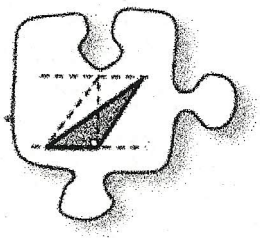
2.2.3 What is the area?



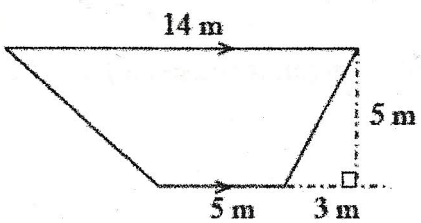
Areas of Parallelograms and Trapezoids

In Lesson 2.2.2, you used your knowledge of the area of a rectangle to develop a method to find the exact area of a triangle that works for all triangles. How can your understanding of the area of triangles and rectangles help with the study of other shapes?
As you work today, ask yourself and your team members these focus questions:

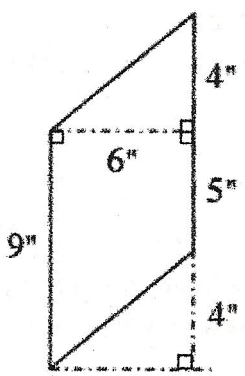
What do you see?
What shapes make up the composite figure?
Is there another way?

2-79. Find the areas of the figures below. Can you find more than one method for each shape?

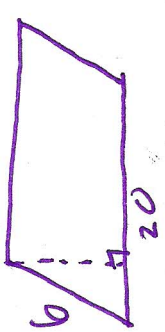
a.



b.

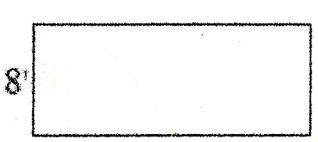


2-80. FINDING THE AREA OF A PARALLELOGRAM

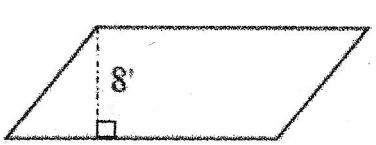


One of the shapes in your Shape Bucket is called a **parallelogram**: a four-sided shape with two pairs of parallel sides. How can you find the area of a parallelogram? Consider this question as you answer the questions below.

a. Kenisha thinks that the rectangle and parallelogram below have the same area. Her teammate Shaundra disagrees. Who is correct? Justify your conclusion.



Rectangle



Parallelogram

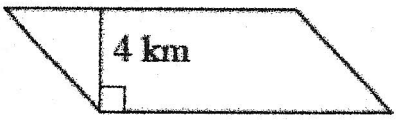
$A = bh$

↑

Has to make a ⊔ w/ the base

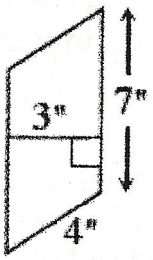
b. In the parallelogram shown in part (a), the two lengths that you were given are often called the **base** and **height**. Several more parallelograms are shown below. In each case, find a related rectangle for which you know both the base and height. Rotating your paper might help. Use what you know about rectangles to find the area of each parallelogram.

(1)



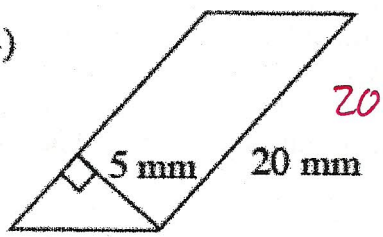
$4 \times 9 = 36 \text{ km}^2$

(2)



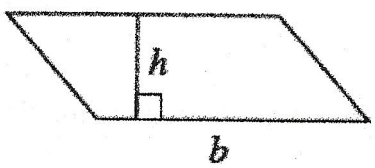
$7 \times 3 = 21 \text{ in}^2$

(3)



$20 \times 5 = 100 \text{ mm}^2$

(4)



$A = hb$

c. Describe how to find the area of a parallelogram when given its base and height.

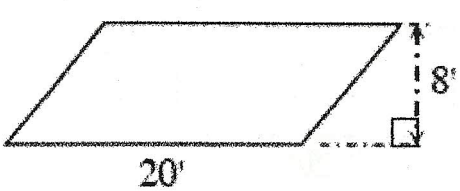
$A = hb$

d. Does the angle at which the parallelogram slants matter? Does every parallelogram have a related rectangle with equal area? Why or why not? Explain how you know.

No

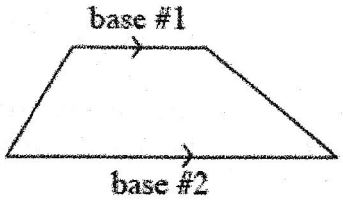
2-81. Shaundra claims that the area of a parallelogram can be found by *only* using triangles.

a. Do you agree? Look at the parallelogram below. Divide it into two triangles. (Do you see more than one way to do this? If you do, ask some team members to divide the parallelogram one way, and the others a second way.)



b. Use what you know about calculating the area of a triangle to find the area of the parallelogram. It may help to trace each triangle separately onto tracing paper so that you can rotate them and label any lengths that you know.

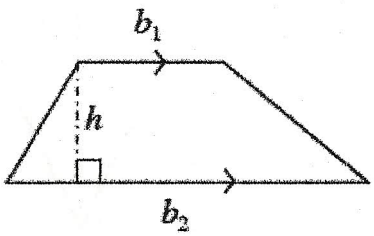
2-82. FINDING THE AREA OF A TRAPEZOID



Trapezoid

Another shape you will study from the Shape Bucket is a **trapezoid**: a four-sided shape that has at least one pair of parallel sides. The sides that are parallel are called **bases**, as shown in the diagram at right. Answer the questions below with your team to develop a method to find the area of a trapezoid.

a. Kenisha sees two triangles inside the trapezoid. If she divides a trapezoid into two triangles, what area will she get? Again assume that the bases of the trapezoid are b_1 and b_2 and the height is h.



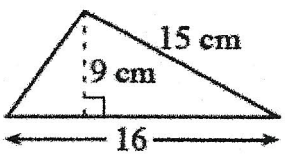
$A = \frac{1}{2} h(b_1 + b_2)$

or

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

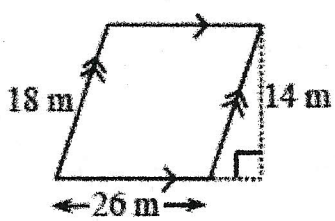
2-83. Calculate the exact areas of the shapes below.

a.



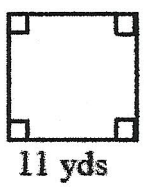
$\frac{9 \times 16}{2} = 72 \text{ cm}^2$

b.



$26 \times 14 = 364 \text{ m}^2$

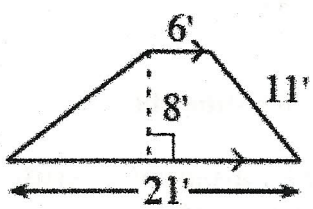
c.



$11 \times 11 =$

121 yds^2

d.



$\frac{8(6+21)}{2} = 108 \text{ ft}^2$