2018 SCSU MATH CONTEST
9th and 10th Grade Test

DIRECTIONS: Select the BEST response from those given. Scientific and graphing calculators are allowed. Symbolic graphing calculators are not allowed.

1. Find the 2018th digit to the right of the decimal in the expansion of $\frac{1}{13}$.

   A. 2 B. 3 C. 6 D. 7 E. 9

2. If *Q* quarts of motor oil cost a total of *C* cents, how many gallons of this oil can you buy for *D* dollars?

   A. $\frac{DQ}{25C}$ B. $\frac{4DQ}{C}$ C. $\frac{DQ}{400C}$ D. $\frac{DQ}{4C}$ E. $\frac{25DQ}{C}$

3. A quadratic equation is given by $ax^2+bx+c=0$. Under what condition does this equation have two distinct real roots?

   A. $a>c$ B. $c^2>4ab$ C. $4ac>0$ D. $b^2<4ac$ E. $b^2>4ac$

4. Simplify the expression $4(x-3)(x+2)-(x-1)^2$.

   A. $3x^2-2x-25$ B. $3x^2-2x-23$ C. $3x^2-4x-23$ D. $3x^2-4x-25$ E. $3x^2-6x-25$

5. Four geese are worth three chickens, and two goats are worth eleven chickens. My bill at the blacksmith's shop is seven chickens, and I paid him six geese and a goat. How many chickens should the blacksmith give to me in change?

   A. 1 B. 2 C. 2.5 D. 3 E. 4

6. The average of *a* and *b* is 10. The average of *b* and 10 is $\frac{c}{2}$. Find the average of *a* and *c*.

   A. 15 B. $\frac{a-b}{2}$ C. 20 D. $\frac{b-a}{2}$ E. 30

7. If $n=3^x+3^x+3^x$, find an expression for n^2.

   A. 9^{x+1} B. 9^{3x} C. 27^{2x} D. 27^{3x} E. 27^{6x}

8. Alice, Ben and Carol found some money. They agreed that Alice should receive \$2 less than one-third of the money; Ben should receive \$8 more than one-fourth of the money; and Carol should receive the remaining \$19. How much money should Alice receive?

   A. \$15 B. \$18 C. \$25 D. \$30 E. \$35

9. A right triangle on the coordinate system has vertices $A(2,1)$, $B(2,5)$, and $C(6,1)$. The triangle is rotated 90° clockwise about point *C*, then reflected through the origin. Find the coordinates of the final image of *B*.

   A. $(-10,-5)$ B. $(-10,5)$ C. $(-5,-2)$ D. $(-5,2)$ E. $(-5,-10)$

10. Find the length of the longest piece of straight dry spaghetti that will fit (without bending or breaking) in a cylindrical can that has a radius of 3 inches and a height of 10 inches.

    A. $\sqrt{13}$ in B. $\sqrt{109}$ in C. $2\sqrt{34}$ in D. 30π in E. 90π in

11. Karen had a dentist appointment at 10 AM at an office that was 40 miles from her home. Driving at an average speed of 50 MPH, she arrived 10 minutes early. What time did she leave her house?

A. 9:00 AM B. 9:02 AM C. 9:04 AM D. 9:06 AM E. 9:12 AM

12. Find the area of the circle described by $x^2+y^2-4x+8y+11=0$.

A. 2π B. 3π C. 4π D. 8π E. 9π

13. A solid rectangular block is formed by gluing 42 cubes with 1-inch edges together. If the base of the block has a perimeter of 18 inches, find the height of the block in inches.

A. 1 B. 2 C. 3 D. 6 E. 7

14. The set S consists of all four-digit numbers that contain no digits other than 2 or 4. Compute the sum of all the numbers in S.

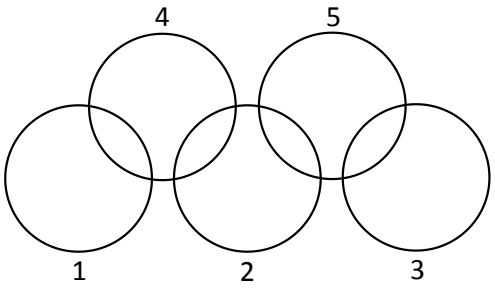
A. 35,553 B. 48,888 C. 53,328 D. 71,104 E. 106,656

15. A square with side length *y* has an area one-third the area of a square with side length $x+y$.

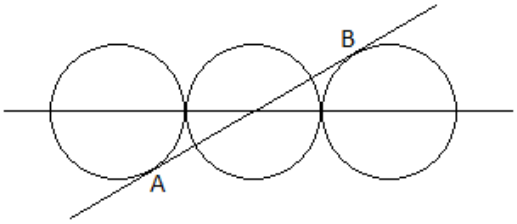
Calculate the ratio $\frac{x}{y}$.

A. $\frac{1}{9}$ B. $\frac{1}{3}$ C. $\frac{1}{\sqrt{3}}$ D. $\frac{\sqrt{3}-1}{1}$ E. $\frac{\sqrt{3}}{1}$

Use the diagrams below to answer questions 16 and 17.



Question 16



Question 17

16. The five numbered rings shown in the diagram above represent five different colors. The colors are Red, Green, Blue, Yellow and Orange, but not necessarily in that order. It is known that

- the Blue ring does not intersect the Green ring,
- the Yellow ring intersects only the Blue ring, and
- the Red ring is to the right of the Green ring and on the same level as the Green ring.

Which ring number is colored Orange?

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

17. The diagram above shows three circles each with radius 2. A line passes through the centers of the three circles, where the middle circle is tangent to each of the others. The diagram also shows a line tangent to the two outer circles at A and B. Find the distance from point A to point B.

A. $4\sqrt{2}$ B. 6 C. $4\sqrt{3}$ D. 8 E. $8\sqrt{3}$

18. A gallon of light blue paint that is in a ratio of 3 parts blue to 7 parts white is mixed with a gallon of darker blue paint that is 5 parts blue to 2 parts white. Find the ratio of blue to white in the mixture.

A. 8 to 9 B. 140 to 71 C. 20 to 50 D. 71 to 70 E. 71 to 69

19. A game-show contestant is shown five prizes with different prices. He is given five price tags and asked to match the tags to the prizes. The contestant doesn't know which tag goes with which prize, so he places the tags randomly. Find the probability the contestant places exactly two price tags correctly.

A. $\frac{1}{6}$ B. $\frac{1}{5}$ C. $\frac{3}{10}$ D. $\frac{2}{5}$ E. $\frac{1}{2}$

20. Farmer Moua can plow a certain field alone in 4 hours. Farmer Anderson can plow the same field alone in 6 hours. At 8 AM they both start to plow the field. An hour later, Farmer Anderson takes a one-hour break and then resumes plowing the field. At what time do the two farmers finish plowing the field?

A. 10:30 AM B. 10:48 AM C. 11:24 AM D. 12 noon E. 1:20 PM

21. An assistant in a dental office just found 9 liters of 1% fluoride solution. The lab also routinely stocks a large quantity of 11% fluoride solution. Find the amount of the 11% solution that should be mixed with the 9 liters of 1% fluoride solution to make a 2% fluoride solution.

A. 0 .5 liter B. 1 liter C. 2 liters D. 2.5 liters E. 3 liters

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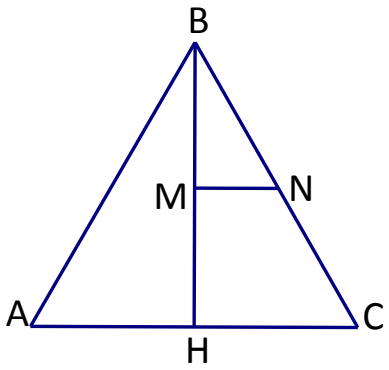
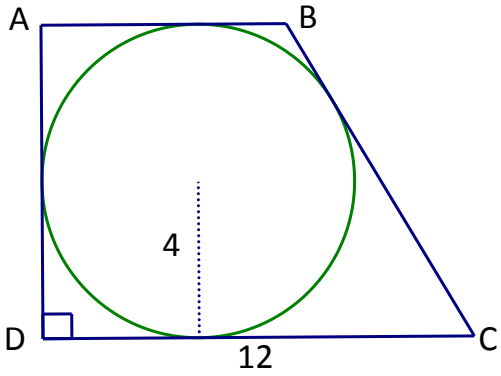
Use the diagrams below to answer questions 22 and 23.



Question 22



Question 23

22. The diagram above shows equilateral triangle ABC with side length equal to 20 cm, BH perpendicular to AC, and MN parallel to AC. Find the area, in square centimeters, of triangle BMN if the length of MN is equal to 5 cm.

A. $10\sqrt{3}$ B. $\frac{25\sqrt{3}}{2}$ C. $20\sqrt{3}$ D. $50\sqrt{3}$ E. None of these

23. The diagram above shows a circle of radius 4 inches inscribed in right trapezoid ABCD, whose longer base is 12 inches. Find the area of the trapezoid, in square inches.

A. 72 B. 84 C. 88 D. 96.5 E. 144

24. Factor and simplify the expression $\dfrac{2x^3-250}{x^2-25}$.

A. $\dfrac{2\left(x^2+5x+25\right)}{x+5}$ B. $\dfrac{2\left(x^2-5x+25\right)}{x+5}$ C. $\dfrac{2\left(x^2+5x-25\right)}{x-5}$ D. $\dfrac{2(x+10)}{x-5}$ E. $\dfrac{2(x-10)}{x-5}$

25. If x and y satisfy $\dfrac{2}{x}+\dfrac{3}{y}=4$ and $\dfrac{1}{x}-\dfrac{2}{y}=1$, find the value of $\dfrac{1}{x+y}$.

A. $\dfrac{16}{71}$ B. $\dfrac{22}{91}$ C. $\dfrac{24}{93}$ D. $\dfrac{22}{71}$ E. None of these

26. A sandwich shop lets you create a sandwich by selecting one kind of bread, one kind of meat, and one kind of cheese. There are 3 options for bread (wheat, rye, and French bread); there are 5 options for meat; and there are 4 options for cheese (Cheddar, Mozzarella, Pepper Jack, and Swiss). One final rule is that you are not allowed to have Swiss cheese on a sandwich with French bread. How many possible sandwiches can be made?

A. 11 B. 12 C. 55 D. 59 E. 85

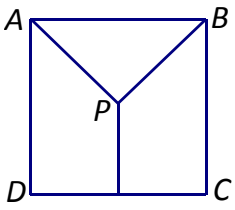
27. Point *A* has coordinates $(18,15)$. The line $y=-\dfrac{1}{2}x+\dfrac{23}{2}$ is the perpendicular bisector of line segment *AB*. Find the sum of the coordinates of Point *B*.

A. -6 B. -3 C. 0 D. 3 E. 6

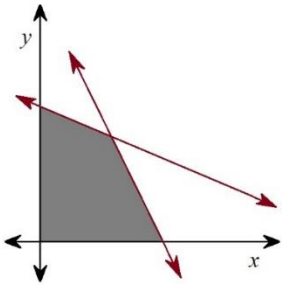
28. Suppose that $|x-2|\le 10$ and $|y+1|\le 3$. Find the maximum possible value of xy.

A. 24 B. 30 C. 32 D. 48 E. 56

Use the diagrams below to answer questions 29 and 30.



Question 29



Question 30

29. The diagram above (not drawn to scale) shows square ABCD with AB = 12. Point P is an interior point such that AP, BP and the distance from P to CD are all equal. Find this distance.

A. 4.5 B. 6 C. 6.5 D. 7.5 E. 8

30. The diagram above (not drawn to scale) shows the coordinate axes and the lines $4x+9y=36$ and $8x+3y=32$. Find the area of the shaded region in square units, to the nearest tenth.

A. 8.9 B. 9.3 C. 10.5 D. 10.7 E. 11.3