

Surface Area of Prisms, Cylinders, and Pyramids

Name: _____ Date: _____ Score: _____ / 24

Q Quick Review

Surface area is the total area of *all* the faces of a solid — imagine unfolding it flat and measuring every piece. For a **rectangular prism**, $SA = 2(lw + lh + wh)$. For a **cylinder**, $SA = 2\pi r^2 + 2\pi rh$ — two circles plus the wrapped-around side. For a **pyramid**, add the base area to the areas of the triangular faces (each face is $\frac{1}{2} \times \text{base} \times \text{slant height}$). Surface area is always measured in *square* units.

◇ **Example:** Find the surface area of a rectangular prism with length 5 cm, width 3 cm, and height 4 cm.
 ⇒ A rectangular prism has three pairs of matching faces, and the formula $SA = 2(lw + lh + wh)$ adds them all up. Find each product: $lw = 5 \times 3 = 15$, $lh = 5 \times 4 = 20$, and $wh = 3 \times 4 = 12$. Add them: $15 + 20 + 12 = 47$. Then double for the matching faces: $2 \times 47 = 94$. The surface area is 94 square centimeters.

Answer: $SA = 94 \text{ cm}^2$

PRACTICE

Find each surface area. Leave π in answers where it appears.

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|--|-------|--|-------|
| 1. Rect. prism: $l = 2, w = 3, h = 4$ | _____ | 11. Cylinder: $r = 2, h = 10$ | _____ |
| 2. Rect. prism: $l = 3, w = 4, h = 5$ | _____ | 12. Cylinder: $r = 5, h = 5$ | _____ |
| 3. Rect. prism: $l = 6, w = 2, h = 3$ | _____ | 13. Cylinder: $r = 6, h = 4$ | _____ |
| 4. Rect. prism: $l = 8, w = 4, h = 2$ | _____ | 14. Square pyramid: base 6, slant height 5 | _____ |
| 5. Rect. prism: $l = 10, w = 3, h = 4$ | _____ | 15. Square pyramid: base 8, slant height 6 | _____ |
| 6. Cube: side 5 | _____ | 16. Square pyramid: base 10, slant height 12 | _____ |
| 7. Cube: side 3 | _____ | 17. Square pyramid: base 4, slant height 3 | _____ |
| 8. Cube: side 10 | _____ | 18. Rect. prism: $l = 7, w = 1, h = 2$ | _____ |
| 9. Cylinder: $r = 3, h = 5$ | _____ | 19. Cube: side 7 | _____ |
| 10. Cylinder: $r = 4, h = 6$ | _____ | 20. Cylinder: $r = 3, h = 7$ | _____ |

◆ Word Problems

21. A gift box is a rectangular prism 8 in long, 4 in wide, and 2 in tall. How much wrapping paper is needed to cover it exactly?

22. A cylindrical paint can has radius 3 in and height 5 in. Find the total surface area in terms of π . _____
23. A square pyramid monument has a base edge of 10 m and a slant height of 12 m. What is its total surface area, including the base? _____
24. A storage cube measures 7 ft on each edge. How many square feet of material are needed to make all six faces? _____



Answer Keys

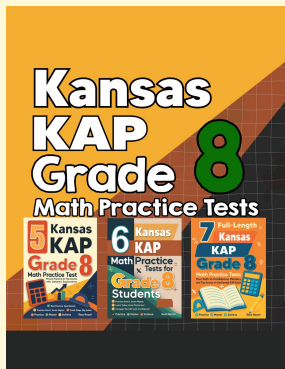
- | | |
|--------------|--------------------------|
| 1. 52 | 13. 120π |
| 2. 94 | 14. 96 |
| 3. 72 | 15. 160 |
| 4. 112 | 16. 340 |
| 5. 164 | 17. 40 |
| 6. 150 | 18. 46 |
| 7. 54 | 19. 294 |
| 8. 600 | 20. 60π |
| 9. 48π | 21. 112 in^2 |
| 10. 80π | 22. $48\pi \text{ in}^2$ |
| 11. 48π | 23. 340 m^2 |
| 12. 100π | 24. 294 ft^2 |

Step-by-Step Explanations

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| <p>1. $SA = 2(6 + 8 + 12) = 2(26) = 52$.</p> <p>2. $SA = 2(12 + 15 + 20) = 2(47) = 94$.</p> <p>3. $SA = 2(12 + 18 + 6) = 2(36) = 72$.</p> <p>4. $SA = 2(32 + 16 + 8) = 2(56) = 112$.</p> <p>5. $SA = 2(30 + 40 + 12) = 2(82) = 164$.</p> <p>6. A cube has 6 equal faces: $6(5^2) = 6(25) = 150$.</p> <p>7. $6(3^2) = 6(9) = 54$.</p> <p>8. $6(10^2) = 6(100) = 600$.</p> <p>9. $SA = 2\pi r^2 + 2\pi rh = 2\pi(9) + 2\pi(15) = 18\pi + 30\pi = 48\pi$.</p> <p>10. $SA = 2\pi(16) + 2\pi(24) = 32\pi + 48\pi = 80\pi$.</p> <p>11. $SA = 2\pi(4) + 2\pi(20) = 8\pi + 40\pi = 48\pi$.</p> <p>12. $SA = 2\pi(25) + 2\pi(25) = 50\pi + 50\pi = 100\pi$.</p> <p>13. $SA = 2\pi(36) + 2\pi(24) = 72\pi + 48\pi = 120\pi$.</p> <p>14. Base = 36; 4 triangles = $4(\frac{1}{2} \cdot 6 \cdot 5) = 60$; total 96.</p> | <p>15. Base = 64; 4 triangles = $4(\frac{1}{2} \cdot 8 \cdot 6) = 96$; total 160.</p> <p>16. Base = 100; 4 triangles = $4(\frac{1}{2} \cdot 10 \cdot 12) = 240$; total 340.</p> <p>17. Base = 16; 4 triangles = $4(\frac{1}{2} \cdot 4 \cdot 3) = 24$; total 40.</p> <p>18. $SA = 2(7 + 14 + 2) = 2(23) = 46$.</p> <p>19. $6(7^2) = 6(49) = 294$.</p> <p>20. $SA = 2\pi(9) + 2\pi(21) = 18\pi + 42\pi = 60\pi$.</p> <p>21. $SA = 2(lw + lh + wh) = 2(32 + 16 + 8) = 2(56) = 112$ square inches.</p> <p>22. $SA = 2\pi r^2 + 2\pi rh = 2\pi(9) + 2\pi(15) = 18\pi + 30\pi = 48\pi$ square inches.</p> <p>23. The base area is $10^2 = 100 \text{ m}^2$. The four triangular faces total $4 \times \frac{1}{2}(10)(12) = 240 \text{ m}^2$. Together that is 340 m^2.</p> <p>24. A cube has 6 equal square faces, so $SA = 6 \times 7^2 = 6 \times 49 = 294$ square feet.</p> |
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