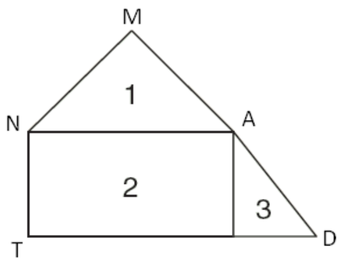
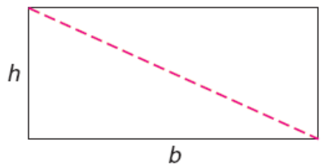
Areas of Triangles and Quadrilaterals

Postulate: Area Addition Postulate: The area of a given polygon equals the sum of the areas of the non overlapping polygons that form the given polygon.

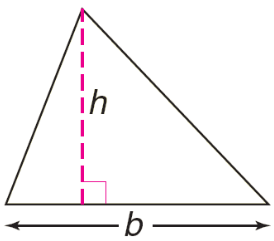
$$A_{total} = A_1 + A_2 + A_3$$



Look at the rectangle below. Its area is *bh* square units. The diagonal divides the rectangle into two congruent triangles. The area of each triangle is half the area of the rectangle, or $\frac{1}{2}bh$ square units.



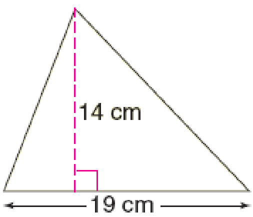
Rule 1: Area of a triangle: If a triangle has an area of *A* square units, a base of *b* units, and a corresponding altitude of *h* units, then $A = \frac{1}{2}bh$



Example 1: Find the area of the triangle.

$$A = \frac{1}{2}bh = \frac{1}{2}(19)(14) = 133$$

The area is 133 cm^2



You can find the area of a trapezoid in a similar way like the area of a triangle. The *altitude* of a trapezoid *h* is a segment perpendicular to each base.

Rule 2: If a trapezoid has an area of *A* square units, bases of b_1 and b_2 units, and an altitude of *b* units, then

$$A = \frac{1}{2}h(b_2 + b_1)$$

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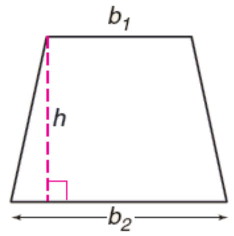
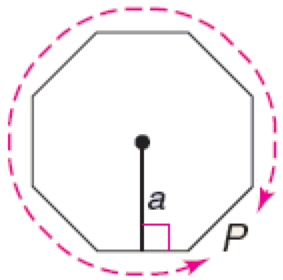


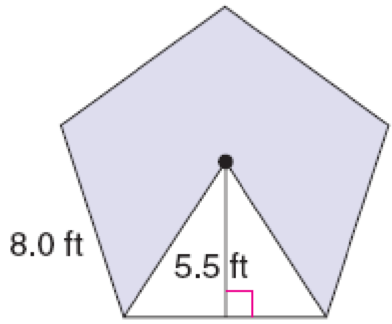
Every regular polygon has a **center**, a point in the interior that is equidistant from all the vertices. A segment drawn from the center that is perpendicular to a side of the regular polygon is called an **apothem** (AP- -them). In any regular polygon, all apothems are congruent.

Theorem 1: Area of a regular polygon

If a regular polygon has an area of *A* square units, an apothem of *a* units, and a perimeter of *P* units, then $A = \frac{1}{2}aP$



Example 2: Find the area of the shaded region in the regular polygon



Area of Pentagon

$$Perimeter = P = 5s = 5(8) = 40\,ft$$

$$A = \frac{1}{2}aP = \frac{1}{2}(5.5)(8) = 110\,ft^2$$

Area of Triangle

$$A = \frac{1}{2}bh = \frac{1}{2}(8)(5.5) = 22\,ft^2$$

To find the area of the region, subtract the areas:

110 - 22 = 88. The area of the shaded region is 88 square feet.