

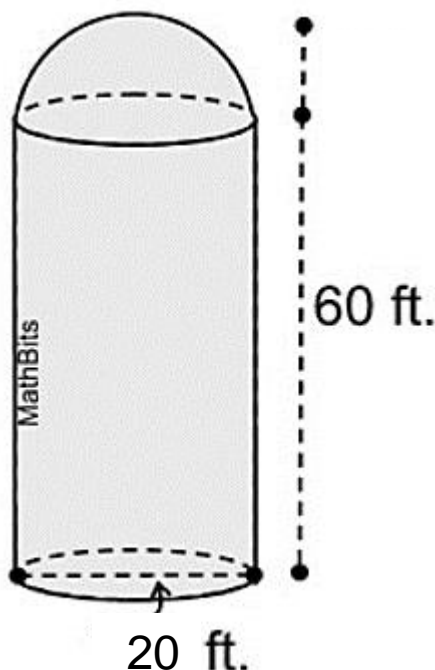
MONTANA COUNCIL OF TEACHERS OF MATHEMATICS  
2019 MATH CONTEST

## Dimensions and Shapes

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

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- A rectangular aquarium 3 feet by 2 feet by 1 foot is  $\frac{2}{3}$  full of water. In cubic feet, how much water is in the tank?  
A)  $\frac{16}{9}$  ft<sup>3</sup>      B) 4 ft<sup>3</sup>      C) 6 ft<sup>3</sup>      D) 9 ft<sup>3</sup>      E) none of these
- A triangle drawn on a map has sides of lengths 8cm, 11cm and 15cm. The shortest of the corresponding real life distances is 122km. Find the longest of the real life distances. Round to the nearest unit.  
A) 65 km      B) 168 km      C) 229 km      D) 166 km      E) none of these
- A fence encloses Ben's rectangular garden that is 30ft by 18ft. If Ben wishes to change the shape of the garden to a circle with the same amount of perimeter fencing as the rectangle, what would be the approximate area of his new circular garden?  
A) 96 ft<sup>2</sup>      B) 183 ft<sup>2</sup>      C) 540 ft<sup>2</sup>      D) 733 ft<sup>2</sup>      E) none of these
- A box of cereal contains 510 grams of cereal. If one serving is  $1\frac{1}{4}$  cups and 1 cup of cereal weighs 26.4 grams, what is the maximum number of complete servings contained in the box?  
A) 15      B) 16      C) 19      D) 26      E) none of these
- James is going to paint the walls in his room. The room is 16 feet long, 12 feet wide and 8 feet high. He subtracts 15% of the wall area for windows and doors. One quart of paint covers 110 square feet. How many quarts of paint will he need to buy paint the walls?  
A) 3      B) 4      C) 12      D) 14      E) none of these
- The area of a rhombus is 20 square cm, and one diagonal is twice the length of the other. What is the length of a side of the rhombus?  
A) 2.24 cm      B) 3.16 cm      C) 4.92 cm      D) 5.48 cm      E) none of these
- Linda wants to put out snacks for math contest writers and notices that she has two open cans of mixed nuts. The capacity of the larger can is three times the capacity of the smaller can. Linda estimates that the smaller can is about  $\frac{3}{4}$  full of nuts and the larger can is about half full. She pours all of the nuts from the smaller can into the larger can. After she does this, about how full is the larger can?  
A)  $\frac{3}{4}$       B)  $\frac{5}{6}$       C)  $\frac{17}{18}$       D) overflowing      E) none of these
- An equilateral triangle has a side of 10 inches. What is the area of the triangle to the nearest whole number?  
A) 25 in<sup>2</sup>      B) 30 in<sup>2</sup>      C) 43 in<sup>2</sup>      D) 50 in<sup>2</sup>      E) none of these
- The circumference of a circle is  $20\pi$  cm. What is its area?  
A)  $50\pi$  in<sup>2</sup>      B)  $100\pi$  in<sup>2</sup>      C)  $200\pi$  in<sup>2</sup>      D)  $400\pi$  in<sup>2</sup>      E) none of these



**For 10-12:** A grain silo (shown at left) is in the shape of a cylinder with a half sphere on top. The diameter of the base of the cylinder is 20 ft and the height of the cylindrical part is 60 ft as marked.

- 10.** The silo, when full can hold 2100 bushels of wheat. On each of five consecutive days, the farmer sells 150 bushels from an initially full silo. After these sales, approximately what percent of the silo's capacity is still filled with wheat?  
 A) 16%      B) 36%      C) 45%      D) 64%      E) none of these

- 11.** The farmer who owns the silo plans to apply a coat of paint to the cylindrical exterior. He is not going to paint the top (half sphere dome). If one can of paint covers 300 square feet of surface, what is the fewest number of cans that the farmer must buy?  
 A) 10      B) 11      C) 12      D) 13      E) none of these

- 12.** What is the volume of the silo (including the half sphere on top) to the nearest cubic foot? Do not approximate  $\pi$ .  
 A) 5864 ft<sup>3</sup>      B) 7959 ft<sup>3</sup>      C) 20944 ft<sup>3</sup>  
 D) 23038 ft<sup>3</sup>      E) none of these

- 13.** If the surface area of a cube is 73.5 cm<sup>2</sup>, what is the perimeter of the base?  
 A) 3.5 cm      B) 7 cm      C) 12.5 cm      D) 14 cm      E) none of these

- 14.** Which of the following side lengths does not form a right triangle?  
 A) 1, 2, 3      B) 3, 4, 5      C) 5, 12, 13      D) 8, 15, 17      E) none of these

- 15.** The bases of an isosceles trapezoid are 6mm and 12mm. Its height is 4mm. Find the perimeter of the trapezoid.  
 A) 20 mm      B) 22 mm      C) 26 mm      D) 28 mm      E) none of these

- 16.** Your town's Parks and Rec department is pouring a half court basketball pad in your local park. The size of the pad is 42 feet by 50 feet and will need to be 4 inches deep. What is the volume of the concrete slab?  
 A) 96 ft<sup>3</sup>      B) 700 ft<sup>3</sup>      C) 2100 ft<sup>3</sup>      D) 8400 ft<sup>3</sup>      E) none of these

- 17.** Concrete costs \$90 per cubic yard. To the nearest thousand, how much will Parks and Rec (#16) pay for the slab?  
 A) \$2000      B) \$7000      C) \$21000      D) \$63000      E) none of these

- 18.** A square has a perimeter of 64 meters. What is the length of its diagonal?  
 A) 8 m      B) 16 m      C) 256 m      D) 512 m      E) none of these

- 19.** You are going to make an open-top box by cutting out square corners ( $x$  inches by  $x$  inches) and folding up the sides. The original sheet of cardboard is 12 inches by 18 inches. Which of the following represents the volume of the box?  
 A)  $(12)(18)x$       B)  $x(12 - x)(18 - 2x)$       C)  $x(12 - 2x)(18 - 2x)$   
 D)  $x(12 - 4x)(18 - 4x)$       E) none of these

- 20.** An equilateral triangle and a square share a side. The perimeter of the triangle is 51 in. Find the area of the square.  
 A) 17 in<sup>2</sup>      B) 68 in<sup>2</sup>      C) 163 in<sup>2</sup>      D) 289 in<sup>2</sup>      E) none of these

## **Dimensions & Shapes 2019 Answer Key**

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