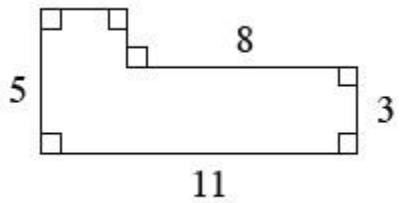
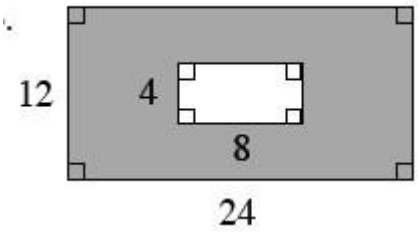
2.2.2 How can I find the area?

Areas of Triangles and Composite Shapes

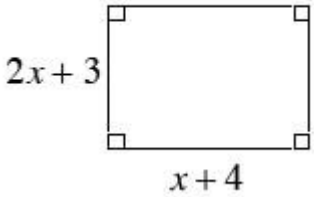
2-66 Examine the variety of shapes below. Work with your team to find the area of each one. If a shape has shading, then find the area of the shaded region. Be sure to listen to your teammates carefully and look for different **strategies**. Be prepared to share your team's method with the class.



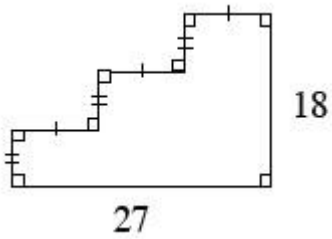
a.



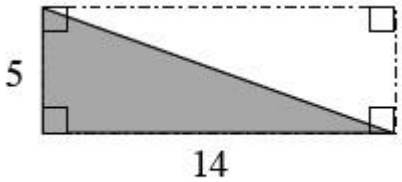
b.



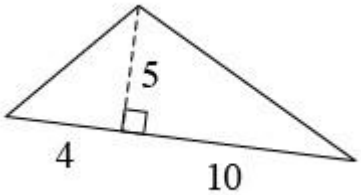
c.



d.



e.



f.

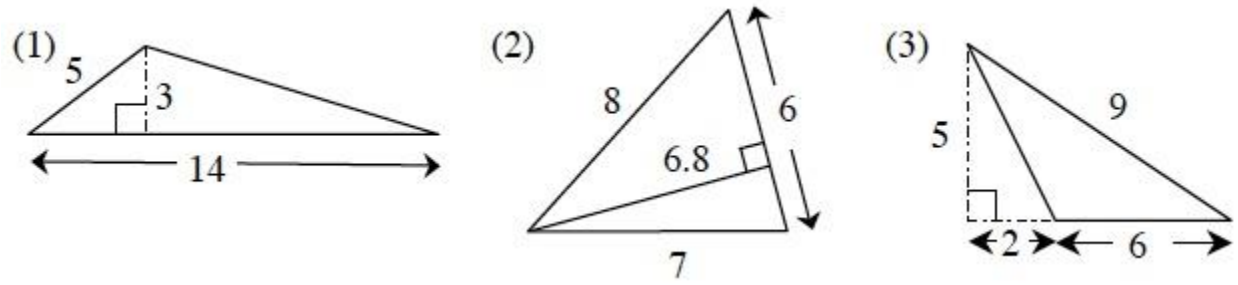
2-67. Noah claimed that he did not need to calculate the area for part (f) in problem 2-66 because it must be the same as the area for the triangle in part (e).

Is Noah's claim correct? How do you know? Draw diagrams that show your thinking.

Explain why the area of any triangle is half the area of a rectangle that has the same base and height. That is, show that the area of a triangle must be $\frac{1}{2}bh$.

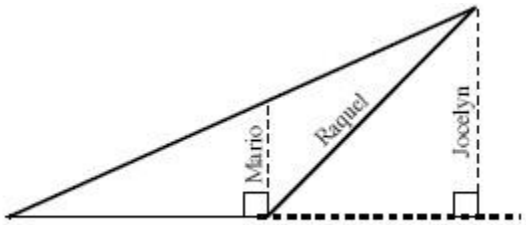
2-68. How do you know which dimensions to use when finding the area of a triangle?

a. Find the area of each triangle. Draw any lines on the diagram that will help. Turning the triangles may help you discover a way to find their areas.



b. Look back at your work from part (a). Which numbers from each triangle did you use to find the area? For instance, in the center triangle, you probably used only the 6.8 and 6. Write an explanation and/or draw a diagram that would help another student understand how to **choose** which lengths to use when calculating the area.

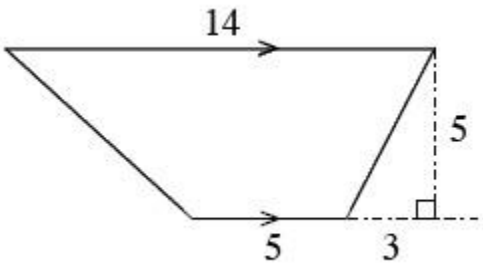
c. Mario, Raquel, and Jocelyn are arguing about where the height is for the triangle below. The three have written their names along the part they think should be the height. Determine which person is correct. Explain why the one you chose is correct and why the other two are incorrect.



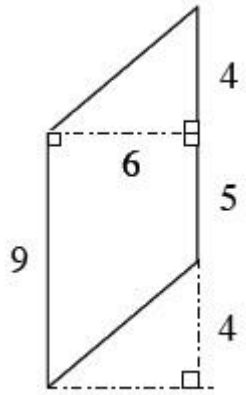
2.2.3 What's the area?

Areas of Parallelograms and Trapezoids

2-75. Find the areas of the figures below. Can you find more than one method for each shape?



a.

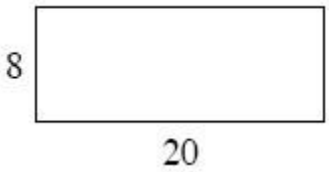


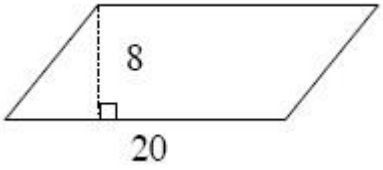
b.

2-76. FINDING THE AREA OF A PARALLELOGRAM

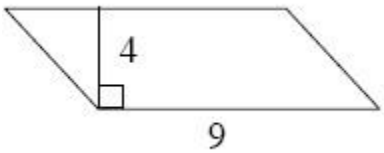
One of the shape in your Shape Bucket is shown below. It is called a **parallelogram**: a four-sided shape with two pairs of parallel sides. How can you find the area of a parallelogram? Consider this question as you answer the questions below.

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

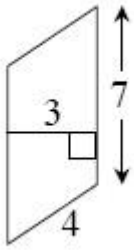




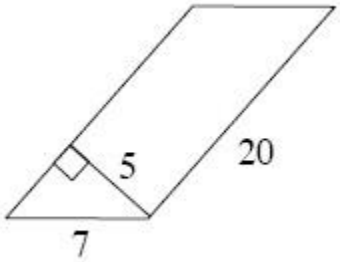
c. In the parallelogram shown in part (a), the two lengths that you were given are often called the **base** and **height**. Several more parallelograms are shown below. In each case, find a related rectangle for which you know both the base and height. Rotating your book might help. Use what you know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



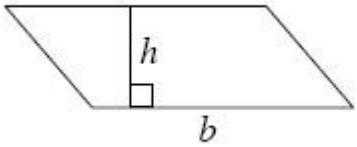
1.



2.



3.



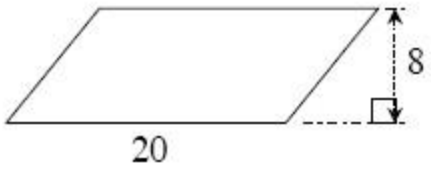
4.

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

b. 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.

2-77. Shaundra claims that the area of a parallelogram can be found by *only* using triangles.

1. Do you agree? Divide the parallelogram 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.)

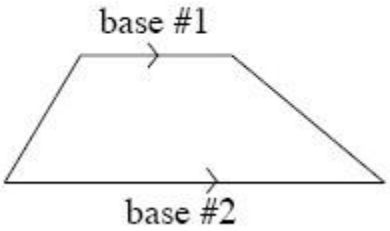


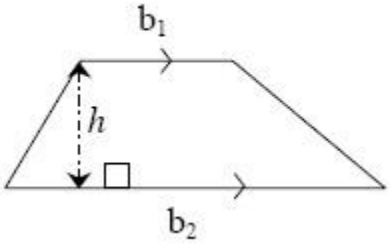
2. Use what you know about calculating the area of a triangle to find the area of the parallelogram. It may help to trace each triangle separately onto tracing paper so that you can rotate them and label any lengths that you know.

3. How does the answer to part (b) compare to the area you found in part (a) of problem 2-76?

2-78. FINDING THE AREA OF A 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 below. Answer the questions below with your team to develop a method to find the area of a trapezoid.





a. While playing with the shapes in her Shape Bucket, Shaundra noticed that two identical trapezoids can be arranged to form a parallelogram. Is she correct?

b. Trace the trapezoid shown above onto a piece of tracing paper. Be sure to label its bases and height as shown in the diagram. Work with a team member to move and rearrange the trapezoid on each piece tracing paper so that they create a parallelogram.

c. Since you built a parallelogram from two trapezoids, you can use what you know about finding the area of a parallelogram to find the area of the trapezoid. If the bases of each trapezoid are b_1 and b_2 and the height of each is h, then find the area of the parallelogram. Then use this area to find the area of the original trapezoid.

d. Kenisha sees it differently. She 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.

e. Are the area expressions you created in parts (b) and (c) **equivalent**? That is, will they calculate the same area? Use your algebra skills to demonstrate that they are equivalent.

2-79. Calculate the exact areas of the shapes below.