Question ID 9966235e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: 9966235e

A cube has an edge length of 68 inches. A solid sphere with a radius of 34 inches is inside the cube, such that the sphere touches the center of each face of the cube. To the nearest cubic inch, what is the volume of the space in the cube not taken up by the sphere?

A. $149{,}796$

B. $164{,}500$

C. $190{,}955$

D. $310{,}800$

ID: 9966235e Answer

Correct Answer: A

Rationale

Choice A is correct. The volume of a cube can be found by using the formula $V = s^3$, where V is the volume and s is the edge length of the cube. Therefore, the volume of the given cube is $V = 68^3$, or $314{,}432$ cubic inches. The volume of a sphere can be found by using the formula $V = \frac{4}{3}\pi r^3$, where V is the volume and r is the radius of the sphere. Therefore, the volume of the given sphere is $V = \frac{4}{3}\pi 34^3$, or approximately $164{,}636$ cubic inches. The volume of the space in the cube not taken up by the sphere is the difference between the volume of the cube and volume of the sphere. Subtracting the approximate volume of the sphere from the volume of the cube gives $314{,}432$ - $164{,}636 = 149{,}796$ cubic inches.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

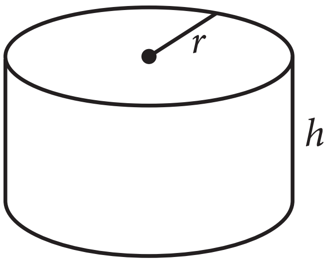
Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID a07ed090

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: a07ed090



The figure shown is a right circular cylinder with a radius of r and height of h. A second right circular cylinder (not shown) has a volume that is 392 times as large as the volume of the cylinder shown. Which of the following could represent the radius R, in terms of r, and the height H, in terms of h, of the second cylinder?

A. $R = 8r$ and $H = 7h$

B. $R = 8r$ and $H = 49h$

C. $R = 7r$ and $H = 8h$

D. $R = 49r$ and $H = 8h$

ID: a07ed090 Answer

Correct Answer: C

Rationale

Choice C is correct. The volume of a right circular cylinder is equal to $\pi a^2 b$, where a is the radius of a base of the cylinder and b is the height of the cylinder. It's given that the cylinder shown has a radius of r and a height of h. It follows that the volume of the cylinder shown is equal to $\pi r^2 h$. It's given that the second right circular cylinder has a radius of R and a height of H. It follows that the volume of the second cylinder is equal to $\pi R^2 H$. Choice C gives $R = 7r$ and $H = 8h$. Substituting $7r$ for R and $8h$ for H in the expression that represents the volume of the second cylinder yields $\pi 7r^2 8h$, or $\pi 49r^2 8h$, which is equivalent to $\pi 392r^2 h$, or $392\pi r^2 h$. This expression is equal to 392 times the volume of the cylinder shown, $\pi r^2 h$. Therefore, $R = 7r$ and $H = 8h$ could represent the radius R, in terms of r, and the height H, in terms of h, of the second cylinder.

Choice A is incorrect. Substituting $8r$ for R and $7h$ for H in the expression that represents the volume of the second cylinder yields $\pi 8r^2 7h$, or $\pi 64r^2 7h$, which is equivalent to $\pi 448r^2 h$, or $448\pi r^2 h$. This expression is equal to 448, not 392, times the volume of the cylinder shown.

Choice B is incorrect. Substituting $8r$ for R and $49h$ for H in the expression that represents the volume of the second cylinder yields $\pi 8r^2 49h$, or $\pi 64r^2 49h$, which is equivalent to $\pi 3{,}136r^2 h$, or $3{,}136\pi r^2 h$. This expression is equal to $3{,}136$, not 392, times the volume of the cylinder shown.

Choice D is incorrect. Substituting $49r$ for R and $8h$ for H in the expression that represents the volume of the second cylinder yields $\pi 49r^2 8h$, or $\pi 2{,}401r^2 8h$, which is equivalent to $\pi 19{,}208r^2 h$, or $19{,}208\pi r^2 h$. This expression is equal to $19{,}208$, not 392, times the volume of the cylinder shown.

Question Difficulty: Hard

Question ID 899c6042

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: 899c6042

A right circular cone has a height of 22 centimeters (cm) and a base with a diameter of $6\ \text{cm}$. The volume of this cone is $n\pi\ \text{cm}^3$. What is the value of n?

ID: 899c6042 Answer

Correct Answer: 66

Rationale

The correct answer is 66. It's given that the right circular cone has a height of 22 centimeters cm and a base with a diameter of $6\ \ \text{cm}$. Since the diameter of the base of the cone is $6\ \ \text{cm}$, the radius of the base is $3\ \ \text{cm}$. The volume V, $\text{in}\ \ \text{cm}^3$, of a right circular cone can be found using the formula $V = \frac{1}{3}\pi r^2 h$, where h is the height, $\text{in}\ \ \text{cm}$, and r is the radius, $\text{in}\ \ \text{cm}$, of the base of the cone. Substituting 22 for h and 3 for r in this formula yields $V = \frac{1}{3}\pi 3^2 22$, or $V = 66\pi$. Therefore, the volume of the cone is $66\pi\ \ \text{cm}^3$. It's given that the volume of the cone is $n\pi\ \ \text{cm}^3$. Therefore, the value of n is 66.

Question Difficulty: Hard

Question ID b0dc920d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: b0dc920d

A manufacturer determined that right cylindrical containers with a height that is 4 inches longer than the radius offer the optimal number of containers to be displayed on a shelf. Which of the following expresses the volume, V, in cubic inches, of such containers, where r is the radius, in inches?

A. $V = 4\pi r^3$

B. $V = \pi(2r)^3$

C. $V = \pi r^2 + 4\pi r$

D. $V = \pi r^3 + 4\pi r^2$

ID: b0dc920d Answer

Correct Answer: D

Rationale

Choice D is correct. The volume, V, of a right cylinder is given by the formula $V = \pi r^2 h$, where r represents the radius of the base of the cylinder and h represents the height. Since the height is 4 inches longer than the radius, the expression $r + 4$ represents the height of each cylindrical container. It follows that the volume of each container is represented by the equation $V = \pi r^2(r + 4)$. Distributing the expression πr^2 into each term in the parentheses yields $V = \pi r^3 + 4\pi r^2$.

Choice A is incorrect and may result from representing the height as $4r$ instead of $r + 4$. Choice B is incorrect and may result from representing the height as $2r$ instead of $r + 4$. Choice C is incorrect and may result from representing the volume of a right cylinder as $V = \pi r h$ instead of $V = \pi r^2 h$.

Question Difficulty: Hard

Question ID 5b2b8866

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 5b2b8866

A rectangular poster has an area of 360 square inches. A copy of the poster is made in which the length and width of the original poster are each increased by 20%. What is the area of the copy, in square inches?

ID: 5b2b8866 Answer

Correct Answer: 2592/5, 518.4

Rationale

The correct answer is 518.4. It's given that the area of the original poster is 360 square inches. Let l represent the length, in inches, of the original poster, and let w represent the width, in inches, of the original poster. Since the area of a rectangle is equal to its length times its width, it follows that $360 = lw$. It's also given that a copy of the poster is made in which the length and width of the original poster are each increased by 20%. It follows that the length of the copy is the length of the original poster plus 20% of the length of the original poster, which is equivalent to $l + \frac{20}{100}l$ inches. This length can be rewritten as $l + 0.2l$ inches, or $1.2l$ inches. Similarly, the width of the copy is the width of the original poster plus 20% of the width of the original poster, which is equivalent to $w + \frac{20}{100}w$ inches. This width can be rewritten as $w + 0.2w$ inches, or $1.2w$ inches. Since the area of a rectangle is equal to its length times its width, it follows that the area, in square inches, of the copy is equal to $1.2l1.2w$, which can be rewritten as $1.21.2lw$. Since $360 = lw$, the area, in square inches, of the copy can be found by substituting 360 for lw in the expression $1.21.2lw$, which yields $1.21.2360$, or 518.4. Therefore, the area of the copy, in square inches, is 518.4.

Question Difficulty: Hard

Question ID 9f934297

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 9f934297

A right rectangular prism has a length of 28 centimeters (cm), a width of $15\ \text{cm}$, and a height of $16\ \text{cm}$. What is the surface area, in cm^2, of the right rectangular prism?

ID: 9f934297 Answer

Correct Answer: 2216

Rationale

The correct answer is $2{,}216$. The surface area of a prism is the sum of the areas of all its faces. A right rectangular prism consists of six rectangular faces, where opposite faces are congruent. It's given that this prism has a length of $28\ \ \text{cm}$, a width of $15\ \ \text{cm}$, and a height of $16\ \ \text{cm}$. Thus, for this prism, there are two faces with area $2815\ \ \text{cm}^2$, two faces with area $2816\ \ \text{cm}^2$, and two faces with area $1516\ \ \text{cm}^2$. Therefore, the surface area, $\text{in}\ \ \text{cm}^2$, of the right rectangular prism is $22815 + 22816 + 21516$, or $2{,}216$.

Question Difficulty: Hard

Question ID dc71597b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: dc71597b

A right circular cone has a volume of $\frac{1}{3}\pi$ cubic feet and a height of 9 feet. What is the radius, in feet, of the base of the cone?

A. $\frac{1}{3}$

B. $\frac{1}{\sqrt{3}}$

C. $\sqrt{3}$

D. 3

ID: dc71597b Answer

Correct Answer: A

Rationale

Choice A is correct. The equation for the volume of a right circular cone is $V = \frac{1}{3}\pi r^2 h$. It's given that the volume of the right circular cone is $\frac{1}{3}\pi$ cubic feet and the height is 9 feet. Substituting these values for V and h, respectively, gives $\frac{1}{3}\pi = \frac{1}{3}\pi r^2(9)$. Dividing both sides of the equation by $\frac{1}{3}\pi$ gives $1 = r^2(9)$. Dividing both sides of the equation by 9 gives $\frac{1}{9} = r^2$. Taking the square root of both sides results in two possible values for the radius, $\sqrt{\left(\frac{1}{9}\right)}$ or $-\sqrt{\left(\frac{1}{9}\right)}$. Since the radius can't have a negative value, that leaves $\sqrt{\left(\frac{1}{9}\right)}$ as the only possibility. Applying the quotient property of square roots, $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$, results in $r = \frac{\sqrt{1}}{\sqrt{9}}$, or $r = \frac{1}{3}$.

Choices B and C are incorrect and may result from incorrectly evaluating $\sqrt{\left(\frac{1}{9}\right)}$. Choice D is incorrect and may result from solving $r^2 = 9$ instead of $r^2 = \frac{1}{9}$.

Question Difficulty: Hard

Question ID 93de3f84

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: 93de3f84

The volume of right circular cylinder A is 22 cubic centimeters. What is the volume, in cubic centimeters, of a right circular cylinder with twice the radius and half the height of cylinder A?

A. 11

B. 22

C. 44

D. 66

ID: 93de3f84 Answer

Correct Answer: C

Rationale

Choice C is correct. The volume of right circular cylinder A is given by the expression $\pi r^2 h$, where r is the radius of its circular base and h is its height. The volume of a cylinder with twice the radius and half the height of cylinder A is given by $\pi(2r)^2\left(\frac{1}{2}\right)h$, which is equivalent to $4\pi r^2\left(\frac{1}{2}\right)h = 2\pi r^2 h$. Therefore, the volume is twice the volume of cylinder A, or $2 \times 22 = 44$.

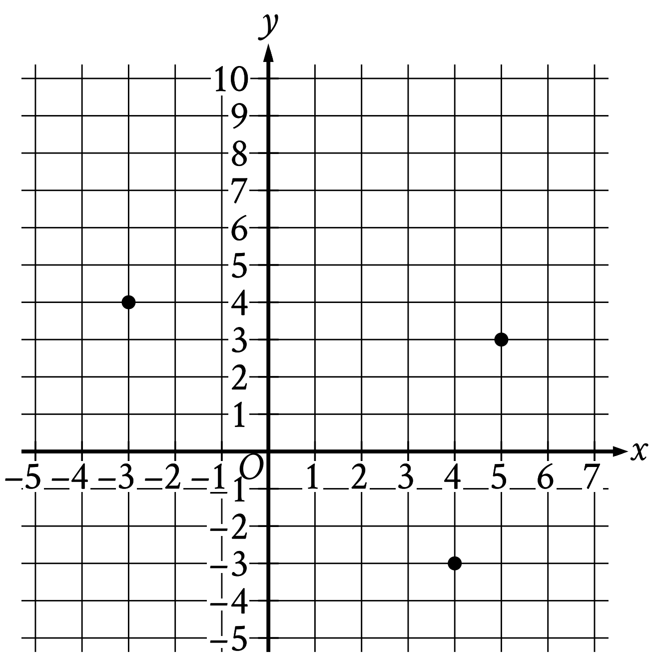
Choice A is incorrect and likely results from not multiplying the radius of cylinder A by 2. Choice B is incorrect and likely results from not squaring the 2 in 2r when applying the volume formula. Choice D is incorrect and likely results from a conceptual error.

Question Difficulty: Hard

Question ID eb70d2d0

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: eb70d2d0



What is the area, in square units, of the triangle formed by connecting the three points shown?

ID: eb70d2d0 Answer

Correct Answer: 24.5, 49/2

Rationale

The correct answer is 24.5. It's given that a triangle is formed by connecting the three points shown, which are $-3, 4$, $5, 3$, and $4, -3$. Let this triangle be triangle A. The area of triangle A can be found by calculating the area of the rectangle that circumscribes it and subtracting the areas of the three triangles that are inside the rectangle but outside triangle A. The rectangle formed by the points $-3, 4$, $5, 4$, $5, -3$, and $-3, -3$ circumscribes triangle A. The width, in units, of this rectangle can be found by calculating the distance between the points $5, 4$ and $5, -3$. This distance is $4 - -3$, or 7. The length, in units, of this rectangle can be found by calculating the distance between the points $5, 4$ and $-3, 4$. This distance is $5 - -3$, or 8. It follows that the area, in square units, of the rectangle is 78, or 56. One of the triangles that lies inside the rectangle but outside triangle A is formed by the points $-3, 4$, $5, 4$, and $5, 3$. The length, in units, of a base of this triangle can be found by calculating the distance between the points $5, 4$ and $5, 3$. This distance is $4 - 3$, or 1. The corresponding height, in units, of this triangle can be found by calculating the distance between the points $5, 4$ and $-3, 4$. This distance is $5 - -3$, or 8. It follows that the area, in square units, of this triangle is $\frac{1}{2}81$, or 4. A second triangle that lies inside the rectangle but outside triangle A is formed by the points $4, -3$, $5, 3$, and $5, -3$. The length, in units, of a base of this triangle can be found by calculating the distance between the points $5, 3$ and $5, -3$. This distance is $3 - -3$, or 6. The corresponding height, in units, of this triangle can be found by calculating the distance between the points $5, -3$ and $4, -3$. This distance is $5 - 4$, or 1. It follows that the area, in square units, of this triangle is $\frac{1}{2}16$, or 3. The third triangle that lies inside the rectangle but outside triangle A is formed by the points $-3, 4$, $-3, -3$, and $4, -3$. The length, in units, of a base of this triangle can be found by calculating the distance between the points $4, -3$ and $-3, -3$. This distance is $4 - -3$, or 7. The corresponding height, in units, of this triangle can be found by calculating the distance between the points $-3, 4$ and $-3, -3$. This distance is $4 - -3$, or 7. It follows that the area, in square units, of this triangle is $\frac{1}{2}77$, or 24.5. Thus, the area, in square units, of the triangle formed by connecting the three points shown is $56 - 4 - 3 - 24.5$, or 24.5. Note that 24.5 and 49/2 are examples of ways to enter a correct answer.

Question Difficulty: Hard

Question ID f329442c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: f329442c

Circle A has a radius of $3n$ and circle B has a radius of $129n$, where n is a positive constant. The area of circle B is how many times the area of circle A?

A. 43

B. 86

C. 129

D. $1{,}849$

ID: f329442c Answer

Correct Answer: D

Rationale

Choice D is correct. The area of a circle can be found by using the formula $A = \pi r^2$, where A is the area and r is the radius of the circle. It's given that the radius of circle *A* is $3n$. Substituting this value for r into the formula $A = \pi r^2$ gives $A = \pi 3n^2$, or $9\pi n^2$. It's also given that the radius of circle *B* is $129n$. Substituting this value for r into the formula $A = \pi r^2$ gives $A = \pi 129n^2$, or $16{,}641\pi n^2$. Dividing the area of circle *B* by the area of circle *A* gives $\frac{16{,}641\pi n^2}{9\pi n^2}$, which simplifies to $1{,}849$. Therefore, the area of circle *B* is $1{,}849$ times the area of circle *A*.

Choice A is incorrect. This is how many times greater the radius of circle *B* is than the radius of circle *A*.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect. This is the coefficient on the term that describes the radius of circle *B*.

Question Difficulty: Hard

Question ID f7e626b2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: f7e626b2

The dimensions of a right rectangular prism are 4 inches by 5 inches by 6 inches.
What is the surface area, in square inches, of the prism?

A. 30

B. 74

C. 120

D. 148

ID: f7e626b2 Answer

Rationale

Choice D is correct. The surface area is found by summing the area of each face. A right rectangular prism consists of three pairs of congruent rectangles, so the surface area is found by multiplying the areas of three adjacent rectangles by 2 and adding these products. For this prism, the surface area is equal to $2(4 \cdot 5) + 2(5 \cdot 6) + 2(4 \cdot 6)$, or $2(20) + 2(30) + 2(24)$, which is equal to 148.

Choice A is incorrect. This is the area of one of the faces of the prism. Choice B is incorrect and may result from adding the areas of three adjacent rectangles without multiplying by 2. Choice C is incorrect. This is the volume, in cubic inches, of the prism.

Question Difficulty: Hard

Question ID 306264ab

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: 306264ab

A right triangle has sides of length $2\sqrt{2}$, $6\sqrt{2}$, and $\sqrt{80}$ units. What is the area of the triangle, in square units?

A. $8\sqrt{2}+\sqrt{80}$

B. 12

C. $24\sqrt{80}$

D. 24

ID: 306264ab Answer

Correct Answer: B

Rationale

Choice B is correct. The area, A, of a triangle can be found using the formula $A=\frac{1}{2}bh$, where b is the length of the base of the triangle and h is the height of the triangle. It's given that the triangle is a right triangle. Therefore, its base and height can be represented by the two legs. It’s also given that the triangle has sides of length $2\sqrt{2}$, $6\sqrt{2}$, and $\sqrt{80}$ units. Since $\sqrt{80}$ units is the greatest of these lengths, it's the length of the hypotenuse. Therefore, the two legs have lengths $2\sqrt{2}$ and $6\sqrt{2}$ units. Substituting these values for b and h in the formula $A=\frac{1}{2}bh$ gives $A=\frac{1}{2}2\sqrt{2}6\sqrt{2}$, which is equivalent to $A=6\sqrt{4}$ square units, or $A=12$ square units.

Choice A is incorrect. This expression represents the perimeter, rather than the area, of the triangle.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 459dd6c5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: 459dd6c5

Triangles ABC and DEF are similar. Each side length of triangle ABC is 4 times the corresponding side length of triangle DEF. The area of triangle ABC is 270 square inches. What is the area, in square inches, of triangle DEF?

ID: 459dd6c5 Answer

Correct Answer: 135/8, 16.87, 16.88

Rationale

The correct answer is $\frac{135}{8}$. It's given that triangles ABC and DEF are similar and each side length of triangle ABC is 4 times the corresponding side length of triangle DEF. For two similar triangles, if each side length of the first triangle is k times the corresponding side length of the second triangle, then the area of the first triangle is k^2 times the area of the second triangle. Therefore, the area of triangle ABC is 4^2, or 16, times the area of triangle DEF. It's given that the area of triangle ABC is 270 square inches. Let a represent the area, in square inches, of triangle DEF. It follows that 270 is 16 times a, or $270 = 16a$. Dividing both sides of this equation by 16 yields $\frac{270}{16} = a$, which is equivalent to $\frac{135}{8} = a$. Thus, the area, in square inches, of triangle DEF is $\frac{135}{8}$. Note that 135/8, 16.87, and 16.88 are examples of ways to enter a correct answer.

Question Difficulty: Hard

Question ID 310c87fe

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	■■■

ID: 310c87fe

A cube has a surface area of 54 square meters. What is the volume, in cubic meters, of the cube?

A. 18

B. 27

C. 36

D. 81

ID: 310c87fe Answer

Correct Answer: B

Rationale

Choice B is correct. The surface area of a cube with side length s is equal to $6s^2$. Since the surface area is given as 54 square meters, the equation $54 = 6s^2$ can be used to solve for s. Dividing both sides of the equation by 6 yields $9 = s^2$. Taking the square root of both sides of this equation yields $3 = s$ and $-3 = s$. Since the side length of a cube must be a positive value, $s = -3$ can be discarded as a possible solution, leaving $s = 3$. The volume of a cube with side length s is equal to s^3. Therefore, the volume of this cube, in cubic meters, is 3^3, or 27.

Choices A, C, and D are incorrect and may result from calculation errors.

Question Difficulty: Hard