My Notes

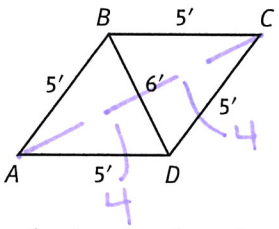
Learning Targets:

- Solve problems using the areas of rhombuses, trapezoids, and composite figures.
- Solve problems involving density.

SUGGESTED LEARNING STRATEGIES: Vocabulary Organizer, Think-Pair-Share, Create Representations, Quickwrite

Lisa begins to explore other tabletop templates. She uses what she has learned about rectangles, triangles, and parallelograms to investigate the areas of other polygons.

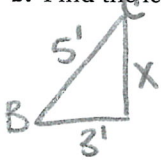
1. Included in the tabletop templates is the rhombus shown.



a. List the properties of a rhombus that relate to the diagonals.

- diagonals are ⊥ bisectors of each other
- diagonals bisect opposite ∠s

b. Find the length of diagonal $\overline{AC}$.



$x = 4$

$2 \cdot 4 = \boxed{8'}$

c. Apply the formula for the area of the triangles formed by the diagonals to find the area of the rhombus.

$a = \frac{1}{2} \cdot 3 \cdot 4 = 6 \cdot 4 = \boxed{24 \text{ ft.}^2}$

↑ 4 △s

d. Derive a formula for the area of a rhombus with diagonal lengths d_1 and d_2.

$a = \frac{1}{2}bh \quad b = \frac{1}{2}d_1, \; h = \frac{1}{2}d_2$

↳ we need 4 so $a_{rhombus} = 4(\frac{1}{2}bh)$

$a = 4(\frac{1}{2}(\frac{1}{2}d_1)(\frac{1}{2}d_2))$

$\boxed{a_{rhombus} = \frac{1}{2}d_1d_2}$

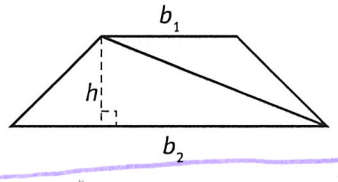
* Rhombi are parallelograms so we can use base • height!

My Notes

The area of a trapezoid with base lengths b_1 and b_2 and height h can be derived by applying what you have already learned about the area of a triangle.

2. Use the figure shown to derive a formula for the area of a trapezoid. Explain how you arrived at your answer.

$A = \frac{1}{2}b_1h + \frac{1}{2}b_2h = \frac{1}{2}h(b_1 + b_2)$



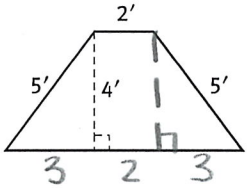
$A_{trapezoid} = \frac{1}{2}h(b_1 + b_2)$

3. Critique the reasoning of others. Lisa states, "The area of a trapezoid is equal to the length of its median times its height." Is she correct? Why?

Yes - Median $= \frac{1}{2}(b_1 + b_2)$

4. Find the area of each of the trapezoids shown below.

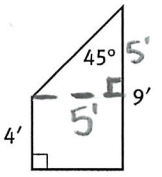
a.



$A = \frac{1}{2} \cdot 4(2+8)$

$= 20 ft.^2$

b.



$A = \frac{1}{2} \cdot 5(9+4)$

$= 32.5 ft.^2$

Lesson 30-3
Areas of Rhombuses and Trapezoids

My Notes

To determine the total cost of a tabletop, Lisa needs to also consider the cost of shipping. The greater the mass of an object, the greater the shipping cost. The mass of the tabletop is dependent on the ***density*** of the material used in its construction.

5. A Cut Above is making the tabletop shown in Item 4a out of two different types of wood: western red cedar and maple. The volume of each tabletop is 4 ft^3. The density of western red cedar is 23 lb/ft^3, and the density of maple is 45 lb/ft^3. If the cost of shipping the tabletops is \$0.50 per pound, which tabletop costs more to ship? How much more?

Western Red Cedar
Mass = 23 · 4 = 92 lb
cost = 92 · 0.5 = \$46

Maple
Mass = 45 · 4 = 180 lb
cost = 180 · 0.5 = \$90

*Maple costs \$44 more to ship!

MATH TERMS

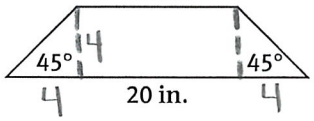
Density is the mass per unit volume of a substance. You can determine the density of a substance using the following formula:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Check Your Understanding

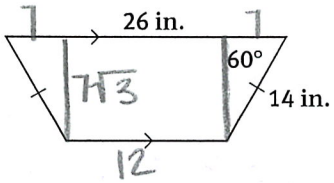
6. Find the area of each trapezoid.

a.



$a = \frac{1}{2} \cdot 4(12+20)$
$= 64 \text{ in.}^2$

b.



$a = \frac{1}{2} \cdot 7\sqrt{3}(26+12)$
$\approx 230.4 \text{ in.}^2$

7. The density of bamboo is about 20 lb/ft^3. What is the mass of a bamboo tabletop that has a volume of 30 ft^3?

$20 = \frac{\text{mass}}{30}$

Mass = 600 lb

My Notes

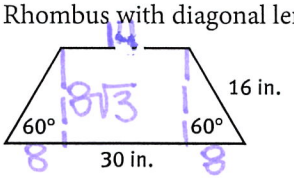
8) 2.5, 2, 2.5, 2, 1.5, 5
$a = \frac{1}{2} \cdot 2 \cdot (5+2)$
$= 7 \text{ ft.}^2$

9) $a = \frac{1}{2} \cdot 6 \cdot 10$
$= 30 \text{ in.}^2$

11) b_1, 7, h, 7, b_2
$P = b_1 + b_2 + 7 + 7 = 32$
$A = \frac{1}{2} \cdot h(b_1 + b_2) = 54$
$b_1 + b_2 = 18$
$\frac{1}{2} \cdot h(18) = 54$
$h = 6 \text{ cm.}$

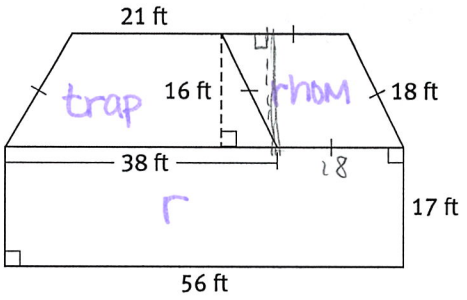
LESSON 30-3 PRACTICE

For Items 8–11, find the area, given the measures of each figure.

8. Isosceles trapezoid with base lengths 2 ft and 5 ft and leg lengths 2.5 ft
9. Rhombus with diagonal lengths 6 in. and 10 in.
10. 

$a = \frac{1}{2} \cdot 8\sqrt{3}(30+14)$
$= 176\sqrt{3} \text{ in.}^3$

11. The area of an isosceles trapezoid is 54 square cm. The perimeter is 32 cm. If a leg is 7 cm long, find the height of the trapezoid.
12. **Attend to precision.** The front face of a manufactured home is shown in the diagram below.



   a. Compute the area.
   b. If the density of the material from which the home is made is 38 lb/ft^3, and the volume of the home is 856 ft^3, what is the mass?

a) $A_{trap} = \frac{1}{2} \cdot 16(21+38) = 472 \text{ ft.}^2$
$A_{rhom} = 18 \cdot 16 = 288 \text{ ft.}^2$
$A_r = 17 \cdot 56 = 952 \text{ ft.}^2$
Total $A = 1712 \text{ ft.}^2$

b) $38 = \frac{\text{Mass}}{856}$
Mass = 32,528 lb.