

**3 x 13**

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

## **Excellence In Mathematics**

*Thirty-Ninth Annual Mathematics Contest*

**Sixth Grade Test ----- March 18, 2017**

- 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. There are 36 problems.
- 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. Phones or other electronic devices may NOT be used for any purpose.
- VI. Your score will be the number of questions you answer correctly. In the event of ties, Problem #36 will be used as a tie-breaker. If ties remain, Problem #35 will be used as a tie-breaker and so on until all ties are broken.

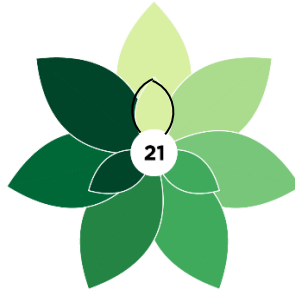
**Note:** More *Botanical Prime* art works of *Nicholas Rougeux* are at: <https://www.c82.net/work/?id=352>

*Sixth Grade Test - Excellence in Mathematics Contest – 2017*

- How many whole numbers between 20 and 100 include the digit “3” at least once?  
A. 16      B. 17      C. 18      D. 19      E. 20
- If the five numbers in answers A through E below were written in order from least to greatest, which would be the middle number?  
A. 0.6      B. 0.00915      C. 0.41      D. 0.083      E. 0.386
- Calculate:  $(68 - 25) + (68 - 75) + (68 - 100) + (68 - 25) + (68 - 50)$  .  
A. 65      B. 75      C. 69      D. 129      E. 143
- On a poster, Nick Rougeux has created a beautiful way to depict the prime factorization of a number. His depictions for 7, 21, and 24 are shown.



**7**  
**7 petals**



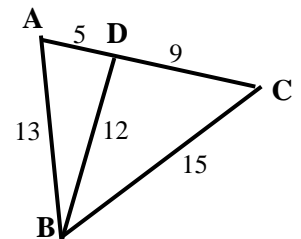
**3 x 7**  
**10 petals**



**2 x 2 x 2 x 3**  
**9 petals**

Following the same pattern, how many petals would Nick’s flower for “**36**” have?

- A. 10      B. 11      C. 12      D. 13      E. 15
- One large can of beef stew can feed 6 adults or 10 children. From 8 cans of beef stew, a church first serves 55 children. How many adults can be served with the remaining beef stew?  
A. 12      B. 15      C. 18      D. 21      E. 25
- Segment BD is perpendicular to segment AC.  
With the given lengths in centimeters, what is the area of triangle ABC?



- The average of 25 consecutive whole numbers is 2017. What is the largest of those 25 numbers?  
A. 2029      B. 2029.5      C. 2030      D. 2041      E. 2042

*Sixth Grade Test - Excellence in Mathematics Contest – 2017*

8. Of an \$8,000 prize, Zeb received 40% while Xena received \$300 more than Caitlyn. How much more money did Zeb receive than Caitlyn?

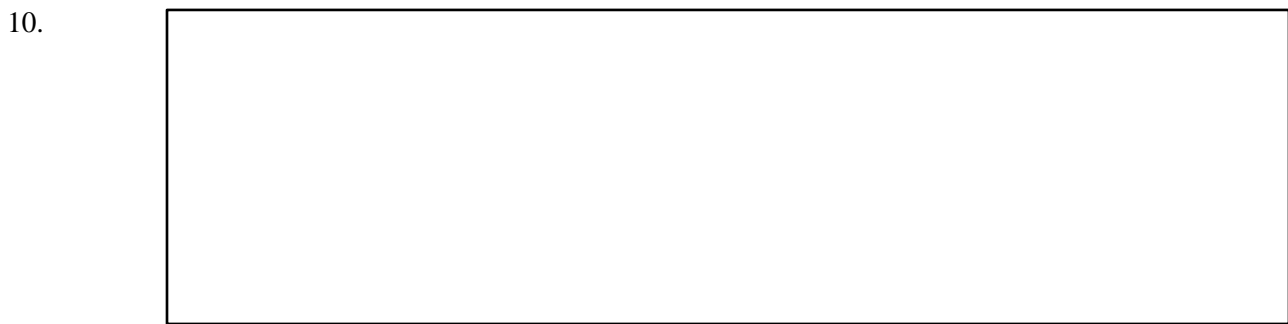
- A. \$500      B. \$650      C. \$800      D. \$950      E. \$1050

9. Make a correct addition problem by replacing each of the letters A, B, C, D, and E with a digit. In this problem, different letters can represent the same digit.

$$\begin{array}{r} \mathbf{E\ 5,\ 8\ 3\ A} \\ + \mathbf{2,\ C\ B\ 8} \\ \hline \mathbf{5\ D,\ 2\ 0\ 4} \end{array}$$

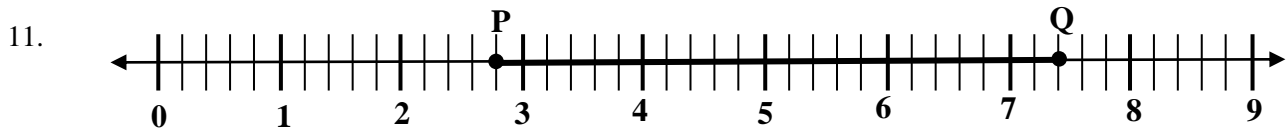
What is the sum  $A+B+C+D+E$ ?

- A. 24      B. 25      C. 26      D. 27      E. 28



Estimate the length and width of this rectangle. Which of the following is the best estimate of the perimeter of this rectangle?

- A. 36 cm      B. 36 mm      C. 1.8 m      D. 18 m      E. 5 cm



The marks on this number line are equally spaced. What is the length of line segment PQ?

- A. 4.25      B. 4.75      C. 4.3      D. 4.6      E. 4.8

12. How many whole numbers lie between  $2 + \sqrt{62}$  and  $10\pi$ ?

- A. 19      B. 20      C. 21      D. 22      E. 23

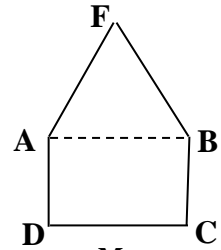
13. A 2-pound bag of oranges costs \$3.24 and a 3-pound bag of apples costs \$3.80. You buy a total of 36 pounds of oranges and apples. If the weight of the apples you buy is twice the weight of the oranges you buy, what is the total cost for your 36 pounds of apples and oranges?

- A. \$48.72      B. \$48.98      C. \$49.84      D. \$52.86      E. \$53.64

*Sixth Grade Test - Excellence in Mathematics Contest – 2017*

14. The equilateral triangle AFB and the rectangle ABCD have the same perimeter. If  $AB = 8$  cm, what is the area of rectangle ABCD?

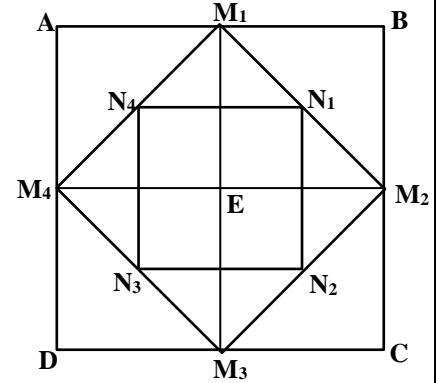
A.  $16 \text{ cm}^2$     B.  $24 \text{ cm}^2$     C.  $32 \text{ cm}^2$     D.  $36 \text{ cm}^2$     E.  $64 \text{ cm}^2$



15. In the diagram, ABCD is a square with center E. All points labeled  $M_i$  or  $N_i$  are midpoints of their respective edges.

How many squares are in this diagram?

A. 8            B. 10            C. 11            D. 12            E. 13



16. Find the sum of the two least whole numbers such that each of the two numbers has a remainder of 1 when divided by 5 and a remainder of 2 when divided by 6.

A. 80            B. 82            C. 84            D. 86            E. 88

17. From 10:40 AM until 1:30 PM, Lance rides his bicycle at an average rate of 24 miles per hour. How many miles has he bicycled?

A. 44            B. 60            C. 64            D. 68            E. 92

18. Determine the sum of the reciprocals of  $4\frac{1}{3}$  and  $2\frac{1}{6}$ .

A.  $9/13$             B.  $9/26$             C.  $18/13$             D.  $2/13$             E.  $13/2$

19. After their California wedding in June, Zan and Jonas took a 4-month trip. The lengths of their flights are recorded in the table below.

<b>Leg</b>	San Francisco	Anchorage	New York City	Windhoek Namibia	Johannesburg South Africa	Cairo Egypt	Santiago Chile	Saint Louis
	Anchorage	New York City	Windhoek Namibia	Johannesburg South Africa	Cairo Egypt	Santiago Chile	Saint Louis	San Francisco
<b>Distance (km)</b>	3240	5430	11700	1180	6230	12800	8230	2810

The Earth is approximately a sphere with a radius of 6370 km. The total flight distance of their trip is equal to how many times around the Earth at the equator? Round to the nearest tenth.

A. 0.8            B. 1.1            C. 1.3            D. 1.5            E. 1.8

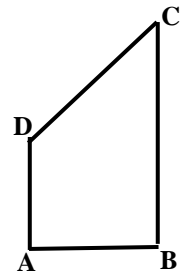
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20. What is the sum of this series:  $1 + 2 - 3 + 4 + 5 - 6 + 7 + 8 - 9 + \dots + 58 + 59 - 60$  ?
- A. 510      B. 525      C. 540      D. 570      E. 600

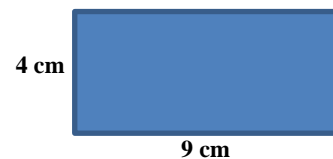
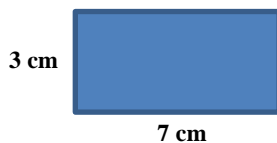
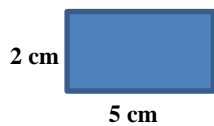
21. In a basketball game, Steph, Kevin, Klay, and Draymond scored all their team's points. Draymond scored  $\frac{1}{6}$  of their points, Steph scored  $\frac{2}{5}$  of their points, Kevin scored twice as many points as Draymond, and Klay made four 3-point baskets and no other points. How many points did Draymond score?
- A. 12      B. 15      C. 18      D. 20      E. 25

22. A jar is  $\frac{4}{5}$  full of red and yellow jelly beans.  $\frac{5}{8}$  of those jelly beans are red. Blue jelly beans are added to fill the jar. What percent of the beans in the full jar are yellow?
- A. 25%      B. 30%      C.  $33\frac{1}{3}\%$       D. 35%      E. 37.5%

23. On trapezoid ABCD, angles A and B are right angles.  $AB = 9$  cm and  $CD = 15$  cm. If the area of the trapezoid is 99 square centimeters, what is its perimeter?
- A. 29 cm      B. 34 cm      C. 41 cm      D. 46 cm      E. 55 cm



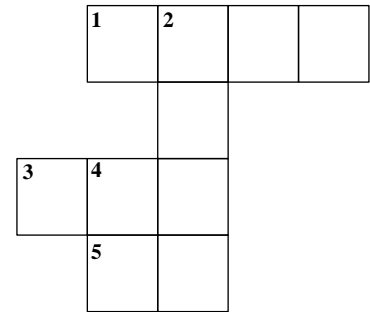
24. The first three rectangles in a sequence are shown. After the first rectangle, the next rectangle in the sequence is 2 cm longer and 1 cm wider than the previous rectangle. In square centimeters, what is the area of the 20<sup>th</sup> rectangle in this sequence?



- A.  $820 \text{ cm}^2$       B.  $860 \text{ cm}^2$       C.  $861 \text{ cm}^2$       D.  $903 \text{ cm}^2$       E.  $945 \text{ cm}^2$
25. Using three different numbers from this set,  $\{-10, -6, -2, 4, 8\}$ , what is the least possible value of  $\frac{A-B}{C}$  ?
- A.  $-9$       B.  $-8$       C.  $-4\frac{1}{2}$       D.  $-1\frac{2}{5}$       E.  $\frac{3}{5}$
26. An 8-foot long board is to be cut into three pieces in the ratio 2:3:7. What is the length of the longest piece?
- A. 4 feet, 2 inches      B. 4 feet, 4 inches      C. 4 feet, 5 inches  
D. 4 feet, 6 inches      E. 4 feet, 8 inches

*Sixth Grade Test - Excellence in Mathematics Contest – 2017*

27. In this *Cross-Number Puzzle*, the clue for each of the five numbers [1-Across; 3-Across; 5-Across; 2-Down; and 4-Down] is “*Power of 2*”. What is the sum of all ten digits in the finished puzzle?



- A. 38      B. 39      C. 40  
D. 41      E. 42

28. From the Norman Conquest of 1066 until the year 1971, the British money system included Pounds (£), Shillings (s), and Pence (d). *12 Pence equaled 1 shilling and 20 Shillings equaled 1 Pound.*

In 1965, a bookseller was given 20 £ for the purchase of three books each worth **4 £, 8 s, 6 d**. How much change did the customer receive?

- A. 6 £, 5 s, 4 d    B. 6 £, 14 s, 6 d    C. 6 £, 15 s, 4 d    D. 6 £, 14 s, 4 d    E. 7 £, 5 s, 6 d

29. In how many different ways can 6 children line up on a toboggan if the two youngest, Sarah and Anthony, each refuse to sit at the front of the toboggan?

- A. 120      B. 384      C. 480      D. 600      E. 720

30. On square ABCD, E is the midpoint of AB, F is the midpoint of BC, and P is the midpoint of FC. What is the ratio of the area of the pentagon AEPCD to the area of triangle EFB?

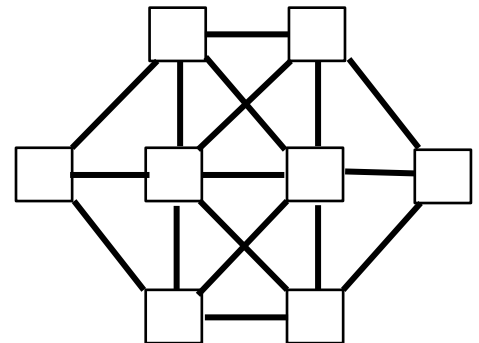
- A.  $13/2$       B.  $13/3$       C. 6      D. 7      E.  $8/3$

31. Megan has a fair 6-sided die labeled with the numbers: 2, 2, 4, 4, 6, 6 . Paolo has a fair 6-sided die labeled with the numbers: 3, 3, 5, 5, 5, 5 . Megan and Paola each roll their die once. What is the probability that Paolo rolls the higher number?

- A.  $4/9$       B.  $1/2$       C.  $5/9$       D.  $2/3$       E. None of these

32. Place the eight numbers 1 through 8 into the boxes in this diagram so that adjacent numbers (for example, 6 and 7) are not connected by a line segment.

How many different ways are there to complete the diagram?  
Note: Two solutions are different if all eight numbers are not in same eight locations.

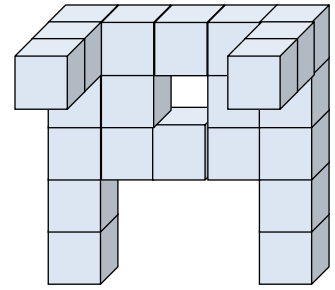


- A. 1      B. 2      C. 4      D. 8      E. 16

*Sixth Grade Test - Excellence in Mathematics Contest – 2017*

33. This “creature” consists of the 22 one-centimeter cubes that you can see. What is the surface area of the creature?

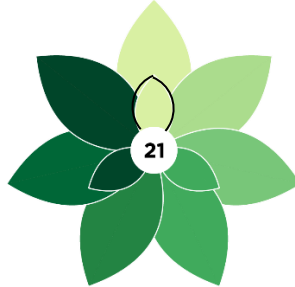
- A.  $68 \text{ cm}^2$     B.  $72 \text{ cm}^2$     C.  $76 \text{ cm}^2$     D.  $79 \text{ cm}^2$     E.  $80 \text{ cm}^2$



34. On a poster, Nick Rougeux has created a beautiful way to depict the prime factorization of numbers from 2 through 101. His depictions for 7, 21, and 24 are shown.



**7**



**3 x 7**



**2 x 2 x 2 x 3**

Following the same pattern, how many of Nick’s 100 flowers will have exactly 11 petals?

- A. 3    B. 4    C. 5    D. 6    E. More than 6

35. In the 3-person version of the game “**Rock, Paper, Scissors**”, assume that each person randomly chooses “*Rock*”, “*Paper*”, or “*Scissors*”, and then all three choices are announced [or “shown”] at the same time.

With three people, the game ends after the first round only if:

- one person chooses *Rock* and the other two choose *Scissors*
- OR one person chooses *Scissors* and the other two choose *Paper*
- OR one person chooses *Paper* and the other two choose *Rock*.

Calculate the probability that the game does end after the first round.

- A.  $8/27$     B.  $1/3$     C.  $11/27$     D.  $1/9$     E.  $2/9$

36. In the diagram, ABCD is a square with center E. All points labeled  $M_i$  or  $N_i$  are midpoints of their respective edges.

How many ways are there to choose a sequence of three squares so that the:

- *The interior of the smallest square you choose is inside the medium square you choose*
- and *the interior of the medium square you choose is inside the largest square you choose?*

- A. 8    B. 9    C. 12    D. 13    E. 17

