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Don Bosco Technical Institute  
proudly presents the



# **45<sup>th</sup> Annual Mathematics Contest**

## **7<sup>th</sup>/8<sup>th</sup> Grade Test**

**February 4, 2017**

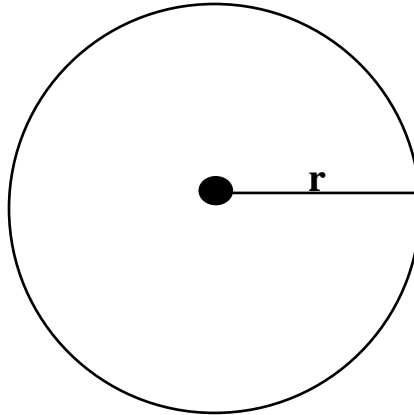
**Directions:**

- This test contains 50 questions.
- You have ONE HOUR to complete this test.
- Solve each problem, choose the best answer, and mark the corresponding letter on your SCANTRON answer sheet.
- Each question is worth one point. Your score will be the number of correct answers. There is no partial credit nor penalty for wrong answers.
- You may write on this test and/or separate the pages. It is yours to take home.
- No calculators may be used on this test.
- Communicating with other contestants is not permitted.

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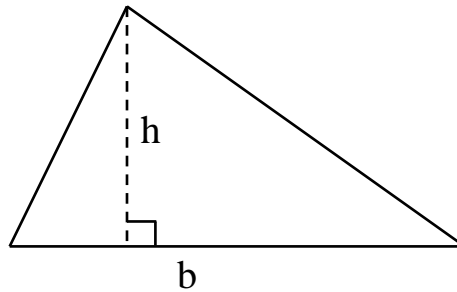
# Formulas



Radius of a Circle:  $r$

Area of a Circle:  $\pi r^2$

Circumference of a Circle:  $2\pi r$



Area of a Triangle =  $\frac{1}{2}$  x base x height =  $\frac{1}{2}bh$

1. A standard, six-sided die has sides numbered 1, 2, 3, 4, 5, and 6 (note: in this case, “die” is the singular of dice). What is the probability the number rolled is greater than 2 and less than 5?

a.  $\frac{1}{2}$

b.  $\frac{1}{3}$

c.  $\frac{2}{3}$

d.  $\frac{1}{4}$

e.  $\frac{1}{6}$

2. Which expression is equivalent to  $3^5 \cdot 3 \cdot 3^4$ ?

a.  $\frac{3^{10}}{27}$

b.  $\frac{3^6 \cdot 18}{2 \cdot 3^2}$

c.  $\frac{3^{11}}{3^2}$

d.  $\frac{1}{3^{-10}}$

e.  $27^{20}$

3. How many integer values of  $k$  exist, in which  $x^2 + kx + 24$  is factorable?

a. 0

b. 2

c. 4

d. 6

e. 8

4. Evaluate  $\frac{x(x+1)}{x+2}$  if  $x = \sqrt{3}$

a.  $3 - \sqrt{3}$

b.  $\sqrt{3} - 3$

c.  $-3 - \sqrt{3}$

d.  $\frac{1+\sqrt{3}}{2}$

e. None of the above

5. Which number is  $\frac{3}{5}$  of the way from  $-\frac{4}{7}$  to  $1\frac{1}{8}$ ?

a.  $\frac{31}{40}$

b.  $\frac{95}{56}$

c.  $\frac{93}{280}$

d.  $\frac{25}{56}$

e.  $\frac{57}{40}$

6. A drawer contains yellow and blue pencils. If the number of yellow pencils is  $\frac{2}{3}$  the number of blue pencils, then the ratio of yellow pencils in the drawer is:

a. 1:2

b. 2:3

c. 3:5

d. 1:3

e. 2:5

7. 504 minutes is what percent of one day?
- 20
  - 25
  - 30
  - 35
  - 40
8. Sarah and John both went to the Science Center today. Sarah goes to the Science Center every 54 days. John goes to the Science Center every 26 weeks. They will both visit the Science Center on the same day in
- 2,106 days
  - 4,914 days
  - 6,234 days
  - 9,828 days
  - None of the above
9. There are 15 more marathon runners wearing black jerseys than wearing white jerseys. The ratio of the black jerseys to white jerseys is 4:1. The number of black jerseys is
- 3
  - 4
  - 5
  - 6
  - 20

10. A boy walks a set distance and rides back in a total of  $6\frac{1}{4}$  hours. He could ride both ways in  $4\frac{1}{2}$  hours. How many hours would it take him to walk both ways?
- 4
  - $4\frac{1}{2}$
  - 6
  - $6\frac{1}{2}$
  - 8
11. A stadium has a wide circular race track. The outer circumference of the track is 633 meters and the inner circumference is 325 meters. What is the width of the track? (assume  $\pi = \frac{22}{7}$ )
- 24
  - 37
  - 44
  - 49
  - 53
12. A boy buys 3 apples for \$1. He then sells them at 5 for \$2. In order to make a profit of \$10, he must sell:
- 75 apples
  - 100 apples
  - 125 apples
  - 150 apples
  - None of these

13. Victor has used his lucky eraser for  $n$  years. If he uses it for 6 more years, he will have used this eraser for  $n^2$  years. What is  $n$ ?
- a. 2
  - b. 3
  - c. 4
  - d. 6
  - e. 9
14. Which of the following is an odd number?
- a.  $1^4 + 1$
  - b.  $11^4 + 7$
  - c.  $7^4 + 5$
  - d.  $5^4 + 3$
  - e.  $3^4 + 2$
15. During a game, Bosco scored one-sixth of its points in the first quarter, one-fourth in the second quarter, one-third in the third quarter, and the remaining points in the fourth quarter. If Bosco scored a total of 48 points in all, how many points did they score in the fourth quarter?
- a. 6
  - b. 8
  - c. 10
  - d. 12
  - e. 16

16. The value of  $(1 + \frac{1}{2})(1 + \frac{1}{3})(1 + \frac{1}{4})(1 + \frac{1}{5})(1 + \frac{1}{6})(1 + \frac{1}{7})$
- a.  $1\frac{1}{120}$
  - b. 1
  - c. 3
  - d.  $3\frac{17}{60}$
  - e. 4
17. There are 8 sections of seats in an auditorium. Each section contains at least 150 seats, but fewer than 200 seats. Which of the following could be the number of seats in this auditorium?
- a. 900
  - b. 1,000
  - c. 1,300
  - d. 1,600
  - e. 1,800
18. Lisa drove to work in the morning at an average speed of 45 miles per hour. She returned home in the evening along the same route and averaged 30 miles per hour. If Lisa spent a total of one hour driving, how many miles did Lisa drive to work in the morning?
- a. 10
  - b. 14
  - c. 16
  - d. 18
  - e. 24



19. Marco is making cookies. He can add 3 ingredients. His choices are almonds, cranberries, oatmeal, chocolate chips, and coconut. How many different combinations of 3 ingredient cookies can he make from the 5 choices?
- a. 6
  - b. 10
  - c. 12
  - d. 14
  - e. 15
20. What is the value of  $x$  in  $3x + 7 = 1 - 2x$ ?
- a.  $-\frac{6}{5}$
  - b.  $\frac{1}{5}$
  - c.  $\frac{6}{5}$
  - d.  $-\frac{7}{6}$
  - e.  $\frac{7}{6}$
21. Dillon is one-third as old as his father. Next year, their ages in years will total 50. How old is Dillon now?
- a. 12
  - b. 14
  - c. 16
  - d. 24
  - e. 36

22. A gardener needs 78 meters of fence to enclose a rectangular garden. The length of the garden is 9 meters more than the width. What is the area of the garden in square meters?

- a. 15
- b. 24
- c. 162
- d. 240
- e. 360

23. Which of these numbers is the largest?

- a.  $\frac{1}{3}$
- b.  $\frac{3}{10}$
- c.  $\frac{333}{1000}$
- d.  $\frac{7}{20}$
- e. 0.33

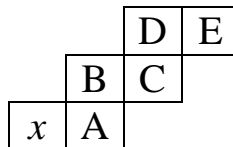
24. The largest possible circle is cut from a square piece of cardboard. If one side of the square measures 5 inches, what is the area of the remaining cardboard (assume  $\pi = \frac{22}{7}$ )

- a.  $\frac{65}{14} \text{ in.}^2$
- b.  $\frac{75}{14} \text{ in.}^2$
- c.  $12 \text{ in.}^2$
- d.  $16 \text{ in.}^2$
- e.  $45 \text{ in.}^2$

25. Two sides of a right triangle are 5 and 12 centimeters long. Find the length of the hypotenuse to the nearest tenth of a centimeter.
- 7.0 cm
  - 10.9 cm
  - 13.0 cm
  - No such triangle is possible
  - Not enough information to solve
26. The measures of two angles of a triangle are equal. The measure of the third angle is  $\frac{7}{8}$  of the sum of the measures of the first two angles. What is the measure of one of the two the equal angles?
- $36^\circ$
  - $48^\circ$
  - $56^\circ$
  - $63^\circ$
  - $84^\circ$
27. In the final game of a basketball tournament, only 7 players from the team played. The scoring average of all 7 players in the final game was 13. The scoring average of everyone but the point guard was 12. How many points did the point guard score in the final game?
- 16
  - 19
  - 21
  - 22
  - 24

28. The figure to the right can be folded into the shape of a cube. In the resulting cube, which of the lettered faces is opposite the face marked  $x$ ?

- a. A
- b. B
- c. C
- d. D
- e. E



29. Christine has 7 gray balls, 4 white balls, and 3 black balls in a bag. What is the least number of balls she must take out of the bag, with her eyes closed, to make sure that she took out at least one ball of each color?

- a. 4
- b. 8
- c. 11
- d. 12
- e. 14

30. If  $\sqrt{2 + \sqrt{x}} = 3$ , then  $x$  is

- a. 1
- b.  $\sqrt{7}$
- c. 7
- d. 49
- e. 121

31. Chandler wants to buy a mountain bike for \$500. For his birthday, his grandparents send him \$50, his aunt sends him \$35, and his cousin gives him \$15. He earns \$16 per week for his paper route. He will use all of his birthday money and all the money he earns from the paper route. What is the earliest he will be able to buy the mountain bike?
- a. 24 weeks
  - b. 25 weeks
  - c. 26 weeks
  - d. 27 weeks
  - e. 28 weeks

32. The average age of 5 people in a room is 30 years. An 18-year-old person leaves the room. What is the average age of the four remaining people?
- a. 25
  - b. 26
  - c. 29
  - d. 33
  - e. 36

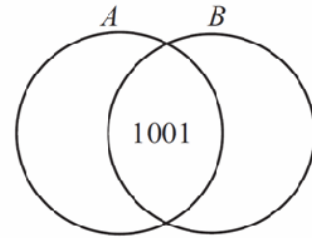
33. To complete the grid below, each of the digits 1 through 4 must occur once in each row and once in each column. What number will occupy the lower right-hand square?

1		2	
2	3		
			4

- a. 1
- b. 2
- c. 3
- d. 4
- e. Cannot be determined

34. Sets  $A$  and  $B$ , shown in the Venn diagram, have the same number of elements. Their union has 2,007 elements and their intersection has 1,001 elements. Find the number of elements in  $A$ .

- a. 503
- b. 1,006
- c. 1,504
- d. 1,507
- e. 1,510



35. Let  $a$ ,  $b$ , and  $c$  be numbers so that  $0 < a < b < c$ . Which of the following is impossible?

- a.  $(a + c) < b$
- b.  $(a \cdot b) < c$
- c.  $(a + b) < c$
- d.  $(a \cdot c) < b$
- e.  $\frac{b}{c} = a$

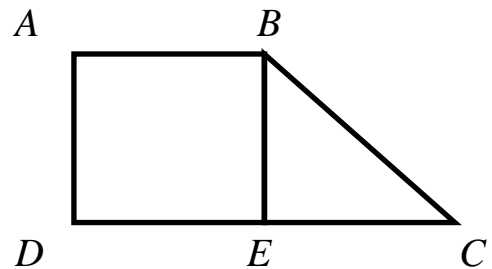
36. A mixture of 30 gallons of paint is 25% red tint, 30% yellow tint, and 45% water. Five gallons of yellow tint are added to the original mixture. What is the percent of yellow tint in the new mixture?

- a. 25%
- b. 35%
- c. 40%
- d. 45%
- e. 50%

37. A haunted house has six windows. In how many ways can a ghost enter the house by one window and leave by a different window?
- a. 12
  - b. 15
  - c. 18
  - d. 30
  - e. 36

38. In trapezoid  $ABCD$ ,  $AD$  is perpendicular to  $DC$ ,  $AD = AB = 3$ , and  $DC = 6$ . In addition,  $E$  is on  $DC$ , and  $BE$  is parallel to  $AD$ . Find the area of triangle  $BEC$ .

- a. 3
- b. 4.5
- c. 6
- d. 9
- e. 18

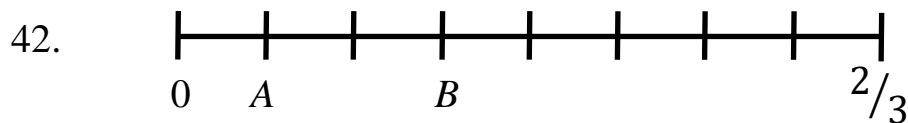


39. The weight of a box with 30 identical chocolates is 21 ounces. When 6 chocolates are removed and eaten, the weight of the box and remaining chocolates is 17.4 ounces. In ounces, what is the weight of the empty box?
- a. 2.2
  - b. 2.4
  - c. 2.8
  - d. 3
  - e. 3.2

40. The first four elements of a sequence are: 7, 11, 4, -7,... Each new element is obtained by subtracting the 2<sup>nd</sup> to last element from the last element. For example, the 4<sup>th</sup> element is -7 because:  $4 - 11 = -7$ . What is the 2007<sup>th</sup> element in this sequence?
- 4
  - 4
  - 7
  - 7
  - 11

41.  $\nabla$  and  $\cup$  are two distinct operations from the set:  $\{+, \times, -, \div\}$   
 If  $\frac{9 \nabla 6}{2 \cup 6} = 45$ , what is the value of  $\frac{6 \nabla 3}{12 \cup 8}$ ?

- $\frac{3}{16}$
- 6
- 12
- 15
- 20



- On the number line, what is the sum of  $A$  and  $B$ ? (Assume equal intervals)
- $\frac{5}{12}$
  - $\frac{1}{2}$
  - $\frac{2}{3}$
  - $\frac{1}{3}$
  - $\frac{7}{12}$



43. Find the largest 3-digit multiple of 9 which does not contain the digit 9. What is the product of its three digits?

- a. 72
- b. 75
- c. 76
- d. 128
- e. 256

44. The minute hand of a clock rotates 300 degrees. In the same amount of time, how many degrees has the hour hand rotated?

- a. 16
- b. 20
- c. 24
- d. 25
- e. 30

45. In this addition problem, each letter represents a different digit from 0 through 9.

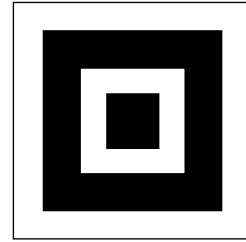
Compute the sum of  $L + R + V$ .

- a. 13
- b. 15
- c. 16
- d. 17
- e. 20

$$\begin{array}{r} L \qquad R \qquad L \\ + \qquad R \qquad V \\ \hline R \qquad L \qquad L \end{array}$$

46. A target consists of four concentric squares of side lengths 1, 3, 5, and 7. What percent of the target is shaded? Round to the nearest percent.

- a. 33%
- b. 35%
- c. 38%
- d. 43%
- e. 53%



47. In feet and inches, the heights of five students are 4' 9", 4' 11", 4' 7", 5' 4", and 4' 7". In inches, what is the positive difference between the mean and median of these five heights?

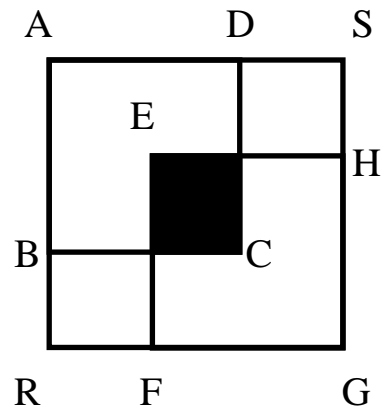
- a. 0.6
- b. 0.8
- c. 1
- d. 1.4
- e. 3

48. If  $\frac{a}{d+b+c} = \frac{4}{3}$  and  $\frac{a}{b+c} = \frac{3}{5}$ , then  $\frac{d}{a} =$

- a.  $\frac{6}{7}$
- b.  $\frac{7}{6}$
- c.  $\frac{7}{11}$
- d.  $-\frac{11}{12}$
- e.  $-\frac{12}{11}$

49. In the figure, the squares  $ABCD$  and  $EFGH$  have equal areas. The area of the shaded square is  $\frac{1}{9}$  of the area of the square  $ABCD$ . Find the area of the square  $ARGS$  if the area of the shaded square is  $49 \text{ in}^2$ .

- a.  $1176 \text{ in}^2$
- b.  $1225 \text{ in}^2$
- c.  $1274 \text{ in}^2$
- d.  $1372 \text{ in}^2$
- e.  $1470 \text{ in}^2$



50. Let  $T = 1$  trillion,  $B = 1$  billion,  $M = 1$  million, and  $H = 1$  thousand.

What is the value of  $\frac{M \cdot B^2}{T \cdot H^2}$

- a. 1
- b.  $10^3$
- c.  $10^6$
- d.  $10^9$
- e.  $10^{12}$

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## Answer Key

- |       |       |       |       |       |
|-------|-------|-------|-------|-------|
| 1. B  | 11. D | 21. A | 31. B | 41. B |
| 2. D  | 12. D | 22. E | 32. D | 42. D |
| 3. E  | 13. B | 23. D | 33. B | 43. D |
| 4. A  | 14. E | 24. B | 34. C | 44. D |
| 5. D  | 15. D | 25. C | 35. A | 45. D |
| 6. E  | 16. E | 26. B | 36. C | 46. B |
| 7. D  | 17. C | 27. B | 37. D | 47. C |
| 8. B  | 18. D | 28. C | 38. B | 48. D |
| 9. E  | 19. B | 29. D | 39. D | 49. B |
| 10. E | 20. A | 30. D | 40. A | 50. C |