LESSON MAKER PRO

Shape Space Lab

Explain triangle relationships and build area formulas.

GRADE 6 · TEKS 6.8

6.8 "Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to represent relationships and solve problems..."

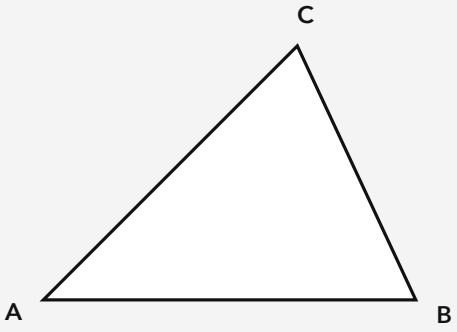
NAME _____ DATE _____

USE STRUCTURE, NOT JUST A FORMULA

Triangle angles total 180°. The longest side faces the largest angle. Three positive lengths make a triangle only when the two shorter lengths add to more than the longest. Cutting and rearranging pieces preserves area if there are no gaps or overlaps. In area models, height is perpendicular to the base.

WORKED EXAMPLE

Triangle ABC has angle A = 45°, angle B = 65° and angle C = x°. Find x and identify the largest angle.



1. 45 + 65 + x = 180.
2. x = 70°.
3. 70° is the largest angle; its opposite side is longest.

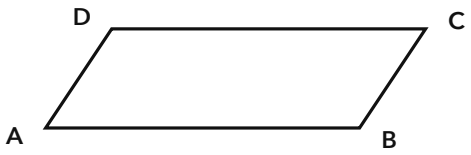
Answer: x = 70°; the largest angle is 70°.

PRACTICE 4 problems

1 Triangle ABC has angle A = 40° and angle B = 60°. Find angle C. List the three opposite sides from shortest to longest and explain the relationship.

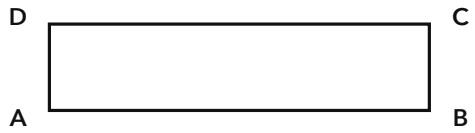
ANSWER

2 Parallelogram ABCD has AB = 9.5 cm and perpendicular height 3 cm. On the printed shape, draw a vertical cut from D to AB. In the blank space above the shape, draw a rightward arrow to show the left triangle moving to the right end to make a rectangle. Use that model to explain A = bh, then write and solve its area equation.



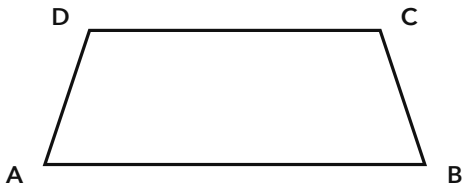
ANSWER

3 Rectangle ABCD has AB = 11 cm and AD = 2.5 cm. Draw diagonal AC directly on the printed rectangle, creating two matching triangles. Use the model to explain the triangle-area formula, then write and solve an equation for the area of triangle ABC.



ANSWER _____

4 Trapezoid ABCD has parallel bases AB = 17 cm and DC = 13 cm, with height 6 cm. Draw diagonal AC directly on the printed trapezoid. Explain how the two triangle areas combine to give the trapezoid formula. Write and solve the area equation.



ANSWER _____

APPLY IT Show your work

1 A right rectangular card box has inside dimensions 7 cm by 3.5 cm by 4 cm. Write and solve a volume equation. Explain why the unit is cubic.

ANSWER _____

2 A rectangular backdrop is 12.5 m long and 2.4 m wide. Write and solve an area equation. Explain why multiplying length by width measures its area.

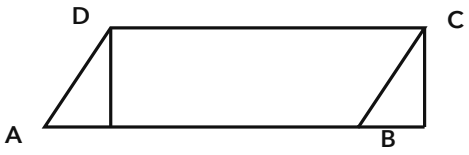
ANSWER _____

CHALLENGE One step up

Which sets of lengths can form a triangle: (3, 4, 7), (4, 5, 7), and (2.5, 3, 6), all in centimeters? Show the decisive sum for each. Explain why equality is not enough.

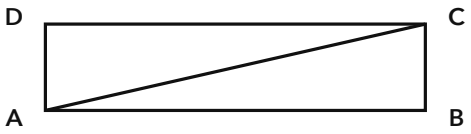
PRACTICE 2

Cut from D to AB at a right angle. Translate the left triangle 9.5 cm to the right: point A reaches B and D reaches C. The cut's foot moves to the new bottom-right corner. The resulting rectangle has width 9.5 and height 3. Thus A = bh = 9.5 × 3 = 28.5 cm². The key shows original and relocated edges.



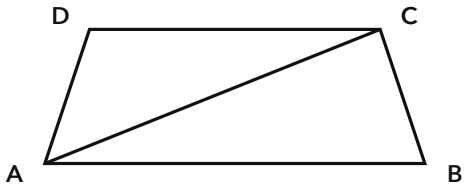
PRACTICE 3

AC splits the rectangle into two congruent triangles with equal area. Each is half of bh, so A = 1/2 × 11 × 2.5 = 13.75 cm².



PRACTICE 4

The two triangles have bases 17 and 13 and share the perpendicular height 6. Their areas add: A = 1/2 × 17 × 6 + 1/2 × 13 × 6 = 1/2 × (17 + 13) × 6 = 90 cm². Generally, A = 1/2(b_1 + b_2)h.



PRACTICE 1

C = 180 − 40 − 60 = 80°. BC is opposite 40°, AC opposite 60°, and AB opposite 80°, so BC < AC < AB. Larger angles face longer sides.

APPLY IT 1

98 cm^3

V = lwh = 7 × 3.5 × 4 = 98 cm³. Multiplying three lengths measures the number of cubic-centimeter units of space.

APPLY IT 2

30 m^2

A = lw = 12.5 × 2.4 = 30 m². A rectangle can be covered by rows of square units; multiplying its two perpendicular dimensions measures that coverage.

CHALLENGE

(3, 4, 7): no, 3 + 4 = 7. (4, 5, 7): yes, 4 + 5 > 7. (2.5, 3, 6): no, 2.5 + 3 < 6. When the sum equals the longest length, the pieces lie along a straight segment and enclose no triangle area.

Require visible decompositions, explanations, and equations, not formula substitution alone. In the parallelogram task, a translation arrow plus the described rectangle is sufficient; students draw directly on the supplied diagrams and need not cut the paper. Ruled lines are for the explanation; they are not the drawing surface. Diagonal models for triangle/trapezoid show why a factor of one-half appears. Diagrams preserve proportions and use vertex labels; dimensions are stated in the prompts. Accept equivalent decimal or fractional answers and valid alternate explanations.