Mathematics Toolkit: Grade 7 Objective 3.C.1.a

Standard 3.0 Knowledge of Measurement

Topic C. Applications in Measurement

Indicator 1. Estimate and apply measurement formulas

Objective a. Estimate and determine the area of quadrilaterals

Assessment Limits:

Use parallelograms or trapezoids and whole number dimensions (0 – 1000)

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Lesson Seeds

Mathematics Grade 7 Objective 3.C.1.a Assessment Limit 1

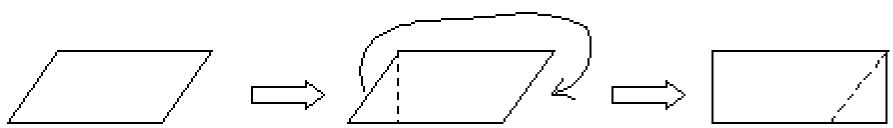
Activities

Connections between the properties of rectangles, trapezoids, and parallelograms should be made so that students will better understand the formulas used to determine the areas of these quadrilaterals.

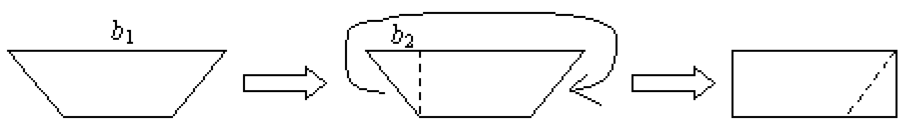
- Discuss the definition of a rectangle and a parallelogram. State that all rectangles are parallelograms, but only those parallelograms with right angles are rectangles.
  - Parallelograms are quadrilaterals with opposite sides parallel.
  - Rectangles are parallelograms with a right angle.

- Demonstrate and discuss how the formula for the area of a parallelogram ($A=bh$) will also apply to a rectangle because a rectangle is always a parallelogram.

- Demonstrate how a parallelogram can be recomposed to form a rectangle. Have the students draw a parallelogram on graph paper. Then have the students cut one end of the parallelogram off by making a vertical cut from a vertex and remove the triangle at the end. Place it at the other end of the figure to form a rectangle.

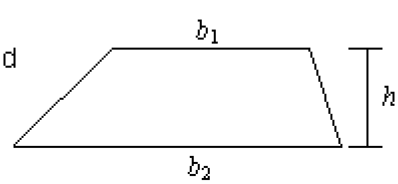


- Demonstrate how an isosceles trapezoid can be recomposed to form a rectangle. The area for an isosceles triangle can now be thought of as $A = bh$. The base in this case is the one formed by subtracting the b_2 from b_1.

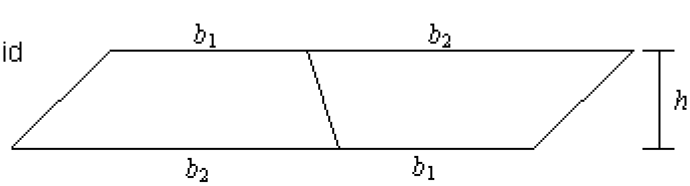


- If the trapezoid is not isosceles, create a copy of the trapezoid, flip it, and join it to the end of the original trapezoid.

Original trapezoid



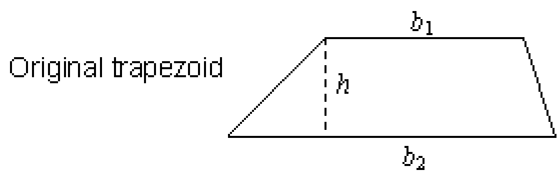
Original trapezoid with its copy



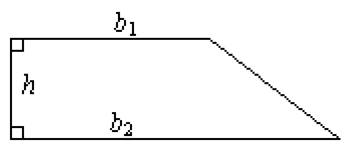
This forms a parallelogram with the same height as the original trapezoid and parallel bases of length b_1+b_2. The area of a parallelogram is A = bh, so the combined area of the two trapezoids is A = $(b_1+b_2)h$. Because we only want half this area, the formula for the area of a trapezoid is:

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

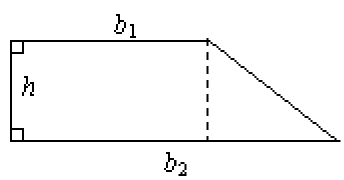
- Demonstrate how any trapezoid can be recomposed to form a rectangle and a triangle.



Translate the base with length b_1 to the left so that the bases and the altitude are perpendicular. Does this trapezoid have the same area as the original? [Yes. The bases and the altitude have the same length as the original.]



Determine the area of the trapezoid by showing it as the composition of a rectangle and a triangle.

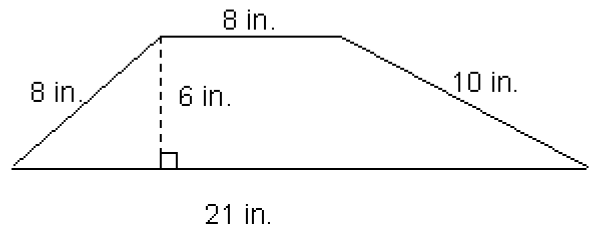


The rectangle has a base with length b_1 and a height of h. The triangle has sides of length h and $b_2 - b_1$.

- Model several area problems using the formulas. Remember for trapezoids, the bases are the sides that are parallel and it makes no difference which one has length b_1 or b_2.

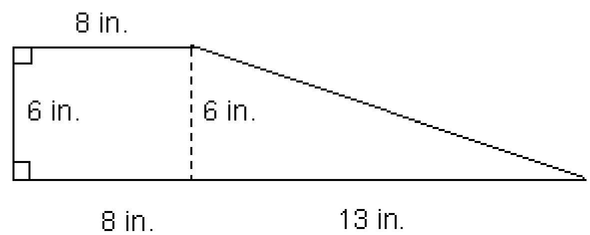
Example 1:

Determine the area of the trapezoid with the formula.



$$A = \frac{1}{2}(b_1 + b_2)h$$
$$= \frac{1}{2}(8 + 21)6$$
$$= 3(29)$$
$$= 87 \text{ square inches}$$

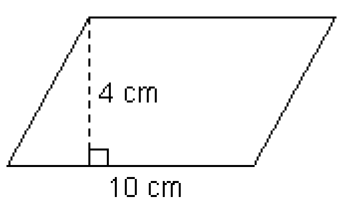
Determine the area of the trapezoid by showing it as the composition of a rectangle and a triangle.



The area of the rectangle is A = bh = (6) (8) = 48 square inches. The area of the triangle is $A = \frac{1}{2}bh = \frac{1}{2}(6)(13) = 39$ square inches. The combined area is 48 + 39 = 87 square inches.

Example 2:

Determine the area of the parallelogram.



$$A = bh$$
$$= (10)(4)$$
$$= 40 \text{ cm}^2$$