

Volumes of Cylinders, Cones, Pyramids and Spheres

Grade 10 – Geometry math · Test Answer Key · Standards: G-GMD.A.1, G-GMD.A.3

Each solution shows the formula, the substitution and the rounded value with units. The scoring notes show how partial credit is earned for the formula, the arithmetic and the explanation.

Standards: G-GMD.A.1, G-GMD.A.3 · **Level:** Grade 10 Geometry

Question 1 Cylinder Volume (2 points)

$$V = \pi(4.5^2)(8) = 162\pi \approx 508.94.$$

$$\approx 508.9 \text{ cm}^3$$

Scoring: 1 point for the formula with the numbers, 1 point for the answer.

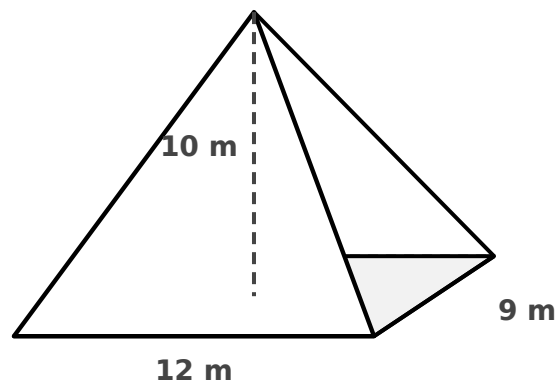
Question 2 Cone Volume (2 points)

$$V = \frac{1}{3}\pi(6^2)(11) = 132\pi \approx 414.69.$$

$$\approx 414.7 \text{ in}^3$$

Scoring: 1 point for the one third, 1 point for the answer.

Question 3 Pyramid Volume (3 points)



Base 12 m by 9 m, height 10 m.

$$\text{Base area} = 12 \cdot 9 = 108. V = \frac{1}{3} \cdot 108 \cdot 10 = 360.$$

360 m³

Scoring: 1 point for the base area, 1 point for the one third, 1 point for the answer.

Question 4 Sphere Volume (2 points)

$$V = \frac{4}{3}\pi(1.8^3) = \frac{4}{3}\pi(5.832) \approx 24.43.$$

$\approx 24.4 \text{ m}^3$

Scoring: 1 point for the formula, 1 point for the answer.

Question 5 Cavalieri Explanation (2 points)

Both have the same height and equal cross-sectional area at every level (40 in²), so Cavalieri's principle gives equal volumes. $V = 40 \cdot 9 = 360$.

360 in³ each

Scoring: 1 point for naming equal slices and equal heights, 1 point for the volume.

Question 6 Capsule Volume (3 points)

Cylinder: $\pi(3^2)(10) = 90\pi$. Two hemispheres make one sphere: $\frac{4}{3}\pi(3^3) = 36\pi$.

$$\text{Total} = 126\pi \approx 395.84.$$

$126\pi \text{ mm}^3 \approx 395.8 \text{ mm}^3$

Scoring: 1 point for the cylinder, 1 point for the sphere, 1 point for the total.

Question 7 Radius from Volume (3 points)

$$\frac{1}{3}\pi r^2(9) = 75\pi, \text{ so } 3r^2 = 75, r^2 = 25 \text{ and } r = 5.$$

5 cm

Scoring: 1 point for the equation, 1 point for r^2 , 1 point for the radius.

Question 8 Area of a Circle (3 points)

The base is half the circumference: $\frac{1}{2} \cdot 2\pi(6) = 6\pi \text{ cm}$. The height is the radius, 6 cm. Area $\approx 6\pi \cdot 6 = 36\pi \text{ cm}^2$.

In general the base is πr and the height is r , so the area is $\pi r \cdot r = \pi r^2$. More, thinner wedges make the shape closer to a true parallelogram.

Base 6π , height 6, area $36\pi \text{ cm}^2$

Scoring: 1 point for base and height, 1 point for the area, 1 point for the explanation.