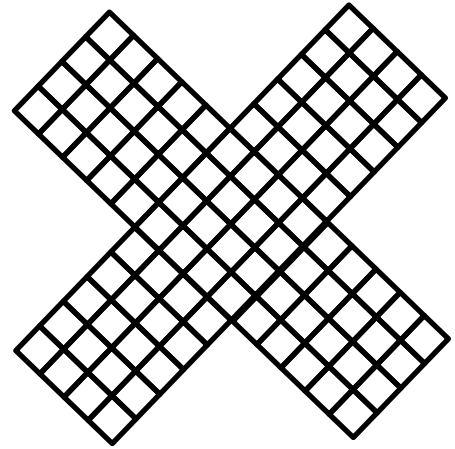


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1. This diagram is the logo of an organization that is trying to stop the killing of elephants for their ivory tusks. Each small 1 by 1 square represents one elephant per day killed in Africa in 2013.



Approximately how many elephants were killed in Africa in 2013 for the ivory in their tusks?

- A. 33,600      B. 35,000      C. 36,500  
D. 42,400      E. 45,600
2. When you multiply *625 million* by *48 trillion*, the product ends in how many zeroes?
- A. 15      B. 18      C. 19      D. 21      E. 22
3. On February 8, 2014, American Sage Kotsenburg won the first ever Olympic gold medal in a snow board event called *Slope Style*. In his trick named the Holy Grail, he rotated 1620 degrees. How many rotations is 1620 degrees?
- A. 3      B. 3.5      C. 4      D. 4.5      E. 9

*Problems #4 and #5 below are from **Buehrle's 1886 Exercises in Arithmetic**.*

4. One acre of land produces 30,000 pounds of beets. What is the value of the beet crop from 3 acres of land if the beets can be sold at \$2.00 per one thousand pounds?
- A. \$45      B. \$180      C. \$20,000      D. \$45,000      E. \$180,000
5. Five boys earn some money selling fish. The first boy earns 36 cents which is  $\frac{1}{5}$  of the whole amount earned; the second boy earns  $\frac{1}{6}$  of the whole; the third boy earns  $\frac{1}{4}$  of the whole; and the fourth boy earns the same as the second boy. If the fifth boy earns the remainder, how much does he receive?
- A. 18¢      B. 24¢      C. 36¢      D. 39¢      E. 69¢

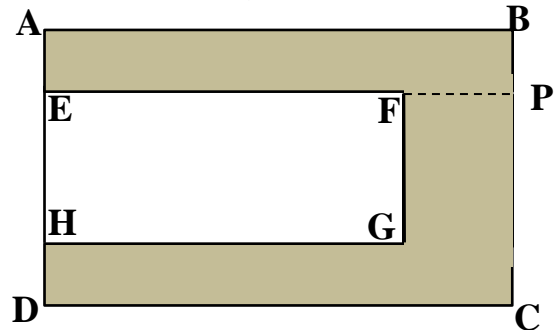
**Problems #6 and #7** below appeared in the category **Math Problems** on a round of **Double Jeopardy** on the January 30, 2014, episode of **Jeopardy**.

Amazingly, no contestant answered either of these questions correctly. Can you?

6. After Barry spends 20% of his savings, he has \$200. How much money did Barry start with?
- A. \$240      B. \$250      C. \$280      D. \$1000      E. \$1200
7. How much does it cost to carpet a rectangular 10 foot by 18 foot room if carpet costs \$10 per square yard?
- A. \$180      B. \$200      C. \$560      D. \$600      E. \$1800
8. If  $857 + 867 + 877 + 887 + 897 + 907 = 827 + 837 + 847 + 857 + 867 + 877 + N$ , what does N equal?
- A. 90      B. 120      C. 150      D. 180      E. 210

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9. In the Giant Slalom ski race in the 2014 Olympics, Bode Miller of the United States won a Bronze medal, finishing 0.53 seconds behind the Gold medal winner Kjetil Jansrud of Norway. If Bode was skiing 70 miles per hour at the finish, how many feet did he ski in 0.53 seconds? Round to the nearest foot. (There are 5280 feet in a mile.)
- A. 23            B. 33            C. 38            D. 47            E. 54
10. This is the **36<sup>th</sup> Annual Excellence in Mathematics contest**.  
From the cover of this test, note that 36 is the 6<sup>th</sup> square number and the 8<sup>th</sup> triangular number.
- What is the sum of the 20<sup>th</sup> square number and the 20<sup>th</sup> triangular number?
- A. 420            B. 540            C. 590            D. 610            E. 800
11. How many  $\frac{1}{16}$ 's are there between  $19\frac{5}{8}$  and  $25\frac{1}{4}$  ?
- A. 90            B. 94            C. 98            D. 102            E. 106
12. Which one of these four numbers is the largest?
- A.  $\sqrt{\frac{1}{49}}$             B.  $\left(\frac{1}{49}\right)^2$             C.  $\frac{1}{\sqrt{\frac{1}{49}}}$             D.  $\frac{1}{\left(\frac{1}{49}\right)^2}$
- E. None, because two of these four numbers are equal and are tied for the largest number
13. In July 2013, Dr. Herrin of Illinois was ordered by a court to return \$500,000 of an insurance settlement to the other parties in a lawsuit. He paid \$150,000 of the amount in US quarters. One US quarter weighs 0.2 ounces. How many pounds of quarters did Dr. Herrin have delivered to the lobbies of two law firms in Marion, Illinois?
- A. 1875            B. 7500            C. 46,875            D. 30,000            E. 187,500
14. For each rectangle ABCD and EFGH, its length is three times its width. If  $AB = 60$  cm and  $FP = 12$  cm, what is the total area of the shaded region?
- A.  $432 \text{ cm}^2$             B.  $436 \text{ cm}^2$             C.  $440 \text{ cm}^2$
- D.  $444 \text{ cm}^2$             E.  $448 \text{ cm}^2$



15. S, T, and L are natural numbers (not necessarily distinct) such that  $\mathbf{S \cdot T \cdot L = 180}$ .  
 What is the minimum possible value of the sum  $\mathbf{S+T+L}$ ?
- A. 16            B. 17            C. 18            D. 19            E. 20
16. According to Oxfam, in January 2014 the total wealth of the richest 85 people on Earth was 1.7 trillion dollars, the same amount as the total wealth of the poorest 3.5 billion people on Earth. Approximately what is the average wealth per person of those 3.5 billion people?
- A. 6            B. 485            C. 920            D. 4850            E. 5700

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17. Assume that the Earth is a sphere with a radius of 3960 miles.  
What is the ratio of the diameter of the Earth to the length of its equator?

- A.  $\pi$             B.  $2\pi$             C.  $\frac{1}{2\pi}$             D.  $\frac{2}{\pi}$             E.  $\frac{1}{\pi}$

18. If  $3 - x = 3x + 15$ , what does  $3x^2 - 5x$  equal?

- A. -78            B. -12            C. 12            D. 42            E. 138

19. If  $x < 0$ ,  $y > 0$ , and  $x + y \neq 0$ , which of the following three expressions must be positive?

- I.  $x(x - y)$             II.  $\sqrt[3]{-xy}$             III.  $\frac{x^2 y}{x + y}$

- A. III only            B. II and III only            C. I and II only            D. I and III only            E. I, II, and III

20. A cylindrical jar of honey that is 2 inches in diameter and 6 inches tall costs \$1.80. At the same price per cubic inch, what is the price of a jar of honey that is 4 inches in diameter and 9 inches tall?

- A. \$5.40            B. \$7.20            C. \$8.10            D. \$10.80            E. \$16.20

21. When Charles Dickens published *David Copperfield* in London in 1850, the British money system was:

**1 Pound = 20 Shillings; 1 Shilling = 12 Pence; 1 Penny = 4 Farthings**

(Note: "Pence" is the British plural for "Penny")

In *David Copperfield*, Mr. Micawber says, "Annual income twenty pounds, annual expenditure nineteen [pounds] nineteen [shillings] and six [pence], result happiness. Annual income twenty pounds, annual expenditure twenty [pounds] and six [pence], result misery."

If a person in Britain in 1850 earned 20 pounds in one year and spent 19 pounds, 19 shillings, and 6 pence, how many farthings has he not spent?

- A. 4            B. 6            C. 12            D. 16            E. 24

22. If  $(x + 3)^2 - 64$  is negative, then the full range of possible values for x is the interval:

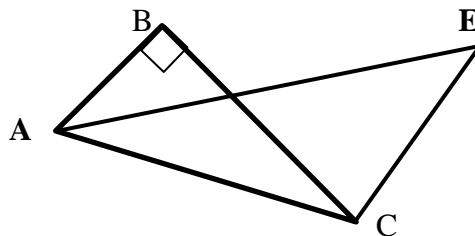
- A.  $(-11, 5)$             B.  $(-\infty, 5)$             C.  $(-\infty, 11)$             D.  $(-8, 8)$             E.  $(-8, 5)$

23. For any non-zero x, y, and z,  $(x \div (y \div z)) \div ((z \div y) \div x)$  equals:

- A.  $x^2$             B.  $\frac{1}{x^2}$             C.  $z^2$             D.  $\frac{1}{z^2}$             E.  $\frac{z^2}{y^2}$

24.  $AC = CE$ ;  $ABC$  is a right triangle;  $EA$  bisects angle  $BAC$ .  
If  $\angle ACE = 112^\circ$ , what is the measure of angle  $ACB$ ?

- A.  $22^\circ$             B.  $30^\circ$             C.  $34^\circ$   
D.  $42^\circ$             E.  $56^\circ$



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25. In feet and inches, the heights of the nine players on the 2013-14 *St. Louis Billiken's* men's basketball team who played the most number of minutes were:

**6'6"; 5'9"; 6'1"; 6'0"; 6'6"; 6'5"; 6'4"; 6'11"; 6'11"**

In inches, what is the positive difference between the median height and the mean height of these nine players?

- A. 0                      B.  $\frac{4}{9}$                       C.  $\frac{5}{9}$                       D.  $\frac{2}{3}$                       E.  $1\frac{4}{9}$

26. Of these four operation symbols, insert three different symbols (and no other symbols or numbers) into the three rectangles to make an equation.  
Be sure to follow the correct order of operations rules of arithmetic.

$$\begin{array}{ccccccc} & \times & \div & - & + & & \\ -6 & \square & 2 & \square & 8 & \square & 4 = 29 \end{array}$$

- Which symbol is NOT used?                      A.  $\times$                       B.  $\div$                       C.  $-$   
D.  $+$                       E. An equation is not possible

27. Of these four operation symbols, insert three different symbols (and no other symbols or numbers) into the three rectangles to make an equation.  
Be sure to follow the correct order of operations rules of arithmetic.

$$\begin{array}{ccccccc} & \times & \div & - & + & & \\ -6 & \square & 2 & \square & 8 & \square & 4 = -2.25 \end{array}$$

- Which symbol is NOT used?                      A.  $\times$                       B.  $\div$                       C.  $-$   
D.  $+$                       E. An equation is not possible

28. A large bucket contains eight quarts of Orange Drink which consists of 40% orange juice and 60% water. After two quarts of the Orange Drink are consumed, the host adds six quarts of pure orange juice. Now, what is the per cent orange juice in the container? Round to the nearest per cent.

- A. 60%                      B. 66%                      C. 67%                      D. 70%                      E. 75%

29. The length of each leg of an isosceles triangle is a whole number of centimeters. How many such isosceles triangles have a perimeter of 20 centimeters?

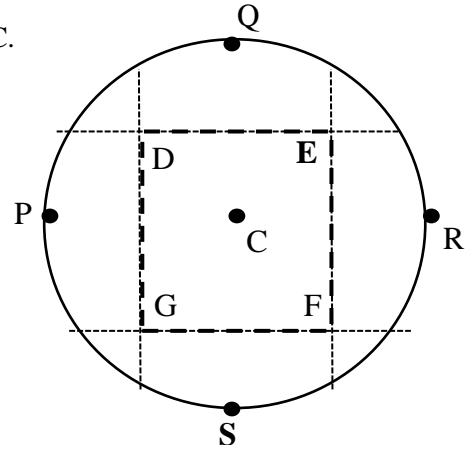
- A. 3                      B. 4                      C. 5                      D. 6                      E. 7

30. For how many eight-digit natural numbers  $N$  is  $\sqrt[3]{N}$  a natural number?

- A. 247                      B. 248                      C. 249                      D. 250                      E. 251

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31. PR and QS are perpendicular diameters of a circle with center C. Square DEFG is formed by the fold lines when the points P, Q, R, and S are folded onto point C.



What is the ratio of the area of circle C to the area of DEFG?

- A.  $\pi$       B.  $\frac{\pi}{2}$       C.  $\sqrt{3}$
- D.  $\sqrt{2}$       E.  $2\sqrt{2}$
32. In the 1980's, statisticians analyzing data noticed that a trend that appeared in different groups of data could reveal an opposite trend when the data was combined into one group. They called this phenomenon *Simpson's Paradox*. As a financial analyst at Google, Zan has studied the occurrence of *Simpson's Paradox* in revenue data collected by Google. Here is an example of *Simpson's Paradox* from baseball.

For a hitter in baseball, let  $H =$  number of hits and  $B =$  number of at-bats. Then a player's *Batting Average*  $A$  is given by:  $A = H/B$  and this number is usually rounded to three decimal places.

Complete this table.

Player	1995 statistics			1996 statistics			Combined 1995-96 stats		
	Hits H	At-Bats B	Average A	Hits H	At-Bats B	Average A	Total Hits	Total At-Bats	1995-96 Average
David Justice	104	411	<b>0.253</b>	45	140	<b>0.321</b>			<b>X</b>
Derek Jeter	12	48	<b>0.250</b>	183	582	<b>0.314</b>			<b>Y</b>

Note that David Justice had a higher batting average in both 1995 and 1996. Compute  $X - Y$ .

- A.  $-0.040$       B.  $-0.005$       C.  $0$       D.  $0.005$       E.  $0.040$
33. The Klog cereal company reduces the price of one box of Oat Flakes by 25%. However, they also reduce the number of ounces of cereal in the box by 10%. By what percent has the price per ounce of Oat Flakes been reduced?
- A. 15%      B.  $16\frac{2}{3}\%$       C. 17.5%      D. 20%      E. 22.5%
34. Valerie and Ian have the following conversation.  
 Valerie, "If you gave me \$1, we would then have the same amount of money."  
 Ian replies, "If instead you gave me \$6, I would have twice the amount of money that you would have."

What is the total amount of money that Valerie and Ian have?

- A. \$38      B. \$42      C. \$46      D. \$50      E. \$54

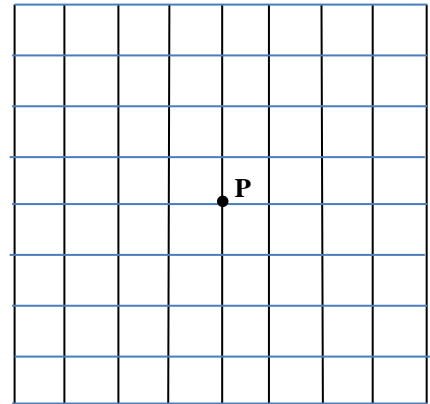
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35. Philomena takes a 4-step random walk on this grid of unit squares.

She starts at intersection P, randomly chooses which direction to go (North South, East, or West), and walks one unit. Three more times, she randomly chooses a direction and walks one unit.

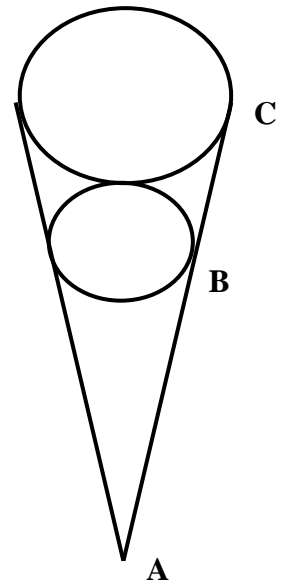
At the end of her 4-step journey, what is the probability that she is at P?

- A.  $5/64$       B.  $3/32$       C.  $7/64$   
 D.  $1/8$       E.  $9/64$



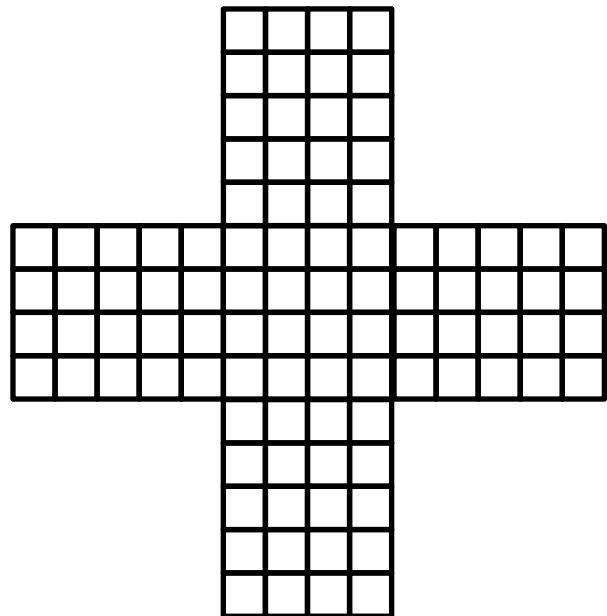
36. The two circles are tangent to each other and to the two lines. Points B and C are the points of tangency. If  $AB = 12$  and  $BC = 6$ , then what is the area of the larger circle? Round to the nearest tenth.

- A. 28.3      B. 34.8      C. 39.1  
 D. 42.4      E. 48.1



37. What is the total number of squares, 1 by 1 through 4 by 4, in this diagram?

- A. 230      B. 232      C. 238  
 D. 241      E. 244



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**Problems #38 and #39** below requires you to solve a *Kakuro* puzzle. Here is a *Kakuro* puzzle and its solution.

		15	6		
	13			12	12
	10 13				
11			10 11		
10					
		15			

		15	6		
	13	9	4	12	12
	10 13	1	2	3	4
11	9	2	10 11	2	8
10	4	3	2	1	
		15	9	6	

**RULES** for completing a *Kakuro* puzzle:

- Fill in each blank square with a natural number from 1 through 9.
- The sum of the numbers in consecutive white squares in each row or column is given.
- In each horizontal or vertical sum, a number CANNOT be repeated. For example, if two numbers sum to 16, they must be 7 and 9, not 8 and 8. (However, the same number could appear in the two sums in one row or column as in the 4<sup>th</sup> column in the above solution.)

**HINT:** Certain sums can be achieved in only one or two ways.  
For example, if four numbers sum to 28, they must either be 4, 7, 8, and 9 or 5, 6, 8, and 9.

#38. Complete this *Kakuro* puzzle.

What is the **product** of the numbers in the squares labeled A, B, and C.

- A. 320            B. 336  
C. 384            D. 432  
E. 504

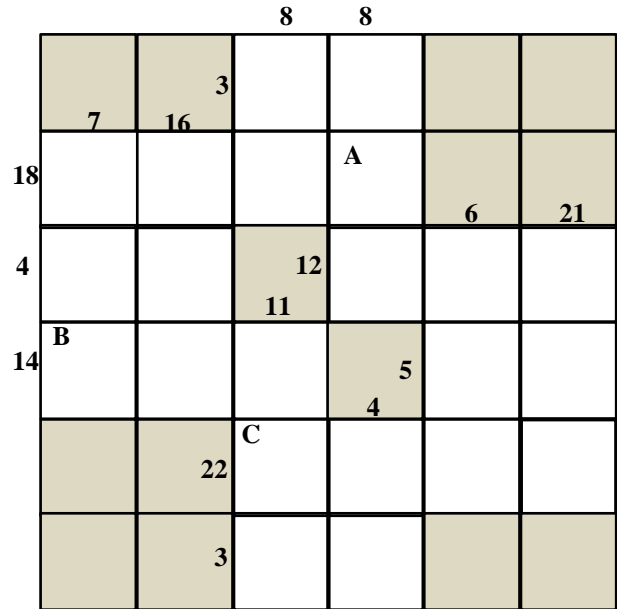
		29	16		
	17	A		28	16
	29 15				
16			16 16		
29	B				
		13		C	

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39. Complete this Kakuro puzzle.

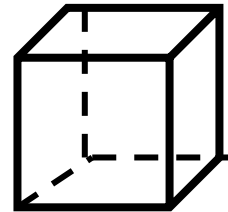
What is the **product** of the numbers in the squares labeled A, B, and C?

- A. 56                  B. 96
- C. 120                D. 140
- E. 160



40. Twelve identical line segments are used to construct a cube.

In how many ways can 3 of the 12 segments be selected so that none of the 3 selected segments are connected? (That is, each of the 3 selected segments does not touch either of the other 2 selected segments.)



- A. 36                  B. 44                  C. 48
- D. 52                  E. 56