The 37th Contest

Mathematics Educators of Greater St. Louis
and St. Louis Community College
at Florissant Valley present

Excellence In MathematicS

Eighth Grade Test
Thirty-Seventh Annual Mathematics Contest
March 21, 2015

I. Do not open the test booklet or begin work until instructed to do so by your proctor.

II. You have 75 minutes to take this test.

III. Listen carefully as the proctor explains where to write your name, the name of your school, your grade level, and how to mark your answers.

IV. You may use a calculator. You only need a four-function calculator, but you may use any calculator approved for the SAT test, which includes most graphing calculators except the TI-92 and TI-Voyager. If you are unsure whether your calculator is allowed, check with your proctor.

V. Your score will be the number of questions you answer correctly. In the event of ties, Problem #40 will be used as a tie-breaker. If ties still remain, Problem #39 will be used as a tie-breaker and so on until all ties are broken.

Eighth Grade Test - Excellence in Mathematics Contest – 2015

1. $\mathbf{48} \cdot \left(\frac{7}{4} \cdot \frac{6}{5} \cdot \frac{5}{6} \cdot \frac{4}{7} \cdot \frac{3}{8}\right)$ equals

A. 8 B. 12 C. 16 D. 18 E. 48

2. Which one of these five inequalities is true?

A. $3.6 < 3\frac{2}{3} < \frac{15}{4}$ B. $3.6 < \frac{15}{4} < 3\frac{2}{3}$ C. $\frac{15}{4} < 3\frac{2}{3} < 3.6$

D. $3\frac{2}{3} < 3.6 < \frac{15}{4}$ E. $3\frac{2}{3} < \frac{15}{4} < 3.6$

3. In circus class in San Francisco, Zan drops 20 feet from a trapeze bar onto a bouncy net and bounces several times. The first time she rebounds 15 feet; then she rebounds 10 feet; then she rebounds 5 feet; and then she stops on the net. Including up and down, what is the total distance that Zan traveled from the time she left the trapeze bar until the time she stopped bouncing?

A. 50 feet B. 65 feet C. 80 feet D. 90 feet E. 100 feet

4. The three digits 1, 6, and 9 can be used to form three different 3-digit square numbers. What is the sum of these three square numbers? Note: Each of these 3-digit numbers contains one 1, one 6, and one 9.

A. 984 B. 1056 C. 1281 D. 1326 E. 1749

5. Two rectangles each have perimeter 64 cm. In area, how much larger is the rectangle with length 18 cm than the rectangle with width 20 cm?

A. 0 cm^2 B. 4 cm^2 C. 8 cm^2 D. 12 cm^2 E. 16 cm^2

6. The numbers 2013, 2014, and 2015 each have exactly three prime factors.
What is the sum of those nine prime numbers?

A. 198 B. 217 C. 559 D. 1135 E. 2094

7. Ridi is 2/3 as tall as his mother. If Ridi's height is 3 feet 6 inches, how tall is his mother?

A. 2 feet 4 inches B. 4 feet 6 inches C. 4 feet 8 inches
D. 5 feet 3 inches E. 5 feet 9 inches

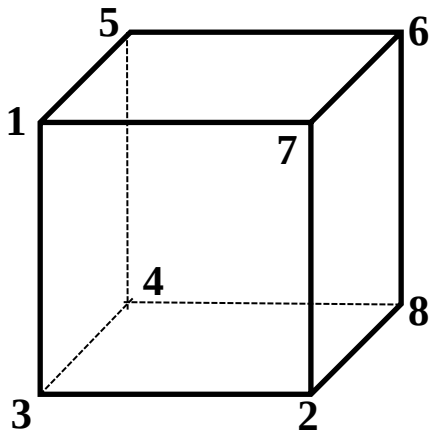
8. In 18 football games in the 2014 season, Marshawn Lynch of the Seattle Seahawks rushed for an average of 84.6 yards per game. In his best 4 games, he ran for 157 yards, 140 yards, 124 yards, and 110 yards.
How many yards per game did he average in the other 14 games?
Round to the nearest tenth of a yard .

A. 55.1 B. 70.8 C. 76.2 D. 79.5 E. 80.3

9. On this 40-item Excellence in Mathematics Contest, the 5-student Green Rock Park Middle School's goal as a team is to get 80% of the questions correct. If four students get 67.5%, 77.5%, 82.5%, and 85% correct, how many questions must their fifth student get correct to earn a team average of exactly 80%?

A. 32 B. 33 C. 34 D. 35 E. 36

10. The vertices of this cube are labeled 1 through 8. For each edge, add the two numbers at the end-points of that edge. For the 12 edges, you should have 11 different sums. Which sum is repeated?



A. 7 B. 8 C. 9
D. 10 E. 11

11. Referring to the cover of this test, *Big Bang Theory's* Sheldon Cooper often wears a T-shirt with the number 73 on it. 73 is his favorite number because 73 is the 21st prime number and 37 is the Nth prime number. What is N?

A. 10 B. 11 C. 12 D. 13 E. 14

12. On November 11, 1911, Springfield Missouri set BOTH its record daily high temperature for November 11 and its record low temperature for November 11. The temperature dropped from 80°F at 3:45 PM to 13°F at midnight. In degrees per hour, what was the average rate of decrease of the temperature? Round to the nearest tenth of a degree per hour.

A. 6.9°F/hr B. 7.2°F/hr C. 7.7°F/hr D. 8.1°F/hr E. 10.7°F/hr

13. If A = 7 and B = 20, then $(\mathbf{A}-\mathbf{B})^{\mathbf{2}}-(\mathbf{B}-\mathbf{A})^{\mathbf{2}}$ equals

A. 0 B. –169 C. –338 D. 169 E. 338

14. Each of the three letters in this sum represents a <u>different</u> non-zero digit. What does A+B+C equal?

$$\begin{array}{r} AB \\ +\ BA \\ \hline CAC \end{array}$$

A. 11 B. 12 C. 13 D. 14 E. 15

15. In rectangle ABCD, M is the midpoint of AB and N is the midpoint of BC. What is the ratio of the area of triangle BND to the area of triangle CMD?

A. 1/4 B. 1/3 C. 1/2 D. 1 E. 2

16. In November 2014, the European Space Agency's Rosetta mission soft-landed its Philae probe on Comet 67P. In its journey from Earth to Comet 67P, the Philae probe flew **K** km. Assume that Philae maintained a constant speed of **S** kilometers per day. Before it landed on Comet 67P and **D** days after its launch from Earth, which algebraic expression represents the number of kilometers remaining in its journey to 67P?

A. **K – DS** B. **K – D – S** C. **DS** D. **K + DS** E. **DS – K**

17. Let $\mathbf{N = 0.\overline{9} = 0.9999\ldots}$ Which <u>one</u> of these five statements is TRUE?

A. $N = \frac{1}{9}$ B. $N = \frac{10}{11}$ C. N = 0.99 D. N < 1 E. N = 1

18. Let: **WA** = number of White Americans **AF** = number of African Americans
HL = number of Hispanic or Latino Americans **AA** = number of Asian Americans
According to the 2010 US Census, the ratio of the populations of these four racial or ethnic groups is approximately: **WA:AF:HL:AA = 16:3:4:1**
If there were a total of 301.4 million Americans in these four populations in 2010, how many more million African Americans were there than Asian Americans? Round to the nearest tenth of a million.

A. 25.1 B. 27.4 C. 30.1 D. 37.7 E. 45.2

19. <u>How many</u> of the following five statements are TRUE?
    1. One mile is longer than one kilometer.
    2. One quart of water has greater volume than one liter of water.
    3. One pound of beef weighs more than one kilogram of beef.
    4. One inch is longer than one centimeter.
    5. A temperature of 0^oC is warmer than a temperature of 0^oF.

A. 1 B. 2 C. 3 D. 4 E. 5

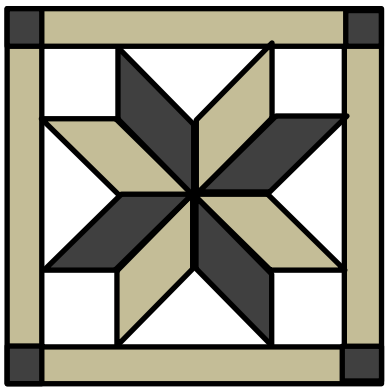
20. At the age of 22 in 1972 when Rick was teaching students in Malaysia, he was 30% older than the average age of his students. When he returns to see them in 2015, what per cent older will he be than the average 2015 age of his ex-students? Round to the nearest tenth of a per cent.

A. 8.5% B. 8.8% C. 10.2% D. 11.3% E. 12.5%

21. A square with perimeter 36 cm has the same area as a circle. What is the circumference of the circle? Round to the nearest tenth of a centimeter.

A. 18.0 B. 21.3 C. 31.9 D. 37.7 E. 56.5

22. In this quilt pattern, each dark gray square is 1 cm by 1 cm, each white square is 2 cm by 2 cm, each light gray rectangle is 1 cm by 8 cm, and the 8 parallelograms are congruent.



What is the total area in square centimeters of the eight regions shaded light gray?

A. 36 B. 40 C. 44

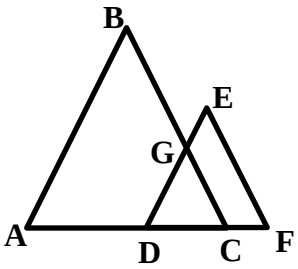
D. 48 E. 64

23. A bag contains 6 red, 9 blue, and 5 green marbles. One at a time, two marbles are randomly drawn without replacement from the bag.

What is the probability that they are the same color? Round to the nearest per cent.

A. 30% B. 31% C. 32% D. 33% E. 34%

24. ABC and DEF are equilateral triangles. AD = 2DC and DC = 2CF



If the perimeter of ABC is 54 cm, what is the perimeter of the trapezoid EFCG?

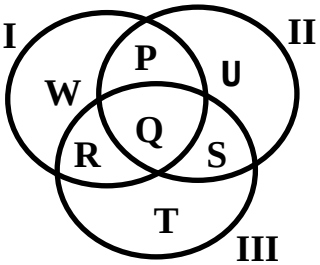
A. 18 cm B. 21 cm C. 24 cm D. 27 cm E. 36 cm

25. Let M be the fifty-digit number **333…3333**; that is, all of M's fifty digits are 3's.

What is the sum of the digits of the product $\mathbf{72 \cdot M}$?

A. 432 B. 441 C. 446 D. 450 E. 455

26. After which of the following steps can you first conclude that point X is in region P?



Step A: X is not in region R

Step B: X is in circle I

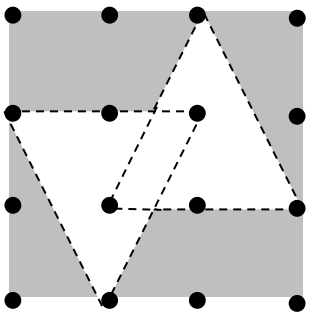
Step C: X is not in circle III

Step D: X is not in region W

Step E: X is in circle II

A. A B. B C. C D. D E. E

27. On this grid of equally spaced lattice points, what fraction of the large square is white?



A. 7/18 B. 4/9 C. 3/8

D. 1/2 E. 5/9

28. The first three verses of the Christmas song ***Twelve Days of Christmas*** are:

On the first day of Christmas my true love sent to me:

A Partridge in a Pear Tree

On the second day of Christmas my true love sent to me:

2 Turtle Doves; and a Partridge in a Pear Tree

On the third day of Christmas my true love sent to me:

3 French Hens; 2 Turtle Doves; and a Partridge in a Pear Tree

This pattern continues until the 12th and final verse:

On the twelfth day of Christmas my true love sent to me:

12 Drummers Drumming; 11 Pipers Piping; 10 Lords a Leaping

9 Ladies Dancing; 8 Maids a Milking; 7 Swans a Swimming

6 Geese a Laying; 5 Golden Rings; 4 Calling Birds

3 French Hens; 2 Turtle Doves; and a Partridge in a Pear Tree

What is the sum of the number of drummers, pipers, lords, ladies, maids, swans, geese, golden rings, calling birds, French hens, turtle doves, and partridges mentioned in the standard 12 verses of the song?

A. 362 B. 363 C. 364 D. 365 E. 366

29. $1+3+5+7+\ldots+2009+2011+2013+2015 = N^2$. What is N?

A. 1006 B. 1007 C. 1008 D. 2014 E. None of these

30. A, B, and C are three different integers from set S. **S = { –8 , –6, –2, 0, 1, 3, 5}**

What is the least possible value of the expression **AB+C**?

A. –34 B. –38 C. –45 D. –46 E. –51

31. Jim is hiking at a pace of 5 km per hour and he takes 96 steps per minute.

To the nearest centimeter, what is the average length of each of Jim's steps?

A. 87 cm B. 88 cm C. 89 cm D. 90 cm E. 91 cm

32. For any whole number N, the N^{th} triangular number T_N is given by: $\mathbf{T_N = \frac{N(N+1)}{2}}$.

Of all triangular numbers T_N, what per cent are multiples of 10?

A. 10% B. 12.5% C. 15% D. 20% E. 25%

33. What is the value of this expression? $\dfrac{\mathbf{2^{2015}+4^{1008}}}{\mathbf{8^{671}+16^{504}}}$

A. 1 B. 4 C. $\frac{3}{2}$ D. $\frac{4}{3}$ E. $\frac{8}{9}$

34. Exactly 120 different 5-digit whole numbers can be written with these 5 digits: 3, 4, 5, 6, 7 .

Note: All five digits are used in each 5-digit number.

How many of those 120 5-digit numbers are divisible by 11?

A. 0 B. 2 C. 4 D. 6 E. 12

35. On a street with 32 houses: 7 have fewer than 6 rooms; 12 have more than 7 rooms; and 4 have more than 8 rooms. How many of these houses have 6, 7, or 8 rooms?

A. 19 B. 20 C. 21

D. 25 E. Cannot be determined with this information

36. The sum of the 10^{th} term and the 13^{th} term of an Arithmetic Sequence equals the 15^{th} term. If the 40^{th} term is 8, what is the 1^{st} term of this sequence?

A. – 2 B. – 1.75 C. – 1.5 D. 0.5 E. 1

37. A pile of nickels, dimes, and quarters is worth \$20.15 . There are 86 coins.

If there is an odd number of nickels, how many more dimes than nickels are there?

A. 2 B. 4 C. 6 D. 8 E. 12

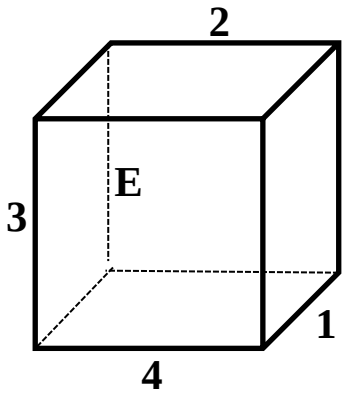
38. ***A Magic Cube***! A cube has 12 edges and 6 faces. The numbers 1 through 12 (without repetition) are assigned to the edges of this cube so that the sum of the numbers on the 4 edges of each **face** is 26.

The numbers 1, 2, 3, and 4 are already assigned.

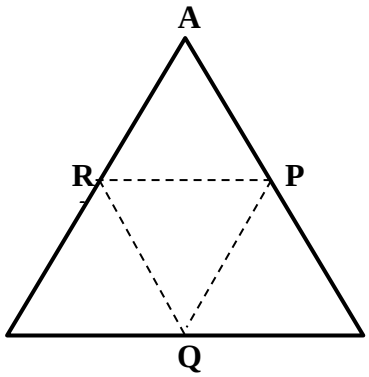
What number is on the edge marked E?

A. 5 B. 6 C. 7

D. 8 E. 9



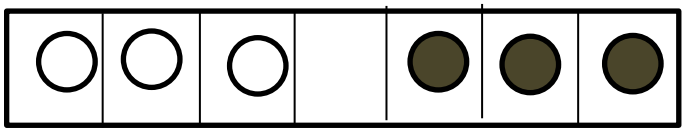
39. An equilateral triangle with vertex A and midpoints P, Q, and R is folded to form a regular tetrahedron with vertices A, P, Q, and R.
. If the height of the tetrahedron is 8 cm, what is the area of triangle PQR? Round to the nearest square centimeter.



A. 13.7 cm^2 B. 27.4 cm^2 C. 30.2 cm^2

D. 38.2 cm^2 E. 41.6 cm^2

40.



The goal of this puzzle is to switch the positions of the 3 unshaded discs with the positions of the 3 shaded discs.

In this puzzle, only these two types of ***moves*** are allowed:

1. Slide one disc to an empty square next to it.
2. Jump over exactly one disc to an empty square (the jumped disc is not removed).

Note: Any move may be to the left or to the right.

What is the minimum number of *moves* needed to switch the positions of the three shaded discs with the three unshaded discs ?

A 15 B. 16 C. 17 D. 19

E. Using only these *moves*, it is not possible to switch the positions of these discs.