

Pellissippi State

Middle School Mathematics Competition

Sponsored by: Oak Ridge Associated Universities

Eighth Grade

Scoring Formula: $4R - W + 30$

Directions:

For each problem there are 5 possible answers listed. You are to work the problems, determine the correct answer, and indicate your choice on the separate answer sheet provided.

Please use only capital letters on the answer sheet (A, B, C, D, E) and print neatly. This will more easily enable us to correctly grade your paper. If there is any question as to what letter an answer is, it will be marked wrong.

If you change your mind about your answer, be sure to erase completely. Avoid wild guessing, as wrong answers count against you. Do not mark more than one answer for any problem. Make no stray marks of any kind on your answer sheet. Additional room for you to work out problems is available on the back of each of the test booklet's pages.

When told to do so, open your test booklet and begin. When you have finished one page, go on to the next. There are 30 questions in all. The working time for the entire test is 60 minutes.

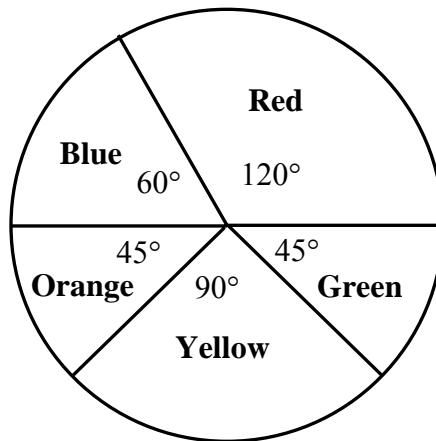
1. Movies-in-a-Flash has a deal for members who pay \$6 per month in dues. They can rent as many movies as they want for 75¢ per movie. In the equation $y = \frac{3x}{4} + 6$, if x represents the number of movies rented, then y will be the total cost (in dollars) in one month. Suppose the equation is graphed. Which statement is true about the graph when the indicated changes are made.
 - a. If the dues change, the y -intercept will change but the slope will not.
 - b. If the dues change, both the y -intercept and the slope will change.
 - c. If the per-movie charge changes, the y -intercept will change but the slope will not.
 - d. If the per-movie charge changes, both the y -intercept and the slope will change.
 - e. It is impossible to determine the change in the graph without knowing the specific prices.

2. When counting in base four, the first ten numbers are these: 1, 2, 3, 10, 11, 12, 13, 20, 21, 22. In base four, what would be the value of $12_{\text{four}} + 13_{\text{four}}$.
 - a. 25_{four} b. 30_{four} c. 31_{four} d. 32_{four} e. 33_{four}

3. In modular arithmetic, $12 \equiv 5 \pmod{7}$ means that 12 and 5 both have the same remainder when divided by 7. Which of the following statements is true? (Assume that a, b, c, d, m , and n are whole numbers with $m \neq 0$.)
 - a. If $a \equiv c \pmod{m}$ and $b \equiv d \pmod{m}$, then $a + b \equiv c + d \pmod{m}$
 - b. If $a \equiv c \pmod{m}$, then $a^n \equiv c \pmod{m}$ c. If $a \equiv c \pmod{m}$ and $a \neq 0$, then $c \neq 0$.
 - d. If $a \equiv c \pmod{m}$, then $ac \equiv c \pmod{m}$ e. If $a \equiv c \pmod{m}$, then $a + c \equiv c \pmod{m}$

4. Lee’s first garden plan was for a rectangle with width w and length l . Then Lee decided to increase the area by 25% but keep the width the same. What is the perimeter of the new garden?
 - a. $2(w + l) + \frac{l}{4}$ b. $2(w + l) + \frac{l}{2}$ c. $2(w + l) + \frac{l}{6}$ d. $2(w + l) + \frac{l}{8}$ e. $2(w + l) + l$

5. A spinner has five sections with the following five colors and central angles: Blue, 60° ; Red, 120° ; Green, 45° , Yellow, 90° , and Orange, 45° . In two spins, what is the probability that it will land on either Blue or Yellow at least once?
 - a. $\frac{5}{12}$
 - b. $\frac{7}{12}$
 - c. $\frac{25}{144}$
 - d. $\frac{95}{144}$
 - e. $\frac{119}{144}$



6. In the metric system, the capacity of one cubic decimeter is 1 liter. How many milliliters would a cubic meter hold?

- a. 10^3 ml b. 10^6 ml c. 10^9 ml d. 10^{12} ml e. 10^{15} ml

7. The following table describes a group of musicians. If three musicians are selected at random without replacement, find the probability that at least one is playing piano.

	flute	piano
male	6	3
female	2	4

- a. $\frac{57}{65}$ b. $\frac{8}{65}$ c. $\frac{27}{125}$ d. $\frac{7}{15}$ e. $\frac{11}{15}$

8. The following table shows inputs and outputs for Function Machine A and for Function Machine B. The number 32 is put into Machine A. The Machine A output from 32 is put into Machine B. Which statement is true?

Function Machine A	
INPUT	OUTPUT
1	6
15	8
32	12
17	61
45	70

Function Machine B	
INPUT	OUTPUT
4	38
8	25
12	17
16	6
20	38

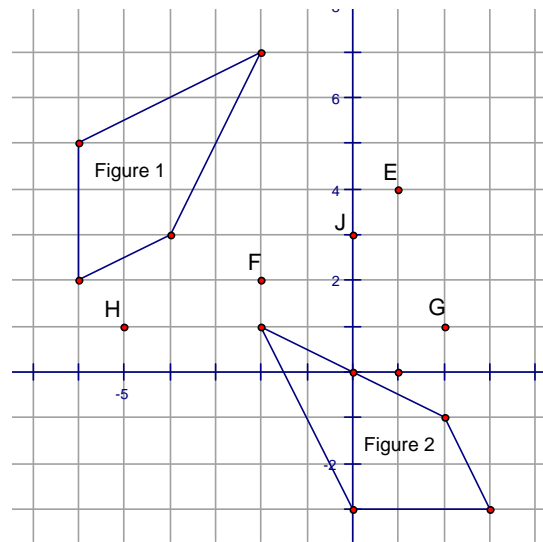
- a. The output from Machine B is 38.
 b. There is an output from Machine B, but it CANNOT be determined from the information given.
 c. The output from Machine B is 17.
 d. The output from Machine B is 6.
 e. Machine B's outputs are impossible because 38 cannot be an output for two different inputs.
9. The following table gives information about the vehicles driven by the townspeople of Mayberry. Assume each person drives exactly one vehicle.

	Male	Female
Car	8	17
Truck	25	6
S.U.V.	12	15

One person is chosen at random. If you know that the person selected is male, what is the probability that the selected person drives an S.U.V.?

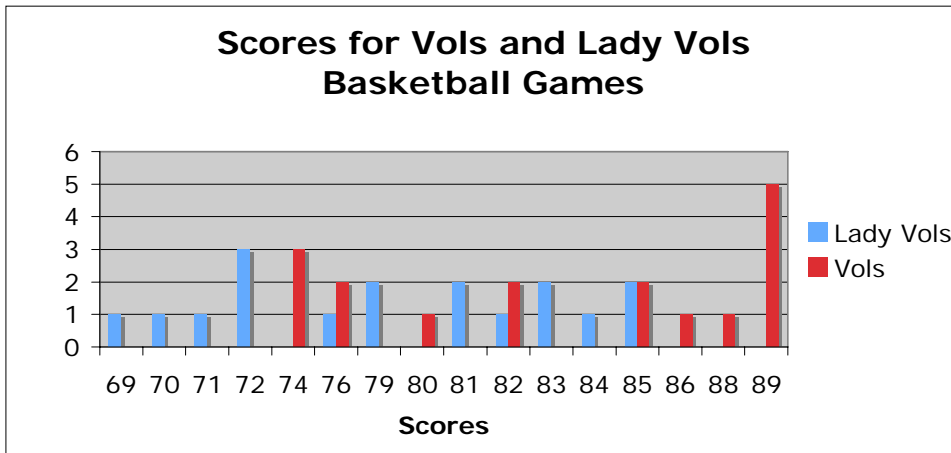
- a. $\frac{4}{9}$ b. $\frac{2}{15}$ c. $\frac{12}{83}$ d. $\frac{4}{15}$ e. $\frac{60}{83}$

10. Figure 2 is the image produced when Figure 1 is rotated 90°. Which of the given points is the center of the rotation?



- a. Point E
- b. Point F
- c. Point G
- d. Point H
- e. Point J

11. The following chart depicts the scores of some games for the Vols and Lady Vols basketball teams this year. Which statement is true for the games in the graph?

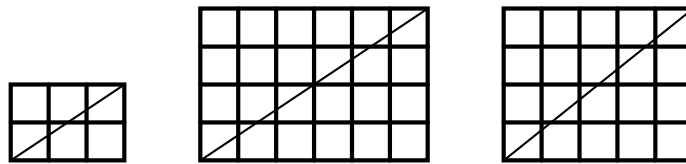


- a. The mean score of the Vols is greater than the mean score of the Lady Vols.
- b. The median score is the same for both teams.
- c. The mode is the same for both teams.
- d. Both the mean and the median scores for the Lady Vols are greater than those of the Vols.
- e. The graph shows that the Vols won more of these games than the Lady Vols.

12. The ages at which the 43 President of the United States were elected have the following statistics:
 Minimum: 42 years
 First Quartile: 50.5 years
 Median: 55 years
 Third Quartile: 57.5 years
 Maximum: 69 years

The interquartile range is the difference between the third and first quartiles. A data point is considered an “outlier” if it is more than 1.5 times the interquartile range below the first quartile OR 1.5 times the interquartile range above the third quartile. Which of the following statements is false?

- Theodore Roosevelt’s age at election, 42 years, is an outlier.
 - Approximately 50% of the Presidents were between the ages of 50.5 and 57.5 years when they were elected.
 - Approximately 50% of the Presidents were between the ages of 42 and 55 years when they were elected.
 - Approximately 50% of the Presidents were between the ages of 55 and 69 years when they were elected.
 - If John McCain is elected at the age of 72, his age would be an outlier.
13. Rectangles are made of small congruent squares. A diagonal drawn from the bottom left to the top right of a rectangle cuts through the interior of some of the squares. (Count only squares for which the diagonal goes through the interior of the square—not just the vertex.) For a 2 x 3, the diagonal goes through 4 squares. For a 4 x 6 it goes through 8. For a 4 x 5 it goes through 8. How many squares would a diagonal of a 120 x 150 rectangle go through?



- 269
- 240
- 3000
- 4500
- 9000

14. Which statement is false about the equation $y = 2^x$.
- If a negative number is substituted for x , then y will be less than 1.
 - If a negative number is substituted for x , then y will be negative.
 - If a negative number is substituted for x , then y will be positive.
 - There is no value for x that will make y equal to zero.
 - When $x = 0$, $y = 1$.

15. The five tiles shown below are in a bag.
- 1

2

3

4

5

Three of the tiles are drawn at random (without replacement). What is the probability that the 3 numbers could be lengths (in decimeters) of the sides of a triangle?

- 10%
- 30%
- 50%
- 70%
- 100%

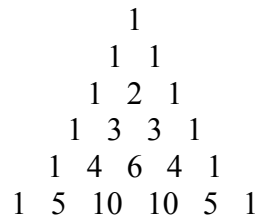
16. In scalene triangle ABC, Angle A has a measure of 80° . Which statement CANNOT be true about triangle ABC?

- a. Triangle ABC is an obtuse triangle.
- b. Triangle ABC is an acute triangle.
- c. \overline{BC} is the shortest side of the triangle.
- d. Triangle ABC is a right triangle.
- e. \overline{BC} is the longest side of the triangle.

17. The least common multiple of two numbers is 120. Neither number is 120. Neither number is 1. Which statement CANNOT be true about the two numbers?

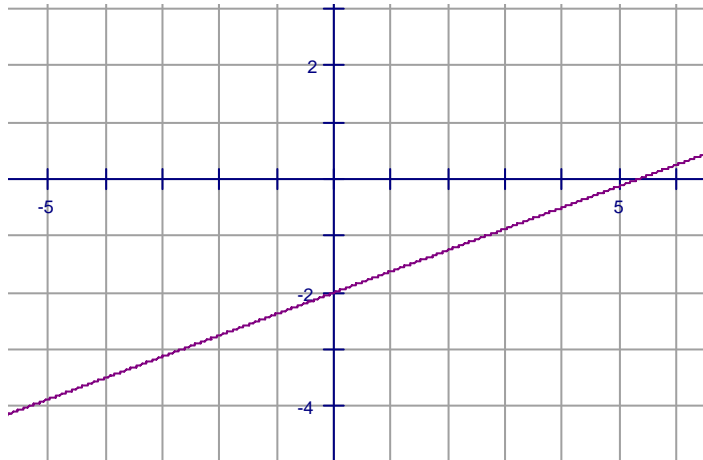
- a. One number is a multiple of 9.
- b. One number is a multiple of five and the other is not.
- c. One number has a factor of 8.
- d. Both numbers are even.
- e. Both numbers are multiples of 5.

18. The first 6 rows of Pascal’s Triangle are shown here. What would be the third number (from the left) in the 20th row?



- a. 171
- b. 210
- c. 105
- d. 180
- e. 190

19. Below is the graph of $y = \frac{3}{8}x - 2$. Which statement is false?

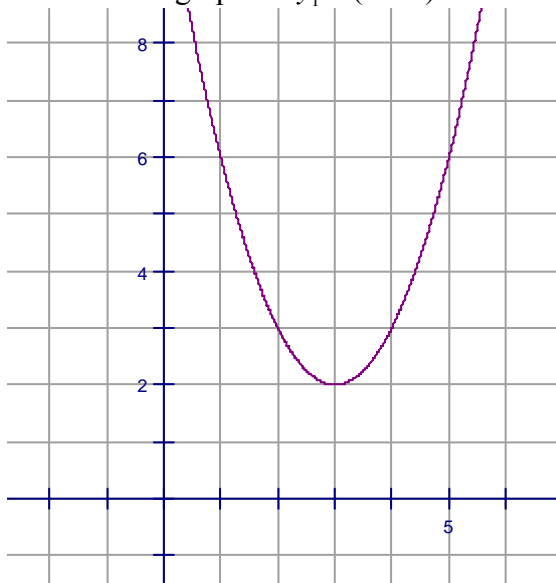


- a. When substituted for x and y , the coordinates of any point on the line will make the equation a true statement.
- b. The y intercept of the graph is the intersection between the y axis and the graph of the equation.
- c. The x intercept of the graph is the intersection between the x axis and the graph of the equation.
- d. When substituted for x and y , the coordinates of any point **not** on the line will make the equation a false statement.
- e. There are infinitely many points on the line whose coordinates will **not** make the equation a true statement when substituted for x and y .

20. A 20-ounce box of noodles contains 10 full servings. You like smaller servings; so you eat $\frac{7}{8}$ of a full serving each time. After you eat as many of your size servings as possible, how many ounces of noodles will be left in the box?

- a. $\frac{3}{7}$ ounce b. $\frac{4}{7}$ ounce c. $\frac{5}{7}$ ounce d. $1\frac{3}{4}$ ounce e. $\frac{3}{4}$ ounce

21. Below is the graph of $y_1 = (x - 3)^2 + 2$. Which would be true of the graph of $y_2 = (x - 3)^2 + 4$?



- a. The graph of y_2 is the same shape as y_1 but the vertex is two units lower.
 b. The graph of y_2 is the same shape as y_1 but the vertex is two units higher.
 c. The graph of y_2 is the same shape as y_1 but the vertex is two units to the left.
 d. The graph of y_2 is the same shape as y_1 but the vertex is two units to the right.
 e. The graph of y_2 is concave down.
22. What does my calculator mean when it says that $6^{-30} = 4.523373907 \times 10^{-24}$? (Spaces are inserted to help with reading the number.)
- a. 6^{-30} is exactly equal to 0.00 000 000 000 000 000 000 000 452 337 390 7.
 b. 6^{-30} is exactly equal to 452 337 390 700 000 000 000 000.
 c. 6^{-30} is approximately equal to 452 337 390 700 000 000 000 000.
 d. 6^{-30} is approximately equal to 0.00 000 000 000 000 000 000 000 452 337 390 7.
 e. 6^{-30} is approximately equal to 45 233 739 070 000 000 000 000.
23. The population of the world is estimated to be 6,657,139,593. The population of Tennessee is estimated to be 6,038,803. Tennessee's population is approximately what percent of the world's population?
- a. 9.07% b. 0.907% c. 0.0907% d. 0.00907% e. 0.000907%

24. A right rectangular prism has height of 4 dm, width of 8 dm, and surface area of 76 dm^2 . What is the volume of the prism?

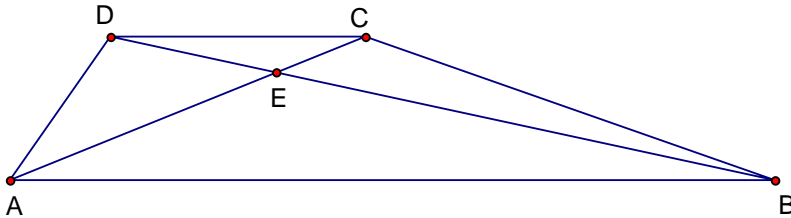
- a. 16 dm^3 b. 19.5 dm^3 c. 24.96 dm^3 d. 32 dm^3 e. 36 dm^3

25. The relationship between Celsius and Fahrenheit temperatures is linear. Given these equivalents, determine the Fahrenheit equivalent of 24° C . (Round to the nearest degree.)

$$\begin{aligned} 0^\circ \text{ C} &= 32^\circ \text{ F} \\ -40^\circ \text{ C} &= -40^\circ \text{ F} \end{aligned}$$

- a. 60° F b. 65° F c. 72° F d. 75° F e. 80° F

26. In trapezoid ABCD shown below, \overline{AB} is parallel to \overline{DC} and $AB = 3 \cdot CD$. E is the intersection of the two diagonals of the trapezoid. What is the ratio between the area of triangle ABE and the area of triangle CDE?



- a. 3:1 b. 4:3 c. 4:1 d. 6:1 e. 9:1

27. After being marked down 40%, the video game's sales price was \$36. What was the original price of the game?

- a. \$45.00 b. \$50.40 c. \$54.00 d. \$60.00 e. \$90.00

28. When Lynn mentally calculated 36×25 , Lynn thought of it as $(9 \times 4) \times 25$. Then Lynn thought about $9 \times (4 \times 25) = 900$. Which property of multiplication did Lynn use?

- a. Associative Property b. Commutative Property c. Distributive Property
d. Identity Property e. Property of Multiplication by Zero

29. The prime factorization of 12 has three factors: $2 \cdot 2 \cdot 3$. If the prime factorization of a has 15 factors and the prime factorization of b has 18 factors, how many factors are in the prime factorization of ab ?

- a. 270 b. 135 c. 66 d. 33 e. 18

30. An identity is an equation that is true for all real numbers. Which of the following equations is an identity?

- a. $a^2 + b^2 = a + b$ b. $\frac{a}{3} + \frac{b}{4} = \frac{a+b}{7}$ c. $a - b = b - a$
d. $(ab)c = ac \cdot bc$ e. $-(a - b) = b - a$