**G2 Unit Exam - 3-Dimensional Geometry**

Topics Covered

* Volume of prisms and pyramids
* Volume of cylinders, cones and spheres
* Density
* Surface area

Standards

G.GMD.3: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

* High Emphasis
* Ex. Determine the volume of a cylinder with a radius of 3 in and a height of 7 in.
* Ex. How is the volume of a cone affected by doubling the height?
* Ex. The surface area of a cube is 486 cm2. What is the volume of the cube?

G.MG.2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

* High Emphasis
* Ex. Given land area and population of cities, classify according to population density.
* Ex. Find the density of an object given mass and measurements.

G.MG.1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

* Low Emphasis
* Ex. A log is 12 feet long and has a diameter of approximately 9 inches. Which statement describes the best way to estimate the volume (in cubic feet) of the log?

7.G.6: Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

* Low Emphasis
* Ex. A rectangular prism has a surface area of 388 cm2. What are the possible dimensions?

**G2 Unit Exam – 3-Dimensional Geometry**

**Answer Key**

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| **#** | **Correct** |  | **#** | **Correct** |  | **#** | **Correct** |  | **#** | **Correct** |  | **#** | **Correct** |  | **#** | **Correct** |
| 1 | 210 |  | 4 | B |  | 7 | A |  | 10 | 47 |  | 13 | 0.75 |  | 16 | A |
| 2 | D |  | 5 | C |  | 8 | B |  | 11 | A |  | 14 | D |  | 17 | 91.2 |
| 3 | D |  | 6 | 9 |  | 9 | A |  | 12 | D |  | 15 | C |  | 18 | D |

19. Rubric

2-Points Examinee states that the cylinder has the greatest volume, and defends their answer.

1-Point Examinee states that the cylinder has the greatest volume, but offers no proof or defense of his or her answer.

20. Rubric

Carol’s Cylinder: Surface Area = 2(3.14)(2.5)(7) + 2(3.14)(2.52) = 149.15 in2

Mike’s Rectangular Prism: Surface Area = 2(3.5)(7) + 2(7)(5) + 2(3.5)(5) = 154 in2

2-Points Examinee states that Carol’s design will minimize the surface area of the package using evidence to support their claim, and the examinee correctly states that the difference of the packages is 4.85 in2.

1-Point Examinee states that Carol’s design will minimize the surface area of the package using evidence to support their claim, but does not correctly determine the difference of the packages to be 4.85 in2.

OR

Examinee correctly determines that the difference of the packages is 4.85 in2, but does not provide evidence that Carol’s design will minimize the surface area of the package.

EXTRA CREDIT

21. 12 minutes

22. 2*x*3 – 2*x*2 – 4*x*

23. 18 feet.

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

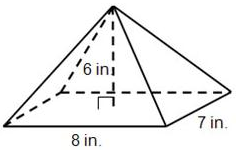
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Calculator use allowed.

1. Find the volume of the rectangular prism in cubic centimeters.

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1. Christine made a cube in technology class. Each edge measured 12 cm. What is the volume of the cube in cubic centimeters?
2. 36 cm3
3. 72 cm3
4. 144 cm3
5. 1728 cm3
6. Find the volume of the figure below.



1. in3
2. 48 in3
3. in3
4. in3
5. Thayer needs to buy an exhaust fan for her bathroom. The bathroom has a width of 7 feet, a length of 10 feet, and a height of 8 feet, and the duct for the fan is 10 feet long. Using the chart below, what size bathroom fan should she purchase?

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| Bathroom Fan Sizing Chart | | | | | |
| Bathroom Size | Duct Length | | | | |
| 10 ft. | 20 ft. | 30 ft. | 40 ft. | 50 ft. |
| 400 ft3 | 60 cfm | 60 cfm | 60 cfm | 60 cfm | 60 cfm |
| 480 ft3 | 60 cfm | 60 cfm | 60 cfm | 60 cfm | 60 cfm |
| 560 ft3 | 70 cfm | 70 cfm | 90 cfm | 90 cfm | 110 cfm |
| 640 ft3 | 90 cfm | 90 cfm | 90 cfm | 90 cfm | 110 cfm |
| 730 ft3 | 90 cfm | 90 cfm | 110 cfm | 110 cfm | 110 cfm |

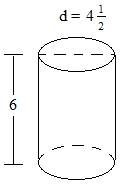
1. ≥ 60 cfm
2. ≥ 70 cfm
3. ≥ 90 cfm
4. ≥ 110 cfm
5. An appliance store sells air conditioners with different BTU ratings, which tell how much heat the air conditioners can remove from the air on one hour. Suppose a customer has a room with a width of 20 feet, a length of 40 feet, and a ceiling height of 10 feet that has a cooling requirement of 2 BTUs per cubic foot.

What would be the best air conditioner BTU rating for the appliance store to recommend to the customer?

1. 4,000
2. 8,000
3. 16,000
4. 48,000

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| 1. A box in the shape of a cube has a volume of 729 cubic inches. What is the length of a side of the box in inches? |  |

1. Consider this cylinder with a diameter (*d*) that is inches (in.).



Which is the best estimate of the volume of the cylinder?

1. 95.4 in.3
2. 381.5 in.3
3. 84.8 in.3
4. 42.4 in.3
5. A tennis ball has a diameter of 2.7 inches. Tennis balls come in containers shaped like cylinders. Three tennis balls, stacked one on top of the other, fit exactly into the container. What is the approximate volume of a tennis ball container?
6. 15.5 cubic inches
7. 46.4 cubic inches
8. 61.8 cubic inches
9. 116.2 cubic inches
10. A rectangle is rotated 360° about an axis as shown.

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| What solid is generated by this rotation?   1. cylinder 2. cone 3. sphere 4. hemisphere |  |

1. In the accompanying diagram, a rectangular container with the dimensions 10 inches by 15 inches by 20 inches is to be filled with water, using a cylindrical cup whose radius is 2 inches and whose height is 5 inches. What is the maximum number of full cups of water that can be placed into the container without the water overflowing the container?

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1. A chemical corporation created a new type of polystyrene. A 7 cubic centimeter (cm3) sample of the polystyrene has a total mass of 7.35 grams.

What is the density of this sample of polystyrene?

1. 1.05 g/ cm3
2. 0.95 g/ cm3
3. 51.45 g/ cm3
4. 14.35 g/ cm3
5. The population of a city that is 200 square miles is 2.5 million.

What is the population density per square mile of the city?

1. 80 people per square mile
2. 500 people per square mile
3. 1,250 people per square mile
4. 12,500 people per square mile

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| 1. A tank in the shape of a right cylinder contains 2,400 liters (l) of gasoline. The weight of the gasoline in the tank is 1,800 kilograms (kg). What is the density of the gasoline in the tank in kilograms per liter? |  |

1. **.** Gold has a density of about 19.32 grams per cubic centimeter. To the nearest gram, what is the mass of a gold cube whose edges each measure 5 cm?
2. 6 grams
3. 97 grams
4. 483 grams
5. 2,415 grams
6. **.** Oak has a density of about 0.711 grams per cubic centimeter. To the nearest gram, what is the mass of an oak cylinder with a radius of 6 cm and a height of 20 cm?
7. 169 grams
8. 483 grams
9. 1,607 grams
10. 3,180 grams
11. Which of the following cities has the greatest population density?

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| **City** | **Population** | **Area (km2)** |
| Guttenberg, New Jersey | 11,481 | 0.507 |
| Colombo, Sri Lanka | 323,257 | 37 |
| Montreal, Canada | 1,649,519 | 365.13 |
| New York, New York | 8,175,133 | 783.73 |

1. Guttenberg, New Jersey
2. Colombo, Sri Lanka
3. Montreal, Canada
4. New York, NY

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| 1. The rectangular prism shown below has a length of 3.0 cm, a width of 2.2 cm, and a height of 7.5 cm.   What is the surface area of the rectangular prism to the nearest tenth of a square centimeter?     1. The edges of a cube each measure 4 cm. What is the surface area of the cube? 2. 24 cm2 3. 16 cm2 4. 64 cm2 5. 96 cm2 |  |

1. Of the three diagrams below, which represents the figure with the greatest volume?

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Identify the figure by name, and then demonstrate how you know it has the greatest volume below:

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1. Mike plans to send a package in a rectangular prism-shaped carton, but Carol suggests that Mike use a cylindrical-shaped carton instead. The prism has dimensions of 5 inches by 3.5 inches by 7 inches, while the cylinder has a diameter of 5 inches and a height of 7 inches.

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|  | * The formula for the surface area of a cylinder is . * The formula for the surface area of a rectangular prism is   . |

Whose idea will minimize the surface area of the package? How much would be the difference? Justify how you know below:

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**EXTRA CREDIT**

1. As shown in the accompanying diagram, the length, width, and height of Richard’s fish tank are 24 inches, 16 inches, and 18 inches, respectively. Richard is filling his fish tank with water from a hose at the rate of 500 cubic inches per minute. How long will it take, to the *nearest minute*, to fill the tank to a depth of 15 inches?

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1. A cardboard box has length *x* – 2, width *x* + 1, and height 2*x*.

Using the fewest number of terms, write an expression, in terms of *x*, to represent the volume of the box.

1. A contractor is determining the maximum size of a new concrete patio for a customer.



* The patio is to be rectangular.
* The thickness of the patio is to be 6 inches.
* The width of the patio is to be 12 feet.
* The cost of the concrete is $80.00 per cubic yard.
* The budget for the concrete is $320.00

What is the length, in feet, of the largest patio that can be constructed with these conditions?

**G2 Unit Exam – 3-Dimensional Geometry**

**Score Sheet and Report**

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