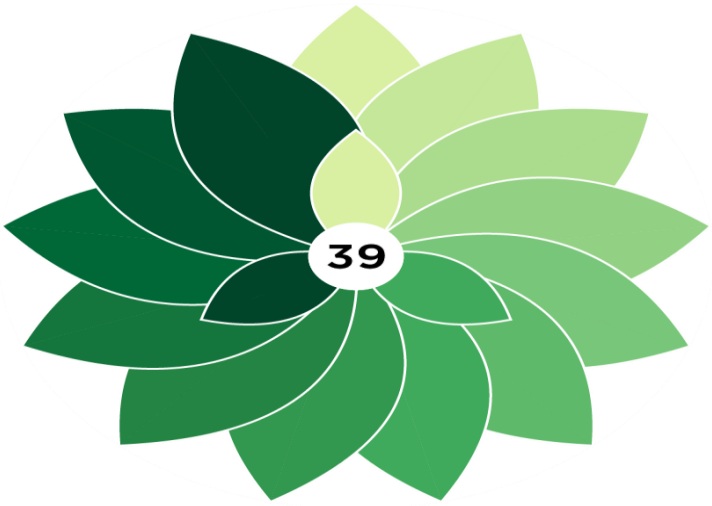


3 x 13

Mathematics Educators of Greater St. Louis

and *St. Louis Community College at Florissant Valley present*

Excellence In MathematicS

Thirty-Ninth Annual Mathematics Contest

Seventh 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. <u>You may use a calculator</u>. 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. **<u>Phones or other electronic devices may NOT be used for any purpose.</u>**

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.

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

Seventh Grade Test - Excellence in Mathematics Contest – 2017

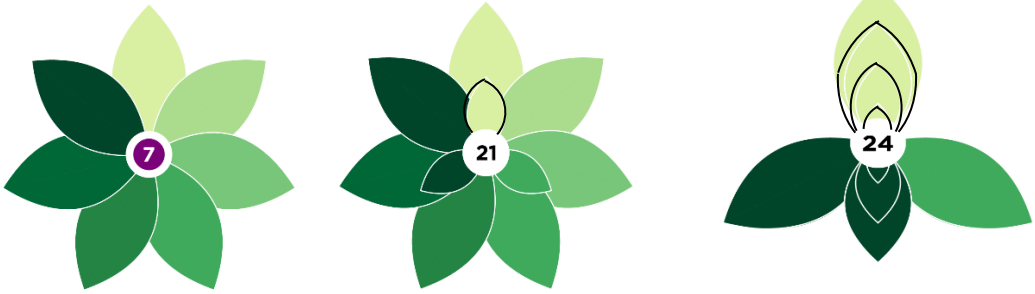
1. One large can of beef stew can feed 6 adults or 10 children. From 8 cans of beef stew, a church first serves 55 children. How many adults can be served with the remaining beef stew?

   A. 12 B. 15 C. 18 D. 21 E. 25

2. Calculate: $(68-25)+(68-75)+(68-100)+(68-25)+(68-50)$.

   A. 65 B. 75 C. 69 D. 129 E. 143

3. 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.



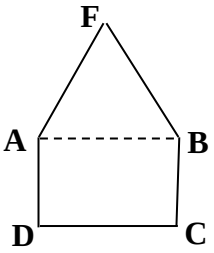
7 **3 x 7** **2 x 2 x 2 x 3**

7 petals **10 petals** **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

4. 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 cm^2 B. 24 cm^2 C. 32 cm^2 D. 36 cm^2 E. 64 cm^2

5. 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

6. Determine the positive difference between the *reciprocal of the sum of* $4\frac{1}{3}$ *and* $2\frac{1}{6}$ and the *sum of the reciprocals of* $4\frac{1}{3}$ *and* $2\frac{1}{6}$.

   A. 151/26 B. 7/13 C. 9/13 D. 13/7 E. 13/9

7. How many integers lie between $\mathbf{2-\sqrt{50}}$ and $\mathbf{3\pi}$?

   A. 12 B. 13 C. 14 D. 15 E. 16

8. 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

9. 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

10.

Age (years)	11	12	13	14	15
Number of Students	8	6	7	1	3

What is the positive difference between the mean age and the median age of this group of students?

A. 0 B. 0.4 C. 0.6 D. 1.0 E. 1.4

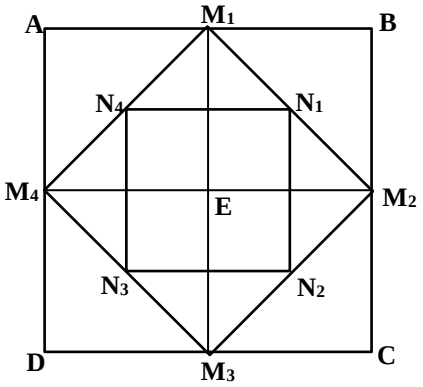
11. M and N are positive integers such that the product MN = 4000. Neither number, M nor N, contains the digit 0. What is the sum of the digits of both M and N?

A. 12 B. 13 C. 15 D. 16 E. 17

12. 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

13. 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

14. How many ounces are there in P pounds and Q ounces?

A. 16P + Q B. $\frac{P}{16} + Q$ C. P + Q D. $P + \frac{Q}{16}$ E. P + 16Q

15. 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.

Leg	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
Distance (km)	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

16. What is the sum of this series: $\mathbf{1+2-3+4+5-6+7+8-9+\cdots+58+59-60}$?

A. 510 B. 525 C. 540 D. 570 E. 600

17. In a basketball game, Steph, Kevin, Klay, and Draymond scored all their team's points. Draymond scored 1/6 of their points, Steph scored 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

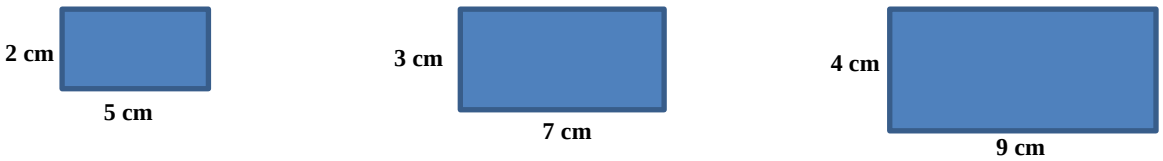
18. A jar is 4/5 full of red and yellow jelly beans. 5/8 of those jelly beans are red. Blue jelly beans are added to fill the jar. What percent of the beans in the full jar are yellow?

A. 25% B. 30% C. $33\frac{1}{3}\%$ D. 35% E. 37.5%

19. For 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

20. The <u>first three</u> 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 20th rectangle in this sequence?

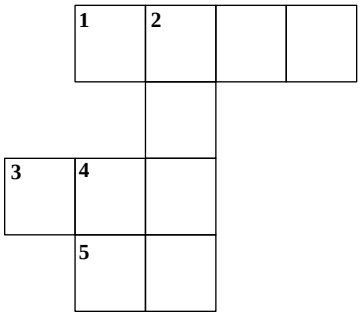


A. 504 cm^2 B. 860 cm^2 C. 861 cm^2 D. 903 cm^2 E. 990 cm^2

21. Using three different numbers from this set, $\{\mathbf{-10,-6,-2,4,8}\}$, what is the least possible value of $\frac{\mathbf{A-B}}{\mathbf{C}}$?

A. -9 B. -8 C. $-4\frac{1}{2}$ D. $-1\frac{2}{5}$ E. $\frac{3}{5}$

22. 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

23. The Fibonacci Sequence: *1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 134*, …. provides surprisingly accurate conversions between *miles per hour* and *kilometers per hour*. For example, 8 mph ≈ 13 kph and 55 mph ≈ 89 kph.

Using the conversion: *1 mph ≈ 1.6093 kph,* what is the percent error when 55 kph is used for an estimate of 34 mph? Round to the nearest tenth of a percent.

A. 0.1% B. 0.5% C. 1.2% D. 1.5% E. 5.2%

24. 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

25. An 8-foot long board is to be cut into three pieces in the ratio 2:3:7. What will be 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

26. 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

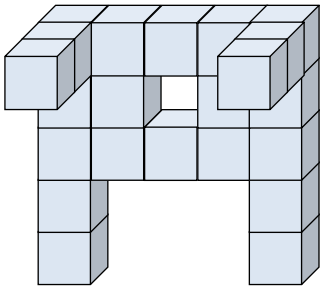
27. On square ABCD, E is the midpoint of AB, F is the midpoint of BC, and P is the midpoint of FC.
What is the ratio of the area of the pentagon AEPCD to the area of triangle EFB?

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

28. 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?

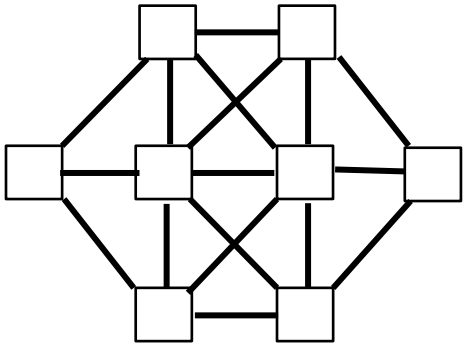
A. 120 B. 384 C. 480 D. 600 E. 720

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



A. 68 cm^2 B. 72 cm^2 C. 76 cm^2 D. 79 cm^2 E. 80 cm^2

30. Place the eight numbers 1 through 8 into the boxes in this diagram so that adjacent numbers (for example, 6 and 7) are <u>not</u> 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

31. 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.

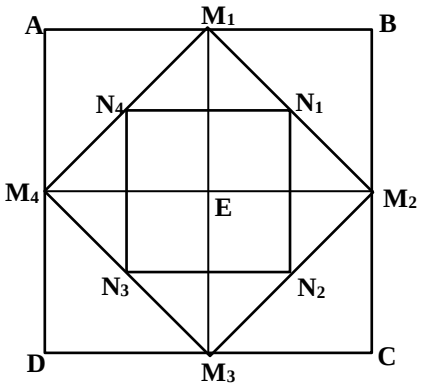
With three people, the game ends after the first round only if:

- one person chooses *Rock* and the other two choose *Scissors*
- <u>OR</u> one person chooses *Scissors* and the other two choose *Paper*
- <u>OR</u> 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

32. 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:

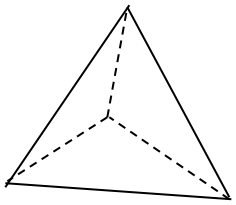
- *The interior of the smallest square you choose is inside the medium square you choose*
- <u>and</u> *the interior of the medium square you choose is inside the largest square you choose?*

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

33. If x, y, and z are integers and $(x+7)^2+(y+1)^2+(z-7)^2=133$, what is the least possible value of the sum $x+y+z$?

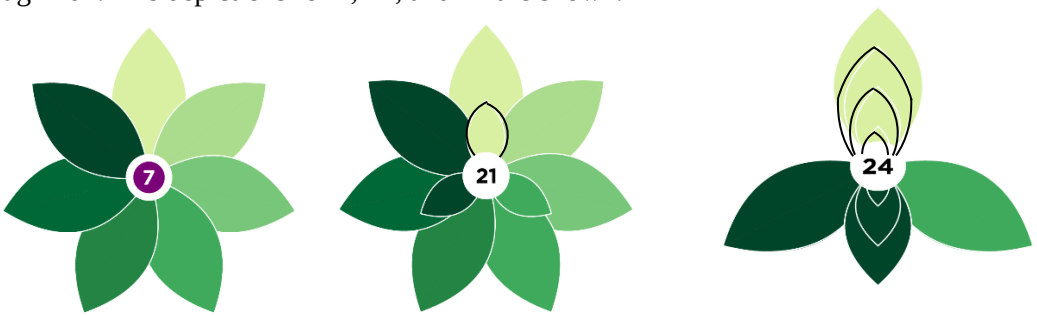
A. -20 B. -17 C. -12 D. 4 E. 12

34. On <u>each</u> of the four faces of a regular tetrahedron, the midpoints of two different edges of the face are randomly selected and connected with a line segment.
What is the probability that three of those four segments form an equilateral triangle?



A. 1/27 B. 2/27 C. 1/9 D. 4/27 E. 2/9

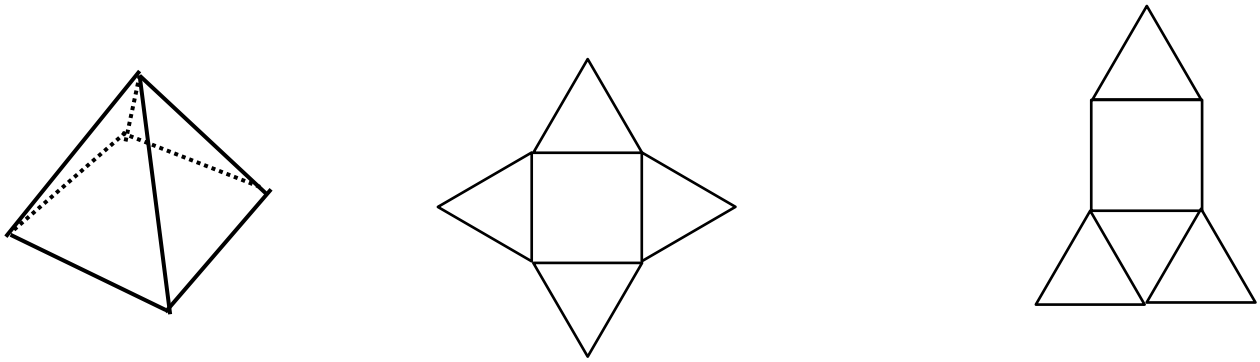
35. On a poster, Nick Rougeux has created a beautiful way to depict the prime factorization of numbers from 2 through 101. His depictions for 7, 21, and 24 are shown.



Following the same pattern, how many of Nick's 100 flowers will have exactly 12 petals?

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

36.



This square-based pyramid has four equilateral triangles as faces.
Two possible "nets" for this pyramid are shown.
A "net" is a set of one square and four equilateral triangles which could be folded to form this pyramid. As shown, any two pieces of a net must meet along an edge [not just a vertex].
Including these two nets, are many total nets are possible?
[Two nets are "different" if one net cannot be rotated and/or flipped onto the other net.]

A. 6 B. 7 C. 8 D. 9 E. More than 9