}$. Which of the following numbers is closest to x?

(a) 2,000,000,000,000,000

(b) 2,000,000,000,000,000,000,000,000

(c) 2,000,000,000,000,000,000,000,000,000,000,000,000

(d) 2,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000

e. You have the option of getting a 10% raise this year and a 5% raise next year, or a 5% raise this year and a 10% raise next year. Does it make a difference and, if it does, which is the better option?

f. If $a_1 = 1$, $a_2 = 3$, and $a_n = a_{n-1} - a_{n-2}$ for $n \geq 3$, then is a_{10} positive or negative?

g. How many prime numbers are less than 100?

Stage 1, Round 3 (3 Questions, 5 Minutes)

1. Erik, Corey, and Brian decided to play the Home Edition of the Sooner Math Bowl.

   (a) How many different outcomes are possible if ties are not allowed?

   (b) How many different outcomes are possible if ties are allowed?

2. Here are the first seven numbers of the Fibonacci sequence:

   $$1, 1, 2, 3, 5, 8, 13, \ldots$$

   Is the 11th number in the Fibonacci sequence even or odd?

3. Please solve for x if x is a real number and:

   $$x = \sqrt[3]{2 - \sqrt[3]{2 - \sqrt[3]{2 - \sqrt[3]{2 - \cdots}}}}$$

Lunch!

Stage 2

Stage 2, Round 1 (Blitz Round, 3 Minutes)

a. How many zeros does 100^{100} have?

b. If you have circle with radius r and its perimeter equals its area, then what is r?

c. Which is larger: 20^{14} or 14^{20}?

d. Consider the sequence $a_1 = -2, a_2 = 12, a_3 = -72, \ldots$.
If you continue this sequence, what is a_5?

e. How many roman numerals are required to write 100? How about 2014?

f. If 201 is a number written in base 4, then which number is it?

g. Imagine the letters of the alphabet are made out of a rubbery material that you can stretch and deform as much as you like, but you can't cut it or glue it together. Which of the following letters can be deformed into the letter A?

$$B, C, D, E, F, G, H, P, Q$$

Stage 2, Round 2 (3 Questions, 5 Minutes)

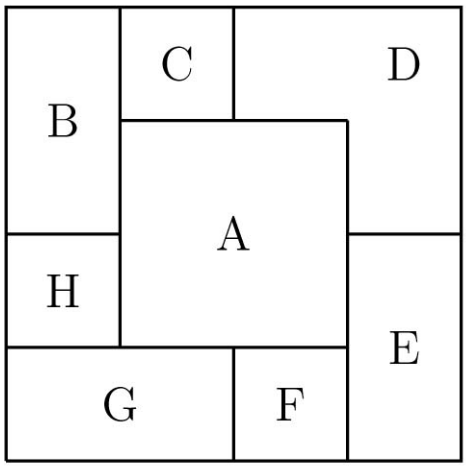
1. Let $P = (a, b)$ and $Q = (c, d)$ be two points on the curve given by $y = x^2$. If the distance between their x-coordinates is exactly 1 unit and the distance between their y-coordinates is as small as possible, what are P and Q?

2. To convert between F degrees Fahrenheit to C degrees Celsius, you use the formula

$$C = \frac{5(F - 32)}{9}.$$

   Which temperature(s) have the same numerical value in both systems?

3. Dr. I. J. Matrix stacked square napkins in a pile as shown below. What is the letter of the napkin Dr. Matrix put down first?



Stage 3

Stage 3, Round 1 (3 Questions, 5 Minutes)

1. The Luhn algorithm is widely used to validate credit card numbers and other identification numbers. It was created by IBM scientist Hans Peter Luhn and patented as U.S. Patent 2,950,048 on August 23, 1960. It tests whether or not a number is valid. We will show how it works by testing the example number 37795657

   i. Reverse the order of the digits (so our example becomes 75659773).

   ii. Double the 2nd, 4th, 6th, 8th, ... digits and if a digit becomes 10 or larger, then subtract 9 (so our example becomes 71619576).

   iii. Add up the digits (so our example becomes $7 + 1 + 6 + 1 + 9 + 5 + 7 + 6 = 54$).

   iv. If the result is evenly divisible by 10 then the original number is okay, otherwise it's a fake (so our example is a fake! However, for example, 37795653 is a valid number.).

   Some of the following numbers are fake. Which are the fake numbers?

   $$11202014, 20142011, 20112014.$$

2. Which is more likely, flipping a fair coin and getting Heads, Heads, Heads, or tossing a fair die and getting Two and Two?

3. What is the area of the largest square which can be drawn inside a circle of radius $7\sqrt{2}$?

Stage 3, Round 2 (3 Questions, 5 Minutes)

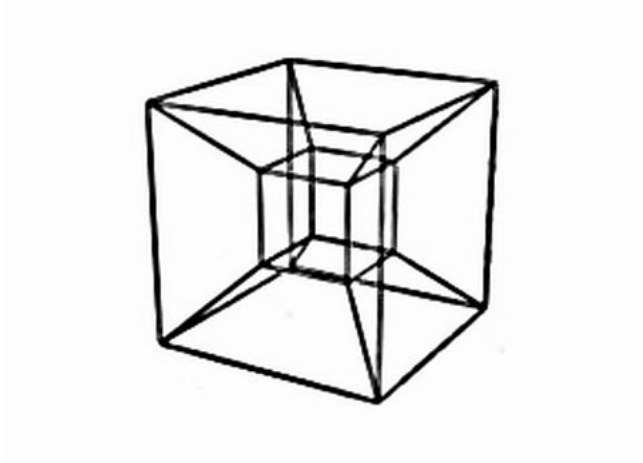
1. We call a polynomial

$$p(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_2 x^2 + a_1 x + a_0$$

a *selfie polynomial* if $p(0) = a_0$, $p(1) = a_1$, $p(2) = a_2$,..., $p(n) = a_n$. If $p(x)$ is a degree 2 selfie polynomial and $p(0) = 1$, then what is $p(x)$?

2. Dr. Matrix is standing on a tower placed on a spherical comet where the tower is 100 feet tall and the radius of the comet is 400 feet. How far is it from Dr. Matrix to the horizon?

3. The following picture of two cubes, one in the center of the other. If the inner cube has side length 1 and the outer cube has side length 3, then what is the length of a straight line from the corner of the inner cube to the corner of the outer cube?



The End!

Spot Prize II (Word Search!)

Name:_____ **School:**_____

K W N O S G D O D Q K N Y C Q N R O S P R O U T S

N O I T A E R C E R A L A R P R J H G N L E V G Y

X S R J U M D B U M A K W Y X L R X E J A Y I S R

R E N D R A G V R F R P N P E J P O C T C M J X N

W E R H P A Y E F B U C O T S L A T C A R F R T E

C O X F S T G E M Z A S C O J I H O L F K I K O H

I B N L B E R O Z R D Q K G A U E L L D H T S D N

G N U D S I C L R Z F E N R E S C H E R T F D U T

A T I W E W E O E O X O S A T O R B L E D N A M R

M E H T E R L M L J G W K P C L I F E M M N M T I

M C B N R L L U A A L K K H P P K D L A A F D J C

Q I G O X A E A X S L T E Y E W M J T R L T P N K

U L J G P X M E N X O D A R A P G H D Q W K R V S

H A T K E M L Y W D X E M L R Q T Z J U A H I I U

W P E A F F P E N R O S E W O K L A H O M A U D X

- ALICE
- CARROLL
- CONWAY
- CRYPTOGRAPHY
- CURVE
- DODGSON
- ESCHER
- FLEXAGON
- FRACTALS
- GARDNER
- HENRY
- LAFFER
- LIFE
- MAGIC
- MANDLEBROT
- MARTIN
- MATH
- NEWCOMB
- NORMAN
- OKLAHOMA
- PARADOX
- PENROSE
- PUZZLE
- RECREATION
- SEGERMAN
- SPROUTS
- TRICKS
- TULSA
- WONDERLAND

Spot Prize II (Word Search!)

Name:_____ **School:**_____

K W N O S G D O D Q K N Y C Q N R O S P R O U T S
N O I T A E R C E R A L A R P R J H G N L E V G Y
X S R J U M D B U M A K W Y X L R X E J A Y I S R
R E N D R A G V R F R P N P E J P O C T C M J X N
W E R H P A Y E F B U C O T S L A T C A R F R T E
C O X F S T G E M Z A S C O J I H O L F K I K O H
I B N L B E R O Z R D Q K G A U E L L D H T S D N
G N U D S I C L R Z F E N R E S C H E R T F D U T
A T I W E W E O E O X O S A T O R B L E D N A M R
M E H T E R L M L J G W K P C L I F E M M N M T I
M C B N R L L U A A L K K H P P K D L A A F D J C
Q I G O X A E A X S L T E Y E W M J T R L T P N K
U L J G P X M E N X O D A R A P G H D Q W K R V S
H A T K E M L Y W D X E M L R Q T Z J U A H I I U
W P E A F F P E N R O S E W O K L A H O M A U D X

- ALICE
- CARROLL
- CONWAY
- CRYPTOGRAPHY
- CURVE
- DODGSON
- ESCHER
- FLEXAGON
- FRACTALS
- GARDNER
- HENRY
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- MANDLEBROT
- MARTIN
- MATH
- NEWCOMB
- NORMAN
- OKLAHOMA
- PARADOX
- PENROSE
- PUZZLE
- RECREATION
- SEGERMAN
- SPROUTS
- TRICKS
- TULSA
- WONDERLAND

Spot Prize I (Crack the Code!)

Name:_____ School:_____

An early form of cryptography was to encode your message by substituting a number for each letter. We've used this technique to encode a famous quote about mathematics. We've given you a few letters to get started. You don't have to be an Einstein to figure this one out, but can you crack the code?!?

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
			1	5				3									7			10					

D	_		_	_	_		_	_	R	R	_		_	_	_	U	_		_	_	U	R
1	15		16	15	8		4	15	7	7	14		22	26	15	10	8		14	15	10	7

D	I	_	_	I	_	U	_	_	I	E	_		I	_
1	3	20	20	3	17	10	2	8	3	5	6		3	16

_	_	_	_	E	_	_	_	I	_	_	.		I		_	_	_		_	_	_	U	R	E
18	22	8	23	5	18	22	8	3	17	6			3		17	22	16		22	6	6	10	7	5

_	_	U		_	I	_	E		_	R	E		_	_	I	_	_
14	15	10		18	3	16	5		22	7	5		6	8	3	2	2

_	R	E	_	_	E	R	.
12	7	5	22	8	5	7	

Spot Prize I (Crack the Code!)

Name:_____ **School:**_____

An early form of cryptography was to encode your message by substituting a number for each letter. We've used this technique to encode a famous quote about mathematics. We've given you a few letters to get started. You don't have to be an Einstein to figure this one out, but can you crack the code?!?

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
			1	5				3									7			10					

D	_		_	_	_		_	_	R	R	_		_	_	_	U	_		_	_	U	R
1	15		16	15	8		4	15	7	7	14		22	26	15	10	8		14	15	10	7

D	I	_	_	I	_	U	_	_	I	E	_		I	_
1	3	20	20	3	17	10	2	8	3	5	6		3	16

_	_	_	_	E	_	_	_	I	_	_	.		I		_	_	_		_	_	_	U	R	E
18	22	8	23	5	18	22	8	3	17	6			3		17	22	16		22	6	6	10	7	5

_	_	U		_	I	_	E		_	R	E		_	_	I	_	_
14	15	10		18	3	16	5		22	7	5		6	8	3	2	2

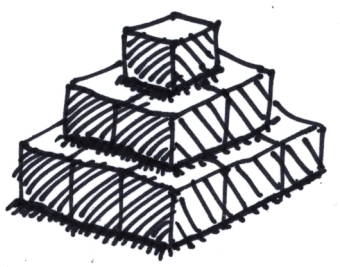
_	R	E	_	_	E	R	.
12	7	5	22	8	5	7	

Lunch Problem (The Pyramids of Boren!)

Name:_____ **School:**_____

Due after lunch at the door to the Math Bowl. Write your solution on the back.

After a long day at the office, President Boren likes to relax by stacking golden cubes in a pyramid shape. For example, a 1-level stack uses only 1 cube and if he makes a 3-level stack he uses 14 cubes and it looks like:



The more stressed President Boren is, the more cubes he stacks!

a. This is President Boren's twentieth year at OU. What is the fewest number of pyramids the President can make if he uses 20 golden cubes?

b. When the Oklahoma football team lost to TCU, he stacked cubes into a 5-level pyramid. How many golden cubes did President Boren use?

c. When the Oklahoma football team lost to Baylor, he stacked his entire collection of 100 golden cubes into the fewest number of pyramids possible. How many pyramids were there?

d. In general, if President Boren stacks golden cubes into an n-level pyramid, then please give a formula which calculates the number of cubes used.