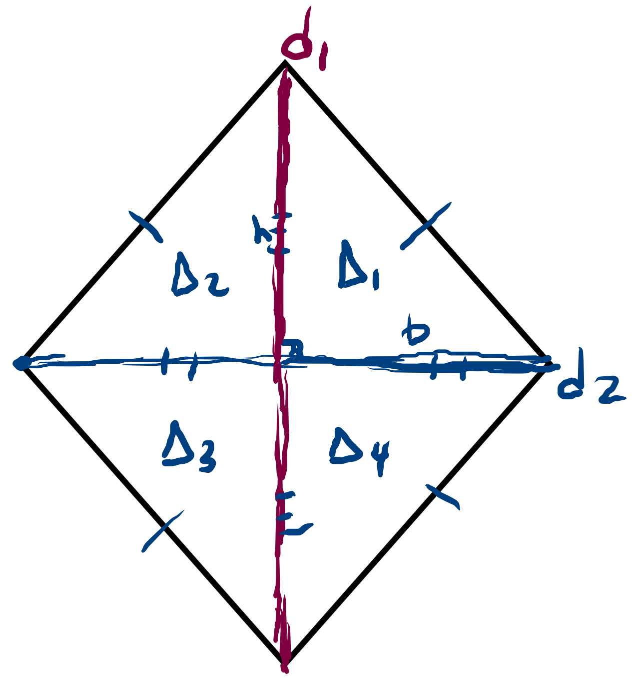
Redo - Area of Rhombus using diagonals.



Area of Rhombus $= 4 \text{ Area } \Delta_1$

$$= 4\left(\tfrac{1}{2} b h\right)$$

$$= 4\left(\tfrac{1}{2} \cdot \tfrac{1}{2} d_2 \cdot \tfrac{1}{2} d_1\right)$$

$$= 4\left(\tfrac{1}{8} d_2 \cdot d_1\right)$$

$$= \tfrac{4}{8} d_2 \cdot d_1$$

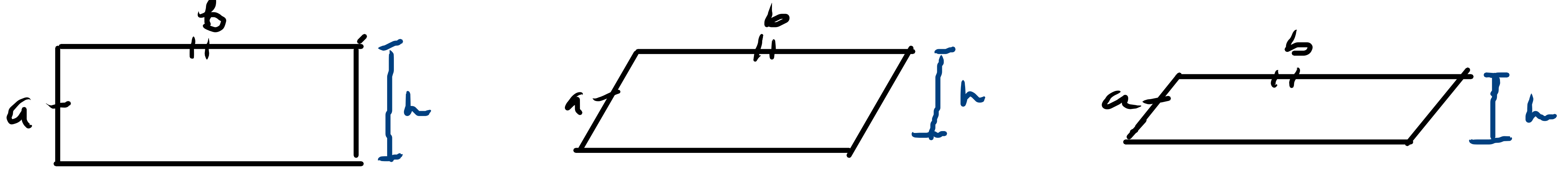
Area of Rhombus $= \tfrac{1}{2} d_2 \cdot d_1 = \dfrac{d_1 \cdot d_2}{2}$

In the picture: $b = \tfrac{1}{2} d_2$

$h = \tfrac{1}{2} d_1$

§12.5 Shearing: Change Shapes w/o Changing Area

Last time: we saw this image:

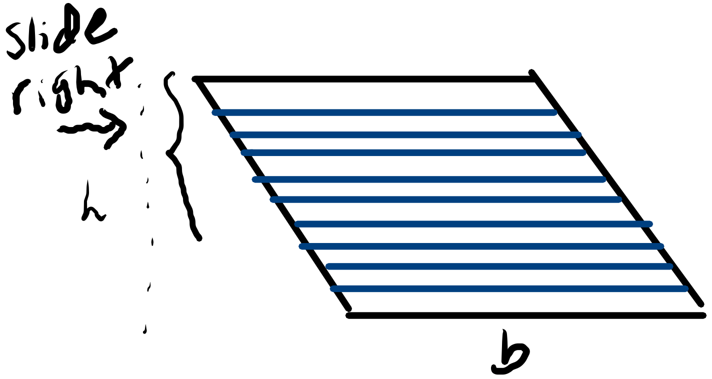


The hieghts is changing and that will change the area.

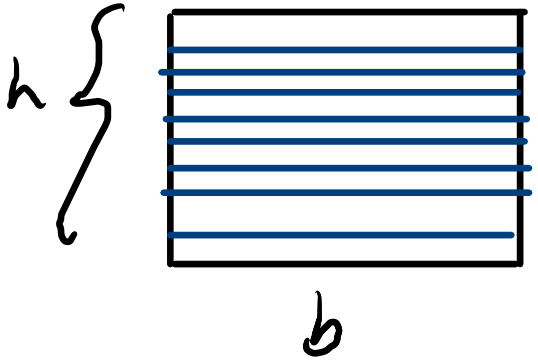
Is it Possible to change Shape w/ area Being the Same?

- Yes! Shearing and Shifting (Cavalieri's Principle)

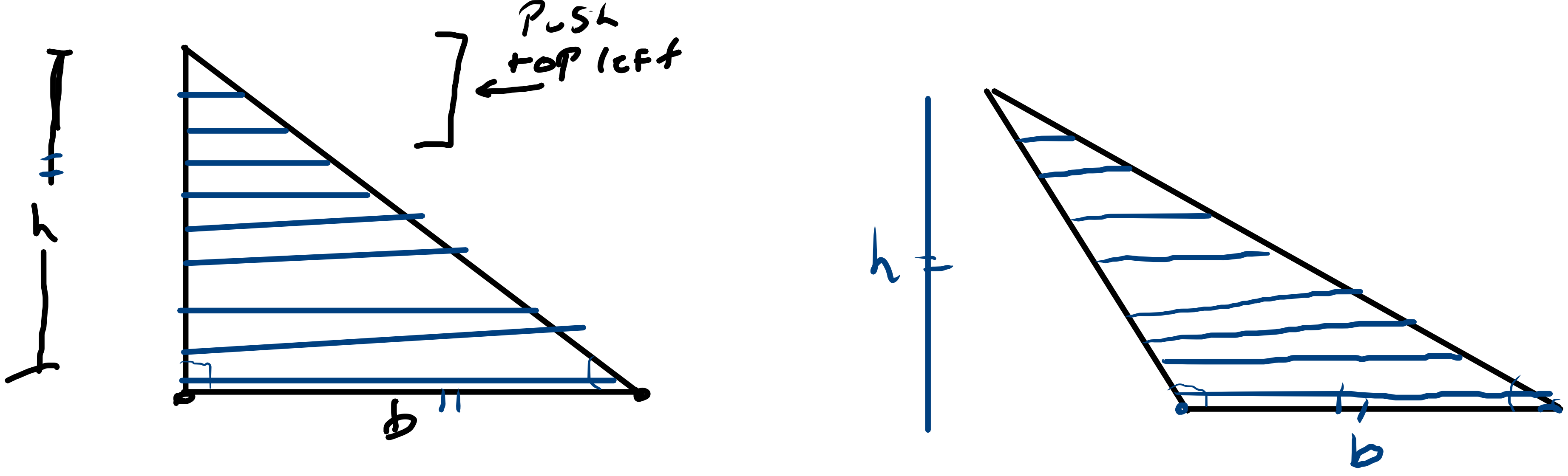
The idea of Shearing (Slicing)



Sliding top right.



* h and b did not change!



What will Change when Shearing.

* Angles.

* Perimeter

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Cavalieri's principle for areas says that when a shape is sheared as just described, the areas of the original and sheared shapes are equal. Also note the following about shearing:

- During shearing, each point moves along a line that is *parallel* to the fixed base.
- During shearing, the thin strips *remain the same width and length*. The strips just slide over; they are not compressed either in width or in length.
- Shearing does not change the height of the "stack" of thin strips. In other words, if you think of shearing in terms of sliding toothpicks, the height of the stack of toothpicks doesn't change during shearing.
- Shearing is different from "squashing" (see Class Activity 12J).

↳ This causes Area to change.

Problem 2 Pg 551 - 552

1. Figure 12.65 shows a parallelogram on a pegboard. (Think of the parallelogram as made out of a rubber band, which is hooked around four pegs.) Show two ways to move points C and D of the parallelogram to other pegs, keeping points A and B fixed, in such a way that the new shape is a parallelogram that has the same area as the original parallelogram.

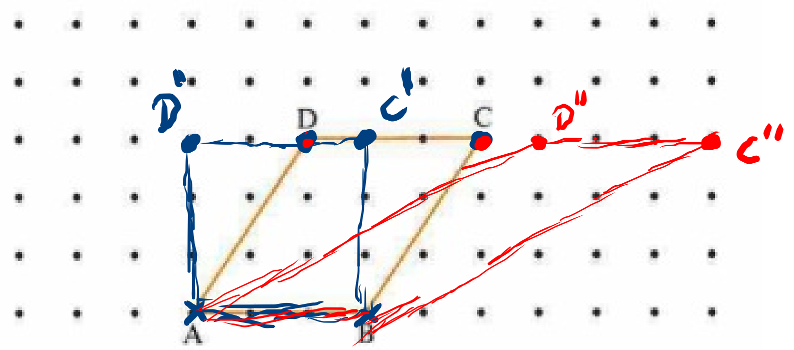

Figure 12.65 Parallelogram on a pegboard.

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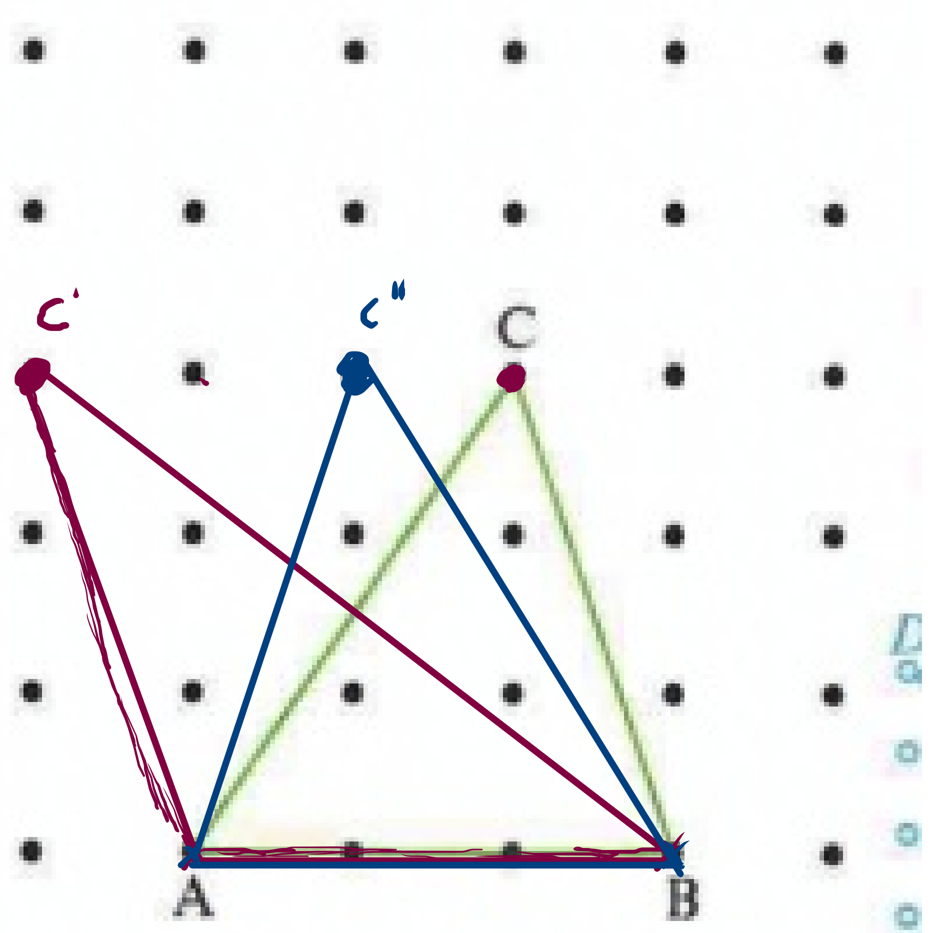
1. Figure 12.68 shows a triangle on a pegboard. (Think of the triangle as made out of a rubber band, which is stretched around three pegs.) Describe or draw at least two ways to move point C of the triangle to another peg (keeping points A and B fixed) in such a way that the area of the new triangle is the same as the area of the original triangle. Explain your reasoning. See the figure.



1st WAY

2ND WAY.

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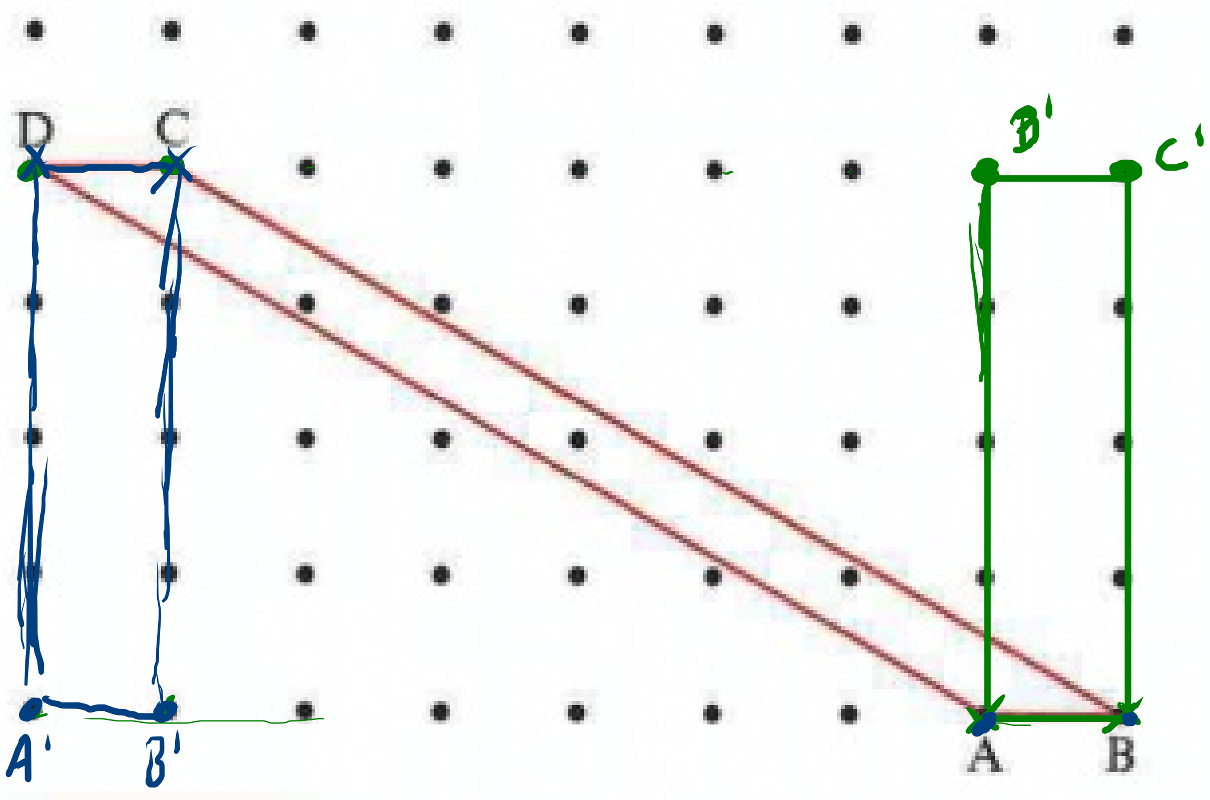
2\. a. Make a drawing to show the result of shearing the parallelogram in Figure 12.69 into a rectangle. Explain how you know you have sheared the parallelogram correctly.



1st WAY

2nd WAY

b. During shearing, what changed and what remained the same?

Remained the same: heights, base, Area

Angles & Perimeter will change

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3. **a.** Make a drawing to show the result of shearing the parallelogram in Figure 12.70 into a rectangle. Explain how you know you have sheared the parallelogram correctly. Note: Shearing does not have to be horizontal.

b. During shearing, what changed and what remained the same? The height and area remain the same during shearing. The perimeter changes during shearing.

Can ALSO move D A up 3 units.

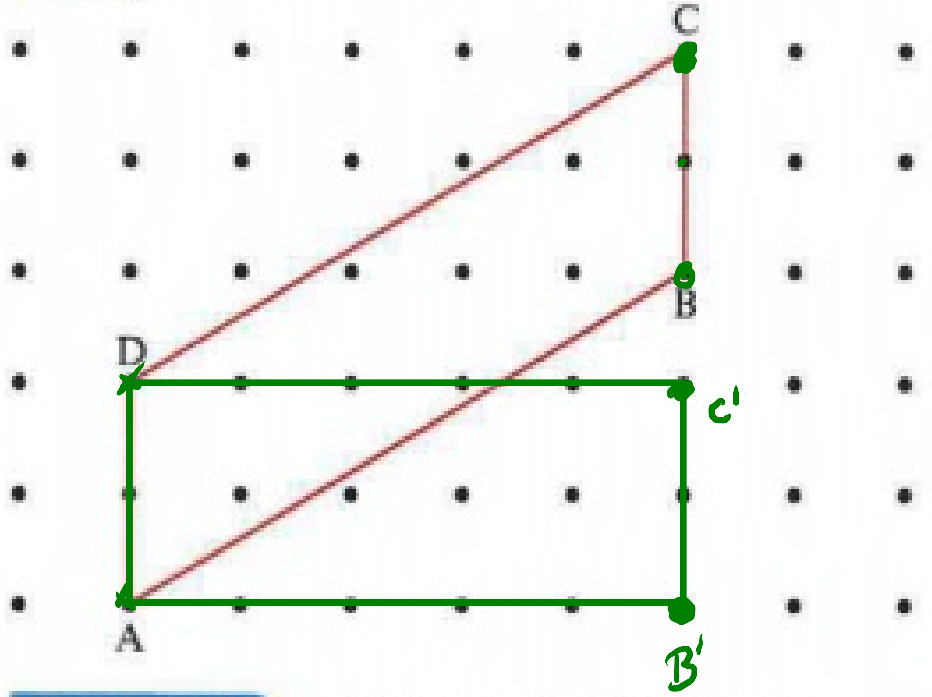
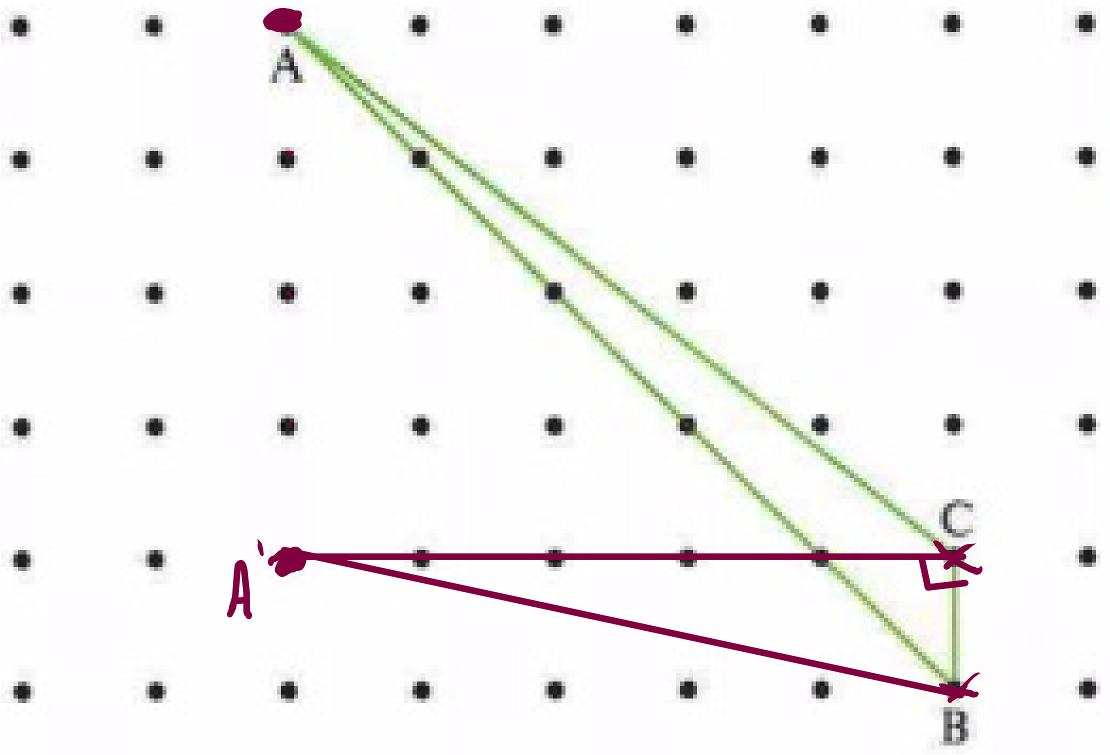


Figure 12.70 Parallelogram to shear.

5. **a.** Make a drawing to show the result of shearing the triangle in Figure 12.72 into a right triangle. Explain how you know you have sheared the triangle correctly. *Hint:* Shearing does not have to be horizontal.



6. The boundary between the Johnson and the Zhang properties is shown in Figure 12.73. The Johnsons and the Zhangs would like to change this boundary so that the new boundary is one straight line segment and so that each family still has the same amount of land area. Describe a precise way to redraw the boundary between the two properties. Explain your reasoning. *Hint:* Consider shearing the triangle ABC.

See the figure below. By moving B parallel to segment AC, we shear triangle ABC keeping the same area.