Surface Area of Prisms, Cylinders, and Pyramids

Models and mappings

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Surface area adds exposed face areas. A closed rectangular prism uses $2(lw + lh + wh)$. A closed cylinder uses $2\pi r^2 + 2\pi rh$; omit a circular base for an open top. A regular square pyramid uses $s^2 + 4(\frac{1}{2}s\ell)$, where ℓ is face slant height, not vertical height. A net can separate bases and lateral faces. Use square units, not cubic units.

Worked example

Find surface area of a closed rectangular prism with length 6, width 3, and height 2.

1. The base area is $6(3) = 18$ square units. The two bases contribute $2(18) = 36$ square units.

2. The side faces contribute $2(6)(2) + 2(3)(2) = 24 + 12 = 36$ square units.

3. Add the exposed faces: $36 + 36 = 72$ square units. Each included face is counted once; no volume calculation is needed.

Answer: 72 square units

Practice Problems

Show your thinking.

1. Find surface area of a closed 5 by 4 by 3 rectangular prism.

2. Find the total surface area of a cube of edge length 4.

3. Find total surface area of a closed cylinder with radius 3 and height 5. Give an exact answer in terms of π.

4. A regular square pyramid has base side 6 and face slant height 5. Find total surface area.

5. An open-top rectangular box has length 8, width 3, and height 2. Find its surface area.

6. A cylinder of radius 2 and height 7 has no top. Find its exposed surface area, including the bottom. Give an exact answer in terms of π.

7. Find only the four triangular face areas together for a regular square pyramid of side 5 and slant height 6.

8. Find only the curved surface area of a cylinder with radius 4 and height 3. Give an exact answer in terms of π.

9. A triangular prism has right-triangle bases with sides $3, 4, 5$ and prism length 7. Find total surface area.

10. A closed cylinder has diameter 10 and height 2. Find its surface area. Give an exact answer in terms of π.

Answer Key

1. 94 square units
2. 96 square units
3. 48π square units
4. 96 square units
5. 68 square units
6. 32π square units
7. 60 square units
8. 24π square units
9. 96 square units
10. 70π square units

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The base area is $5(4) = 20$ square units. The two bases contribute $2(20) = 40$ square units.

2. The side faces contribute $2(5)(3) + 2(4)(3) = 30 + 24 = 54$ square units.

3. Add the exposed faces: $40 + 54 = 94$ square units. Each included face is counted once; no volume calculation is needed.

Problem 2

1. The base area is $4(4) = 16$ square units. The two bases contribute $2(16) = 32$ square units.

2. The side faces contribute $2(4)(4) + 2(4)(4) = 32 + 32 = 64$ square units.

3. Add the exposed faces: $32 + 64 = 96$ square units. Each included face is counted once; no volume calculation is needed.

Problem 3

1. The curved surface unwraps to a rectangle with area $2\pi rh = 2\pi(3)(5) = 30\pi$ square units.

2. There are 2 included circular bases, contributing $2\pi(3)^2 = 18\pi$ square units.

3. The required area is $30\pi + 18\pi = 48\pi$ square units. Count only the specified exposed surfaces, not enclosed volume.

Problem 4

1. Each face has area $\frac{1}{2}(6)(5) = 15$ square units; its slant height is perpendicular to the base edge within that face.

2. The four faces total $4(15) = 60$ square units. The base adds $6^2 = 36$ square units.

3. The required area is $60 + 36 = 96$ square units. Vertical pyramid height would not replace face slant height.

Problem 5

1. The base area is $8(3) = 24$ square units. Only one base is included because the top is open.

2. The side faces contribute $2(8)(2) + 2(3)(2) = 32 + 12 = 44$ square units.

3. Add the exposed faces: $24 + 44 = 68$ square units. Each included face is counted once; no volume calculation is needed.

Problem 6

1. The curved surface unwraps to a rectangle with area $2\pi rh = 2\pi(2)(7) = 28\pi$ square units.

2. There are 1 included circular bases, contributing $1\pi(2)^2 = 4\pi$ square units.

3. The required area is $28\pi + 4\pi = 32\pi$ square units. Count only the specified exposed surfaces, not enclosed volume.

Problem 7

1. Each face has area $\frac{1}{2}(5)(6) = 15$ square units; its slant height is perpendicular to the base edge within that face.

2. The four faces total $4(15) = 60$ square units. The base is not included.

3. The required area is $60 + 0 = 60$ square units. Vertical pyramid height would not replace face slant height.

Problem 8

1. The curved surface unwraps to a rectangle with area $2\pi rh = 2\pi(4)(3) = 24\pi$ square units.

2. There are 0 included circular bases, contributing $0\pi(4)^2 = 0\pi$ square units.

3. The required area is $24\pi + 0\pi = 24\pi$ square units. Count only the specified exposed surfaces, not enclosed volume.

Problem 9

1. Each base area is $\frac{1}{2}(3)(4) = 6$, so the two bases contribute 12.

2. The lateral rectangles total $(3 + 4 + 5)(7) = 12(7) = 84$ square units.

3. The total is $12 + 84 = 96$ square units. The prism length multiplies the triangle perimeter, not its area.

Problem 10

1. The curved surface unwraps to a rectangle with area $2\pi rh = 2\pi(5)(2) = 20\pi$ square units.

2. There are 2 included circular bases, contributing $2\pi(5)^2 = 50\pi$ square units.

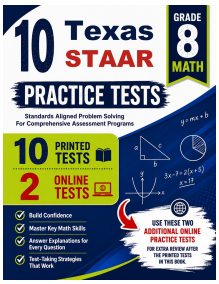
3. The required area is $20\pi + 50\pi = 70\pi$ square units. Count only the specified exposed surfaces, not enclosed volume.

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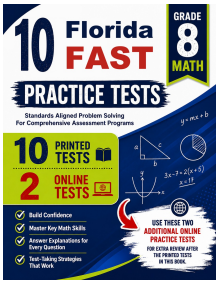
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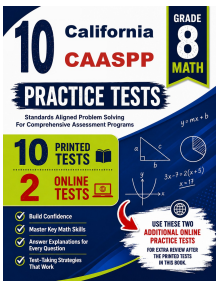
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