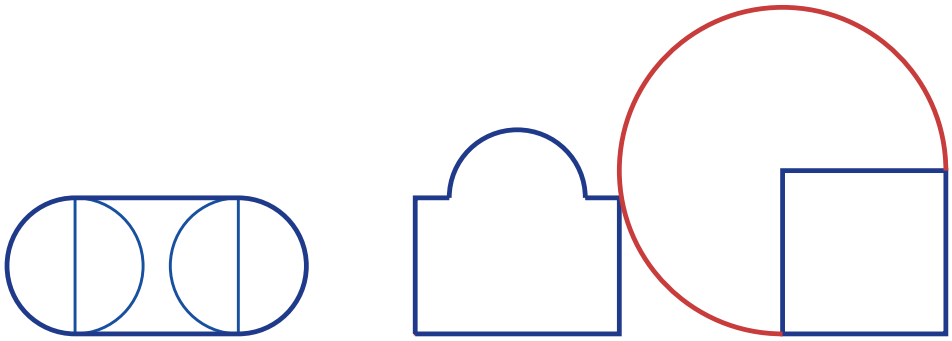
Area & Perimeter of Composite Figures with Circles

Name: _____	Date: _____	Score: _____ / 17

Composite figures that include circles require you to think in two different ways at once! For **area**, add or subtract circular pieces just as you do with other composite shapes. For **perimeter**, walk only along the outside edge—count straight segments and curved arcs, but skip any shared interior edges. Keeping area calculations separate from perimeter calculations is the trick that prevents the most common mistakes!



Stadium / Discorectangle | Rectangle – semicircle | Quarter-circle region

Key Concepts & Quick Review

Semicircle area: $\frac{1}{2}\pi r^2$. **Quarter-circle area:** $\frac{1}{4}\pi r^2$. **Semicircle arc length:** πr.

Perimeter rule: add up *all* outer edges — straight lengths + arc lengths. Do not include any shared interior edge.

Examples

① A stadium shape has a rectangle $20\,m \times 10\,m$ with two semicircles ($r = 5\,m$) on the short ends. Find the total area and perimeter.

Think It Through: Think of the stadium as one rectangle plus two semicircles. Two semicircles make one full circle, so the total area is rectangle area plus circle area: $20 \times 10 + \pi(5)^2 = 200 + 78.5 = 278.5\,m^2$. For perimeter, only trace the outside edge: the two long straight sides add to $40\,m$, and the two semicircular arcs make one full circle with circumference $2\pi(5) = 31.4\,m$. Together that gives $71.4\,m$.

Answer: *Area* $\approx 278.5\,m^2$; *perimeter* $\approx 71.4\,m$

② A $12\,cm \times 10\,cm$ rectangle has a circular hole of diameter $6\,cm$ cut from its centre. Find the shaded (remaining) area.

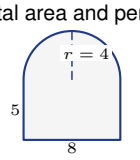
Think It Through: Use subtraction: find the area of the large rectangle and remove the circular hole. The rectangle area is $12 \times 10 = 120\ cm^2$. The hole has diameter $6\,cm$, so its radius is $3\,cm$. Its area is $\pi(3)^2 = 9\pi \approx 28.27\,cm^2$. Subtracting gives $120 - 28.27 \approx 91.73\,cm^2$.

Answer: $\approx 91.7\,cm^2$

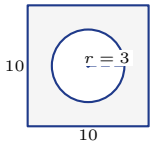
Practice Problems

Find area and/or perimeter of each composite figure ($\pi \approx 3.14$).

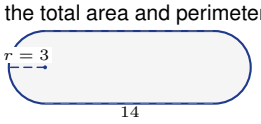
1. Find the total area and perimeter.



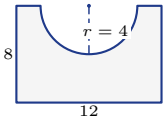
2. Find the area left after the circle is removed.



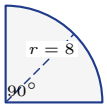
3. Find the total area and perimeter.



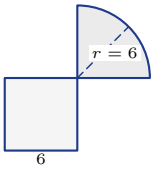
4. Find the area left after the semicircle is removed.



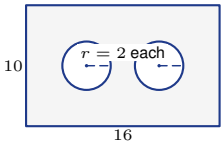
5. Find the area of the quarter circle.



6. Find the total area of the combined figure.

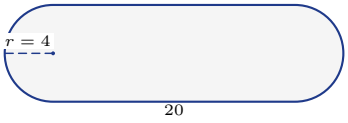


7. Find the area left after both circles are removed.

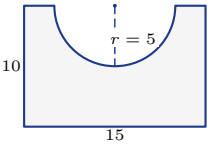


8. Find the perimeter, including the curved edge.

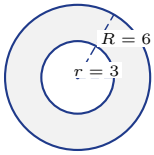
9. Find the total area and perimeter.



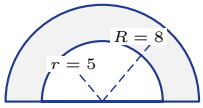
10. Find the area left after the semicircle is removed.



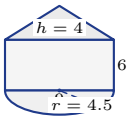
11. Find the area of the ring.



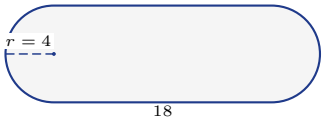
12. Find the area of the half-ring.



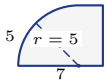
13. Find the total area of the combined figure.



14. Find the perimeter of the stadium shape.



15. Find the area left after the quarter circle is removed.



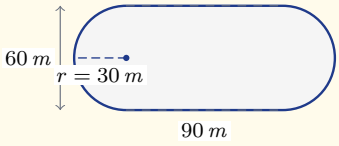
Study Tips

☞ For the **perimeter**, trace your pencil around the outside edge. Only count segments and arcs that are on the boundary.

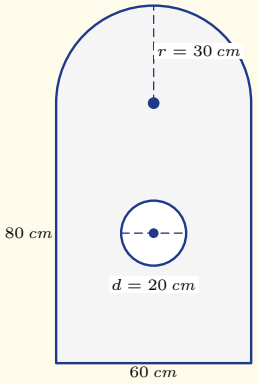
- A semicircle adds πr to the perimeter (the curved arc) but its diameter is *internal* — don't add it twice.
- For **ring (annulus) area**: $A = \pi R^2 - \pi r^2 = \pi(R^2 - r^2)$, where R is the outer and r the inner radius.

Word Problems

16. An athletics track surrounds a rectangular grass field that is $90\ m$ by $60\ m$. Two semicircular ends (radius $30\ m$ each) are added to the short sides. Find the total area enclosed by the track and the length of the inside lane. A sprinkler covers the rectangular field only — what area does it not water?



17. A stained glass window is a rectangle $60\ cm$ wide and $80\ cm$ tall, with a semicircular arch ($r = 30\ cm$) on top. A circular medallion of diameter $20\ cm$ is mounted in the centre of the rectangle. Find the total window area (including arch) and the area of colored glass (excluding the clear medallion).



Answer Keys

1) Area 65.12; perimeter 30.56
2) 71.74
3) Area 112.26; perimeter 46.84
4) 70.88
5) 50.24
6) 64.26
7) 134.88
8) 25.7
9) Area 210.24; perimeter 65.12
10) 110.75
11) 84.78
12) 61.23
13) 103.79
14) 61.12
15) 15.38
16) Total area $8{,}227.4\ m^2$; inside lane $368.5\ m$; unwatered area $2{,}827.4\ m^2$
17) Window area $6{,}213.7\ cm^2$; medallion area $314.2\ cm^2$; colored glass $5{,}899.5\ cm^2$

Step-by-Step Explanations

Strategy: For Constructing Triangles (SSS, SAS, ASA Conditions), name the information given, then decide whether it fixes one triangle, many triangles, or no triangle. The final construction answer should say whether the triangle is unique, impossible, or flexible.

Practice 1: A triangle has side lengths 3, 4, and $5\ cm$. Identify the construction condition. **Answer:** SSS; valid right triangle

For the first sample, check which information is fixed: sides, included angles, or enough angles to determine the triangle shape.

Practice 10: A triangle has side lengths a, a, and a. Classify the triangle and give its angle measures. **Answer:** equilateral; $60°$ each

Late in the set, check which information is fixed: sides, included angles, or enough angles to determine the triangle shape.

Word-problem notes:

11. Answer: Valid: $9 + 12 = 21 > 15$ ✓; SSS; right triangle since $9^2 + 12^2 = 225 = 15^2$.

First check whether the three rod lengths can make a triangle. They do, because the sum of any two sides is greater than the third. Since all three sides are given, this is an SSS triangle. To test whether it is a right triangle, use the Pythagorean relationship: $9^2 + 12^2 = 81 + 144 = 225$, and $15^2 = 225$. Because these match, the bracket is a right triangle.

12. Answer: ASA; $\angle R = 62°$; no — AAA gives infinitely many similar triangles of different sizes.

The information gives two angles and the side between them, so the triangle is specified by ASA. To find the third angle, subtract from $180°$: $180° - 42° - 76° = 62°$. If another surveyor only knows the three angle measures, that is AAA information. AAA fixes the shape but not the size, so it allows infinitely many similar triangles rather than one unique triangle.

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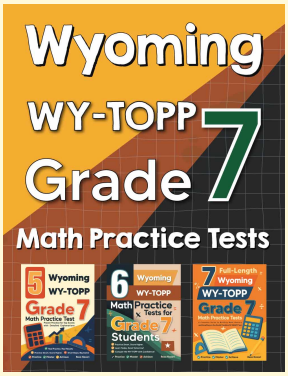

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