MONTANA COUNCIL OF TEACHERS OF MATHEMATICS
2017 MATH CONTEST
TEAM 9-10

DIRECTIONS: DO NOT WRITE ON THIS TEST. Place the best answer for each question on the separate answer sheet.

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1. A car travels 1 mile uphill at 30 miles per hour (mph). How fast should it travel 1 mile downhill in order to have an average speed of 60 mph for the entire 2 mile stretch?

A) 60 mph **B)** 70 mph **C)** 90 mph **D)** 120 mph **E)** none of these

2. The number of bacteria in a bottle doubles each minute. The bottle is completely filled with bacteria after 30 minutes. After how many minutes was the bottle half full?

A) 15 minutes **B)** 17 minutes **C)** 23 minutes **D)** 29 minutes **E)** none of these

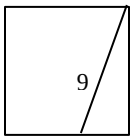
3. A man is 3/8 of the way across a railroad bridge when he suddenly hears a train which is traveling at 60 mph. He can run in either direction in an effort to get off the bridge. No matter in which direction he chooses to run, he and the train will arrive at that end of the bridge at the same time. How fast does he run?

A) 6 mph **B)** 12 mph **C)** 15 mph **D)** 30 mph **E)** none of these

4. Simplify the expression: $\frac{x^{(2b-1)}}{x^{(5-b)}}$

A) x^{b+4} **B)** x^{b-6} **C)** x^{-3b} **D)** x^{3b-6} **E)** none of these

5. Find the area of the square.



A) $\sqrt{56}$ **B)** 45 **C)** 49 **D)** 56 **E)** none of these

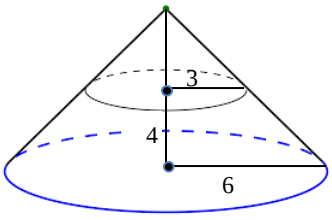
6. Find the roots of $x^2 - bx - 4d$.

A) $\boldsymbol{x = \frac{b \pm \sqrt{b^2+16d}}{2}}$ **B)** $\boldsymbol{x = \frac{-b \pm \sqrt{-b^2+16d}}{2}}$

C) $\boldsymbol{x = \frac{b \pm \sqrt{b^2-16d}}{2b}}$ **D)** $\boldsymbol{x = \frac{-b \pm \sqrt{b^2-16d}}{2b}}$ **E)** none of these

7. If the volume of the entire cone is 96π, what is the volume of just the top part of the cone?

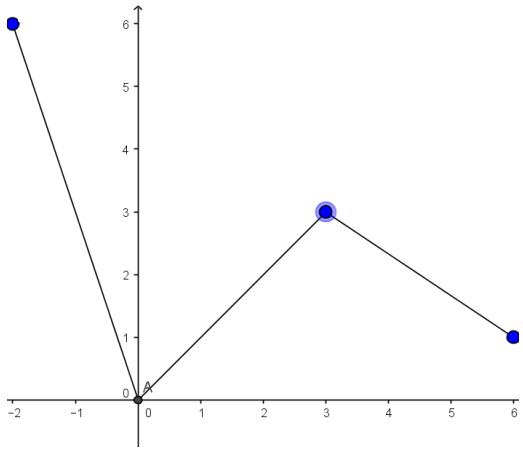
A) 12π **B)** 18π **C)** 36π **D)** 48π **E)** none of these



8. Pi is transcendental. What does this mean, in mathematics?

A) It is equal to the ratio of two integers **B)** It was Ralph Waldo Emerson's favorite number
C) Its square root is imaginary **D)** It cannot be expressed as an integer, or as a root or quotient of integers **E)** none of these

9. Choose the function rule that best represents the graph at right.



A) $f(x) = \begin{cases} -3x, & 0 \le x \le 6 \\ x, & 0 \le x \le 3 \\ \frac{-2}{3}x + 5, & 1 \le x \le 3 \end{cases}$ **B)** $f(x) = \begin{cases} -3x, & -2 \le x \le 0 \\ x, & 0 \le x \le 3 \\ \frac{-2}{3}x + 5, & 3 \le x \le 6 \end{cases}$

C) $f(x) = \begin{cases} -3x, & 0 \le x \le 6 \\ x, & 0 < x \le 3 \\ \frac{-2}{3}x + 5, & 1 \le x < 3 \end{cases}$ **D)** $f(x) = \begin{cases} -3x, & -2 \le x \le 0 \\ x, & 0 < x \le 3 \\ \frac{-2}{3}x + 5, & 3 < x \le 6 \end{cases}$

E) none of these

10. Which of the following is the first perfect cube in the Fibonacci sequence (other than 1)?

A) 8 **B)** 27 **C)** 64 **D)** 125 **E)** none of these

11. $1! + 2! + 3! + 1^1 + 2^2 + 3^3 =$

A) 23 **B)** 38 **C)** 41 **D)** 46 **E)** none of these

12. Use the identity $\cos(x + y) = \cos x \cos y - \sin x \sin y$ to compute $\cos\left(\frac{5\pi}{6} + \frac{\pi}{4}\right)$.

A) $\frac{-\sqrt{3}}{4} - \frac{\sqrt{2}}{2}$ **B)** $\frac{-\sqrt{6}}{4} - \frac{\sqrt{2}}{4}$ **C)** $\frac{\sqrt{3}}{4} - \frac{\sqrt{2}}{2}$ **D)** $\frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4}$ **E)** none of these

13. The smallest prime number that makes a composite number if you reverse its digits is:

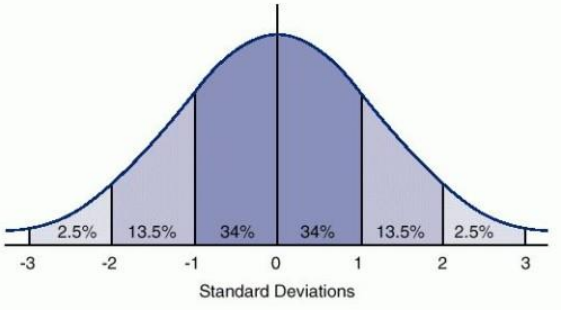
A) 11 **B)** 13 **C)** 17 **D)** 19 **E)** none of these

14. Which of the following is not a triangle congruence criterion?

A) Hypotenuse-Leg **B)** Angle-Side-Angle **C)** Side-Angle-Side **D)** Angle-Angle-Angle **E)** none of these

15. The image at right shows an example of a:

I. Bell Curve
II. Normal Curve
III. Gaussian Curve



A) I **B)** I and II **C)** I and III **D)** all of these **E)** none of these

TEAM 9-10 2017 Answer Key

1. C
2. D
3. C
4. D
5. D
6. A
7. A
8. D
9. D
10. A
11. C
12. B
13. D
14. D
15. D