Composite Figures: Area and Perimeter

Models and mappings

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

QUICK REVIEW

Partition a composite region into nonoverlapping rectangles, triangles, or circles, or subtract a completely specified cutout. Use $A = lw$, $A = \frac{1}{2}bh$, and $A = \pi r^2$. Perimeter follows exposed boundary only: shared edges are not exterior. A semicircle has curved length πr and area $\frac{1}{2}\pi r^2$; its diameter counts only when exposed. Keep length units separate from square units.

Worked example

An 8 by 6 rectangle has a 3 by 2 rectangular corner removed. The cutout sides follow the rectangle sides. Find area and perimeter.

1. The area is the outer rectangle minus the corner: $8(6) - 3(2) = 48 - 6 = 42$.

2. The exposed lengths are $8, 6-2, 3, 2, 8-3, 6$, totaling $8+4+3+2+5+6 = 28$.

3. The corner removal replaces exterior lengths $3+2$ with equal inner lengths $3+2$, so perimeter stays $2(8+6) = 28$.

Answer: 42 square units; 28 units.

Practice Problems

Show your thinking.

1. A 10 by 7 rectangle has a 4 by 3 rectangular corner removed, aligned with the outer sides. Find remaining area.

2. A 9 by 6 rectangle has a 2 by 4 rectangular corner removed along the outer sides. Find perimeter of the L-shaped region.

3. A 7 by 4 rectangle and a 3 by 2 rectangle meet along an entire 2-unit edge with no overlap. Find combined area and perimeter.

4. A triangle of base 8 and perpendicular height 3 is attached outside an 8 by 5 rectangle along the entire 8-unit side. Find total area.

5. A semicircle is attached outside a 10 by 4 rectangle along the entire 10-unit side as diameter. Find exact area.

6. A semicircle is attached outside an 8 by 3 rectangle along its entire 8-unit side. Find exact perimeter of the combined region.

7. A circular hole of radius 2 is wholly inside a 12 by 8 rectangle. Find exact remaining area.

8. A square frame has outer side 9 and a centered square opening of side 5. Find frame area and total boundary length, including the opening.

9. A 3 by 2 rectangular notch is cut inward from the middle of a 10-unit side of a 10 by 6 rectangle. Notch mouth is 3 and depth 2. Find perimeter.

10. Two semicircles of radius 3 are attached outside opposite 6-unit ends of a 10 by 6 rectangle. Find exact area and perimeter.

Answer Key

1. 58 square units
2. 30 units
3. 34 square units; 28 units.
4. 52 square units
5. $40 + \frac{25}{2}\pi$ square units
6. $14 + 4\pi$ units
7. $96 - 4\pi$ square units
8. 56 square units; 56 units.
9. 36 units
10. $60 + 9\pi$ square units; $20 + 6\pi$ units.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The full rectangle area is $10(7) = 70$ square units.

2. The removed corner area is $4(3) = 12$, leaving $70 - 12 = 58$ square units.

3. Alternatively, two nonoverlapping rectangles have areas $10(7-3) = 40$ and $(10-4)3 = 18$; $40+18 = 58$ confirms the result.

Problem 2

1. The original perimeter is $2(9 + 6) = 30$ units.

2. The cut removes exterior pieces $2 + 4 = 6$ but adds inner boundary pieces $2 + 4 = 6$. Thus $30 - 6 + 6 = 30$.

3. The remaining L-shape has perimeter 30 units. Unlike a hole or middle notch, an axis-aligned corner cut does not change this perimeter.

Problem 3

1. The areas add: $7(4) + 3(2) = 28 + 6 = 34$ square units.

2. The separate perimeters total $2(7+4)+2(3+2) = 22+10 = 32$; remove twice the shared length: $32 - 2(2) = 28$.

3. The area is 34 square units and the exposed perimeter is 28 units. The common edge was counted in both separate perimeters and must be removed twice.

Problem 4

1. The rectangle area is $8(5) = 40$ square units.

2. The attached triangle area is $\frac{1}{2}(8)(3) = 12$, giving $40 + 12 = 52$ square units.

3. The common 8-unit edge has area 0. Since the triangle is outside, the union area remains $52 - 0 = 52$ square units.

Problem 5

1. The rectangle area is $10(4) = 40$. The semicircle radius is $10/2 = 5$.

2. The semicircle area is $\frac{1}{2}\pi(5)^2 = \frac{25}{2}\pi$, so total area is $40 + \frac{25}{2}\pi$.

3. The shared diameter has area 0, so the exact total stays $40 + 12.5\pi$ square units. A full circle would incorrectly add 25π.

Problem 6

1. The shared diameter 8 is internal. The other three rectangle sides total $3 + 8 + 3 = 14$ units.

2. The semicircular arc has radius $8/2 = 4$ and length $\pi(4) = 4\pi$.

3. The boundary is $14 + 4\pi$ units. Including the shared diameter would overcount by 8 units.

Problem 7

1. The outer rectangular area is $12(8) = 96$ square units.

2. The hole removes $\pi(2)^2 = 4\pi$, leaving $96 - 4\pi$ square units.

3. The full 4π square units are removed because the circle is wholly inside. Check $0 < 96 - 4\pi < 96$, as expected after removing a hole.

Problem 8

1. The material area is $9^2 - 5^2 = 81 - 25 = 56$ square units.

2. The outer boundary is $4(9) = 36$ and the inner boundary is $4(5) = 20$, totaling 56 units.

3. Area subtracts the hole, but total boundary adds its perimeter. The equal numerical results 56 have different geometric units.

Problem 9

1. The original perimeter is $2(10 + 6) = 32$ units. The notch removes a 3-unit straight mouth.

2. The notch adds sides $2 + 3 + 2 = 7$, so new perimeter is $32 - 3 + 7 = 36$.

3. The middle notch increases perimeter by twice its depth, $2(2) = 4$, unlike a corner removal. The mouth does not remain an exterior segment.

Problem 10

1. The rectangle area is $10(6) = 60$; the two semicircles form one full circle of area $\pi(3)^2 = 9\pi$.

2. The exposed straight sides total $10 + 10 = 20$. The two arcs total $2\pi(3) = 6\pi$.

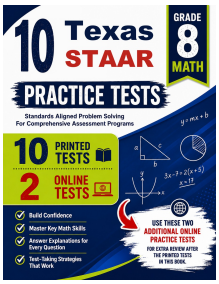
3. The combined area is $60 + 9\pi$ and perimeter is $20 + 6\pi$. Both 6-unit attachment diameters are internal, not exposed.

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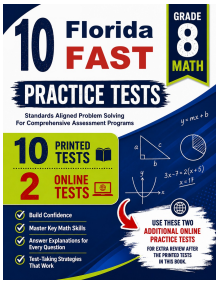
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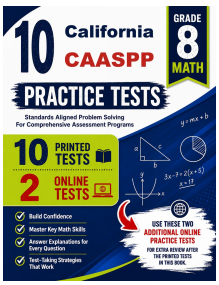
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