ANSWER KEY

	G	A	M	E	S
a	27	48	140	2	224
b	1	28	81	46	185
c	64	60	50,000	5	181
d	82	26	15	12	900
e	7	12	763	21	41
f	266	24	7	4000	2
g	7	1958	97	22	1858
h	6	2002	0.06	119	
j	2	37	71	114	
k	5	0	2	200	

G = 2
A = 2500
M= 27
E= 30
S = 8
x = 375

Solutions

G = Geography and Other Fun Facts About the United States

a. A landlocked state is any state whose territorial boundaries do not touch an ocean, gulf, or bay. All landlocked states are located among the contiguous 48 states on the North American mainland.
A state is singly landlocked if you travel through only one other US state or Canadian province to reach an ocean, gulf, or bay. Doubly landlocked means traveling through two states or one state and one Canadian province, and triply landlocked requires traveling through three states or 2 states and one Canadian province.
There are 16 singly landlocked states: (Arizona, Arkansas, Idaho, Kentucky, Michigan, Minnesota, Montana, Nevada, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, and West Virginia). There are 10 doubly landlocked states: Colorado, Illinois, Indiana, Iowa, Kansas, Missouri, South Dakota, Utah, and Wisconsin. There is only one triply landlocked state: Nebraska. Therefore, 16+10+1 = 27

b. 1. The address of the official residence of the Vice President of the United states is 1 Observatory Circle, U.S. Naval Observatory, Washington DC.

c. 64
http://www.uncovercolorado.com/wp-content/uploads/2013/12/Map-Colorado-Counties-1200px.png

d. Las Vegas Area Code: 891; Colorado Springs Area Code: 809; 891-809 = 82

e. 7 (Wyoming, Colorado, Utah, New Mexico, Nevada, Arizona and California)

f. Teddy Roosevelt: 60; George Washington: 67; Abraham Lincoln: 56; Thomas Jefferson: 83. Therefore 60+67+56+83 = 266

g. As of August 1, 2017, there are 7 rollercoasters in the four Walt Disney World Theme Parks in Orlando, FL. (Barnstormer – Fantasyland in Magic Kingdom; 7 Dwarfs Mine Train – Fantasyland in Magic Kingdom; Big Thunder Mountain – Frontierland in Magic Kingdom; Primeval Whirl – Dinoland USA in Animal Kingdom; Expedition Everest – Asia in Animal Kingdom; Rock 'n' Roller Coaster – Sunset Blvd in Disney Hollywood Studios)

h. 6 (Arkansas, Hawaii, Mississippi, Ohio, Tennessee, and Texas)

j. Lynda Bird Johnson Robb – March 19, 1944 & Barron Trump – March 20, 2006. Therefore 2006-1944=62

k. There were 5 states admitted to the Union after 1900: Oklahoma (1907); New Mexico (1912); Arizona (1912); Alaska (1959) and Hawaii (1959).

A = All You Ever Wanted to Know about Mu Alpha Theta

a. 48

b. The phone number of the National Office of Mu Alpha Theta is 405-325-0144.
$$4+0+5+3+2+5+0+1+4+4 = 28$$

c. The Mathematical Association of America has been a primary sponsor of Mu Alpha Theta since 1958.
d. 24 states have hosted National Conventions (New York, Virginia, Maine, Tennessee, Utah, Massachusetts, Colorado, Mississippi, Texas, California, Pennsylvania, Missouri, Louisiana, Oklahoma, Wisconsin, Hawaii, Arkansas, Florida, Iowa,

Washington, Alabama, Illinois, Georgia and New Jersey). Therefore 26 states have never hosted a convention.
e. There are 12 National Officers.
f. Mr. Taylor has hosted 3 conventions (2011, 2016, 2018) and Dr. Morris has hosted 8 conventions (1989, 1992, 2000, 2003, 2006, 2008, 2012, 2015)
g. *The Mathematical Log* was first issued in print form in September 1958.
h. The last issue of *The Mathematical Log* was issued in 2002.
j. The Kalin award was first issued in 1981 and this year's recipient will be the 37th recipient.
k. There are 4 Student Delegate officers and 4 Mu Alpha Theta Regions so the difference is zero.

M = Math and Science

a. 140
b. 81

c.

Cars Sold	Fleet Total mpg	Average mpg
150000	3750000	$\dfrac{3750000}{150000} = 25$
x	$35x$	35
$150000 + x$	$3750000 + 35x$	$\dfrac{3750000 + 35x}{150000 + x} = 27.5$

$$37.5(150000 + x) = 3750000 + 35x$$
$$4125000 + 27.5x = 3750000 + 35x$$
$$375000 = 7.5x$$
$$50000 = x$$

d. Largest value: MDCLXVI (1666); Smallest value: MCDXLIV (1444). Therefore 1666-1444=222.
e. The following commercial jets are currently used by Boeing: 737, 747, 767, 777, 787. The average of these five numbers is 763 (not a Boeing Jet). Source: http://www.boeing.com/commercial/
f. There are only seven times when the values are in numerical order and give a valid time and are listed in the chart below along with the time represented.

1	One	Seven	Three	Two	17:32	5:32 PM
2	One	Seven	Three	Zero	17:30	5:30 PM
3	One	Seven	Two	Zero	17:20	5:20 PM
4	One	Six	Three	Two	16:32	4:32 PM
5	One	Six	Three	Zero	16:30	4:30 PM
6	One	Six	Two	Zero	16:20	4:20 PM
7	One	Three	Two	Zero	13:20	1:20 PM

g. $748 - $651 = $97

$P(\text{intoxicated or accident}) = P(\text{intoxicated}) + P(\text{accident}) - P(\text{accident while intoxicated})$

h. $0.35 = 0.32 + 0.09 - x$

$0.35 = 0.41 - x$

$-0.06 = -x$

$0.06 = x$

j.

M	A	T	H	E	M	A	T	I	C	S	= 71
14	3	2	8	1	14	3	2	5	12	7	

k. There are 2: Zinc and Zirconium.

E = Entertainment, Sports, and Literature

a. As of June 2017, only the Colorado Rockies and the Miami Marlins have never won a division title. Both appeared as wild card teams before playing in the World Series.

b. There are 46 tracks on the official Hamilton cast album.

c. If Prince William chose his name as king, he would be known as King William V.

d. 12 people have won an EGOT in only the competitive categories: Richard Rodgers, Helen Hayes, Rita Moreno, John Gielgud, Audrey Hepburn, Marvin Hamlisch, Jonathan Tunick, Mel Brooks, Mike Nichols, Whoopi Goldberg, Scott Rudin, and Robert Lopez

e. The New York Yankees have won 27 World Series Games and the Pittsburgh Steelers have won 6 Super Bowls. 27-6 = 21

f. $$\frac{20000}{\left[(451)(22) \div 1984\right]} = \frac{20000}{\left[5.0010080645\right]} = \frac{20000}{5} = 4000$$

g. The word "one" is written on the $1 bill eight times, the word "five" is written on the $5 bill three times, the word "ten" is written on the $10 bill three times, the word "twenty" is written on the $20 bill five times, and the word "fifty" is written on the $50 bill three times. 8 + 3 + 3 + 5 + 3 = 22.

h. There are 150 chapters in the book of Psalms and 31 chapters in the book of Proverbs. The difference is 119, which is also the chapter number of the longest chapter in the Bible: Psalm 119.

i. There are 56 Nancy Drew mysteries that were printed with the initial publisher Grosset & Dunlap and are considered to the "classic" Nancy Drew books.   G&D also printed the original 58 Hardy Boys books. Sources: http://nancydrew.info/ and http://hardyboys.us/hbos.htm

j. Drivers complete 200 laps that are each 2.5 miles long while driving in the Indianapolis 500.

S = Seven Falls – "The Grandest Mile of Scenery in Colorado"

Source of clues a, c, e, g: https://www.broadmoor.com/broadmoor-adventures/seven-falls/colorado-grandest-mile/ Source of clues b, d, e, f (also confirms a, c, e, g): https://en.wikipedia.org/wiki/Seven_Falls

a. There are 224 steps for the staircase from the base of the falls to the peak.
b. The wheelchair accessible elevator bypasses 185 steps to get to the Eagle's Nest Observation Platform.
c. The falls tumble 181 feet down the head of the canyon. They dance from granite face to granite face in seven distinct leaps.
d. The Pillars of Hercules are 900 feet above the floor of the canyon.
e. The distance between the Pillars of Hercules and the George Washington profile are 41 feet apart.
f. There are two hiking trails that begin at the top of Seven Falls: Trail to Inspiration Point and Trail to Midnight Falls.
g. Restaurant 1858 takes its name from the Gold Rush era and the famous motto of the time 'Pike's Peak or Bust'.

To obtain the final solutions:

$$G = \dfrac{f^{(g-e)}\left(\dfrac{c}{j}\right)}{\left(\dfrac{d-a}{k}\right)+(h-b)}$$

$$G = \dfrac{266^0\,(32)}{\dfrac{55}{5}+5}$$

$$G = \dfrac{32}{11+5} = \dfrac{32}{16} = 2$$

$$A = \left(\sqrt{\dfrac{a+c}{\dfrac{f}{e}+j^k}}+(h-g)\right)^{(b-d)}$$

$$A = \left(\sqrt{\dfrac{48+60}{\dfrac{24}{12}+37^0}}+(2002-1958)\right)^{(28-26)}$$

$$A = (6+44)^2$$
$$A = 50^2$$
$$A = 2500$$

$$M = \left(\dfrac{ch}{a+e+g}\right)^{\left(\frac{j-k}{d-\sqrt{b}+f+10}\right)}$$

$$M = \left(\dfrac{(50000)(0.06)}{140+763+97}\right)^{\left(\frac{71-2}{15-\sqrt{81}+7+10}\right)}$$

$$M = \left(\dfrac{3000}{1000}\right)^{\left(\frac{69}{15-9+7+10}\right)}$$

$$M = 3^{\frac{69}{23}}$$

$$M = 3^3 = 27$$

$$E = \dfrac{\dfrac{f}{k}}{h-j} + \sqrt[c]{dg - e} + \dfrac{b}{a}$$

$$S = \left(g - e^f\right) - \left(\dfrac{d-a}{b-c}\right)$$

$$S = \left(1858 - 41^2\right) - \left(\dfrac{900 - 224}{185 - 181}\right)$$

$$E = \dfrac{\dfrac{4000}{200}}{119 - 114} + \sqrt[5]{(12)(22) - 21} + \dfrac{46}{2}$$

$$S = 177 - \dfrac{676}{4}$$

$$S = 177 - 169$$

$$S = 8$$

$$E = \dfrac{20}{5} + \sqrt[5]{264 - 21} + 23$$

$$E = 4 + 3 + 23$$

$$E = 30$$

$$G = 2$$

$$A = 2500$$

$$M = 27$$

$$E = 30$$

$$S = 8$$

$$x = \left(\dfrac{A}{M - G}\right)\left(\dfrac{E}{S}\right)$$

$$x = \left(\dfrac{2500}{27 - 2}\right)\left(\dfrac{30}{8}\right)$$

$$x = 375$$