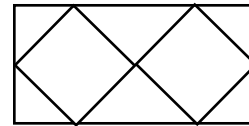


MONTANA COUNCIL OF TEACHERS OF MATHEMATICS  
2018 MATH CONTEST  
ADVANCED

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

1. You are creating a metal tube that will have a radius of 4 cm and a height of 12 cm. Find the volume that this will be able to hold.  
A)  $48\pi \text{ cm}^3$       B)  $96\pi \text{ cm}^3$       C)  $192\pi \text{ cm}^3$       D)  $576\pi \text{ cm}^3$       E) none of these
2. Find the surface area of the cylinder in Problem 2, given that it will have both a top and bottom when completed.  
A)  $60\pi \text{ cm}^2$       B)  $64\pi \text{ cm}^2$       C)  $112\pi \text{ cm}^2$       D)  $128\pi \text{ cm}^2$       E) none of these
3. A used car is worth \$12,500 and decreases in value by 18% per year. Which equation models the value of the car after  $x$  years?  
A)  $y = 12,500(1.8)^x$       B)  $12,500 - 0.18x$       C)  $12,500(.82)^{x-1}$       D)  $12,500(.82)^x$       E) none of these
4. You are planting two square gardens as shown in the figure below. Each square is  $64 \text{ ft}^2$ . You wish to surround the gardens with a rectangular fence as shown. What is the area enclosed by the fence?  
A)  $64 \text{ ft}^2$       B)  $128 \text{ ft}^2$       C)  $192 \text{ ft}^2$       D)  $256 \text{ ft}^2$       E) none of these
5. In the figure up to the right, how much fence is needed for the rectangle?  
A) 24 ft      B)  $16\sqrt{2}$  ft      C) 64ft      D)  $48\sqrt{2}$  ft      E) none of these
6. John and Troy are playing catch. The equation  $y = -16t^2 + 24t + 4$  models the height of the ball as John throws it to Troy. What is the maximum height of the ball to the nearest foot?  
A) 4 feet      B) 13 feet      C) 24 feet      D) 25 feet      E) none of these
7. Solve  $\log_3(4x + 1) = 4$   
A) 2.75      B) 12      C) 12.25      D) 20      E) none of these



A park ranger measured the depth of the water in a lake at the same spot over a period of several weeks and recorded the results in the following table

Day	Depth of length in meters
7	15.29
14	15.43
21	15.71
28	15.57
35	15.85

8. Find the mean ( $\bar{x}$ ) and standard deviation ( $s$ ) of the above data to the nearest tenth.  
A)  $\bar{x} = 15.6, s = 0.2$       B)  $\bar{x} = 15.6, s = 0.6$       C)  $\bar{x} = 15.7, s = 0.2$       D)  $\bar{x} = 15.7, s = 0.6$       E) none of these
9. What would the 6<sup>th</sup> week reading need to be in order to have an average of 15.62 meters.  
A) 15.25 meters      B) 15.62 meters      C) 15.85 meters      D) 15.87 meters      E) none of these
10. The ranger realizes that his tape measure had accidentally had the first meter cut off on the tape, so all measurements were measured incorrectly. How will the standard deviation change in the new data set as compared to the previous data set?  
A) Increase by 1 meter      B) Decrease by 1 meter      C) Increase by 1/5 meter      D) Stays the same      E) none of these

**ADVANCED 2018 page 2**

11. Which is one of the solutions to the system of equations:

$$\begin{cases} y = x^2 - 5 \\ y = \frac{1}{3}x + 3 \end{cases}$$

- A) (2,2)                      B) (3, 4)                      C) (4, 1)                      D) (4, 12)                      E) none of these

12. Reagan competes in the 100 meter butterfly. If there are 8 swimmers in her age group, how many different possibilities would there be for the top three placings?

- A) 24 placings                      B) 56 placings                      C) 336 placings                      D) 512 placings                      E) none of these

13. Suzi has a free throw percentage of 0.798. What is the probability that she will make at least 4 of her next 5 free throws?

- A) 0.410                      B) 0.5                      C) 0.733                      D) 0.798                      E) none of these

14. Write the equation of the ellipse centered at the origin, represented by the oval table 32 inches in length and 24 inches in width

- A)  $\frac{x^2}{16} - \frac{y^2}{12} = 1$                       B)  $\frac{x^2}{32} + \frac{y^2}{24} = 1$                       C)  $\frac{x^2}{256} + \frac{y^2}{144} = 1$                       D)  $\frac{x^2}{1024} + \frac{y^2}{576} = 1$                       E) none of these

15.  $f(x) = \frac{x+4}{5}; g(x) = x^2$ . Find  $g(f(2))$

- A)  $\frac{4}{25}$                       B)  $\frac{36}{25}$                       C)  $\frac{8}{5}$                       D)  $\frac{24}{5}$                       E) none of these

16. An airplane flying at an altitude of 10,000 feet is approaching the airport. The angle of decline from the plane to the end of the runway is  $39.2^\circ$ . What is the approximate flight path distance from the plane to the end of the runway?

- A) 1.2 miles                      B) 1.5 miles                      C) 3 miles                      D) 4 miles                      E) none of these

17. Write as a single logarithmic expression:  $\ln x + 3\ln y - 5\ln z$

- A)  $\ln(15xyz)$                       B)  $\ln\left(\frac{3xy}{5z}\right)$                       C)  $y^3z^5$                       D)  $\ln\left(\frac{xy^3}{z^5}\right)$                       E) none of these

18.  $\begin{bmatrix} 7 & 3 \\ 2 & 4 \\ -1 & -2 \end{bmatrix} + x \begin{bmatrix} 1 & 3 \\ 2 & -3 \\ 8 & 5 \end{bmatrix} = \begin{bmatrix} 8 & 6 \\ 4 & z \\ y & 3 \end{bmatrix}$

- A)  $x = -1, y = -9, z = -2$                       B)  $x = 0, y = 8, z = -3$                       C)  $x = 1, y = 7, z = 1$                       D)  $x = 2, y = 15, z = -2$                       E) none of these

19. Simplify the following:  $\frac{2+\sqrt{3}}{1-\sqrt{3}}$

- A)  $\frac{-5-3\sqrt{3}}{2}$                       B) 2                      C)  $\frac{3+\sqrt{3}}{2}$                       D)  $\frac{5+3\sqrt{3}}{4}$                       E) none of these

20. Consider the equation  $y = 2 \sin(x) + 3$ . What is the amplitude and period of this function?

- A) per. =  $2\pi$ , amp. = 3                      B) per. = 1, amp. = 2                      C) per. =  $\pi$ , amp. = 3                      D) per. =  $2\pi$ , amp. = 2                      E) none of these

**ADVANCED 2018 Answer Key**

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